Mississippi Canyon 252
Pre-Assessment Plan for the Collection of Data to Determine Potential Exposure and Injuries of Threatened Gulf Sturgeon

Prepared by: Glenn Constant, U.S. Fish and Wildlife Service

For the
MC 252 NRDA Fish Technical Working Group

Mississippi Canyon 252 Trustees

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Approval of this work plan is for the purposes of obtaining data for the Natural Resource Damage Assessment. Each party reserves its right to produce its own independent interpretation and analysis of any data collected pursuant to this work plan.

This plan will be implemented consistent with existing trustee regulations and policies. All applicable state and federal permits must be obtained prior to conducting work.

Each laboratory shall simultaneously deliver raw data, including all necessary metadata, generated as part of this work plan as a Laboratory Analytical Data Package (LADP) to the trustee Data Management Team (DMT), the Louisiana Oil Spill Coordinator's Office (LOSCO) on behalf of the State of Louisiana and to BP (or ENTRIX behalf of BP). The electronic data deliverable (EDD) spreadsheet with pre-validated analytical results, which is a component of the complete LADP, will also be delivered to the secure FTP drop box maintained by the trustees' Data Management Team (DMT). Any preliminary data distributed to the DMT shall also be distributed to LOSCO and to BP (or ENTRIX on behalf of BP). Thereafter, the DMT will validate and perform quality assurance/quality control (QA/QC) procedures on the LADP consistent with the authorized Quality Assurance Project Plan, after which time the validated/QA/QC'd data shall be made available simultaneously to all trustees and BP (or ENTRIX on behalf of BP). Any questions raised on the validated/QA/QC results shall be handled per the procedures in the Quality Assurance Project Plan and the issue and results shall be distributed to all parties. In the interest of maintaining one consistent data set for use by all parties, only the validated/QA/QC'd data set released by the DMT shall be considered the consensus data set. In order to assure reliability of the consensus data and full review by the parties, no party shall publish consensus data until 7 days after such data has been made available to the parties. Also, the LADP shall not be released by the DMT, LOSCO, BP or ENTRIX prior to validation/QA/QC absent a showing of critical operational need. Should any party show a critical operational need for data prior to validation/QA/QC, any released data will be clearly marked "preliminary/unvalidated" and will be made available equally to all trustees and to BP (or ENTRIX on behalf of BP).

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APPROVED:

Department of Interior Trustee Representative: 9/28/2010 Date

Department of Commerce Trustee Representative: 9/23/10 Date

Louisiana Trustee Representative: 10/6/10 Date

BP Representative: 9/26/10 Date

SUMMARY

This document presents a plan for monitoring the movements of the Gulf sturgeon in the bays and estuaries of north Central Gulf of Mexico. It will also document the physical condition of Gulf sturgeon through visual observation, tissue collection, and photo-documentation as they enter the Gulf of Mexico during the annual fall migration and the subsequent migration back into freshwater rivers in the spring. The collection of data on Gulf sturgeon movement and fate outlined in this Plan to Determine Potential Exposure and Injuries of Threatened Gulf Sturgeon (Plan) is a pre-assessment phase activity within the NRDA process for the MC 252 Spill.

INTRODUCTION

Gulf sturgeon (*Acipenser oxyrinchus desotoi*) are listed as threatened under the Endangered Species Act of 1973 (7 U.S.C. § 136, 16 U.S.C. § 1531, as amended) and are jointly managed by the U.S. Fish and Wildlife Service (FWS) and National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS). A recovery plan for the species was completed in 1995 and most recently reviewed in 2009. This Plan has been developed to be consistent with the management options as listed in the initial recovery plan and its current revision. The 2009 review of the Gulf Sturgeon Recovery Plan (Recovery Plan) lists seven (7) river systems that have evidence of reproducing populations; the Pearl, Pascagoula, Escambia, Yellow, Choctawhatchee, Apalachicola, and Suwannee Rivers. The Ochlockonee and Blackwater rivers have been added to the list in recent years. Population status varies among these rivers, and there is evidence of impacts to populations in the Escambia, Pearl, and Pascagoula Rivers from recent Hurricanes Ivan (2004) and Katrina (2005). Critical habitat was designated by FWS in 2003 (68 FR68 13370) and it covers most of the Gulf coast from the Suwannee River in Florida to Lake Pontchartrain in Louisiana (Fig 1). Gulf sturgeon populations began to decline in the late 1800's from overfishing and population numbers continued to decline in the 1900's as access to spawning habitat was limited where rivers were dammed and habitat was altered by urbanization (Sulak and Clugston 1999). Shifts in demography continue to place demands on the resources of inland river systems that provide spawning and summer refuge areas, making the integrity of the coastal wintering habitat an increasingly critical component of sanctuary for Gulf sturgeon populations.

STUDY OBJECTIVES

This Plan focuses primarily on collecting information that will facilitate the evaluation of potential injury of the Deepwater Horizon (MC 252) Oil Spill to adult sturgeon. It sets in place the infrastructure to measure physiological indicators of potential injury, including mortality estimates, and behavioral aberrations of adult sturgeon as they overwinter in the GOM and then return to the rivers in the spring. Attention to mature fish in this species is especially important because Gulf sturgeon can live more than 40 years and it takes females from 8 to 19 years to reach sexual maturity and males from 7 to 21 years (Huff 1975). Males can spawn each year, but individual female sturgeon likely spawn every other year (Fox *et al.* 2000). Delayed maturity and dependence on a relatively small

portion of the population to perpetuate the species make these fish more vulnerable than many species in the GOM to potential impacts of the MC252 Spill.

The main objectives of this Pre-assessment plan are:

(1) Document the condition of Gulf sturgeon during the fall and spring migrations and compare condition of adult Gulf sturgeon between migrations;

(2) Collect blood samples from up to 180 adult Gulf sturgeon from among nine major river systems associated with the MC252 incident; and

(3) Document offshore movement and habitat use of up to 180 adult Gulf sturgeon during the overwintering period throughout its known range.

Other Technical Working Groups (TWGs) for the MC 252 Spill NRDA are proposing plans to monitor environmental and biological parameters that may supplement our overall evaluation of impacts to Gulf sturgeon populations and habitat. We will continue to coordinate with those TWGs to ensure that data to support assessment of potential impacts to Gulf sturgeon is collected and supplement them as may be necessary.

BIOLOGY

Gulf sturgeon are anadromous fish that spend summer months in rivers along the northern Gulf of Mexico (GOM) and winter months in bays and estuaries from Louisiana to Florida (Sulak and Clugston 1999, Ross *et al* 2009). Sturgeon are benthic feeders and rely heavily on sessile invertebrate organisms for sustenance in all stages of life (Mason and Clugston 1993, Fox *et al.* 2002, Harris *et al.* 2005, Ross *et al.* 2009). Adults migrate upstream from the Gulf in the spring to spawn in freshwater rivers, over hard substrate such as gravel or limestone outcroppings, and typically seek these habitats upwards of 150 km from the river mouth (Heise et al. 2004, Edwards *et al.* 2003, Paruka and Scollan 2008). As water temperatures decrease in late September through November, sturgeon migrate out of inland river systems to the GOM to overwinter and feed (Carr *et al.* 1996, Fox *et al.* 2002, Ross *et al.* 2009). Sub-adults and juveniles typically remain in protected waters, i.e., bays and estuaries, while adults venture further offshore where they are typically found in waters 2-10 m deep within 5 km of the shoreline in the eastern Gulf drainages like the Suwannee and Choctawhatchee Rivers, and infrequently as far as 35 to 40 km offshore near the Pearl and Pascagoula rivers in the western part of the range. Adults most frequently utilize areas of high sand concentration within a few km of the shoreline and barrier islands that enclose the estuaries and bays along the Gulf coast (Fox *et al.* 2002, Brooks and Sulak 2005, Ross *et al.* 2009).

The invertebrate community structure and density are important determinants in the suitability of forage in wintering habitat for all age classes of sturgeon (Wooley and Crateau 1985, Fox *et al.* 2002, Harris *et al.* 2005, Sulak *et al.* 2009). Adult sturgeon feed almost exclusively in the marine environment during winter months and feed very little in the freshwater environment (Wooley and Crateau 1985, Mason and Clugston 1993)

therefore adequate invertebrate forage in the wintering areas is critical to the condition of Gulf sturgeon. They have been reported to lose on average 12% of their body weight while in freshwater rivers and then to regain 20% of their body weight in marine and estuarine habitats (Carr *et al.* 1996).

Adult Gulf sturgeon likely remain upstream in sheltered rivers along the entire Gulf Coast during summer months. However, Gulf sturgeon will return to overwinter in the GOM between September and November, and remain in estuaries and bays until February when the next spawning cycle commences. Given their life cycle, adult sturgeon may be negatively impacted upon return to the gulf in the fall as a result of the discharge of oil and application of chemical dispersants from the Deepwater Horizon (MC 252) Oil Spill.

SPATIAL COVERAGE OF THE PLAN

Changes to the environment may result from the presence of hydrocarbons and dispersants in the water column, substrate, and invertebrate fauna. This Plan proposes monitoring for potential disturbance over the entire range of Gulf sturgeon wintering habitat, and will designate control measure areas in the eastern GOM where it may be found that disturbance has not occurred.

Although there is the possibility that inland areas used by sturgeon in the summer months could be fouled if the oil moves into them, the probability of movement into the river systems seems low. At this time, inland areas will be outside the reach of this monitoring effort. If projections for oil distribution change, an addendum to this Plan may be made to incorporate monitoring the inland habitat areas. Even in this Plan, some attention to the extreme lower river reaches will occur to detect the possibility that sturgeon may seek refuge within the river systems due to impacted areas in the GOM.

STUDY RATIONALE: CONCERNS RELATED TO THE SPILL:

Exposure and Potential Injury: Physical Fouling. Adult sturgeon will begin to migrate back to the Gulf in September and overwinter in areas that may be impacted by oil. If oil and dispersant by-product concentrations in the water are at toxic or fouling levels, injury to Gulf sturgeon by gill-fouling or direct ingestion during feeding is a potential threat and injury could range from reduced general condition to mortality. More likely is the ingestion of fouled substrate or benthic organisms where residual toxicity may persist long after the water column has cleared. Bioaccumulation in forage species and in foraging habitat could lead to direct mortality, impaired physical condition, reduced foraging and predator avoidance capabilities, toxin bioaccumulation and reproductive problems in Gulf sturgeon.

Potential Injury: Behavior Modification. Potential changes in behavior could occur if the density and distribution of oil cause loss of forage or otherwise unsuitable conditions in critical habitat. The combination of oil, dispersants, by-products, oxygen deficiency, and shifts in forage abundance may send sturgeon seeking forage and refuge in areas

beyond the native range. Avoidance of specific habitats or shifts in foraging behavior would subsequently raise concerns over how such modified behavior may affect condition, interfere with the anadromous routine, and impair reproductive success.

STUDY APPROACH:

Physical Fouling. Adult Gulf sturgeon (> 1300 mm total length) will be collected in gill nets for 5 weeks from September through November (migration time varies among river systems) as they return to the GOM from spawning in freshwater rivers where they have been since February 2010. Six field teams will cover nine rivers using netting and handling protocols guidelines that have been established through the Gulf Sturgeon Recovery Team and will be observed in all field surveys (Appendix 1). The external physical condition, including the internal gill cavity, of all sturgeon collected during the 5 week period will be evaluated and photographed to document presence or absence of oil. The photo-documentation will serve as baseline information from which to evaluate sturgeon collected when the process is repeated as sturgeon enter rivers for spawning migration starting in February 2011. All fish, including any juvenile fish collected in the fall, will be photographed and released regardless of condition. Passive integrated transponder tags (PIT) and visible fin tags will be injected into each fish to provide a permanent unique identifier for individual fish for future evaluation. PIT tags are essentially coded devices encapsulated in glass that are injected into the fish and require the use of a scanning device to be detected. Each team will be required to carry a scanning device capable of detecting the PIT tags.

Netting will resume for a 5 week period from late February through early April to capture sturgeon as they return from the GOM during the spring spawning migration. If evidence of oil is observed in netting surveys, comparisons of conditions for adult fish between fall and spring migration will be used as a general assessment to determine the percentage of fish observed with oil. Direct before-and-after comparisons of photographs will be conducted for recaptured adults.

Behavior Monitoring. Gulf-wide ultrasonic telemetry surveillance provides a necessary mechanism to directly evaluate potential changes in sturgeon behavior that may be attributable to the presence of oil in the environment. An array of 135 Vemco ® VR2w receivers will be deployed strategically along the coast from Louisiana to Florida (Fig 2). The array will record post-spill movement in the GOM from October 2010 to March 2011 to evaluate how sturgeon utilize GOM habitat. Transmitters will be implanted in 180 fish from 1 September 2010 to 30 November 2010. Field crews will surgically implant transmitters in 20 fish from each of the 9 listed river systems during fall migration survey. The Gulf Sturgeon Recovery team reviewed data from tagging efforts and has determined that mortality related to surgical implantation is minimal and that tag retention is higher for surgically implanted transmitters.

The proposed array stretches across approximately 800 km of the Northern Gulf Coast, including 70 km of area near the Chandeleur Islands (Fig 2). It is strategically designed to cover the entire wintering habitat with a manageable number of receivers to adequately

detect movement that can be used to evaluate habitat use. The location of receivers along the coast was guided by observations made of sturgeon at various depths and distances from shore in previous research (Ross *et al.* 2009, Sulak *et al.* 2009, Brooks and Sulak 2005, Harris *et. al.,* 2005, Fox *et al.* 2002, Sulak and Clugston 1999, Carr *et al.* 1996). Those data and others are available to support the array design and to provide adequate baseline information against which to compare observed sturgeon distribution over the period of this assessment.

The array provides a detection mechanism that is functional for evaluation at two spatial levels. At its most detailed level, it is set to maximize detection probability for sturgeon over the entire winter range and to provide high resolution capability or detecting small scale shifts in sturgeon movement patterns. Variable spacing of telemetry receivers is non-random and positioned within the coastal geography to maximize detections and minimize the number of receivers necessary to provide adequate coverage of the wintering habitat. Maximum distance between receivers will be 25 km in areas where observed wintering habitat is narrow and tight to the coast, while areas where the habitat forms a broader coverage along the coast and includes barrier islands will have receivers set on a finer grid.

In addition, the array includes "gates" that segment the coastal area into broader regions that can be evaluated at a coarse scale. Given that the effective range of ultrasonic equipment is between 300 m and 500 m in marine environments and is subject to swings in detection range that accompany climatic variation (Fig 3), the gate concept provides better detection of animals passing by strategically placed linear arrays of 3 to 4 receivers placed 600 m to 1000 m apart. Telemetry research on sturgeon in the GOM has shown that most sturgeon have been detected between 500 m and 2000 m of the shoreline. The gate concept provides a high degree of certainty that the regional location of most fish will be known for the entire duration of monitoring in the event that individual detections within each region are limited by reduced range of detection due to environmental factors during some periods of the assessment.

Of particular interest will be analyses that assess shifts in behavior and differential use of impacted and non-impacted areas. Those analyses will rely on designation of impacted areas by other NRDA plans, particularly for benthic substrate condition, benthic macroinvertebrate density, and benthic macroinvertebrate species composition to outline boundaries for comparison.

Exposure. Blood will be collected from adult Gulf sturgeon in the fall as they migrate out to wintering areas and again in the spring as they return to natal rivers to spawn. Biomarker tests for polycyclic aromatic hydrocarbons (PAHs) have been proposed as a method to document PAH exposure, but the NRDA is currently evaluating the appropriate assays to conduct for this purpose. Adult Gulf sturgeon have been inland in river systems that have sheltered them from possible exposure for the entire duration of the spill. Collecting blood *prior to* potential exposure as they migrate into the GOM will be the only possible opportunity to collect baseline information. Once exposed to oiled areas (GOM), there will be no way to assess the possibility of pre-existing biomarker

levels, except by comparison to the results from unoiled areas that have similar baseline hydrocarbon concentrations in the drainages. Although not proposed as part of the current scope of work in this work plan, the trustees intend to conduct biomarker assays as per future guidance from the NRDA.

FIELD EFFORT:

Non-NRDA NOAA Ongoing Telemetry Efforts: Under the endangered and threatened species programs for NOAA and FWS, there is an independent telemetry monitoring effort for the Gulf sturgeon within some of the major river basins along the northern Gulf coast (Appendix 1). Some of the researchers listed in this Non-NRDA effort have volunteered to assist NOAA by implanting transmitters in 20 adult Gulf sturgeon from the Pearl, Pascagoula, Yellow, Blackwater, Apalachicola, and Choctawhatchee rivers as part of a collaborative mortality study effort designed by the Gulf Sturgeon Recovery team. The study is designed to determine the mortality rate of adult sturgeon (adult sturgeon are considered to be sturgeon greater that 1300 mm in total length) over a 5 year period. Monitoring will take place only in the rivers (not in the GOM) over the study period to observe the number of fish that leave and return to the rivers. A rate of diminishing returns will be established over time and will provide mortality estimates to be used in modeling population size of Gulf sturgeon within each river system. There are 120 transmitters that have been purchased by NOAA for this project, but labor to net fish and implant transmitters is voluntary and unfunded.

Collaboration between NRDA Plan and the Non-NRDA NOAA Study. This NRDA Plan will contract the group of participants in the existing NOAA endangered species project, and add additional participants to conduct netting, document sturgeon condition, implant identification markers, collect blood, and implant telemetry transmitters as per the methodology in Appendix 1. While it is not mandatory for BP representatives to be present during all field activities, BP retains the option to have representatives attend and observe field activities. Team leaders are currently endangered species permit holders (or listed as covered on existing permits) for Gulf sturgeon research and operate within the approval and oversight of the Gulf Sturgeon Recovery Team. In order to complete the survey of all 9 river systems listed as important to Gulf sturgeon, an additional 60 transmitters are requested. Combining the 120 transmitters to be deployed by the Non-NRDA NOAA study, with the 60 additional transmitters to be purchased under this study, brings the total number of fish with transmitters that are detectable by the proposed telemetry array to 180 fish (120 from the Non-NRDA NOAA study + 60 from this NRDA Plan). That matches the total number of fish that this Plan states as the target number (20 from each of the 9 river systems listed).

Telemetry Network Deployment: The total grid will contain 135 Vemco ® VR2w receivers plus 15 additional units to replace lost or damaged units. Deployment of offshore stations will be by concrete anchors with tethered buoys and stainless steel cable and hardware. All deployment operations will require a team of at least three people that are certified in compliance with NRDA required courses. Contractor (SAIC) will deploy 135 receivers, maintain all receivers, and download all receivers every 6 weeks at the

locations shown in Figure 1 (lat long locations to be provided to contractor in separate table) according to protocols in the following task list.

Task 1: Purchase Equipment – SAIC will purchase all materials and equipment needed to construct deployment buoy and anchor assembly as outlined in budget Addendum 2.

Task 2: Construct Buoy/Anchor Assembly – SAIC will construct buoy and anchor assembly onsite and have them delivered to deployment stations for each river. Project supervisors will assist SAIC on-site with logistic information regarding appropriate launch and access points for the regional deployment adjacent to the particular river system assigned. Costs include delivery of buoy and anchor assembly to various deployment sites, and may be reduced by sub-contracting the entire construction task to a local outside construction company if timely service can be negotiated.

Task 3: Deploy Receivers - SAIC personnel will travel from the SAIC regional office in Valparaiso, FL to each regional area, rent an appropriate vessel that is Coast Guard approved for the number of people needed and equipped with a sufficient mechanical winch to safely handle 100 kg anchor blocks. Receiver deployment will begin as soon as possible and must be completed by 1 November 2010. NMFS, FWS, and/or BP representatives may attend and observe all deployment activities. Cost efficiencies could be realized by setting up teams within each regional area and designating deployment locations and number of receivers to be deployed per team. Since there is specific time limit to deploy the receivers, this could be accomplished with one boat.

Task 4: Download Receivers - SAIC will download data and service telemetry receivers once every 6 weeks for 6 months. Two crews of no fewer than 3 people will operate simultaneously to download receivers over the entire study area. While it is not mandatory for BP representatives to be present during all field activities, BP retains the option to have representatives attend and observe field activities. Raw data will be delivered electronically via FTP download to the appropriate NOAA or FWS oversight office where it will be prepared for delivery into the NRDA database. Maintenance and service of receivers will be monthly from November through April. Data transfer will be electronic to the FWS or NMFS and to NRDA and will be in the raw format directly downloadable from telemetry equipment. Data will then be shared as agreed to through the MC 252 Spill NRDA.

SAMPLE PROCESSING

After completing all field sampling activities for a given day, the field team must deliver the collected samples, datasheets and electronic information (including photographs and GPS track log) to an appropriate NMFS or USFWS regional oversight location.

- Blood samples must be appropriately packaged and prepared for shipment to the receiving laboratory(ies).
- **Chain-of-custody** forms must be completed.

- All data from all field forms should be entered into the appropriate Excel file format (Forms or Flat version) either by the field sampler or a data management team member. Once the file is completed, it should be submitted to the data management team for incorporation into the database.
- All photographs must be archived, in accordance with the instructions in the **NOAA Field Photography Guidance** (NRDA_Field_Photographpy_Guidance.doc, available on the case FTP site).
- Synchronize the photos with the GPS track in accordance with the instructions in the **NOAA ARD-FAST Using GPS-Photo Link** instructions (GPSPhotoLink.doc, available on the case FTP site).
- Import the photos into the ORR PhotoLogger database. (This will allow the photos to be uploaded to ERMA.) See the document **NOAA PhotoLogger** for more information.
- All field data sheets will be scanned and originals stored in a secure location.

HEALTH AND SAFETY

- The team leader and field crew parties should have completed all applicable health and safety training as directed by NOAA or state agency oil spill policy.
- All field team members must complete the NOAA safety training and documentation requirements as set forth in "**Safety Requirements for All Personnel Working on NOAA-led NRDA teams for MS Canyon 252 Incident**" (NOAA Safety Documentation Requirements.doc).
- All field team members should read all of the documents in the Safety directory on the case's ftp site [redacted].
  Exception: if field activities do not include use of or helicopter, then familiarity with the safety documents for these vehicles is not required.
- Each field team must submit a plan, not later than the night prior to going into the field. This plan must specify:
  - The team leader;
  - Names of all team members;
  - The sampling location(s)-- please use the grid coordinates as shown in Maps 1 to 3 below;
  - What kind of sampling they are doing;
  - Expected arrival time at sampling area (daily);
  - Expected departure from sampling area (daily);
  - Team deployment date;
  - Team return date.

  This information may be reported in one of two ways:

1. Fill out the Excel spreadsheet "**Team Member Information Form – Excel.xls**"[1] and send it to [redacted] Please use one tab for each team.
2. If you cannot submit this spreadsheet electronically, you can call in and report the information using this number: [redacted]

- Field teams must adhere to all procedures set forth in the **MC252 Site Safety Plan** ("NRDA MC 252 Site Safety Plan_5.13.10.pdf"). [2]

PROJECT MANAGEMENT AND REPORTING

Stephania Bolden of the NOAA Fisheries Service, St Petersburg, FL (contact information listed in budget table) will designate an overall project manager to operate out of the NOAA Fisheries Service Panama City Field office. Additional Regional support in project management for the western states (LA and MS) will come from FWS contract labor to be designated by Glenn Constant (contact listed in budget table) and stationed in Ocean Springs, MS. Both project managers will be responsible for ensuring the dissemination and completion of all health and safety requirements, assigning tasks and verifying the complete execution of all field trips, consolidating and delivering all data.

As detailed in the budget spreadsheet provided as a separate file, the total costs for this scope of work totals $1,782,575. The Parties acknowledge that this budget is an estimate, and that actual costs may be higher. BP's commitment to fund the costs of this work includes any additional reasonable costs within the scope of this work plan that may arise. The trustees will make a good faith effort to notify BP in advance of any such increased cost. This field effort will obtain boats through the Vessel of Opportunity program whenever practical.

[1] This file is available on the case's ftp site: [redacted]

[2] This file is available on the case's ftp site: [redacted]

Literature Cited:

Brooks, R.A., and K.J.Sulak 2005. Quantitative assessment of benthic food resources for juvenile Gulf sturgeon, Acipenser oxyrinchus desotoi in the Suwannee River estuary, Florida, USA. Earth and Environmental Science 28(5):

Carr S.H., Tatman F, and Chapman FA. 1996. Observations on the natural history of the Gulf of Mexico sturgeon (Acipenset oxrinchus desotoi Vladykov 1995) in the Suwannee River, Southeastern United States. Ecology of Freshwater Fish 1996:169-174. © Munksgaard, 1996.

Edwards, R. E., K. J. Sulak, M. T. Randall, and C. B. Grimes. 2003. Suwannee River (FL) Gulf sturgeon (Acipenser oxyrinchus desotoi) movements and nearshore Gulf of Mexico habitat determined by acoustic telemetry. Gulf of Mexico Science 1:59–70.

Fox, D.A., J.E. Hightower, and F.M. Parauka. 2000. Gulf sturgeon spawning migration and habitat in the Choctawhatchee River system, Alabama–Florida. Transactions of the American Fisheries Society 129: 811–826

Fox, D. A., J. E. Hightower, and F. M. Parauka. 2002. Estuarine and nearshore marine habitat use by Gulf sturgeon from the Choctawhatchee River system, Florida. American Fisheries Society Symposium 28:111–126.

Harris, J.E., D.C. Parkyn, and D.J. Murie. 2005. Distribution of Gulf of Mexico Sturgeon in Relation to Benthic Invertebrate Prey Resources and Environmental Parameters in the Suwannee River Estuary, Florida. Transactions of the American Fisheries Society 2005; 134: 975-990.

Heise, R. J., W. T. Slack, S.T. Ross, M. A. Dugo. 2004. Spawning and associated movement patterns of Gulf sturgeon in the Pascagoula River drainage, Mississippi. Trans. Am. Fish Soc.133, 221–230.

Huff, J.A. 1975. Life History of the Gulf of Mexico Sturgeon, Acipenser oxyr,hynchus desotoi in Suwannee River, Florida. Mar. Res. Publ. No. 16. 32 pp.

Leathem, W., P. Kinner, D. Maurer, R. Briggs and W. Treasure. 1973. Effect of spoil disposal on benthic invertebrates. Marine Pollution Bulletin 4: 122-125.

Mason, W.T., Jr. and J.P. Clugston. 1993. Foods of the Gulf Sturgeon in the Suwannee River, Florida. Transactions of the American Fisheries Society 122:378-385.

Paruka, F. and D. Scollan. 2008. Documentation of Gulf Sturgeon Spawning in the Apalachicola River, Florida, Spring 2008. U. S. Fish and Wildlife Service Report 27 pp.

Shaw, J. K., P. G. Johnson, R. M. Wewing, C. E. Comiskey, C. C. Brandt, and T. A. Farmer. 1982. Benthic macroinfauna community characterization in Mississippi Sound

and adjacent waters. Final Report. U.S. Army Engineer District, Contract No. DACW01-80-C-0427. Mobile, Alabama.

Sulak, K.J., and J.P. Clugston. 1999. Recent advances in the life history of Gulf of Mexico sturgeon, *Acipenser oxyrinchus desotoi*, in the Suwannee River, Florida, USA: a synopsis. Journal of Applied Ichthyology 15:116-128.

Sulak, K.J., M. T. Randall, R. E. Edwards, T. M. Summers, K. E. Luke, W. T. Smith, A. D. Norem, W. M. Harden, R. H. Lukens, F. Parauka, S. Bolden, and R. Lehnert. (2009) Defining winter trophic habitat of juvenile Gulf Sturgeon in the Suwannee and Apalachicola rivermouth estuaries, acoustic telemetry investigations. Journal of Applied Ichthyology 25:5, 505-515

Ross, S.T. , W.T. Slack, R.J. Heise, M.A. Dugo, H. Rogillio, B.R. Bowen, P. Mickle and R. W. Heard. 2009. Estuarine and coastal habitat use of gulf sturgeon (Acipenser oxyrinchus desotoi) in the north-central Gulf of Mexico. Estuaries and Coasts 32:360-374.

Ross, S.T., B.R. Kreiser, W.T. Slack, M.A. Dugo, R.J. Heise, B.R. Bowen, and P. Mickle. 2003. Movement, spawning sites, habitat use, and genetic structure of Gulf sturgeon (Acipenser oxyrinchus desotoi) in the Pascagoula drainage, Mississippi (year 7). Museum Technical Report 103. Mississippi Department of Wildlife, Fisheries and Parks, Mississippi Museum of Natural Science. Jackson

Reynolds, C.R. 1993. Gulf sturgeon sighting: a summary of public responses. USFWS Publication No. PCFO-FR 93-01.

Wooley, C. M., and E. J. Crateau. 1985. Movement, microhabitat, exploitation, and management of Gulf of Mexico sturgeon, Apalachicola River, Florida. North American Journal of Fisheries Management 5: 590-605.

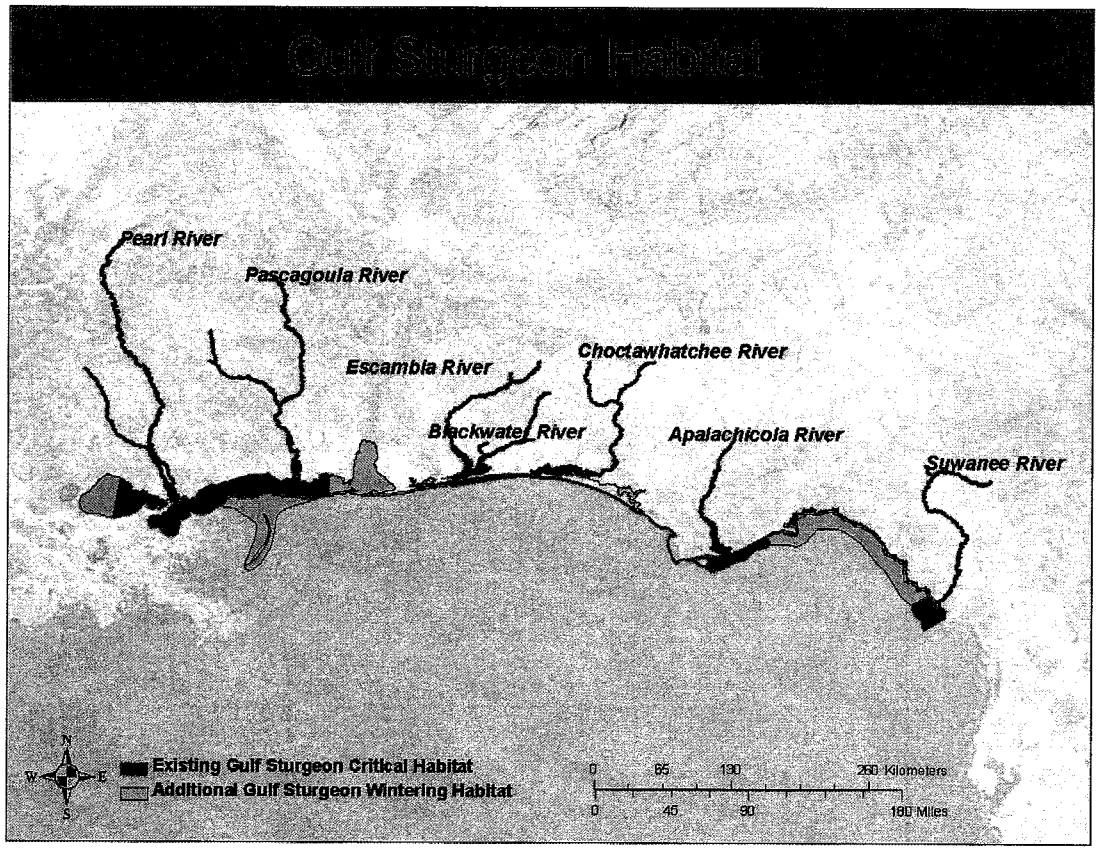

Figure 1. Gulf sturgeon critical habitat and wintering habitat.

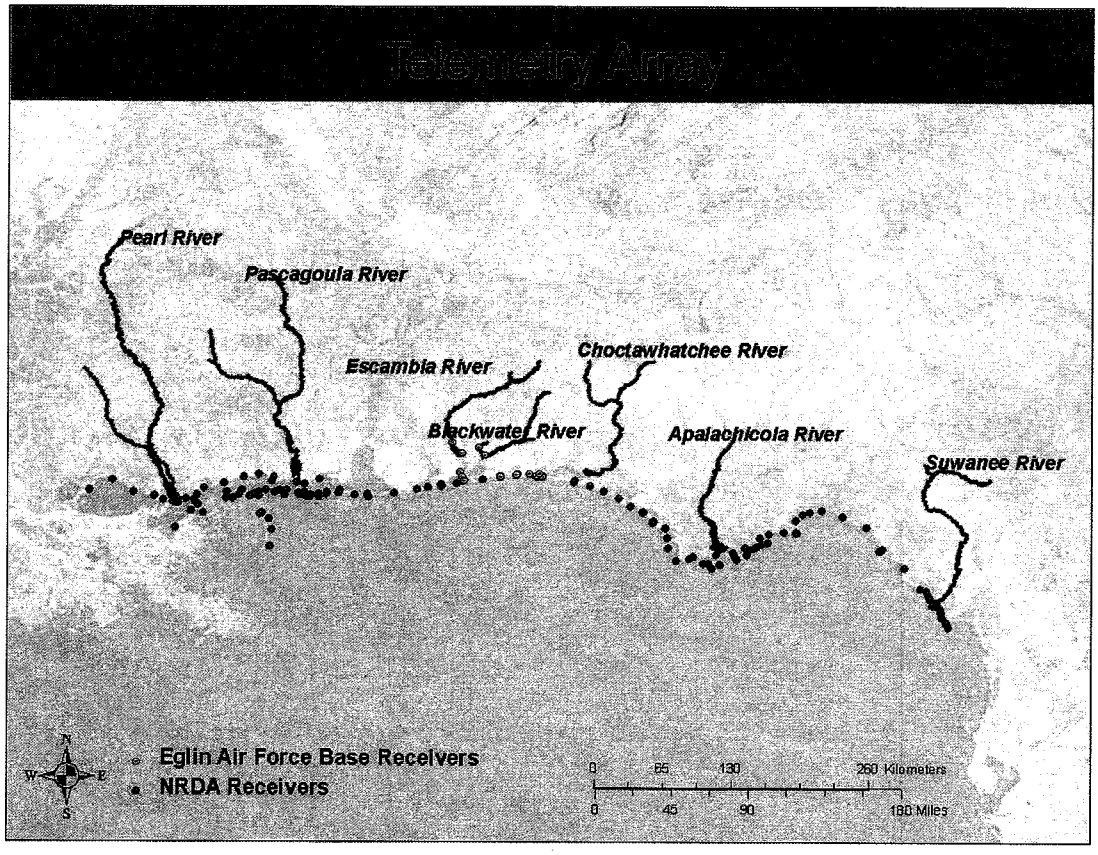

Figure 2. Telemetry receiver locations. Note that Elgin Air Force base is one of the participants and has agrees to leave receivers in the Gulf and supply all data collected to NRDA.

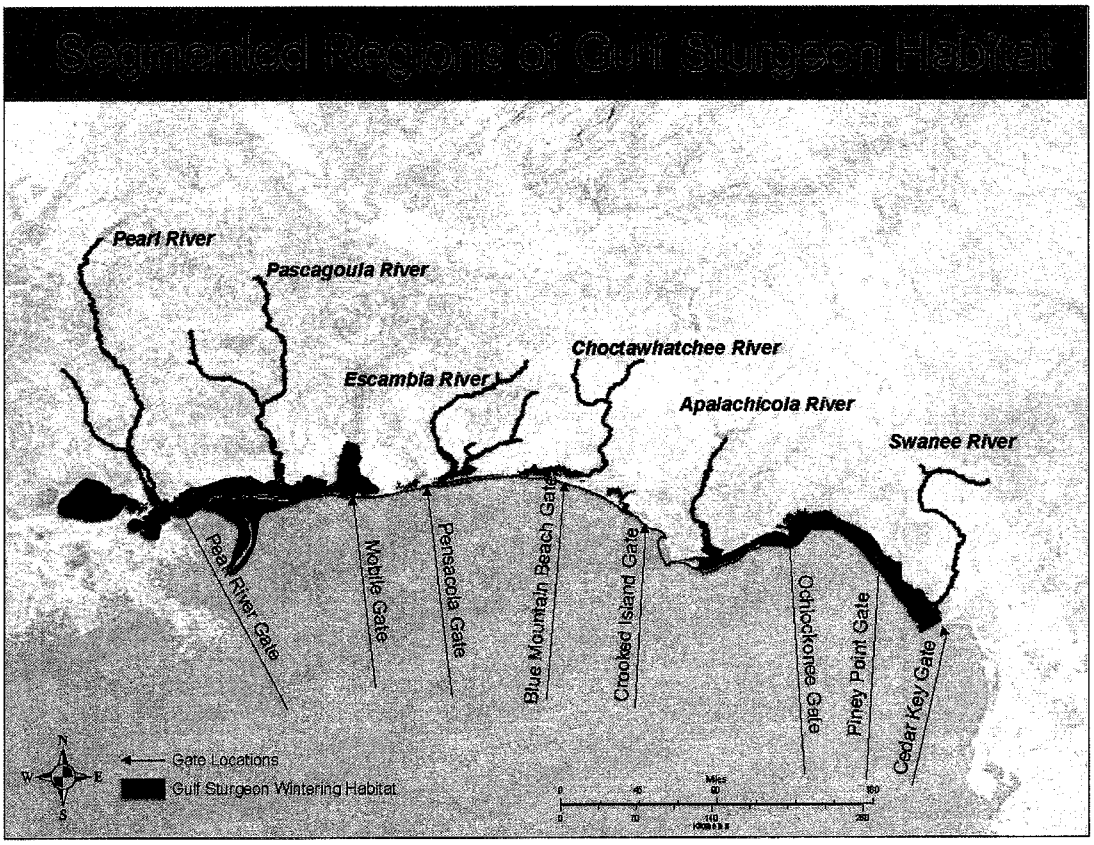

Figure 3. Red and black arrows indicate the location along the shoreline where a linear array of receivers will form a "gate" between segments of the Gulf within Gulf sturgeon habitat to track regional movement of sturgeon with greater probability of detection.

MC252 NRDA Gulf Sturgeon Survey
Effort Datasheet

Page_____ of _____

DATE _____ RESEARCHER _____ SET #_____

BAY, RIVER, OR MARINE? _____
LOCATION NAME abbr (see key for names) _____

LATITUDE (dd.mmsss)_____ LONGITUDE (dd.mmsss)_____

SURVEY TYPE _____
(NRDA, Outmigration, juvenile, summer, winter, non-random, spring)

GEAR SET TIME (military time, first part of gear in water) _____
SET END TIME _____

GEAR TYPE abbr _____ (GEAR = Drift Gillnett=DG, Anchored Gillnet=AG)

Environmental Data

	Water temp °C	**Salinity ppt**	**Depth m**	**DO mg/L**	**Conduct mS**	**pH**
Surface			-			
Bottom						

Notes_____-
_____
_____
_____
_____

GULF STURGEON CATCH DATASHEET **Page_____ of ______**

Date__________________ Set Number (from
EFFORT ID____________ GEAR__________ TEND OR HAUL? (Circle) TEND/HAUL #______
TIME BEGIN_________ TIME END_________

Stretch mesh (cm)	Panel length (m)	Panel depth (m)	HR	Twine size (mm)	Animal #	FL (cm)	TL (cm)	Wt (kg)	Sex (M,F,U)	PIT Scan type (AVID or BIO)	Old or new tag	Tbar Number L	Tbar Number R	Color L R	Other tag type observed	Other tag #	Samples taken	Sample #
											OLD							
											NEW							
											OLD							
											NEW							
											OLD							
											NEW							
											OLD							
											NEW							
											OLD							
											NEW							
											OLD							
											NEW							

Animal #	Note	PIT Tag #	Animal #	Old or New	PIT Tag #

Appendix 1. Sturgeon Netting and Sample Collection

Six teams of three persons will conduct netting in the 9 river systems listed in the Gulf Sturgeon Recovery plan and NOAA's 2010 5-Year Review of the Recovery Plan.

East Pearl River Principle Investigator Glenn Constant USFWS Baton Rouge, LA [redacted]	West Pearl River Principle Investigator Dr. Todd Slack US Army Engineer and Development Center [redacted]
Apalachicola, Ochlockonee, Blackwater, Yellow, and Escambia Rivers Principle Investigator Frank Paruka USFWS Panama City, FL [redacted]	Pascagoula River Principle Investigator Dr. Mark Petersen University of Southern Mississippi [redacted]
Choctawhatchee River Principle Investigator Dr. Dewayne Fox Delaware State University [redacted]	Suwannee River Principle Investigator Dr Ken Sulak USGS Gainesville, FL [redacted]

NETTING: Net attributes will be recorded on data sheets provided, including information on twine, mesh, hanging ratio, length. Nets should be no smaller than 4 inch stretch mesh and no larger than 12 inch stretch mesh. A 2-hour maximum soak time for anchored nets is required in the Gulf sturgeon netting handling guidelines and all nets are to be attended by field crews. Start and end times will be recorded for all nets individually. Night fishing is acceptable, but no nets are to be left unattended overnight. GPS coordinates will be taken at the net location.

PROCESSING FISH: Fish are to be removed from nets immediately and handled in accordance with fish handling guidelines in the Gulf Sturgeon Recovery Plan (as amended). Total length and fork length will be measured for each fish in millimeters. Weight will be recorded in kilograms. Genetic samples (fin clips) will be collected and stored in ethanol for preservation and delivery to NOAA Fisheries Service Panama City Laboratory, [redacted].

Each fish will be electronically scanned for the presence of Passive Integrated Transponder (PIT) tags. Previously implanted PIT tag information will be recorded and new PIT tags will be injected in the soft tissue at the base of the dorsal fin if no PIT tag is found or if an existing tag is of a different frequency. PIT tags will be 134.2 kHz tags (12.5 mm x 2.07mm). All fish handled, including juvenile sturgeon. A Power Tracker V or VIII will be standard reader.

T-bar tags will placed in the pectoral fins. Each researcher will have their own tags with telephone numbers. Tag color and full number (including leading zeros) will be indicated on each data sheet. Existing T-Bar tags will be replaced if they have been sloughed off or fouled.

An ultrasonic acoustic transmitter will be implanted in 20 adult fish from each of the 9 river systems. Transmitters will be VEMCO® model V16-6H set to 90 second intervals and will be surgically implanted into the gastric cavity according to procedures listed by NMFS and FWS. Only adult fish will be implanted with transmitters.

All fish will be photographed from both sides while resting on the ventral surface, then positioned to one side for a photograph of the ventral surface. Additional photographs will be taken inside each opercular cavity when it is opened during ordinary respiratory movements. Field crews should not attempt to hold open the opercular cavity to obtain photographs. Photographs will be taken with a GPS camera.

Blood samples will be drawn using a 10 ml sterile luer lock syringe (one per animal) fitted with a 27 – 21 gauge sterile needle (one per animal). After each animal has been photographed, measured, and tagged, the area posterior to the caudal fin should be swabbed with alcohol and the needle inserted into the caudal vein. Blood (10 ml) should be extracted and evenly dispensed to four separate sterile blood collection tubes. One will contain Strek cell stabilization reagent (Strek tube) for flow cytometry. One will be PAX gene Blood RNA tube (PAX tube) for genomics analysis. Two will be hematocrit tubes (hematocrit tubes) with critoseal. All tubes will be labeled with the PIT tag number of the fish as listed on the Gulf Sturgeon Catch Datasheet. All tubes will be immediately place on ice and transported back to NRDA designated laboratory where they will be stored at 4° C.

Appendix 2: Sturgeon Surgery Protocol

August 2010

The following protocol was developed at a workshop conducted June 2-3, 2010 at the Panama City FWS Lab by Gulf sturgeon researchers. Special thanks to Mr. Jerre Mohler of FWS for leading the workshop. Dr. Dewayne Fox, Mr. Frank Parauka and Ms. Kate Fleming provided essential information and assistance during the workshop. This protocol was developed to assist Gulf sturgeon researchers in using the best standard practices when deploying tags in Gulf sturgeon and relied on information provided in Fox et al. 2001. Brand names were provided by the researchers to assist others; neither FWS nor NMFS endorses any particular vendor or brand.
This protocol should be cited as: NMFS and USFWS. 2010. Gulf sturgeon surgery protocol. 4pp.

Morphometrics
Captured fish are to be measured (both total length and fork length) to the nearest 1 mm and weighed to the nearest 0.5 kg. Fish are then placed into anesthetic bath made up of bay water and MS-222 or tricainemethane sulfonate (trade name: "Finquel"® by Argent Chemical Laboratories, Redmond, Washington);

Anesthesia
The concentration of MS-222 suggested for surgical implantation of transmitters should be sufficient to anesthetize the fish and eliminate any observable response during the procedure while allowing for rapid post-operative recovery; thereby, minimizing holding time. For surgical implantation of internal tags and procedures requiring similar incisions, sutures, and holding time, a simple anesthetic bath containing ambient water and MS-222 at 50-100 mg/L is recommended. It is advisable to check the pH of the anesthesia bath and adjust as necessary with sodium bicarbonate since MS-222 is a hydrochloride, and can acidify water when used in freshwater settings.

Reproductive Status
Gender and reproductive status of individual fish may be determined via incision made using a surgical scalpel on the mid ventral line about 40–60 mm anterior to the insertion of the pelvic fins. Upon reaching the peritoneum, a retractor can then be placed into the surgical area to spread the musculature and enable a clear view of the area. Gonadal tissue was located with use of a blunt probe. External appearance of the gonad can then be noted and a biopsy (1 cm3 fragment) taken using surgical forceps and a scalpel. Samples should be preserved in a vial containing buffered 10% formalin for histological analysis.

Reproductive stage can then e determined by staining gonadal tissue with hematoxylin and eosin, sectioning (3m) samples and mounting sections on a glass slide to examine

using light microscopy. Fish can be classified as either immature, maturing, or ripe . According to this classification scheme, maturing fish had spawned in a previous year and were between spawning events at the time of collection.

Tags and Receivers

1. Transmitters - VEMCO V-16 6H tags will be used programmed to transmit at 90 second intervals so that tags should last 6.4 years.
2. Receivers - VEMCO VR2W receivers will be used.
3. PIT tags and Readers:
    a. PIT tags – we will standardize to 134.2 kHz tags (12.5 mm x 2.07mm). All fish handled will be re-tagged with a new 134.2 PIT tag. PIT tags will be placed in the soft tissue at the base of the dorsal fin on either side of fish.
    b. A Power Tracker V or VIII will be standard reader.
4. T-bar tags will be placed in the pectoral fins. Each researcher will utilize their own tags with telephone numbers. Tag color and full number (including leading zeros) will be indicated on data sheet. T-Bar tags will be replaced as they are sloughed off or become fouled. It is suggested that the tag number appear twice on each t-bar tag (distal and proximal) in case part of tag becomes broken off.

Surgery

A. Supplies:

1. Tray for tools – use 70% EtOH to sterilize tools, tags and transmitters.
2. Vials for fin clips (ethanol)/gonad samples (10% formalin)
3. Sutures – Ethicon PDS II suture material CP1 -Chromic Gut, with cutting needle instead of tapered. Beware: suture material expires and disintegrates over time.
4. OTC – inject at 20mg/kg of body weight to mark hard parts.
5. Transmitters may be coated with polymer to make them biologically inert. Recommend MDX4-4210, Medical grade elastomer from Dow Corning http://www.factor2.com/MDX4_4210_Replacement_p/a-103.htm
6. Floy Tags
7. PIT tags

8. Tools
    a. Forceps
    b. Hemostats
    c. Scissors
    d. Scalpels
    e. Blades for scalpels
    f. Egg scooper
    g. PIT tag applicator
    h. FLOY gun
9. Other supplies:
    a. Towel
    b. Syringes/needles
    c. Latex gloves
    d. Betadine/Vaseline mix for topic antibiotic
    e. MS22
    f. Measuring tape and scale
    g. Clipboard/datasheets
    h. Pencils

B. Procedure:

Surgical implantation of transmitters should be conducted using sterilized transmitters and equipment to help minimize post operative infection rates.
Lay fish ventral side up on the sling in the anesthetic/surgery box. Allow appropriate time for anesthetic to work. Using the scalpel make an incision about 3-5 scutes forward of the pelvic fins. Carefully cut through into the body cavity and elongate incision to accommodate transmitter. A retractor can be used to open the incision to examine internal organs. Insert the sterilized transmitters and close the incision using sterile resorbtive suture material. To ensure proper closure, a single interrupted suturing technique about 1 cm apart should be used with each suture individually tied.

Apply a thin layer of petroleum jelly mixed with topical Betadine over the incision areas to protect against infection. A mixture of betadine + petroleum jelly will increase longevity of application. The intent of the betadine ointment is to coat the sutures until the fish's mucous has a chance to coat them. The betadine has antibacterial properties but also antifungal properties, which may be even more important.
Allow the fish to recover before release.

Project Budget

Telemetry Equipment					
	Quantity	Cost Each			total
Vemco VR2w Receivers	150	1450			217500
V16-6h Transmitters	60	350			21000
V100 mobile tracking unit	5	4000			20000
Passive Integrated Transponder Tags	400	5			2000
Telemetry Reveiver Batteries	300	25			7500
				Total Telemetry Equipment	268000
Project Management (Regional Oversight to Business as Usual)					
AL, FL	USFWS - Panama City, FL (contract Labor)			Salary	
Project to be administered by Dr. Stephania Bolden NOAA Fisheries St. Petersburg Office ST. Petersburg, FL 33701 [redacted]	Overall Coordinatorand Regioal Project Manager for AL and FL - GS 11 (1 year Term - contrat labor)			94956	94956
LA, MS	USFWS - Ocean Springs, MS (contract labor)				
	Regional Project Manager for LA and MS - GS 11 (1 year term - contract labor)			94956	94956
Labor and Administrative costs for netting, tagging, data collection, NRDA reporting and training					
West Pearl River	USFWS - Baton Rouge, LA (contract labor)		hourly rate	hours	cost
Principle Investigator	Principle Investigator - Glenn Constant - (no cost included)		0	200	0
Glenn Constant	Supervisor - (1 year term - contract labor)		40	200	8000
USFWS	Crew Leader field time		40	500	20000
Baton Rouge, LA	Biologist (crew field time - contract labor - gs7)		30	500	15000
[redacted]	Biologist (crew field time - contract labor - gs7)		30	500	15000
[redacted]	Travel (crew of 3 Sept-Oct and Feb-March 30 nights @ $100/per night)				9000
	[1] Standard Field Equipment for Each River System				10160
				Total East Pearl River	77160
East Pearl River	USACE - ERDC Vicksburg		hourly rate	hours	cost
Principle Investigator	Principle Investigator - Dr. Todd Slack - administrative oversight and planning		[redacted]	[redacted]	10500
Dr. Todd Slack	PI -Supervisor field time				35000
US Army Enginner and Development Center	Biologist (crew field time)				25000
Vicksburg, MS	Biologist (crew field time)				25000
[redacted]	Travel (crew of 3 Sept-Oct and Feb-March 30 nights @ $100/per night)				9000
[redacted]	[1] Standard Field Equipment for Each River System				10160
	Indirect Costs		[redacted]		48070
				Total West Pearl River	162730
Apalachicola, Ochlockonee, Blackwater, Yellow, and Escambia Rivers	USFWS Panama City Fish and Wildlife Conservation Office		hourly rate	hours	cost
Principle Investigator	Project Supervisor (GS 11 - 1 year term contract labor) - administrative oversight and planning		40	150	6000
Frank Paruka	PI -Supervisor field time		40	500	20000
USFWS	Biologist (GS-7 - 1 year term - crew field time)		30	500	15000
Panama City, FL	Biologist (GS-7 - 1 year term - crew field time)		30	500	15000
[redacted]	Travel (crew of 3 Sept-Oct and Feb-March)				9000
	[1] Standard Field Equipment and Maintenance for Each River System (x 4 rivers)				50800
				Total Ochlockonee, Blackwater, Yellow, and Escambia Rivers	115800
Pascagoula River	University of Southern Mississippi		hourly rate	hours	cost
Principle Investigator	Principle Investigator - Dr. Mark Petersen - administrative oversight and planning		[redacted]	[redacted]	[redacted]
Dr. Mark Petersen	PI -Supervisor field time				
University of Southern Mississippi	Field Technician				
[redacted]	Field Technician				
	Travel (crew of 3 Sept-Oct and Feb-March)				
[redacted]	[1] Standard Field Equipment for Each River System				
	Indirect Costs		[redacted]		[redacted]
				Total Pascagoula River	105288.4
Choctawhatchee River	Deleware State University		hourly rate	hours	cost
Principle Investigator	Principle Investigator - Dr. Dewayne Fox - administrative oversight and planning		[redacted]	[redacted]	[redacted]
Dr. Dewayne Fox	PI - Supervisor field time				
Deleware State University	Field Technician				
[redacted]	Field Technician				
[redacted]	Travel (crew of 3 Sept-Oct and Feb-March)				
	[1] Standard Field Equipment for Each River System				
	indirect costs		[redacted]		[redacted]
				Total Apalchicola River	105288
Suwannee River	USGS - SPSC Gainesville, FL (contract labor)		hourly rate	hours	cost
Principle Investigator	Project Supervisor Dr. Ken Sulak - administrative oversight and planning		55	150	8250
Dr Ken Sulak	PI - Supervisor field time		55	500	27500
USGS	Biologist (GS-7 - contract field crew)		30	500	15000
Gainesville, FL 32653	Biologist (GS-7 - contract field crew)		30	500	15000
[redacted]	Travel (crew of 3 Sept-Oct and Feb-March)				9000
	[1] Standard Field Equipment for and Maintenance Each River System				10160
				Total Pascagoula River	84910
Data management and GIS support					
LA, MS, AL, FL	University of Florida - Dr. Bill Pine		85	300	[redacted]
	indirect costs		[redacted]		
				Total Data Mangement Cost	32640
Receiver Deployment (deployment and removal of receivers, including vessel)					
LA, MS, AL, FL	[2]SAIC (Contractor) includes indirect costs	[redacted]			[redacted]
			Total Receiver Deployment		647986.7
Biometrics and Data Processing and QA					
LA, MS,AL, FL	USGS - Wetland Science Center, La	0	0		0
				Grand total	1782575

1 - Standard equipment list and expenses applies to all contracts. USFWS Panama City will cover 4 river systems and will require 4 times the equipment

[1] Standard Field Equipment for and Maintenance Each River System		Cost	
Nets	5	400	2000
Fuel	400	2.9	1160
GPS camera (Ricoh photopro or comparable)	1	1000	1000
Field supplies	1	1000	1000
Boat Maintenance and Repair	1	5000	5000
		Total	10160

2 - See separate budget from SAIC - Elgin Air Force Base Contractors for cost of receiver deployment, not including the cost of receivers or batteries.

TASK 1: PURCHASE EQUIPMENT - One time costs			
Items Needed	**$/unit**	**Quantity Needed**	**Total cost**
Copper Foil Sheet	$3.95	135	$533.25
Inflatable buoy	$47.51	135	$6,413.85
Aluminum bare pipe (48" long)	$22.34	135	$3,015.90
Aluminum bare pipe (10 - 12" long)	$6.28	135	$847.80
3/8" x 6" Stainless steel hex bolt	$3.65	135	$492.75
3/8" X 6" Stainless steel eyebolt with nut	$3.30	135	$445.50
3/8" Stainless steel washers (pack of 20)	$6.23	27	$168.21
3/8" Stainless steel nuts (pack of 5)	$3.00	81	$243.00
Crimp/Sleeve	$2.23	450	$1,003.50
Stainless steel thimble and clamp set for 3/8" wire rope	$7.00	135	$945.00
Cable Ties (pack of 100)	$16.20	5	$81.00
1/4" stainless steel cable - 250 ft spool (approx. 50 ft/buoy)	$320.00	30	$9,600.00
Cement blocks with metal rods (two 60-lb bags of QuickCrete per anchor block)	$5.00	270	$1,350.00
1.5 ft of ½ in PVC pipe (20-ft sticks)	$5.25	11	$57.75
Cardboard boxes (12"L x 12"W x 14"D)	$2.00	135	$270.00
2-ft of 1x4 lumber – spacer between boxes (4-ft boards)	$2	68	$136.00
Miscellaneous tools/other equipment (drills, wrenches, welders, etc...)			$1,000
SUBTOTAL	$455.94		$26,604
Shipping charges (Estimate: 20% of total)	$91.19		$5,321
TASK 1 TOTAL	[redacted]		[redacted]

TASK 2: CONSTRUCT BUOY/ANCHOR ASSEMBLY - One time costs				
Task	**Hourly rate**	**# of hours required for 1 buoy system**	**# of buoys needed**	**Total cost**
Supervisor will lead and manage the construction process of assembling each buoy/anchor system. This will include pouring and mixing concrete for anchor blocks, welding aluminum pipes together, cutting the cables to desired lengths, inflating the buoys, attaching buoys to aluminum pipes, drilling holes in pipes to attach receiver to pipe/buoy with bolts and cable ties, attaching buoy/pipe/receiver assembly to concrete block.	$ [redacted]	[redacted]	135	$ 34,425.00
Technician will assist supervisor in construction process to assemble buoy/anchor system for each receiver to be deployed.	$ [redacted]	[redacted]	135	$ 34,425.00
TOTAL FOR LABOR				$ 68,850.00
Other costs		**Weekly cost**	**# of weeks needed**	**Total cost**
Supervisor/technician team would need to rent a concrete mixer for the high amounts of concrete needed to make the anchors for the receivers. Assumption: Renting a 9 cubic-foot concrete mixer for a week would accommodate the construction of 75 blocks.		[redacted]	[redacted]	$1,400.00
TASK 2 TOTAL				[redacted]

TASK 3: DEPLOY RECEIVERS - One time costs				
Task	**Hourly rate**	**# of hours required for 1 buoy system**	**# of buoys needed**	**Total cost**
Supervisor will manage the initialization of each receiver.	$ [redacted]	[redacted]	135	$ 23,287.50
Technician will assist the Supervisor in initializing each receiver to include, but not limited to, recording serial numbers and setting up software to receive data.	$ [redacted]	[redacted]	135	$ 34,425.00
Supervisor will lead and manage the deployment of receivers at various locations in the Gulf.	$ [redacted]	[redacted]	135	$ 62,100.00
Technician will assist the Supervisor in deploying each receiver at various locations in the Gulf, which includes documenting GPS points of deployment location and associating each receiver with their corresponding locations.	$ [redacted]	[redacted]	135	$ 91,800.00
TOTAL FOR LABOR				**$ 211,612.50**
Other costs		**Weekly cost**	**# of weeks required**	**Total cost**
Assumption: Renting a boat for a week (including weekly fee, gas, oil, and insurance) will accommodate the deployment of 25 receivers.		$900.00	6	$5,400.00
TASK 3 TOTAL				[redacted]

Task 4: DOWNLOAD RECEIVERS - Recurring costs				
Task	**Hourly rate**	**# of hours required for 1 buoy system**	**# of downloads required for 135 receivers deployed for 6 months and downloaded once a month**	**Total cost**
Supervisor will lead and manage all downloading activities on the boat.	$ [redacted]		540	$ 62,100.00
Technician will assist the Supervisor in downloading each receiver.	$ [redacted]		540	$ 91,800.00
Supervisor will oversee and review data summaries and updates provided by the Technician.	$ [redacted]		540	$ 31,050.00
Technician will be responsible for uploading data from local receivers into local database and organizing it to be incorporated into master database. Technicians wil also be responsible for providing data summaries from each download and reporting any significant findings to supervisor.	$ [redacted]		540	$ 68,850.00
TOTAL FOR LABOR				**$ 253,800.00**
Other costs		**Weekly cost**	**# of weeks required**	**Total cost**
Assumption: Renting a boat for a week (including weekly fee, gas, oil, and insurance) will accommodate downloading data from 25 receivers. 2 Boats		$1,800.00	20	$36,000.00
TASK 4 TOTAL				$ 289,800.00

Indirect Cost (6%)	$39,000.00
Deployment Total	$94,986.71

Nets	5	400	2000
Fuel	400	2.9	1160

Field supplies	1	1000	1000
Boat Maintenance and Repair	1	5000	5000
		Total	9160

GPS camera (Ricoh photopro or comparable)	1	1000			1000
Vemco VR2w Receivers	150	1450			217500
V16-6h Transmitters	60	350			21000
V100 mobile tracking unit	5	4000			20000
Passive Integrated Transponder Tags	400	5			2000
Telemetry Reveiver Batteries	300	25			7500
		Total Equipment			269000