

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

FINAL REPORT

Bottom-Set Gillnet Comparative Gear Study to Reduce Sea Turtle Bycatch



Submitted to:

**Henry Milliken
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543
Phone: 508-495-2294
Email: henry.milliken@noaa.gov**

Submitted by:

**Rick Usher
A.I.S., Inc.
14 Barnabas Road
Marion, MA 02738
Phone: 774-200-0563**

February 7, 2018

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Final Report

Report title: Bottom-Set Gillnet Comparative Gear Study to Reduce Sea Turtle Bycatch

Key project partners: Henry Milliken, NMFS NEFSC Protected Species Branch
Eric Matzen, NMFS NEFSC Protected Species Branch
Captain Charlie Locke, F/V Salvation
Kathryn Roy, Kerry Lyons, and Rick Usher, A.I.S., Inc.

Funding Agency: National Marine Fisheries Service

NOAA Contract No.: EA133F-14-SE-3694

Recipient name: NMFS Northeast Fisheries Science Center

NOAA COR: Henry Milliken

Report by: Rick Usher

Date: February 07, 2018

Although released by NOAA, the information in this paper does not reflect, represent, or form any part of the support of the policies of NOAA or the Department of Commerce. Further, release by NOAA does not imply that NOAA or the Department of Commerce agrees with the information contained herein.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

This project was a collaboration of NOAA National Marine Fisheries Service (NMFS) Protected Species Branch (PSB), A.I.S Inc. (AIS), and the commercial fishing industry. Principal Investigator (PI) Henry Milliken and Co-Investigator (CI) Eric Matzen of the Northeast Fisheries Science Center (NEFSC) Protected Species Branch (PSB) provided direction on the design of the experimental gillnets and the scope of the project. Rick Usher and his team at AIS were responsible for vessel selection and procurement, providing qualified sea turtle observers, at-sea data collection, and field logistics as well as data entry, project management, analysis, and drafting this report. Sea trials were conducted out of Cape Hatteras, North Carolina onboard the F/V Salvation, operated by Captain Charlie Locke.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Table of Contents

Summary	1
Introduction and Background	1
Project Goals and Objectives	2
Research Methods	2
Gear Design	3
Sea Trials	4
Sampling and Data Collection	5
Progress Reports	7
Data Management	7
Data Analysis	7
Results	8
Catch and Bycatch – General Description	8
Sea Turtle Bycatch	8
Other Species	9
Environmental Conditions	9
Discussion	10
References	12
List of Table and Figures	13
Appendix I: Vessel Suitability Report	31
Appendix II Weekly Progress Reports	36

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Summary

This project tested the effectiveness of experimental gillnets in reducing the bycatch of loggerhead sea turtles (*Caretta caretta*) in the US monkfish gillnet fishery. Data were also collected on other sea turtle species interacting with the gear. The experimental gillnets were eight meshes deep (12" mesh) with 24" tie-downs at each float. These nets were compared with traditional, commercial gillnets (control) that were twelve meshes deep (12" mesh) with 48" tie-downs at every other float. A commercial fishing vessel (F/V Salvation), owned and operated by Charlie Locke, was contracted to conduct sea trials during February and March of 2017. An A.I.S., Inc. (AIS) observer, approved by NMFS in the capture and handling of sea turtles, was deployed onboard the vessel to collect operational, environmental, and biological data throughout the duration of the study. The two gillnet treatments were fished in pairs; each pair consisted of one control string (4 nets at 300 ft. per net) and one experimental string of the same number and length. The pair of nets was set close to each other, in the same direction, and on similar seafloor types. Comparable soak times were achieved by alternating the order of the first net hauled on each set between experimental and control throughout the duration of the study. The vessel completed 120 hauls, 60 control gillnets and 60 experimental nets, producing 60 pairs of comparable data.

There was no significant difference in the capture of loggerhead sea turtles between treatments. Fourteen loggerheads were captured in the control nets and eight were captured in the experimental nets resulting in a $P(T \leq t)$ one tail value of 0.125 and a $P(T \leq t)$ two tail value of 0.248 (see [Table 1](#)). It is interesting to note that during the first seven trips of the study, ten loggerhead turtles were captured in the control nets while none were captured in the experimental nets. During the final five trips of the study, eight loggerheads were captured in the experimental nets and four were captured in the control nets. The median surface temperature during the final five trips was 51.44° F as compared to a median surface temperature of 62.06° F when loggerheads were only captured in the control nets. [Figure 1](#) depicts these temperature differentials.

Introduction and Background

The Northeast Fisheries Science Center (NEFSC) estimated that from 2012-2016 the total bycatch of loggerhead sea turtles (*Caretta caretta*) in the gillnet fishery was approximately 705 (141 annually) turtles in the US Greater Atlantic Region (Murray 2018). The highest loggerhead bycatch occurred in the northern Mid-Atlantic from July to October in large mesh gear where monkfish or skate was the targeted species.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Because all sea turtles in US waters are listed under the Endangered Species Act (ESA) and bycatch in fisheries is a significant threat to these species, the NEFSC and Atlantic States Marine Fisheries Commission (ASMFC) collaborated to develop gear modifications to reduce the bycatch of sea turtles. In 2013, the NEFSC and the ASMFC sponsored a workshop with scientists and industry stakeholders to discuss gear modifications that could result in reducing sturgeon and sea turtle bycatch without significant reduction in the capture of targeted species, primarily monkfish (*Lophius americanus*) and winter skate (*Lophius americanus*). Based on studies that were conducted in coastal waters off New Jersey (Fox 2013) and southern Virginia (He and Jones 2013), it appeared that a low profile net was successful in reducing the bycatch of Atlantic sturgeon. Since no sea turtles were encountered in either study, it was not known if the low profile net configuration would reduce sea turtle bycatch. To test this hypothesis, the NEFSC developed this study in an area of high loggerhead abundance to focus on the bycatch of loggerhead sea turtles. Observed bycatch of sea turtles in the large mesh monkfish fishery were predominantly loggerhead, but other species, including Kemp's ridley (*Lepidochelys kempi*), have also been documented.

Project Goals and Objectives

The goal of the research was to assess the reduction of loggerhead sea turtle bycatch in the Mid-Atlantic large mesh gillnet fishery through design and tests of an experimental low profile gillnet.

The specific objectives were:

- Conduct sea trials using traditional commercial monkfish gillnets and experimental low profile gillnets in the southern Mid-Atlantic waters when sea turtles were known to be present to determine if there was a significant difference in the capture rate of loggerhead sea turtles in the two net configurations.
- Adhere to ESA permit, handle turtles according to procedures specified in 50 CFR 2223.206(d)(1)(i), tag and collect data on all sea turtles and sturgeon captured and minimize risk of injury or mortality.

Research Methods

All research methods were established by the NEFSC Protected Species Branch (PSB) and conducted under the guidance of PI Henry Milliken and CI Eric Matzen.

An Endangered Species Act (ESA) permit was obtained for the purpose of capturing and handling sea turtles in this study. On December 30, 2016, the final NMFS ESA Permit No. 17225 was issued to the NEFSC. The NEFSC also applied and received a Scientific and Educational Activity Permit (SECP) from the North Carolina Division of Marine

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Fisheries (NCDMF), which allowed the study to be conducted in North Carolina state waters; this increased the geographic area in which the study could be performed.

The project team consisted of the AIS project manager Rick Usher, biologists Henry Milliken and Eric Matzen of the NMFS NEFSC, and Charlie Locke, owner/captain of the F/V Salvation. It was agreed that the time period of March-April 2016 would allow the study to occur at a time when the bycatch of elasmobranchs would be reduced. This was important because the effort to remove the elasmobranchs would lengthen the time needed to haul the gear which could increase the likelihood of injury and mortality to the sea turtles. It is also a time when sea turtles are known to be present in the study area off Cape Hatteras, NC. The team discussed starting earlier than March if the water temperatures were warm enough for sea turtles to be in the area. To minimize the risk of sea turtle mortality, we used fewer nets per string than originally planned and reduced the soak time duration to one hour or less. The reduced soak time would also help avoid large catches of elasmobranchs. The original 10-14 net string was reduced to four nets per string. In the event that teleost/elasmobranch or sea turtle catch rates became too great and prevented hauling the nets within the one-hour soak time limit, consideration would be given to amending the study to using three nets per string.

A modified ESA Permit 17225-01 was issued that increased the number of incidental takes for all sea turtle species and sturgeon, which provided a sufficient number of incidental takes to complete the number of hauls scheduled for this study and any potential future studies. This ESA permit covers multiple projects.

Gear Design

The control nets were commercial monkfish gillnets typical to those used in the Mid-Atlantic region. They were 300 feet long, 12 meshes deep, and made of 0.90 mm diameter, 12” stretched mesh size, green nylon monofilament netting. The headrope was made of 3/8” polypropylene (PP) ropes with standard gillnet floats spaced every 12’. The footrope consisted of 75 lbs. per 600’ lead line. Tie-down lines (48” in length) were spaced every 24’ (see [Figure 2](#)). The control net’s characteristics (tie downs, float spacing, netting diameter, mesh size, etc.) were the same as what has been and is currently used in the Mid-Atlantic commercial monkfish gillnet fishery. The experimental gillnet was exactly the same as the control net in terms of netting materials, headrope, and footrope, but was 8 meshes deep instead of 12 meshes. In addition, tie-down lines in the experimental nets were spaced every 12’ and were 24” in length, instead of 48” (see [Figure 3](#)). The tie-down lines were on every float in the experimental nets while they were on every other float in the control nets. Each string of gear contained four panels of the same type (control or experimental). Each comparison contained one string of four control net panels and one string of four experimental net

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

panels. All control and experimental gillnets (including spare nets) were supplied by NOAA Fisheries, NEFSC.

Sea Trials

Sea trials were conducted in the coastal waters southeast of Cape Hatteras, NC between February 18, 2017 and March 24, 2017 onboard the F/V Salvation. The F/V Salvation was inspected by AIS Project Manager Kathryn Roy prior to the start of the sea trails to ensure there was adequate protected species sampling space and sufficient net hauling capabilities, as well as a valid USCG Fishing Vessel Safety Decal and appropriate safety equipment that met the requirements for the Northeast Fisheries Observer Program (NEFOP). The vessel specifications and description are contained in a vessel suitability report submitted to Henry Milliken in January 2017 (see [Appendix 1](#)). The F/V Salvation is a custom built, 32' fiberglass over wood V-hull. The five gross ton vessel has a 10' beam, 2' draft and is powered by a 250 horsepower Honda four stroke outboard engine mounted on a stern bracket. The vessel was designed by Glenn Bradley of Wanchese, NC to fish and navigate the shallow inlets and coastal waters of North Carolina. The vessel has an aft steering station. The net reel is positioned on the bow and utilizes a stainless steel roller overhanging the bow to haul gillnets.

The captain/owner of the F/V Salvation, Charlie Locke, has empirical knowledge of the North Carolina coastal fisheries and the locations where sea turtles are commonly found throughout the inshore waters off Cape Hatteras, NC. Capt. Locke has extensive collaborative research experience and has demonstrated a commitment to reducing bycatch in the commercial gillnet fisheries.

Several meetings with all project participants were held to ensure that the observer, captain and crew understood the scope, goals, ESA permit requirements, and protocols (including regulatory) of the project. A final meeting was held on January 11, 2017 and the project timeline, gear configuration, hauling time requirements, area for the project, reporting, sampling and data requirements were discussed and finalized. The project commenced with the first trip on February 18, 2017 and ended with the final trip completed on March 24, 2017. Sixty hauls each of the control and experimental gear were completed during the twelve trips. The trip identification numbers, date of trip, and the number of hauls for each type of gear are summarized in [Table 2](#).

Based on his years of fishing experience, Capt. Locke chose several locations that would provide bottom contours and water temperatures where it would be likely to encounter loggerhead sea turtles to test the nets. The areas selected to deploy the nets were determined based on discussions with Capt. Locke who was familiar with the area south of Cape Hatteras, both nearshore and further offshore. The majority of the hauls occurred along an area of hard bottom south of Diamond Shoals depicted on NOAA nautical chart

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

11555 as a fish haven in the vicinity of N 35° 08' and W 75°39'. According to Capt. Locke there are railroad cars sunk there to form an artificial reef that were adjacent to natural hard bottom. This area is known to be frequented by sea turtles during the late winter and early spring. Sea turtles were frequently observed on the surface during the sea trials.

The control and experimental nets were set alternately to allow each treatment to have an equal soak time. The ESA permit required that all gillnets soak a maximum of one hour to prevent any sea turtle or other protected species mortality. Because of the concern that the net might encounter large numbers of elasmobranchs, the first net of each pair was only allowed to soak approximately 20 minutes before beginning to haul it back to allow enough time to haul back the second gear within the one-hour soak time and to assess the number of elasmobranchs in the area. Both the control and experimental strings were set in close proximity to the other, along similar bottom structure and contour to allow an equal opportunity to encounter sea turtles. Generally, areas were fished depending on sea state, water clarity, water temperature, and visual abundance of sea turtles at the surface. Sea states of less than 3 feet were preferred to facilitate handling the captured turtles and sea surface temperatures above 60° F were selected if the temperatures varied in the area being fished. The nets were fished both in North Carolina state waters and in the Exclusive Economic Zone (EEZ) outside the 3-mile state water line. The inshore depths ranged from 30' - 49' [mean = 41.5'] and the offshore depths ranged from 58' - 76' [mean = 69.25']. The locations for each set are depicted in [Figure 4](#). Prior to setting any of the study gillnets in state waters, the NCDMF was notified via e-mail or phone call to ensure compliance with the SECP.

The number of pairs hauled each day varied from one to seven. The day that only one pair was hauled (trip was aborted) was due to exceeding the take limit of Kemp's ridley sea turtles. On the first trip of the study, two Kemp's ridley turtles were captured and the first set on the following day four loggerhead turtles and one Kemp's ridley were captured so the project was put on standby until a revised ESA permit was issued, to ensure the permit's incidental takes were not exceeded. The average number of paired hauls per day for the study was five.

Sampling and Data Collection

AIS provided an experienced NMFS approved Protected Species Observer (PSO) to collect the data onboard the F/V Salvation. Ms. Kerry Lyons completed all of the trips during the project. Ms. Lyons has 5 years experience working on projects involved with the capturing and handling of sea turtles and other protected species. She was approved for the project and listed as a Co-Investigator on the ESA Permit 17225-01. Co-

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Investigator Eric Matzen was also onboard for the first three trips to monitor the study protocols and to assist with sea turtle sampling.

The following data were collected for each haul:

- Trip number, haul number and date
- Gear type (experimental or control)
- Wind speed and direction
- Water depth at beginning and end of haul
- Soak duration
- Surface temperature, salinity and dissolved oxygen using a YSI meter
- Begin and end time, as well as longitude and latitude for setting and hauling each string
- Number of nets per string and set method
- Number of teleost and elasmobranch species captured for each haul
- Visual observation of water clarity

Additionally, if a sea turtle or Atlantic sturgeon take was encountered in the haul the following information was collected:

- Entanglement description and location within the net
- Protected Species ID number and species name
- Scanned for pit tag and pit tag number detected or inserted
- All measurements as required by NMFS NEFOP observer protocols
- https://www.nefsc.noaa.gov/fsb/manuals/2016/Operations_Manual.pdf page 101
- For sea turtles: dorsal color, vertebral, lateral and infra-marginal scute counts, whether it had 1 pair of pre-frontals, and presence/absence of overlapping scutes
- Skin biopsies were taken according to NMFS protocols

Comments regarding sea turtle behavior on deck, reflex tests, shell, skin, flipper, and head condition, as well as behavior at release were recorded. This study occurred outside of the fishing grounds for monkfish because the rate of capture in the fishery is low and enough samples would require a level of effort beyond our capability and financial resources. This gear has been tested for catch retention and shown to retain an acceptable level of targeted catch studies (Fox 2013 & He and Jones 2013). Because the focus of the study was to determine the capture rate of the experimental versus the control (traditional commercial) net for sea turtles, the observer did not collect weight and length data of the fish and elasmobranchs captured. Rather, a tally count of these species was kept.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

For all captured sea turtles, photos were taken of the head, dorsal view, ventral view (if possible), any injuries or unique identifying characteristics, and a photo with a project identification number and scaling. Each turtle was scanned with a PIT tag scanner and if a PIT tag was located, the number was recorded along with any other tags presents (flipper, satellite, etc.). If no PIT tag was located then the observer inserted one. All sea turtles were also tagged with Inconel tags on their hind flippers (one on each) and the numbers recorded according to NMFS protocols. The sea turtle tagging information is summarized in [Table 3](#).

Progress Reports

Weekly project reports summarizing the trips during that period were prepared and provided to the Principal Investigator, Henry Milliken. The reports summarized the catch and incidental take data collected, other pertinent information, and any problems encountered. Additionally, there was frequent communication via telephone calls to the PI for guidance and to discuss any problems encountered to ensure progress was achieved as planned. The weekly progress reports are located in [Appendix III](#).

Data Management

During and after the completion of each trip, the data collected were recorded in a NMFS-approved data sheet on a haul-by-haul basis and after each trip, the data collector reviewed their data for accuracy and submitted it to the AIS Project Manager (PM). The PM reviewed the data for missing or suspect information, and worked with the data collector to resolve any issues. Following the completion of the final trip, all data sheets were delivered to NMFS for data entry and analysis. The completed sheets were then scanned and attached as separate files with this report. A haul-by-haul summary of each trip is contained in [Table 4](#).

Data Analysis

The study's goal was to evaluate the effectiveness of the low profile gillnet on the bycatch of loggerhead sea turtles to determine if their capture rates were reduced. The data analysis focused on loggerheads and did not include incidental captures of Kemp's ridley sea turtles. Comparison data analysis was performed on capture rates between the control and experimental gillnets, bottom and surface temperatures, depth of sets, soak duration and wind speeds to determine what factors may have influenced the capture of the sea turtles.

One-tailed and two-tailed paired t-tests were performed on the captures of loggerheads between the experimental and control nets. The data analysis focused on loggerheads. Six captures of Kemp's ridley sea turtles occurred with three in the control and three in the experimental gear. Because loggerheads are the predominant bycaught species, we

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

focused on analyzing the loggerhead takes. Loggerhead captures occurred in 17 pairs during the course of the study. Additionally, box and whisker plots were developed showing the median, first and third quartiles and the range (whiskers). The loggerhead captures were plotted to assess effects of surface and bottom temperature as well as depth.

Results

There was very little variation in soak time between the control and experimental nets, as can be seen in [Figure 5](#). The median soak time for the control net was 32 minutes (total of 2106 min. for the study) and for the experimental net was 33 minutes (total of 2133 min. for the study). The mean depth for the two test nets was the same, with the mean depth of the control and experimental net being 68' (see [Figure 6](#)).

The median surface temperature when loggerhead turtles were captured was 62.06°F in the control net and 51.44°F in the experimental net. The median bottom temperature when loggerhead turtles were captured was 61.96°F for the control net and 56.76°F for the experimental net. This trend indicates that as temperatures were warmer, less turtles were encountered in the experimental nets. This may be attributed to the loggerhead turtles avoiding the cooler bottom temperature and navigating higher in the water column. During the times that loggerheads were captured in the lower profile experimental nets the bottom temperature was the same or warmer than the surface temperature (see [Figure 1](#)).

Catch and Bycatch – General Description

The majority of all teleost and elasmobranch species captured during this study were released unless they were commercially valuable and could be landed under the federal and state permits registered to the F/V Salvation. Due to the short soak duration, the catch rates were generally low except on trip number 008 on haul number 004 when 21 large black drum were captured, the majority of which were above the legal landing size of 25". The following species were encountered during the study; angel sharks, clearnose skates, cownose rays, sand tiger sharks, butterfly rays, blacknose sharks, nurse sharks, stingrays unknown, southern rays, tiger shark, and false albacore.

Sea Turtle Bycatch

A total of 28 sea turtles were caught in the 120 gillnet sets during the study, 22 of which were loggerhead and 6 were Kemp's ridley. The locations of the sea turtle captures are depicted in [Figure 7](#). All sea turtles were captured alive and released unharmed with no noticeable injuries. Nine of the 22 loggerhead turtles that were encountered in the study

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

were brought aboard and had both PIT and Inconel flipper tags applied. Two of those also had satellite tags attached to their dorsal carapace by the CI. The other 13 loggerhead turtles fell out of the gear before they could be handled by the crew. This is attributable to the weight of some of the large loggerheads since the monofilament meshes parted as they were brought out of the water. The loggerheads that could be brought on board had carapaces that ranged from 67 cm to 79 cm, and some of the specimens that fell out of the net were significantly larger. Others were only lightly entangled by a flipper through a mesh and fell out of the net as soon as it exited the water. All six Kemp's ridley turtles (notch to tip length 37.9-53 cm) were brought onboard and had both PIT tags and Inconel flipper tags applied to them.

Fourteen of the 22 loggerhead turtles encountered were captured in the control net and eight were captured in the experimental net. A one tailed paired T-Test on the sets where at least one turtle was captured in the pair, showed that this difference (43% reduction) was not significant [$P(T \leq t) = 0.166$]. The six Kemp's ridley turtles were evenly caught by both net configurations, with three in each the control and experimental nets.

Go Pro cameras were attached to four of the control nets and five of the experimental nets during the study in an attempt to capture any sea turtle interactions. This was done randomly (*ad hoc*) when time allowed, and no specific protocol for placement on the net was followed. No sea turtles were captured on the videos but the video did show the variability in visibility on different days.

Other Species

The only other protected species captured during the study were two Atlantic sturgeon and both were caught in the control net. The sturgeon that was brought onboard was sampled and released alive and the other fell out of the net. It initially floated but then recovered and swam away.

Environmental Conditions

All of the hauls during this study were set and hauled on days with wind speeds averaging 15 knots or less and in sea states of 3' or less. The median wind speed when hauling the control gear was 11 knots and 11.75 knots when hauling the experimental gear. [Figure 8](#) compares the wind speeds of the two treatments. Wind and sea conditions greater than 15 knots and 3' would have made handling the sea turtles difficult and would have increased the potential of injury to turtles and/or biologists/crew that were handling and sampling the turtles. The sea surface temperatures ranged from 50.18°F to 71.60°F (see [Figure 9](#)). Bottom temperatures ranged from 40.37°F to 69.76°F (see [Figure 10](#) and [Figure 11](#)). These temperature fluctuations indicate the dynamics of the hydrology in the area fished during this time of year and the influence of the Gulf Stream. Salinity ranged

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

between 32 ppt and 38 ppt and the surface dissolved oxygen ranged between 6.9 mg/l to 12.8 mg/l.

Discussion

The study's results suggest that when sea surface temperature is warmer than the bottom temperature, the likelihood of the low profile gillnet capturing loggerhead sea turtles was low, as none were taken when this occurred. Conversely, all the captures in the low profile gillnet occurred when the bottom temperatures were warmer than the sea surface temperatures. As this study did not occur in the monkfish fishing areas, due to the need to capture turtles, its conservation benefit is unknown. Yet, because the bottom temperatures are usually colder than the surface temperatures in the fishing grounds of the offshore monkfish fishery, this study suggests that the low profile gillnet deserves more evaluation to assess if it has a conservation benefit in the offshore monkfish fishery. This work was intended as a pilot study to determine if there was any potential conservation benefit for sea turtle bycatch in the monkfish fishery. From these results, it is clear that the low profile gillnet design deserves more study as it could be a potential gillnet design that could mitigate loggerhead sea turtle captures.

The study raised many questions about what may have affected the catch rates of sea turtles in both of the gears tested. Since the study did not mimic the traditional methods for gillnet gear fished in the Mid-Atlantic monkfish gillnet fishery, the results may not be comparative to any previous studies conducted with these gears. To ensure the soak time restrictions (no greater than one hour) described in the ESA permit were followed; only one pair of nets was set at a time. In the Mid-Atlantic monkfish fishery soak times are much greater, generally between 24 and 96 hours, and nets are fished in more varied weather conditions. There were also concerns that if the catch rate of sharks and rays in any of the sets was very large it would be difficult to meet the one hour maximum soak time duration (due to removing the catch from the net), especially if both nets had large catches. There is no prior data on bottom set 12" gillnet mesh size in this area and the possibility of encountering schools of migrating elasmobranchs. Therefore, the first net of each pair was allowed to soak approximately 20 minutes before beginning to haul it back to allow enough time to haul back the second gear within the one-hour soak time. Going forward it may be beneficial to set some test hauls prior to the start of the project to get a better feel for the potential species that may be encountered and their relative abundance. This would allow researchers to better determine the soak time (to get closer to a one hour soak time) and get comfortable with the study protocols. The median soak time for the control net during the study was 32 minutes and the average experimental net soak time was 33 minutes.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

GoPro cameras were attached to some of the nets to attempt to capture a turtle entanglement on video. As the study progressed, the video revealed significant variations in visibility due to the fluctuations of the waters that were encountered in the study region. The area is close to where Gulf Stream waters push over the shallow waters just south of Cape Hatteras and meet the turbid, less saline waters exiting Pamlico Sound. For this reason, the visibility was highly variable from day to day. Although we do not know for sure, as turbidity was not measured, there could be a correlation between turbidity and visibility and the number of sea turtles encountered in the nets. Using GoPro cameras on every set to determine visibility may be beneficial for future studies as there also may be a difference in visibility between the surface and the bottom due to the thermocline or halocline. If visibility is thought to be a significant factor in sea turtles avoiding gillnets, a study could be conducted to test 104 mm monofilament nets versus 90 mm of the same configuration. The 104 mm net should be more visible due to the increased diameter of the monofilament netting as studies have shown that loggerhead sea turtles use vision to forage (Narazaki et al. 2013). Consideration to testing the nets at night may also provide further data to the effect of visibility on capture rate of sea turtles. The current study was conducted when the wind was primarily below 15 knots, which may have created a bias, as turbidity tends to increase in this shallow water region as sea state increases. Water clarity for this study was only based on observer observations. If further studies are conducted, a turbimeter/turbid sensor or secchi disc would be advised. A turbimeter may be preferred so measurements can be recorded at the surface and near the bottom where the net is located. No sea turtles were captured in any of the video collected during this study.

Another way to minimize the potential biased effect of visibility would be to alternate the gear set (experimental and control) on the first haul of each day. There was lower visibility at that time due to the angle of the sun in the early morning. During this study, the control net was set first on nine of the 12 fishing days. Going forward, it would be recommended to alternate this as evenly as possible. A further recommendation, that would be beneficial for future studies, would be to limit the number of paired sets to a maximum of five per day (10 hauls) to better distribute the fishing effort over a longer period if by-catch of elasmobranchs or teleost species was not excessive.

During the survey, 13 of the 22 loggerhead turtles that were entangled in the nets fell out prior to being able to get the turtle onboard and sampled. This was primarily due to the gillnet meshes breaking under the weight of the large loggerhead turtles. In any potential future studies, and if it is desired to sample as many of the sea turtles as possible, the use of a long handled dip net would potentially increase the number of turtles brought aboard. The majority of the turtles that fell out were within 10 feet of the vessel as the meshes broke when turtles were being lifted from the water. Since collecting as much data on sea

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

turtles as possible is advantageous, using a dip net to enhance safe capture of turtles that fall out of the net near the vessel should be considered to increase the ability to tag these turtles that would otherwise swim away.

Finally, although not amenable to statistical analysis, the apparent shift of bycatch from control to experimental nets between the two time periods is interesting. A shift in bottom temperature occurred between the two periods as well. If the apparent shift in bycatch represents a real behavioral difference, and if that behavioral difference is linked to bottom temperature, then it would be important to test this net design in the areas where it is intended to be used. This would ensure that any temperature or other effects on turtle behavior would be appropriately captured in the experimental design.

References

He P, Jones N. 2013. Design and Test of a Low Profile Gillnet to Reduce Atlantic Sturgeon and Sea Turtle Bycatch in Mid-Atlantic Monkfish Fishery. [Final Report; 40 p.] NOAA NMFS Contract No. EA133F-12-SE-20

Fox, DA, Armstrong JL, Brown LM, Wark K. 2013. Year Three, the Influence of Sink Gillnet Profile on Bycatch of Atlantic Sturgeon in the Mid-Atlantic Monkfish Fishery. [Report; 27 p.] NOAA NMFS Contract No. EA-133F-12-RQ-0697.

Tomoko Nagasaki , Katsufumi Sato, Kyler J. Abernathy, Greg J. Marshall, Nobuyuki Miyazaki Loggerhead Turtles (*Caretta caretta*) Use Vision to Forage on Gelatinous Prey in Mid-Water (PLOS One 2013)

List of Table and Figures

List of Tables

Table 1. Paired t-test on loggerhead captures between Experimental and Control.	14
Table 2. Trip Summary Table	15
Table 3. Summary of Sea Turtles Data and Tags	16
Table 4. Haul-by-Haul Data Summary	17
Table 5. Sea Turtle Incidental Take Table	21

Table of Figures

Figure 1. Surface and Bottom Temperature Differentials. Plot of captures by date and differential between surface and bottom temperature. Captures above the line show captures when the surface temperature is greater than the bottom temperature.....	22
Figure 2. Specifications and Rigging of Control Gear.....	23
Figure 3. Specifications and Rigging of Experimental Gear.....	23
Figure 4. Set locations of experimental and control gear.....	24
Figure 5. Box and whisker plot (1st and 3rd quartiles, median, and range) of the soak duration of all experimental and control gillnet sets.	25
Figure 6. Box and whisker plot (1st and 3rd quartiles, median, and range) of the depth of all sets for the experimental and control gillnets.	26
Figure 7. Locations of hauls and takes for sea turtles encountered in the study.....	27
Figure 8. Box and whisker plot (1st and 3rd quartiles, median, and range) of recorded wind speed when loggerheads were captured in the respective gear.....	28
Figure 9. Box and whisker plot (1st and 3rd quartiles, median, and range) of recorded surface temperatures when loggerhead captures.....	29
Figure 10. Box and whisker plot (1st and 3rd quartiles, median, and range) of bottom temperature by gear type when <i>loggerheads</i> were captured.	30

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Table 1. Paired t-test on loggerhead captures between Experimental and Control.

t-Test: Paired Two Sample for Means: Alpha = 0.05

Analysis only used pairs where one treatment caught a turtle

	<i>Experimental</i>	<i>Control</i>
Mean	0.411764706	0.823529412
Variance	0.257352941	1.029411765
Observations	17	17
Pearson Correlation	-0.7	
Hypothesized Mean Difference	0	
df	16	
t Stat	1.198289379	
P(T<=t) one-tail	0.124126685	
t Critical one-tail	1.745883676	
P(T<=t) two-tail	0.248253369	
t Critical two-tail	2.119905299	

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Table 2. Trip Summary Table

Trip ID	Date	Personnel onboard	# of Control Strings Set	# of Nets / String	# of Experimental Strings Set	# of Experimental Nets / String	Comments
001	2/18/2017	Charlie Locke, Rhomsey Alwar, Eric Matzen, Kathryn Roy, Kerry Lyons	2	4	2	4	butterfly ray
002	2/19/2017	Charlie Locke, Rhomsey Alwar, Eric Matzen, Kathryn Roy, Kerry Lyons	1	4	1	4	nurse shark, cownose ray, blacknose shark, angel shark
003	2/23/2017	Charlie Locke, Rhomsey Alwar, Eric Matzen, Kerry Lyons, Rick Usher	8	2	8	2	On the previous day it was decided to reduce each string to 3 nets. The mate accidentally removed 2 nets from the experimental gear and this was not verified until after the first haul so on haul # 1 the control had 3 nets and the experimental gear had 2 nets. The control string was reduced to 2 nets for the remainder of the day so the gear would be fishing equally. By-catch cownose rays, sand tiger sharks, angel sharks, sting ray
004	2/27/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	7	3	7	3	By-catch butterfly ray, angel sharks, southern ray, cownose ray
005	2/28/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	4	3	4	3	By-catch southern ray
006	3/9/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	8	3	8	3	By-catch butterfly rays, southern rays, cownose rays, sand tiger shark
007	3/11/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	6	3 for 3 sets and 4 for 3 sets	6	3 for 3 sets and 4 for 3 sets	On the previous day it was decided to return to 4 panels strings if time allowed. After 3 sets with 3 panel strings, one more panel was added to both treatments. By-catch angel sharks, cownose ray, clearnose skate, sand tiger shark. 2 Atlantic Sturgeon were caught on haul # 05
008	3/12/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	3	4	3	4	By-catch angel shark, southern ray, cownose ray, black drum (large catch of large black drum)
009	3/17/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	7	4	7	4	By-catch angel shark, southern ray, cownose ray, sand tiger shark, butterfly ray
010	3/20/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	4	4	4	4	By-catch angel shark, sand tiger shark, southern ray, butterfly ray, cownose ray
011	3/21/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	4	4	4	4	By-catch tiger shark, sand tiger shark, angel shark
012	3/24/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	6	4	6	4	By-catch angel sharks, sand tiger sharks, false albacore, cownose ray, clearnose skate
Totals			60	4	60	4	

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Table 3. Summary of Sea Turtles Data and Tags

Date	Trip#	Haul	Set time	Gear	ID	Species	Bio Sample Obtained	Pit tag number	Flipper (Iconel) tag #'s (LEFT/RIGHT)	Notch to tip length (cm)	Notch to notch (cm)	Width (cm)	Comments
2/18/2017	001	002	6:59	Experimental	LK01	Kemps Ridley	Yes	4369755C3C	EEZ788/EEZ799	38.2	37.6	40	dove and swam, released alive
2/18/2017	001	003	8:24	Experimental	LK02	Kemps Ridley	Yes	436750080F	LLC633/LLC625	45	44.3	44	dove and swam, released alive
2/19/2017	002	001	6:51	Control	CC03	Loggerhead	Yes	436A11023A	EEZ790/EEZ791	68.4	67	66	dove and swam, released alive
2/19/2017	002	001	6:51	Control	LK04	Kemps Ridley	Yes	436779522E	LLC627/LLC628	44	43.1	45	dove and swam, released alive
2/19/2017	002	001	6:51	Control	CC05	Loggerhead	Yes	4367670574	LLC629/LLC630	67	68.5	65	dove and swam, released alive
2/19/2017	002	001	6:51	Control	CC06	Loggerhead	Yes	436A076916	LLC636/LLC637	69	66.7	64	dove and swam, released alive
2/19/2017	002	001	6:51	Control	CC07	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
2/23/2017	003	002	7:01	Control	CC08	Loggerhead	Yes	4349412F2B	MMJ101/EEZ793	76	75.5	71.1	dove and swam, released alive
2/27/2017	004	002	6:49	Control	CC09	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
2/27/2017	004	006	8:57	Control	CC10	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
2/27/2017	004	010	11:07	Control	CC11	Loggerhead	Yes	436802613F	MMJ106/MMJ107	76.5	74.5	73	dove and swam, released alive
2/27/2017	004	011	12:12	Control	CC12	Loggerhead	Yes	43490B3358	LLC634/LLC635	79	78.5	76.1	dove and swam, released alive
3/9/2017	006	001	7:44	Control	CC13	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
3/11/2017	007	001	7:22	Control	LK14	Kemps Ridley	Yes	436801414F	LLC632	37.9	36.7	38	only right flipper tagged due to injury on left flipper, dove and swam, released alive
3/11/2017	007	011	12:59	Experimental	LK15	Kemps Ridley	Yes	43490A5102	MMJ110,MMJ111	42.5	42	42.4	dove and swam, released alive
3/11/2017	007	012	13:03	Control	LK16	Kemps Ridley	Yes	43672E282A	MMJ112,MMJ113	53	52	52.5	dove and swam, released alive
3/12/2017	008	002	5:35	Experimental	CC17	Loggerhead	Yes	43492A3929	MMJ114,MMJ115	77	75	71	dove and swam, released alive
3/17/2017	009	009	12:09	Experimental	CC18	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
3/20/2017	010	004	12:35	Control	CC19	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
3/20/2017	010	004	12:35	Control	CC20	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
3/20/2017	010	007	14:58	Experimental	CC21	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
3/21/2017	011	002	7:35	Experimental	CC22	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
3/21/2017	011	003	8:41	Experimental	CC23	Loggerhead	Yes	434A375840	MMJ126,MMJ127	74.5	72.5	71.6	dove and swam, released alive
3/21/2017	011	005	9:54	Control	CC24	Loggerhead	Yes	436A2F0667	MMJ128,MMJ129	74.6	72.7	68.5	dove and swam, released alive
3/21/2017	011	006	9:59	Experimental	CC25	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
3/21/2017	011	007	11:04	Experimental	CC26	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
3/24/2017	012	005	10:02	Control	CC27	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive
3/24/2017	012	010	12:28	Experimental	CC28	Loggerhead	No	N/A	N/A	N/A	N/A	N/A	fell out of gear, didn't come aboard, dove and swam, released alive

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Table 4. Haul-by-Haul Data Summary

Date	Trip #	Haul	Set time	Gear	Soak Duration (min)	Depth (ft)	Set Latitude	Set Longitude	Wind Speed (nm/hr)	Wind Direction	# Nets	Surface Temp (°C)	Surface Temp (F)	Top Logger	Mid Logger	Bottom Logger	Salinity (ppt)	Dissolved Oxygen (mg/l)	Species name	Species number	Comments
2/18/2017	001	001	0648	Control	29	63	35 07 48	75 40 24	12	225	4	14.5	58.1				35	9.2			No catch.
2/18/2017	001	002	0659	Experimental	39	60	35 07 48	75 40 6	12	225	4	14.5	58.1	60.368	60.602	62.33	35	9.2	Butterfly Ray	1	
2/18/2017	001	003	0824	Experimental	26	58	35 08 42	75 38 42	12	225	4	14.3	57.74	60.152	60.818	61.016	34	10			No catch.
2/18/2017	001	004	0829	Control	43	57	35 08 42	75 38 24	12	225	4	14.3	57.74				34	10			No catch.
2/19/2017	002	001	0651	Control	29	68	35 07 18	75 39 18	10-15		4	16.7	62.06				35.7	9.6	Nurse Shark, Cownose Ray, Angel	1,3,2,1	
2/19/2017	002	002	0659	Experimental	44	67	35 07 24	75 39 0	10-15	230	4	16.7	62.06	62.096	62.042	62.006	35.7	9.6	Angel Shark	1	Noticed one net was 0.8,
2/23/2017	003	001	0656	Experimental	24	74	35 06 42	75 39 24	5-8	180	2	17.7	63.86	63.752	62.132	60.584	36	9.1	Angel Shark	1	loggerheads and kemps at surface; 2 nets accidentally
2/23/2017	003	002	0701	Control	31	70	35 06 48	75 39 24	5-8		3	17.7	63.86				36	9.1	Sting Ray unk	1	3 nets for this haul only, 1 removed next haul to match 2 nets on experimental gear for the day. On the previous day it was decided to reduce each string to 3 nets. The mate accidentally removed 2 nets from the experimental gear and this was not verified until after the
2/23/2017	003	003	0804	Control	29	71	35 07 0	75 39 30	5-8	180	2	17.7	63.86				36	9.1	Angel Shark	1	
2/23/2017	003	004	0809	Experimental	37	71	35 07 6	75 39 24	5-10	180	2	17.7	63.86	63.5	62.15	61.106	36	9.1			No catch.
2/23/2017	003	005	0906	Experimental	24	67	35 07 0	75 39 18	5-10	180	2	17.7	63.86	63.644	62.24	61.448	36	9.1	Sand Tiger Shark	1	Large rip in first net (~20ft hole)
2/23/2017	003	006	0910	Control	36	67	35 07 6	75 39 18	5-10	180	2	17.6	63.68				36	9.1	Sand Tiger Shark	2	Go Pro on net.
2/23/2017	003	007	1009	Control	27	73	35 06 30	75 39 12	5-10	180	2	17.6	63.68				36	9.1			No catch. Clear water/good vis. One loggerhead seen at surface.
2/23/2017	003	008	1012	Experimental	34	71	35 06 36	75 39 12	5-10	180	2	17.6	63.68	63.284	61.88	60.782	36	9.1			No catch. Go Pro on net.
2/23/2017	003	009	1104	Experimental	26	74	35 06 30	75 39 36	5-10	180	2	17.4	63.32	63.284	61.736	60.998	36	9.1			No catch.
2/23/2017	003	010	1107	Control	32	74	35 06 36	75 39 36	5-10	180	2	17.4	63.32				36	9.1			No catch.
2/23/2017	003	011	1157	Control	25	70	35 06 48	75 39 42	5-10	180	2	17.4	63.32				36	9.1			No catch. Go Pro on net.
2/23/2017	003	012	1202	Experimental	34	70	35 06 54	75 39 36	5-10	180	2	17.4	63.32	63.032	61.574	60.944	36	9.1			No catch.
2/23/2017	003	013	1256	Experimental	27	65	35 08 6	75 40 54	5-10	180	2	17.3	63.14	63.194	62.276	62.15	36	9.1			No catch. Loggerhead seen at
2/23/2017	003	014	1300	Control	36	64	35 08 6	75 40 48	5-10	90	2	17.3	63.14				36	9.1			No catch.
2/23/2017	003	015	1351	Control	27	65	35 08 0	75 40 30	5-10	90	2	17.3	63.14				36	9.1			No catch.
2/23/2017	003	016	1355	Experimental	35	65	35 08 6	75 40 36	5-10	90	2	17.3	63.14	62.88	61.79	61.79	36	9.1	Cownose Ray	1	Go Pro on net.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Haul by Haul Data Summary continued

Date	Trip #	Haul	Set time	Gear	Soak Duration (min)	Depth (ft)	Set Latitude	Set Longitude	Wind Speed (nm/hr)	Wind Direction	# Nets	Surface Temp (°c)	Surface Temp (f)	Top Logger	Mid Logger	Bottom Logger	Salinity (ppt)	Dissolved Oxygen (mg/l)	Species name	Species number	Comments
2/27/2017	004	001	0644	Experimental	29	62	35 08 12	75 40 36	5-10	180	3	20.7	69.26	69.386	67.28	66.578	35	8.1			No catch. Clear water/good vis. Loggerhead seen at surface.
2/27/2017	004	002	0649	Control	36	64	35 08 6	75 40 42	5-10	180	3	20.7	69.26				35	8.1	Angel Shark, Cownose Ray	1,1	Clear water/good vis. Portuguese Man of War seen at surface.
2/27/2017	004	003	0745	Control	30	66	35 08 0	75 40 36	5-10	180	3	20.7	69.26				35	8.1			No catch. Clear water/good vis.
2/27/2017	004	004	0751	Experimental	39	63	35 08 12	75 40 42	5-10	180	3	20.7	69.26	70.754	69.566	67.802	35	8.1			No catch. Clear water/good vis.
2/27/2017	004	005	0852	Experimental	32	68	35 07 6	75 39 6	5-10	180	3	21.7	71.06	70.772	69.89	68.774	35	8.1	Southern Ray	1	Clear water/good vis.
2/27/2017	004	006	0857	Control	41	68	35 07 0	75 39 12	5-10	180	3	21.7	71.06				35	8.1	Angel Shark, Southern Ray	1,1	Clear water/good vis.
2/27/2017	004	007	0957	Control	31	69	35 06 54	75 39 30	7-10	140	3	21.7	71.06				35	8.1			No catch. Clear water/good vis. Loggerhead seen at surface.
2/27/2017	004	008	1001	Experimental	41	70	35 06 48	75 39 30	7-10	140	3	21.7	71.06	71.258	71.15	69.116	35	8.1	Southern Ray	1	Clear water/good vis.
2/27/2017	004	009	1102	Experimental	30	72	35 06 30	75 39 12	7-10	140	3	22	71.6	71.438	70.934	68.954	35	8.1			No catch. Clear water/good vis.
2/27/2017	004	010	1107	Control	38	71	35 06 30	75 39 18	7-8	140	3	22	71.6				35	8.1	Angel Shark, Butterfly Ray	1, 1	Loggerhead seen at surface.
2/27/2017	004	011	1212	Control	30	71	35 06 36	75 39 30	10-12	50	3	22	71.6				35	8.1	Southern Ray	1	Clear water/good vis.
2/27/2017	004	012	1218	Experimental	44	71	35 06 30	75 39 36	10-12	50	3	22	71.6	71.546	69.908	69.224	35	8.1			No catch. Clear water/good vis.
2/27/2017	004	013	1318	Experimental	29	69	35 06 36	75 39 36	10-12	50	3	22	71.6	69.908	67.19	66.902	35	8.1			No catch. Clear water/good vis.
2/27/2017	004	014	1323	Control	39	69	35 06 42	75 39 42	10-12	50	3	22	71.6				35	8.1	Butterfly Ray	1	Clear water/good vis.
2/28/2017	005	001	0646	Control	30	67	35 08 0	75 40 36	5-10	180	3	20.8	69.44				36	8.4			No catch. Strong current. Loggerhead seen at surface.
2/28/2017	005	002	0651	Experimental	40	61	35 08 12	75 40 30	5-10	180	3	20.8	69.44	69.8	69.44	67.604	36	8.4			No catch. Strong current.
2/28/2017	005	003	0750	Experimental	30	66	35 08 12	75 40 54	10-12	230	3	20.8	69.44	68.954	69.008	68.036	36	8.4	Southern Ray	1	Strong current.
2/28/2017	005	004	0754	Control	42	64	35 08 18	75 40 48	10-12	230	3	20.8	69.44				36	8.4			No catch. Strong current.
2/28/2017	005	005	0857	Control	29	66	35 08 6	75 40 54	10-12	230	3	20.9	69.62				36	8.4			No catch. Strong current.
2/28/2017	005	006	0901	Experimental	41	66	35 08 6	75 40 42	10-12	230	3	20.9	69.62	69.728	69.026	67.892	36	8.4			No catch. Strong current.
2/28/2017	005	007	1004	Experimental	29	60	35 08 54	75 41 30	10-15	230	3	19.6	67.28	67.622	67.964	67.73	36	8.4			No catch. Strong current.
2/28/2017	005	008	1008	Control	40	60	35 09 0	75 41 24	10-15	230	3	19.6	67.28				36	8.4			No catch. Strong current.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Haul by Haul Data Summary continued

Date	Trip #	Haul	Set time	Gear	Soak Duration (min)	Depth (ft)	Set Latitude	Set Longitude	Wind Speed (nm/hr)	Wind Direction	# Nets	Surface Temp (°C)	Surface Temp (f)	Top Logger	Mid Logger	Bottom Logger	Salinity (ppt)	Dissolved Oxygen (mg/l)	Species name	Species number	Comments
3/9/2017	006	001	0744	Control	31	70	35 06 48	75 39 36	5-10	360	3	17.1	62.78				38	33.4	Southern Ray	1	Loggerhead seen at surface.
3/9/2017	006	002	0749	Experimental	42	69	35 06 42	75 39 36	5-10	360	3	17.1	62.78	66.938	66.884	66.840	38	33.4	Southern Ray,	1,1	
3/9/2017	006	003	0854	Experimental	31	68	35 07 0	75 39 24	5-10	360	3	17.1	62.78	66.596	66.128	66.128	38	33.4			No catch.
3/9/2017	006	004	0858	Control	40	67	35 07 0	75 39 12	5-10	360	3	17.1	62.78				38	33.4	Cownose Ray	1	
3/9/2017	006	005	0959	Control	28	66	35 07 24	75 39 24	5-10	360	3	16	60.8				38	33.4			No catch. Loggerhead seen at
3/9/2017	006	006	1003	Experimental	38	68	35 07 12	75 39 12	5-10	360	3	16	60.8	66.254	66.506	66.448	38	33.4			No catch.
3/9/2017	006	007	1101	Experimental	30	66	35 07 18	75 39 36	5-10	360	3	16	60.8	66.254	66.38	66.434	38	33.4			No catch. Loggerhead seen at surface. Go Pro attached to net.
3/9/2017	006	008	1107	Control	39	66	35 07 12	75 39 30	5-10	360	3	16	60.8				38	33.4			No catch.
3/9/2017	006	009	1203	Control	29	68	35 06 54	75 39 30	5-10	360	3	18.2	64.76				38	33.4	Southern Ray, Cownose Ray, Sand	5,1,1	Loggerhead seen at surface.
3/9/2017	006	010	1208	Experimental	44	70	35 06 48	75 39 24	5-10	360	3	18.2	64.76	67.1	66.92	66.884	38	33.4	Southern Ray, Butterfly Ray,	7,1,1	
3/9/2017	006	011	1315	Experimental	29	60	35 08 18	75 40 30	5	360	3	18.4	65.12	64.184	65.984	65.966	38	33.4			No catch.
3/9/2017	006	012	1319	Control	39	60	35 08 6	75 40 30	5	360	3	18.4	65.12				38	33.4			No catch.
3/9/2017	006	013	1413	Control	30	70	35 08 6	75 40 36	0	-	3	18.4	65.12				38	33.4			No catch. Lost buoy from 1st net - retrieved after haul back. Buoy dragged by unknown species moving at a fast speed. When
3/9/2017	006	014	1417	Experimental	41	65	35 08 6	75 40 48	0	-	3	18.4	65.12	64	66.002	65.984	38	33.4			No catch.
3/9/2017	006	015	1514	Experimental	30	61	35 08 18	75 41 0	0-5	360	3	18.4	65.12	63.518	65.048	65.21	38	33.4			No catch.
3/9/2017	006	016	1518	Control	39	63	35 08 24	75 41 12	0-5	360	3	18.4	65.12				38	33.4			No catch.
3/11/2017	007	001	0722	Control	32	48	35 10 48	75 42 42	15	360	3	16.9	62.42				35	10.3	Angel Shark	2	
3/11/2017	007	002	0726	Experimental	45	49	35 10 42	75 42 48	15	360	3	16.9	62.42	62.51	62.474	62.474	35	10.3			No catch.
3/11/2017	007	003	0831	Experimental	30	39	35 11 12	75 42 36	15	360	3	16.9	62.42	62.222	62.186	62.168	35	10.3			No catch.
3/11/2017	007	004	0836	Control	40	43	35 11 6	75 42 42	15	360	3	16.9	62.42				35	10.3			No catch.
3/11/2017	007	005	0933	Control	30	30	35 11 42	75 42 24	15	360	3	16.9	62.42				35	10.3	Cownose Ray	1	
3/11/2017	007	006	0937	Experimental	42	35	35 11 30	75 42 18	15	360	3	16.9	62.42	61.826	61.826	61.772	35	10.3			No catch.
3/11/2017	007	007	1040	Experimental	29	30	35 11 36	75 42 24	15	360	4	16.9	62.42	61.286	61.142	60.782	35	10.3	Angel Shark, Clearnose Skate,	7,1,1	4th net added to gear
3/11/2017	007	008	1049	Control	43	33	35 11 24	75 42 24	15	360	4	16.9	62.42				35	10.3			No catch. 4th net added to gear. Loggerhead seen at surface.
3/11/2017	007	009	1151	Control	30	44	35 10 54	75 42 42	10-15	360	4	16.9	62.42				35	10.3	Cownose Ray	1	Loggerhead seen at surface.
3/11/2017	007	010	1155	Experimental	42	46	35 10 42	75 42 42	10-15	360	4	16.9	62.42	62.888	62.744	62.708	35	10.3			No catch.
3/11/2017	007	011	1259	Experimental	30	34	35 10 24	75 44 36	5-10	360	4	16.9	62.42	62.33	62.006	62.096	35	10.3	Angel Shark	2	
3/11/2017	007	012	1303	Control	42	44	35 10 12	75 44 30	5-10	360	4	16.9	62.42				35	10.3	Angel Shark, Sand	2, 1	
3/12/2017	008	001	0531	Control	30	47	35 10 48	75 42 24	15	45	4	14.5	58.1				38	37.8	Angel Shark, Cownose Ray,	2,1,1	Before sunrise
3/12/2017	008	002	0535	Experimental	47	49	35 10 36	75 42 36	15	45	4	14.5	58.1	62.6	62.6	62.582	38	37.8	Angel Shark	1	Before sunrise
3/12/2017	008	003	0717	Experimental	30	44	35 11 0	75 42 36	15-20	45	4	14.5	58.1	62.33	62.276	51.784	38	37.8			No catch.
3/12/2017	008	004	0721	Control	46	46	35 10 54	75 42 48	15-20	45	4	14.5	58.1				38	37.8	Black Drum	21	Drum not of keeping size.
3/12/2017	008	005	0835	Control	37	37	35 11 12	75 43 0	15-20	45	4	14.5	58.1				38	37.8			No catch.
3/12/2017	008	006	0843	Experimental	43	40	35 11 0	75 43 6	15-20	45	4	14.5	58.1	37.598	37.31	40.37	38	37.8			No catch.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Haul by Haul Data Summary continued

Date	Trip #	Haul	Set time	Gear	Soak Duration (min)	Depth (ft)	Set Latitude	Set Longitude	Wind Speed (nm/hr)	Wind Direction	# Nets	Surface Temp (°C)	Surface Temp (°F)	Top Logger	Mid Logger	Bottom Logger	Salinity (ppt)	Dissolved Oxygen (mg/l)	Species name	Species number	Comments
3/17/2017	009	001	0716	Experimental	30	40	35 11 0	75 42 36	15-18	45	4	15.7	60.26	48.974	49.856	46.976	35	8.2	Angel Shark	1	
3/17/2017	009	002	0721	Control	40	44	35 10 48	75 42 42	15-18	45	4	15.7	60.26				35	8.2	Angel Shark	2	
3/17/2017	009	003	0828	Control	30	46	35 11 24	75 41 0	15-18	45	4	15.7	60.26				35	8.2			No catch.
3/17/2017	009	004	0834	Experimental	43	46	35 11 12	75 41 0	15-18	45	4	15.7	60.26	58.478	58.442	58.478	35	8.2			No catch.
3/17/2017	009	005	0954	Experimental	30	71	35 07 0	75 39 36	15-18	45	4	14.8	58.64	49.658	46.076	45.788	35	8.2			No catch. Kemps seen at surface.
3/17/2017	009	006	0959	Control	41	71	35 06 48	75 39 36	15-18	45	4	14.8	58.64				35	8.2			No catch.
3/17/2017	009	007	1102	Control	29	72	35 06 48	75 39 18	15-18	45	4	14.8	58.64				35	8.2			No catch. Loggerheads seen at surface.
3/17/2017	009	008	1107	Experimental	41	73	35 06 36	75 39 12	15-18	45	4	14.8	58.64	60.116	59.792	56.606	35	8.2			No catch.
3/17/2017	009	009	1209	Experimental	32	70	35 06 48	75 39 18	15-18	45	4	14.8	58.64	55.49	54.398	49.28	35	8.2			No catch. Loggerheads seen at surface.
3/17/2017	009	010	1214	Control	44	73	35 06 36	75 39 18	15-18	45	4	14.8	58.64				35	8.2	Sand Tiger Shark	1	
3/17/2017	009	011	1317	Control	31	67	35 06 48	75 39 18	10	45	4	14.8	58.64				35	8.2	Southern Ray,	2, 1	Loggerheads seen at surface. Go
3/17/2017	009	012	1324	Experimental	44	72	35 06 36	75 39 18	10	45	4	14.8	58.64	51.872	53.312	51.44	35	8.2			No catch. Loggerheads seen at surface.
3/17/2017	009	013	1425	Experimental	29	70	35 06 48	75 39 12	5-10	45	4	14.8	58.64	41.792	39.129	41.612	35	8.2	Butterfly Ray	2	Loggerheads seen at surface. Go
3/17/2017	009	014	1430	Control	39	72	35 06 42	75 39 24	5-10	45	4	14.8	58.64				35	8.2	Angel Shark, Southern Ray,	1,1,1,1	Loggerheads seen at surface.
3/20/2017	010	001	1117	Control	29	69	35 07 0	75 39 18	15-18	315	4	10.1	50.18				32	6.9	Angel Shark	2	Loggerheads seen at surface.
3/20/2017	010	002	1122	Experimental	46	65	35 06 48	75 39 18	15-18	315	4	10.1	50.18	49.802	51.872	53.996	32	6.9	Angel Shark	1	
3/20/2017	010	003	1231	Experimental	30	73	35 06 48	75 39 12	15-18	315	4	10.1	50.18	49.046	50.036	49.46	32	6.9			No catch. Loggerheads seen at surface.
3/20/2017	010	004	1235	Control	47	74	35 06 36	75 39 24	15-18	315	4	10.1	50.18				32	6.9	Sand Tiger Shark,	1,1,1	Net hung up, tear in 4th net.
3/20/2017	010	005	1350	Control	30	71	35 06 42	75 39 36	15-18	315	4	10.4	50.72				32	6.9	Sand Tiger Shark	1	Loggerheads seen at surface.
3/20/2017	010	006	1355	Experimental	42	76	35 06 30	75 39 30	15-18	315	4	10.4	50.72	49.352	50.918	51.404	32	6.9	Butterfly Ray, Angel	1,1	Loggerheads seen at surface.
3/20/2017	010	007	1458	Experimental	29	72	35 06 42	75 39 18	15	315	4	10.4	50.72	46.076	45.518	47.912	32	6.9			No catch. Loggerheads seen at surface. Net hung up, tear in
3/20/2017	010	008	1502	Control	43	74	35 06 30	75 39 24	15	315	4	10.4	50.72				32	6.9	Angel Shark,	2, 1	
3/21/2017	011	001	0729	Control	30	71	35 06 24	75 39 30	10-12	270	4	10.8	51.44				32	12.8	Tiger Shark, Sand Tiger Shark	1,1	Overcast, poor H20 vis. Loggerheads seen at surface.
3/21/2017	011	002	0735	Experimental	44	74	35 06 30	75 39 24	10-12	270	4	10.8	51.44	53.366	54.05	54.302	32	12.8	Angel Shark	1	Overcast, poor H20 vis.
3/21/2017	011	003	0841	Experimental	30	74	35 06 30	75 39 36	10-12	270	4	10.8	51.44	54.581	54.968	54.95	32	12.8	Angel Shark, Sand	1,1	Overcast, poor H20 vis.
3/21/2017	011	004	0846	Control	47	72	35 06 36	75 39 24	10-12	270	4	10.8	51.44				32	12.8	Angel Shark, Sand	1,1	Overcast, poor H20 vis.
3/21/2017	011	005	0954	Control	30	72	35 06 30	75 39 24	10-12	270	4	10.6	51.08				32	12.8			No catch. Overcast, poor H20 vis.
3/21/2017	011	006	0959	Experimental	43	72	35 06 36	75 39 12	10-12	270	4	10.6	51.08	56.696	58.118	55.922	32	12.8	Sand Tiger Shark	1	Overcast, poor H20 vis.
3/21/2017	011	007	1104	Experimental	30	76	35 06 30	75 39 36	10-15	270	4	10.6	51.08	57.884	57.938	59.036	32	12.8			No catch. Overcast, poor H20 vis.
3/21/2017	011	008	1109	Control	42	76	35 06 42	75 39 30	10-15	270	4	10.6	51.08				32	12.8	Sand Tiger Shark	2	Overcast, poor H20 vis.
3/24/2017	012	001	0721	Control	29	72	35 06 42	75 39 6	10	90	4	11.7	53.06				33	26.8	Angel Shark, Sand Tiger Shark, False	4,2,2	Sunny, H20 poor vis. Loggerheads and Kemps seen at surface.
3/24/2017	012	002	0727	Experimental	50	73	35 06 36	75 39 18	10	90	4	11.7	53.06	53.348	54.608	54.644	33	26.8	Angel Shark	8	Sunny, H20 poor vis.
3/24/2017	012	003	0843	Experimental	29	73	35 06 30	75 39 36	10	180	4	11.7	53.06	56.174	55.796	54.77	33	26.8	Angel Shark	5	Sunny, H20 poor vis. Loggerheads seen at surface.
3/24/2017	012	004	0847	Control	48	72	35 06 42	75 39 24	10	90	4	11.7	53.06				33	26.8	Angel Shark	6	Part cloudy. H20 poor vis.
3/24/2017	012	005	1002	Control	30	73	35 06 18	75 39 30	10	180	4	12.1	53.78				33	26.8	Sand Tiger Shark	1	Part cloudy, H20 poor vis. Loggerheads seen at surface.
3/24/2017	012	006	1007	Experimental	43	75	35 06 30	75 39 36	10	180	4	12.1	53.78	57.452	58.424	56.948	33	26.8	Angel Shark	1	Part cloudy. H20 poor vis.
3/24/2017	012	007	1114	Experimental	29	72	35 06 36	75 39 6	10	180	4	12.1	53.78	58.37	58.784	56.948	33	26.8			No catch. Part cloudy, H20 poor vis. Loggerheads seen at surface.
3/24/2017	012	008	1119	Control	41	72	35 06 48	75 39 12	10	180	4	12.1	53.78				33	26.8	Sand Tiger Shark, Angel Shark	2	Part cloudy, H20 poor vis. Loggerheads seen at surface.
3/24/2017	012	009	1233	Control	28	68	35 06 54	75 39 24	5-10	180	4	12.6	54.68				33	26.8			No catch. Part cloudy, H20 poor vis. Loggerheads seen at surface.
3/24/2017	012	010	1228	Experimental	43	67	35 07 0	75 39 12	5-10	180	4	12.6	54.68	62.15	63.58	59.414	33	26.8	Cownose Ray	1	Sunny, H20 poor vis.
3/24/2017	012	011	1333	Experimental	28	70	35 07 6	75 39 24	5-10	180	4	12.6	54.68	69.188	69.008	69.764	33	26.8	Clearnose Skate	1	Sunny, H20 poor vis.
3/24/2017	012	012	1337	Control	43	68	35 07 6	75 39 24	5-10	180	4	12.6	54.68				33	26.8	Angel Shark	1	Loggerheads seen at surface.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Table 5. Sea Turtle Incidental Take Table

Release Location														
Date	Trip ID	Haul #	Species	Length (cm)	Condition	Latitude	Longitude	Bio Sample ID	Comments	Control	Experimental	Released Alive	Retained in Freezer	Discarded Dead
2/18/2017	001	2	Kemps Ridley	38.2	Alive	3508.4	7538.8	LK01	dove and swam		1	1		
2/18/2017	001	3	Kemps Ridley	45	Alive	3508.8	7538.4	LK02	dove and swam		1	1		
2/19/2017	002	1	Loggerhead	68.4	Alive	3507.3	7539.2	CC03	dove and swam	1		1		
2/19/2017	002	1	Kemps Ridley	44	Alive	3507.3	7539.2	LK04	dove and swam	1		1		
2/19/2017	002	1	Loggerhead	67	Alive	3507.4	7538.9	CC05	dove and swam	1		1		
2/19/2017	002	1	Loggerhead	69	Alive	3507.4	7538.9	CC06	dove and swam	1		1		
2/19/2017	002	1	Loggerhead	n/a	Alive	n/a	n/a	N/A	fell out of gear, didn't come aboard, dove and swam	1		1		
2/23/2017	003	2	Loggerhead	76	Alive	3507.4	7539.7	CC08	dove and swam	1		1		
2/27/2017	004	2	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, dove and swam	1		1		
2/27/2017	004	6	Loggerhead	n/a	Alive	n/a	n/a	n/a	swam	1		1		
2/27/2017	004	10	Loggerhead	76.5	Alive	3506.4	7539.4	CC11	dove and swam	1		1		
2/27/2017	004	11	Loggerhead	79	Alive	3506.5	7539.6	CC12	dove and swam	1		1		
2/28/2017	005	N/A	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
3/9/2017	006	1	Loggerhead	n/a	Alive	n/a	n/a	N/A	fell out of gear, didn't come aboard, dove and swam	1		1		
3/11/2017	007	1	Kemps Ridley	37.9	Alive	3510.7	7542.8	LK14	dove and swam	1		1		
3/11/2017	007	11	Kemps Ridley	42.5	Alive	3510.2	7544.5	LK15	dove and swam		1	1		
3/11/2017	007	12	Kemps Ridley	53	Alive	3510.6	7544.3	LK16	dove and swam	1		1		
3/11/2017	007	5	Atlantic Sturgeon	156.2	Alive	3511.7	7542.4	AOO1	swam away	1		1		
3/11/2017	007	5	Atlantic Sturgeon	n/a	Alive	3511.6	7542.4	N/A	fell out of gear, didn't come aboard, swam away	1		1		
3/12/2017	008	2	Loggerhead	77	Alive	3510.6	7542.6	CC17	dove and swam		1	1		
3/17/2017	009	9	Loggerhead	n/a	Alive	n/a	n/a	N/A	fell out of gear, didn't come aboard, swam away		1	1		
3/20/2017	010	4	Loggerhead	n/a	Alive	n/a	n/a	N/A	fell out of gear, didn't come aboard, swam away	1		1		
3/20/2017	010	4	Loggerhead	n/a	Alive	n/a	n/a	N/A	fell out of gear, didn't come aboard, swam away	1		1		
3/20/2017	010	7	Loggerhead	n/a	Alive	n/a	n/a	N/A	fell out of gear, didn't come aboard, swam away		1	1		
3/21/2017	011	2	Loggerhead	n/a	Alive	n/a	n/a	N/A	fell out of gear, didn't come aboard, swam away		1	1		
3/21/2017	011	3	Loggerhead	74.5	Alive	3506.7	7531.4	CC23	dove and swam		1	1		
3/21/2017	011	5	Loggerhead	74.6	Alive	3506.6	7539.2	CC24	dove and swam	1		1		
3/21/2017	011	6	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away		1	1		
3/21/2017	011	7	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away		1	1		
3/24/2017	012	5	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away	1		1		
3/24/2017	012	10	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away		1	1		
Total										19	11	30	0	0

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

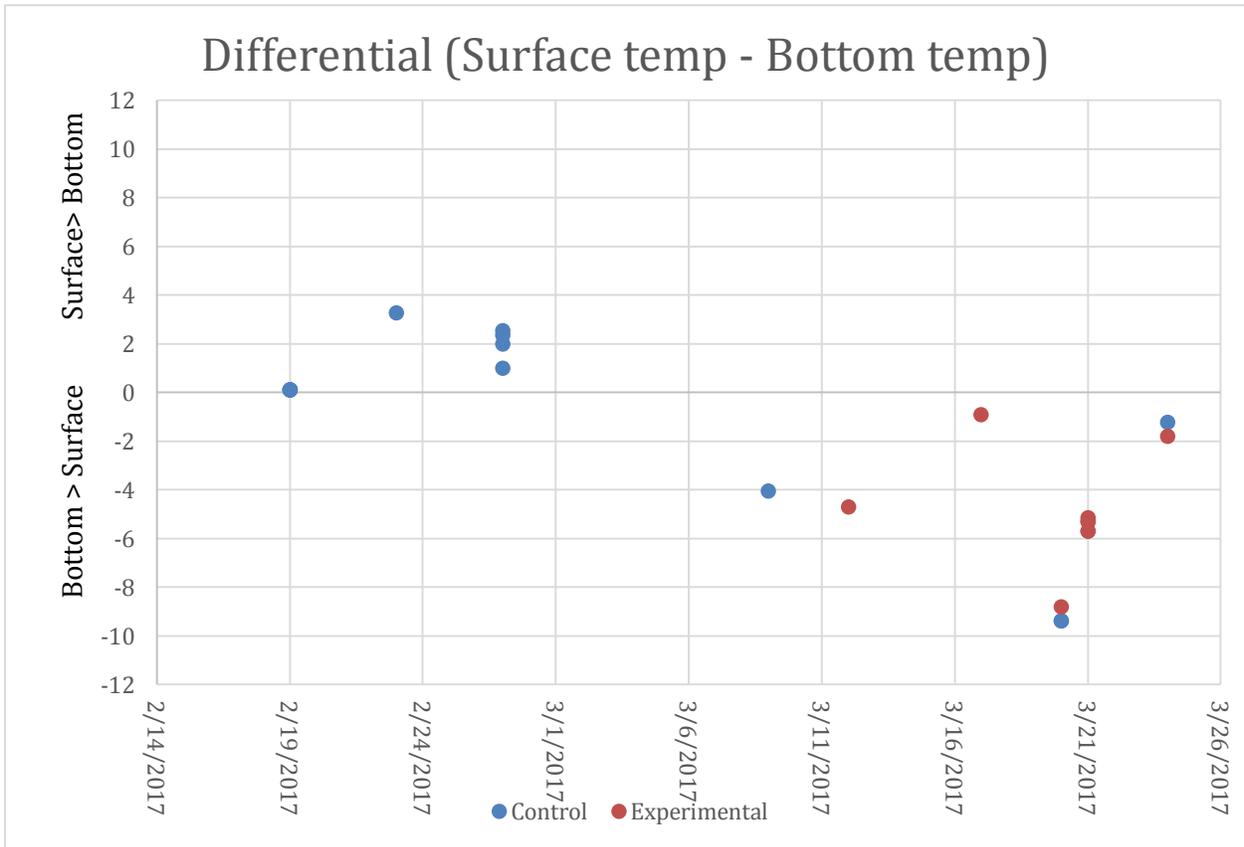


Figure 1. Surface and Bottom Temperature Differentials. Plot of captures by date and differential between surface and bottom temperature. Captures above the line show captures when the surface temperature is greater than the bottom temperature.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

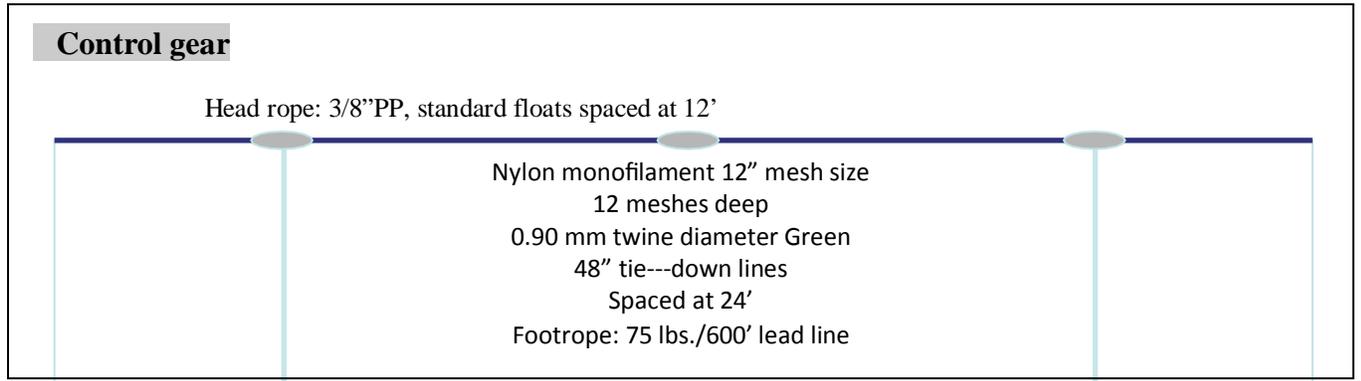


Figure 2. Specifications and Rigging of Control Gear

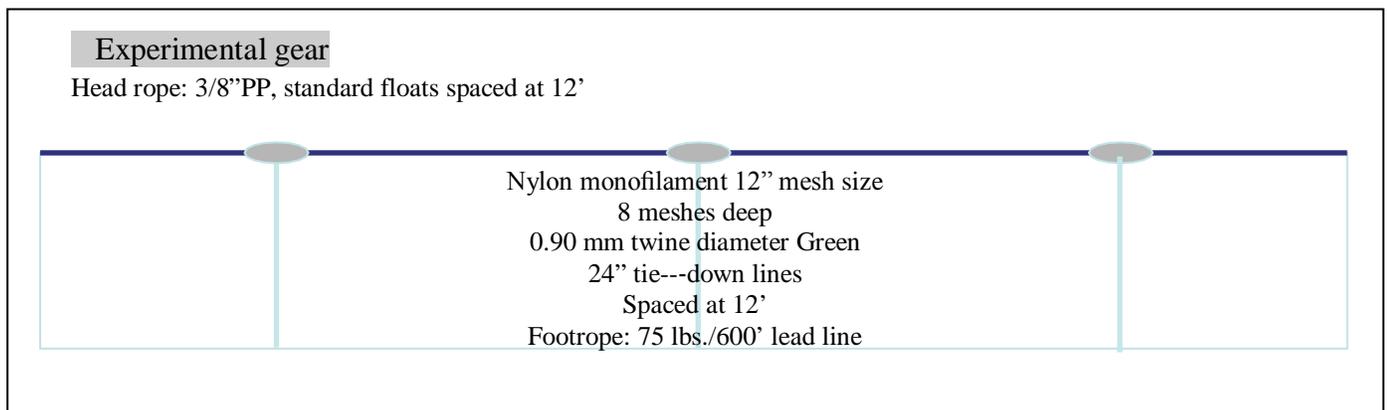


Figure 3. Specifications and Rigging of Experimental Gear

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

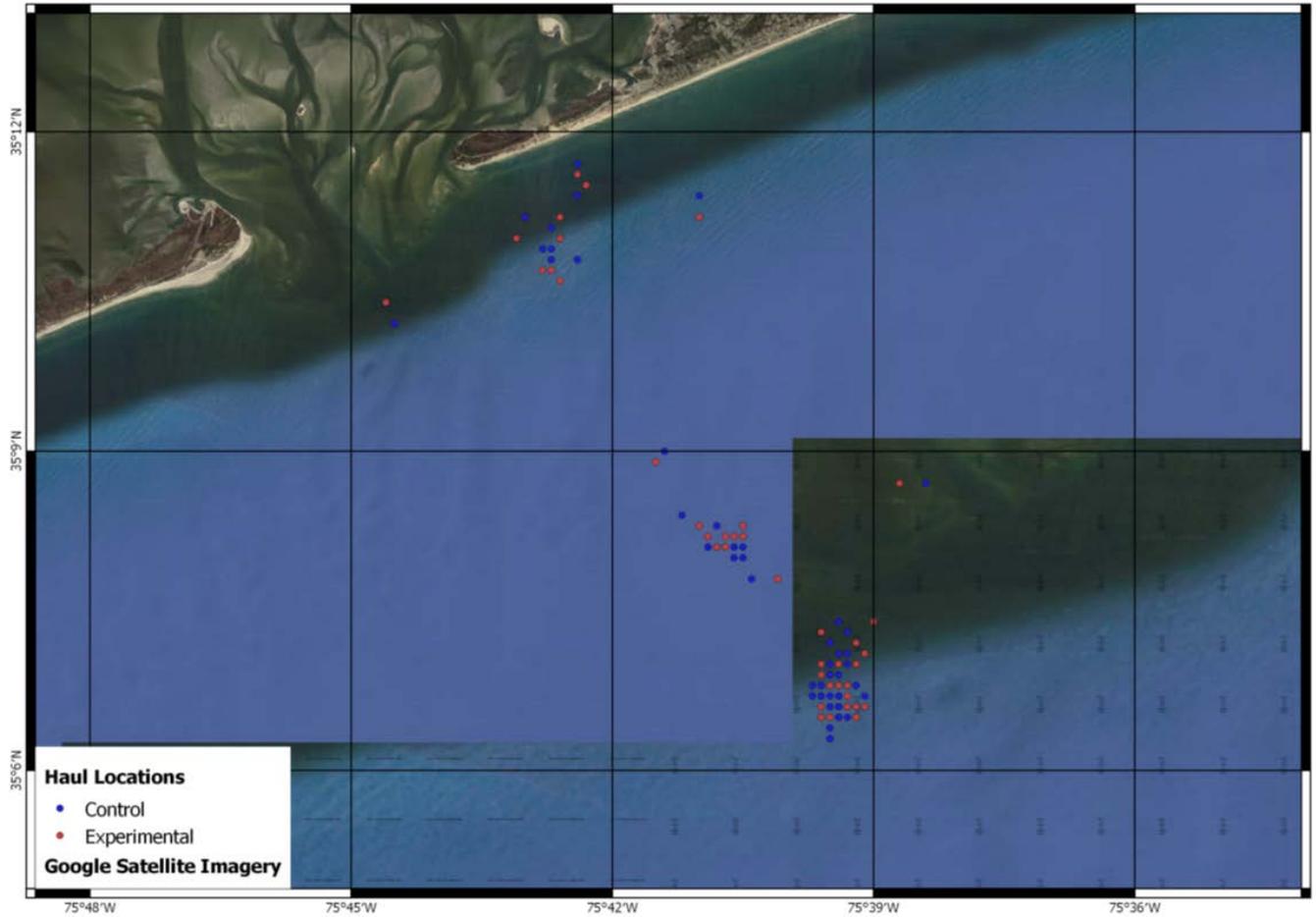


Figure 4. Set locations of experimental and control gear

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

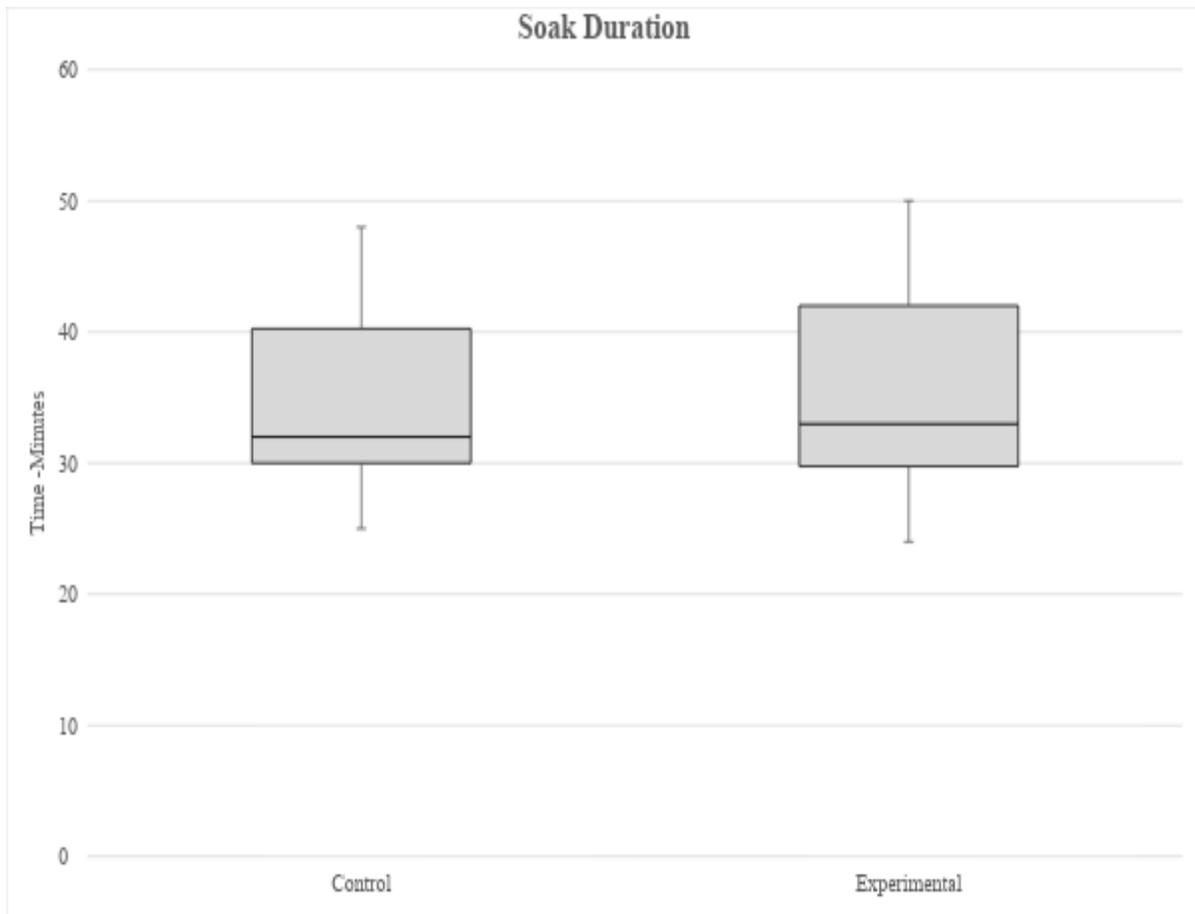


Figure 5. Box and whisker plot (1st and 3rd quartiles, median, and range) of the soak duration of all experimental and control gillnet sets.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

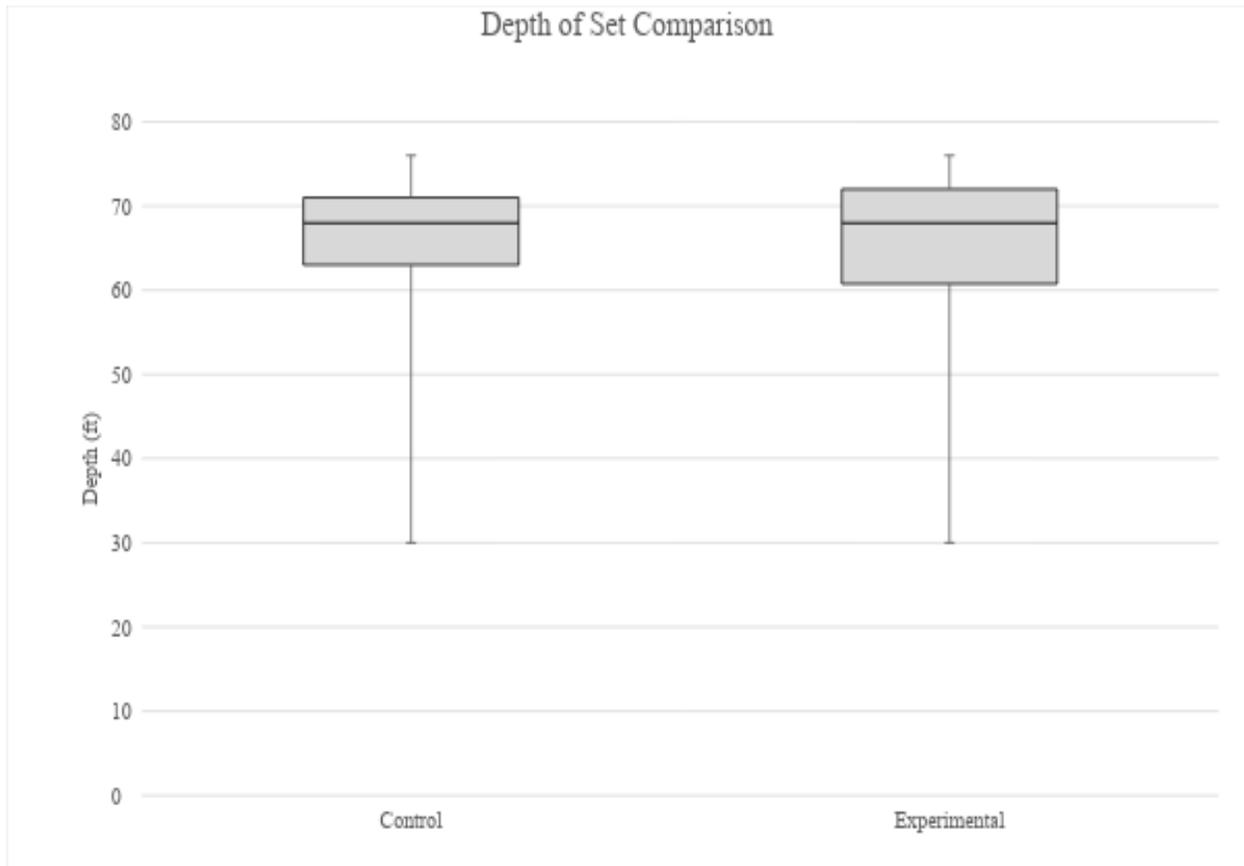


Figure 6. Box and whisker plot (1st and 3rd quartiles, median, and range) of the depth of all sets for the experimental and control gillnets.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

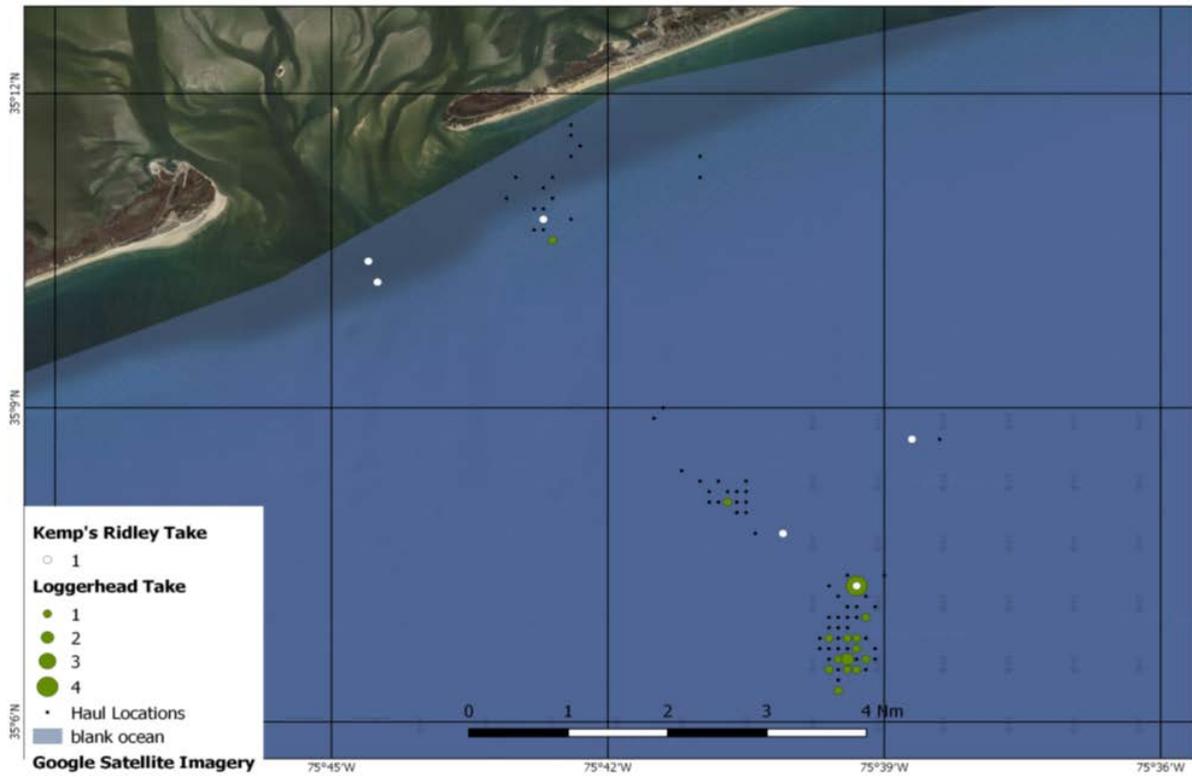


Figure 7. Locations of hauls and takes for sea turtles encountered in the study.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

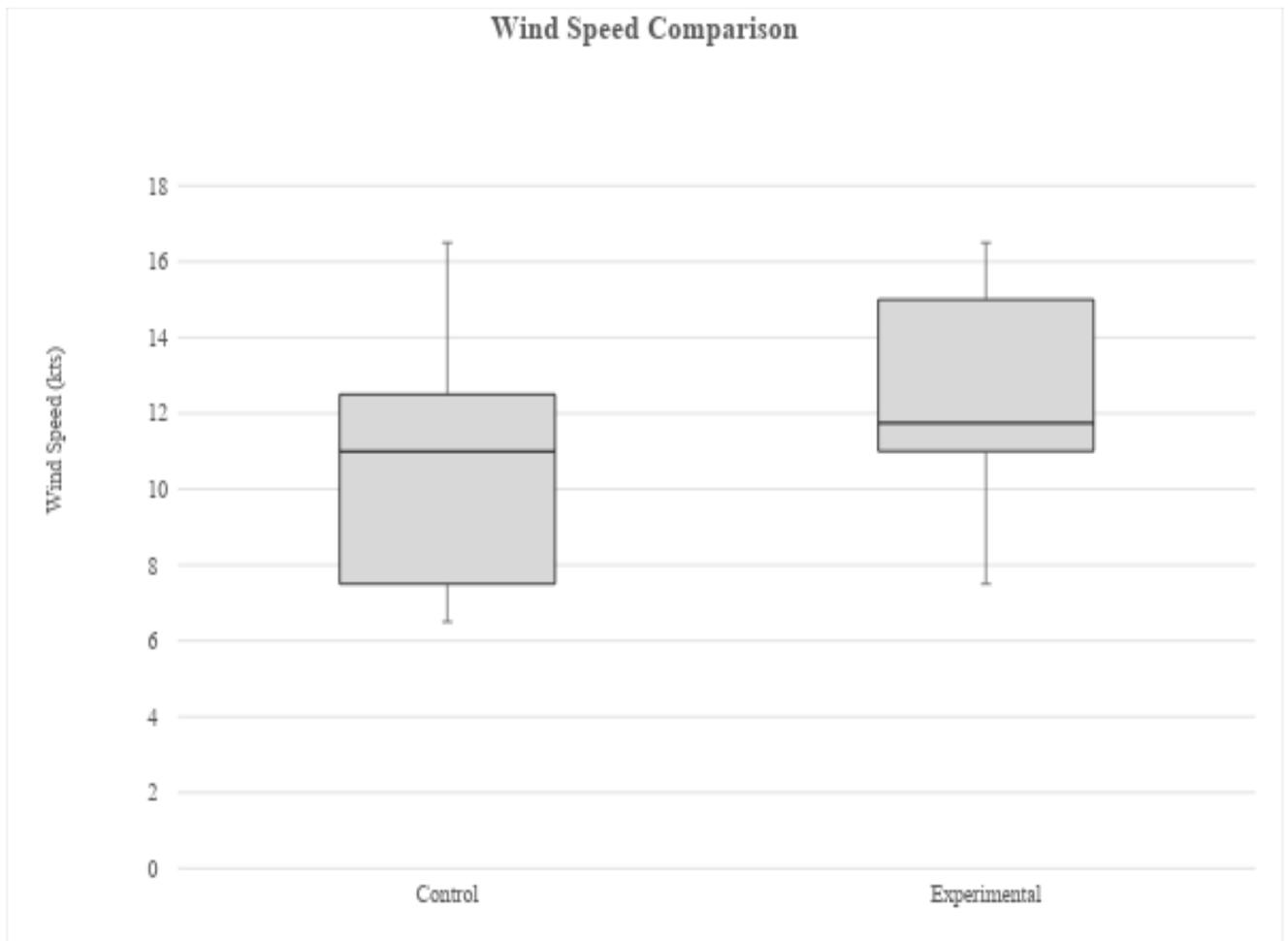


Figure 8. Box and whisker plot (1st and 3rd quartiles, median, and range) of recorded wind speed when loggerheads were captured in the respective gear.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

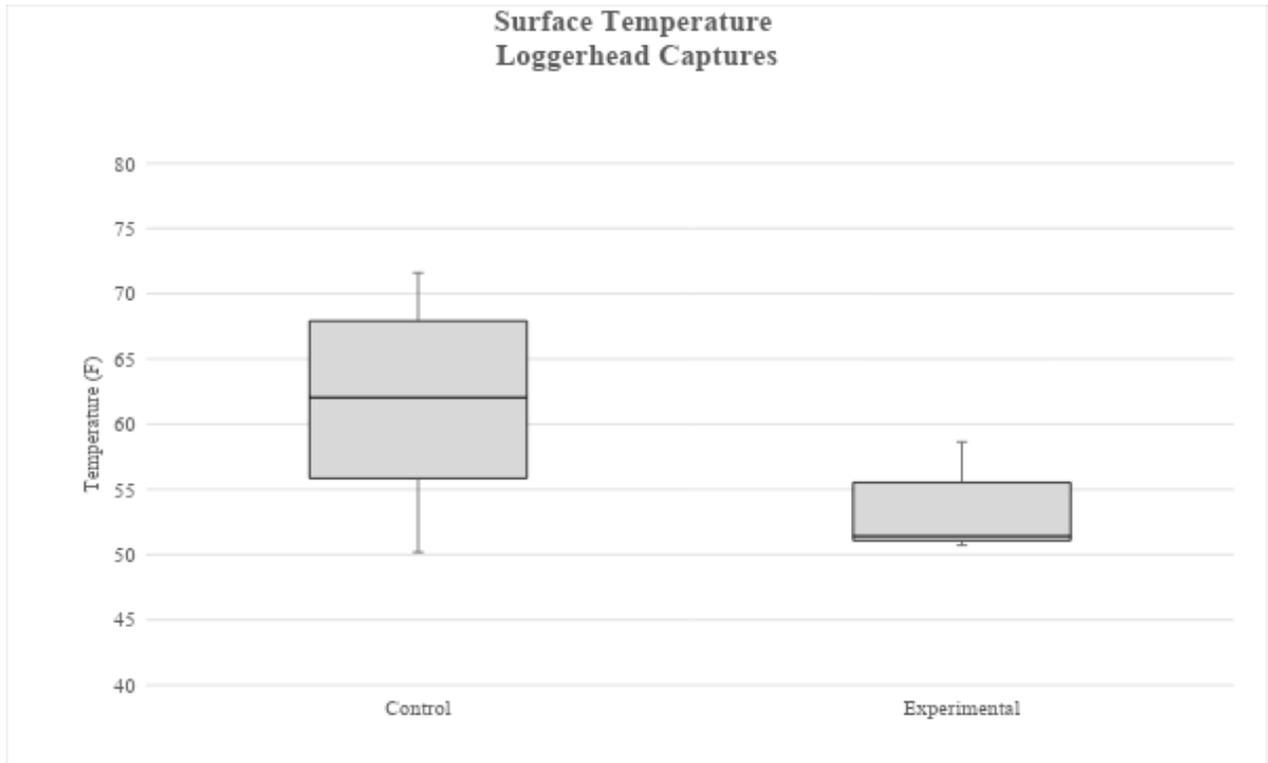


Figure 9. Box and whisker plot (1st and 3rd quartiles, median, and range) of recorded surface temperatures when loggerheads were captured in the respective gear..

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

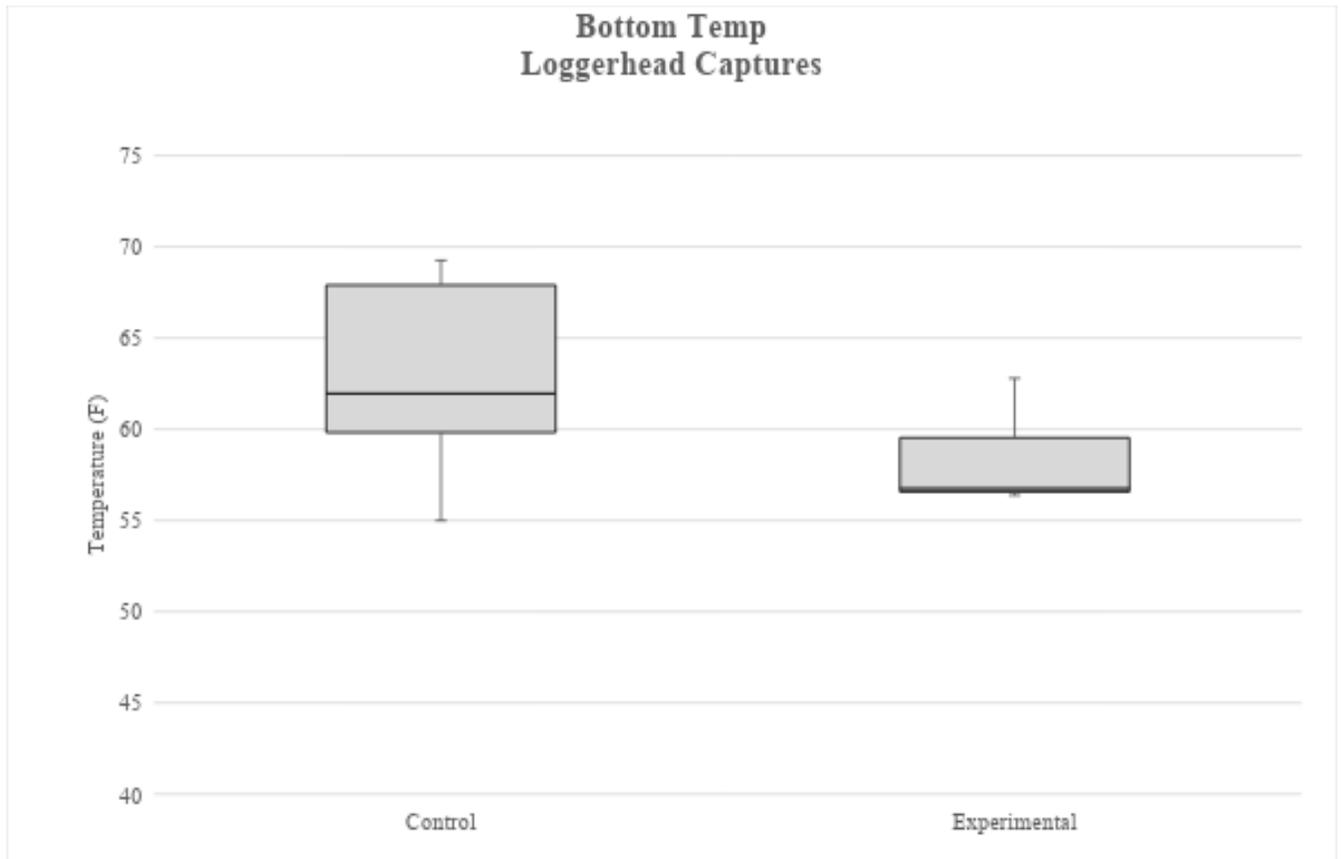


Figure 10. . Box and whisker plot (1st and 3rd quartiles, median, and range) of bottom temperature by gear type when loggerheads were captured in the respective gear..

Appendix I: Vessel Suitability Report

VESSEL SUITABILITY REPORT

Reduction of Turtle By-catch in the Bottom-Set Gillnet Fisheries Gear Study



Submitted Via E-mail to:

**Henry Milliken
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543
Phone: 508-495-2294
Email: henry.milliken@noaa.gov**

Submitted by:

**Rick Usher
A.I.S., Inc.
14 Barnabas Road
Marion, MA 02738
Phone: 774-200-0563**

January 29, 2017

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Fishing Vessel and Captain Chartered for Study Overview

A.I.S. Inc. (AIS) contracted Mr. Charlie Locke, the captain and owner of the F/V Salvation, to provide a fishing vessel and crew services to set and haul 60 control and 60 experimental gillnets. Mr. Locke has over 20 years of experience fishing gillnet gear and operating vessels out of the Mid-Atlantic and Southeast Regions. Mr. Locke and the F/V Salvation are well suited to complete the tasks required in the statement of work for this contact.

Captain Experience

Mr. Locke began his fishing career in the Florida gillnet fishery and moved to the North Carolina area after Florida banned the use of gillnets in state waters. He has empirical knowledge of the North Carolina coastal fisheries and the locations where sea turtles are commonly found throughout the inshore waters off Cape Hatteras, NC. Mr. Locke has collaborative research experience. Over the years he has demonstrated a commitment to reducing by-catch in the commercial gillnet fisheries. He has participated in the Sandbar Shark Research Fishery since 2010. This work involved collaboration with Fisheries Biologists from the Southeast Fisheries Science Center's Panama City office and working with fisheries observers to collect and report catch and bycatch data. As a member of the Atlantic Large Whale Take Reduction Team, he worked with the Southeast Subgroup to develop measures to reduce the by-catch of whales in the Southeastern U.S. Atlantic Shark Gillnet Fishery. Mr. Locke's commercial fishing, research experience, and interest in conservation make him an ideal partner for the study.

Vessel Description

The F/V Salvation is a custom-built 32' fiberglass over wood V-hull. The five gross ton vessel has a 10' beam and draws 2' of water. It is powered by a 250 horsepower outboard engine mounted on a stern drive. The vessel was designed by Glenn Bradley of Wanchese, NC to fish and navigate the shallow inlets and coastal waters of North Carolina. The vessel has an aft steering station. The net reel is positioned on the bow and utilizes a stainless steel roller overhanging the bow (known as a bow-picker) to haul gillnets. This gillnet hauling design is commonly utilized in the Mid-Atlantic and Southeast inshore fisheries because it allows smaller vessels to stow a large amount of nets on the reel without taking up deck space.

The F/V Salvation's configuration is different from the larger and deeper draft gillnet vessels traditionally used to prosecute the Northeast groundfish fisheries. Gillnet vessels in the Northeast typically utilize Crosley haulers positioned mid-ship to haul gear from deeper depths.

For this study the bow-picker net hauling configuration is advantageous because it allows the captain and crew to carefully handle, extract, and bring the sea turtles captured aboard the vessel for sampling prior to reaching the bow roller.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Documentation Number	NC 1043 DC
Owner/Operator	Charles Locke
Address	P.O. Box 761 Wanchese NC 27981
Phone	252-438-6856
Cell	252-982-6488
Homeport	Wanchese, North Carolina
Length overall	32
Beam	10
Draft	2
Tonnage	5
Hull material	Glass over wood
Current USCG Safety Decal Number	235902
Life Raft Capacity	Not required in area fished
Years experience principal operator	15
Previous research experience	6 years in SEFSC Highly Migratory Species (HMS) sandbar shark research fishery
Areas usually fished	Inshore waters of North Carolina and Florida
Primary fisheries	Shark, mackerel, and bottom fish
Engine make	Honda
Engine model	250
Horsepower	250
Gillnet Hauler Type	Hydraulic driven Reel Style
Deck space for Sampling	60 sq. ft.
Number of Days Capable of being at Sea	1
Number of berths	None
Number of crew	2
GPS Make/Model	Furuno 1850
Radar	n/a
Communications	2 VHF radios
Cell phone	Yes
Inmarsat satellite phone	No

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694



Figure 1. F/V Salvation Bow View

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694



Figure 2. F/V Salvation Stern View

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Appendix II Weekly Progress Reports

PROGRESS REPORT 02/16/2017 – 2/28/17

Reduction of Turtle By-catch in the Bottom-Set Gillnet Fisheries Gear Study



Accuracy, Integrity, Service

Submitted Via E-mail to: **Henry Milliken**
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543
Phone: 508-495-2294
Email: henry.milliken@noaa.gov

Submitted by: **Rick Usher**
A.I.S., Inc.
14 Barnabas Road
Marion, MA 02738
Phone: 774-200-0563

Project Kickoff Meeting and Start Up

The project team held an initial kickoff meeting on January 11, 2017 from 1000 - 1200 at the A.I.S., Inc. (AIS) office in Marion, MA. Henry Milliken (NEFSC FSB), Eric Matzen (NEFSC FSB), Rick Usher (AIS), Kathryn Roy (AIS) attended the meeting in-person. Captain Charlie Locke participated in the meeting via conference line. The major topics discussed were:

- Rationale for the study
- Project Timeframe
- Equipment, supplies, and gillnets
- Sampling requirements
- Reporting requirements
- Primary and Secondary Samplers
- Logistics

The team agreed that March to April was the best time to conduct the study. This time period would allow the team to avoid excessive by-catch. It was also a time when sea turtles were known to be present in the area. The team discussed potentially starting earlier than March if the water temperatures were warm enough for sea turtles to be in the area. The changes to the statement of work were also discussed. These changes included using fewer nets per sting and reducing the soak time duration to one hour or less. The reduced soak time would help the team to avoid large catches of elasmobranchs and reduce the potential for mortality to sea turtles.

After considering using three nets per string, we decided to start the study using four nets per string. If by-catch or catch rate of sea turtles was too great and prevented us from hauling the nets within the one hour soak time limit we would reconsider using three nets per string. Transportation of the nets to the study area, team member responsibilities, and sampling equipment were also decided at the meeting.

Another topic of discussion during the meeting was the ESA permit. Kathryn Roy, the primary AIS sea sampler identified during the ESA permitting process, was not approved for sea turtle capture in the final ESA permit. The ESA permit did however approve her for sampling the sea turtles once they were onboard the vessel. To ensure the project would be able to start as planned, an alternative AIS employee, Kerry Lyons was contacted. Her resume was provided to the NMFS PSB to seek approval for both capture and sampling.

On 1/26/17, Henry Milliken informed the project team that the Harbor Porpoise Take Reduction Plan (HPTRP) had a large mesh gillnet closure from February 15th to March 15th in the area around Cape Hatteras where the project was scheduled to be conducted. After checking with the Permits and Conservation Division at the NMFS Office of Protected Species in Silver Spring there was deliberation on some of the legal issues surrounding the permit and fishing with excluded gear in the closed area. This was resolved on 02/07/17 and clearance to conduct the

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

research in the HPTRP closed area was approved by the Deputy Chief of the Protected Species Division.

On 1/27/17, Kerry Lyons was issued a letter from the NEFSC approving her for capture and sampling activities for the project. It was decided that Kerry Lyons would be the primary sea turtle observer for this project. Kathryn Roy would act as the alternate sea turtle observer and participate in the first two trips of the study to learn proper sea turtle capture and handling techniques from Kerry Lyons. After Kathryn completed the first two trips and demonstrated an understanding of the techniques necessary to safeguard sea turtles, Eric Matzen provided a letter documenting her capabilities to support approval by NMFS for her to be authorized to capture sea turtles at a later date.

On 02/07/17 Henry Milliken applied for a permit with the North Carolina Division of Marine Fisheries (NCDMF) to conduct the research activities for this project within the state waters of North Carolina. On 02/13/17 the NCDMF issued Scientific Collection Permit Number 1905256. Being able to conduct the study in North Carolina waters provided logistical flexibility to the project.

Another project meeting was held via conference call on 02/13/17 with Henry Milliken, Eric Matzen, Kathryn Roy, and Rick Usher. At this meeting the team decided to begin the study as soon as possible since the water temperatures were higher than average this year and Capt. Locke had been observing a significant amount of sea turtles during his fish activities the previous week. The project safety plan, sampling equipment inventory, and plans for transporting the nets to Cape Hatteras were finalized. The team planned to load the nets on the F/V Salvation on 02/17/17. The first day to set and haul the gillnet gear was scheduled for 02/18/17.

Project Progress

Five trips were made between 02/18/2107 and 2/28/17. Table 1 is summary of each trip. The table includes the trip id, personnel onboard, the number of strings set for each treatment, the number of nets in each string and relevant comments. The incidental take data for each trip is summarized in Table 2.

On trip 001 there were two incidental takes of Kemp's ridley turtles. The second trip was aborted after only one set due to an incidental take of another Kemp's ridley turtle and four loggerhead turtles. This was done to ensure we did not exceed the take limit for Kemp's ridley turtles, which was set at four in the initial ESA permit issued. AIS conferred with Henry Milliken and he submitted a request for additional incidental takes for all sea turtles for ESA Permit No. 17225 to the Permits and Conservation Division at the NMFS Office of Protected Species. We suspended the study activities until 2/23/17 pending an amendment to the permit that was expected to be issued by 2/24/17. On 2/23/17 there was one incidental take of a loggerhead turtle and no Kemp's ridley turtles.

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

A modified ESA Permit 17225-01 was issued on 2/24/17. This permit modification increased the number of incidental takes for all sea turtle species and sturgeon significantly and should be sufficient to complete the number hauls scheduled for this year’s study and potentially future studies.

Windy weather prevented research from 2/24/17 – 2/26/17 and trips 004 and 005 were completed on 2/27/17 and 2/28/17. There were no major by-catch incidents, with only occasional elasmobranchs and no teleost or sturgeons taken so far. The majority of the by-catch consisted of cownose rays, southern rays, angel sharks, sand tiger sharks, nurse shark, and butterfly rays.

Ms. Roy participated on the first two trips of the study and obtained instructions and experience from CI Eric Matzen on the capture of protected species. There were seven sea turtles captured on these trips, which presented a good opportunity to gain experience in capture methodology. On 2/24/17 the NEFSC issued a letter authorizing Kathryn Roy to capture protected species during the duration of this study, which will provide AIS with alternative staff to participate in the study and to ensure the project will always have qualified observers available.

Table 1. Trip Summary Table

Trip ID	Date	Personnel onboard	# of Control Strings Set	# of Nets / String	# of Experimental Strings Set	# of Experimental Nets / String	Comments
001	2/18/2017	Charlie Locke, Rhomsey Alwar, Eric Matzen, Kathryn Roy, Kerry Lyons	2	4	2	4	cownose ray, butterfly rays, angel sharks
002	2/19/2017	Charlie Locke, Rhomsey Alwar, Eric Matzen, Kathryn Roy, Kerry Lyons	1	4	1	4	nurse shark, butterfly rays, southern rays
003	2/23/2017	Charlie Locke, Rhomsey Alwar, Eric Matzen, Kerry Lyons, Rick Usher	8	2	8	2	On the previous day it was decided to reduce each string to 3 nets. The mate accidentally removed 2 nets from the experimental gear and this was not verified until after the first haul so on haul # 1 the control had 3 nets and the experimental gear had 2 nets. The control string was reduced to 2 nets for the remainder of the day so the gear would be fishing equally. By-catch cownose rays, sand tiger sharks, angel sharks
004	2/27/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	7	3	7	3	By-catch butterfly ray, angel sharks, southern ray
005	2/28/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	4	3	4	3	By-catch butterfly ray, angel sharks, southern ray

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Table 2. Incidental Take Table

Date	Trip ID	Haul #	Species	Length (cm)	Condition	Release Location			Comments	Control	Experimental	Released Alive	Retained in Freezer	Discarded Dead
						Latitude	Longitude	Bio Sample ID						
2/18/2017	001	2	Kemps Ridley	38.2	Alive	3508.4	7538.8	LK01	dove and swam		1	1		
2/18/2017	001	3	Kemps Ridley	45	Alive	3508.8	7538.4	LK02	dove and swam		1	1		
2/19/2017	002	1	Loggerhead	68.4	Alive	3507.3	7539.2	CC03	dove and swam	1		1		
2/19/2017	002	1	Kemps Ridley	77	Alive	3507.3	7539.2	LK04	dove and swam	1		1		
2/19/2017	002	1	Loggerhead	68.5	Alive	3507.4	7538.9	CC05	dove and swam	1		1		
2/19/2017	002	1	Loggerhead	69	Alive	3507.4	7538.9	CC06	dove and swam	1		1		
2/19/2017	002	1	Loggerhead	n/a	Alive	n/a	n/a	----	fell out of gear, didn't come aboard	1		1		
2/23/2017	003	2	Loggerhead	76	Alive	3507.4	7539.7	CC08	dove and swam	1		1		
2/27/2017	004	2	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard	1		1		
2/27/2017	004	6	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard	1		1		
2/27/2017	004	10	Loggerhead	76.5	Alive	3506.4	7539.4	CC11	dove and swam	1		1		
2/27/2017	004	11	Loggerhead	79	Alive	3506.5	7539.6	CC12	dove and swam	1		1		
2/28/2017	005	N/A	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

PROGRESS REPORT 03/01/17 – 3/15/17

Reduction of Turtle By-catch in the Bottom-Set Gillnet Fisheries Gear Study



Accuracy, Integrity, Service

Submitted Via E-mail to: **Henry Milliken**
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543
Phone: 508-495-2294
Email: henry.milliken@noaa.gov

Submitted by: **Kathryn Roy and Rick Usher**
A.I.S., Inc.
14 Barnabas Road
Marion, MA 02738
Phone: 774-392-7127 / 774-200-0563

Weekly Overview

Unfortunately during this reporting period Captain Locke became very ill from 03/01/17 through 03/08/17 and the team was unable to complete any trips until he felt up to working again. After his recovery, they were able to get 34 hauls (17 sets) in over three sea days before windy weather prevented research from 3/13/17-3/15/17.

A project meeting was held via conference call on 03/10/17 between Kathryn Roy, Rick Usher, Captain Charlie Locke and Kerry Lyons to discuss returning to four net sets from the three that had previously been agreed upon. This plan was initiated the following day with success. Efforts were made to maintain the one-hour soak time with the increased net numbers, in order to avoid large catches of elasmobranchs and reduce the potential for mortality to sea turtles.

Project Progress

Three trips (006, 007, and 008) were made between 03/01/2107 and 3/15/17. Table 1 is a summary of each trip. The table includes the trip id, personnel onboard, the number of strings set for each treatment, the number of nets in each string and relevant comments. The incidental take data for each trip is summarized in Table 2.

The majority of the by-catch for these three trips consisted of cownose rays, southern rays, angel sharks, sand tiger sharks, clearnose skate, butterfly rays, and large black drum (25 lb. to 40 lb.) which were well over the legal size of 15"-27" for North Carolina waters. There were also two Atlantic Sturgeon captured in the control net on trip 007 (haul # 05) on 03/11/17. One sturgeon was too large to be brought on deck, and while it briefly swam belly up post-release, it recovered quickly and swam away. The sturgeon that came aboard was quickly sampled and measured. Unfortunately, in the rush to get the animal back into the water, there was no weight obtained, nor was the animal scanned for pit-tags or pit-tagged. Going forward the CI has been instructed to collect data on sturgeon if they are in good condition and this can be accomplished without injuring them. There were five sea turtles captured on these trips.

A trip was attempted on 03/06/17 but was quickly aborted due to the Captains lingering illness as he felt it was unsafe for him and the crew if he became worse while at sea. The Captain recovered and they headed out again a couple days later. On trip 006, a single loggerhead turtle was captured in the control gear. The live turtle had only a flipper entangled through one mesh, fell out of the gear due to its size, and swam away. Captain Locke commented that there were more rays captured in the experimental gear on this day. He believes rays are tangled much easier in the lower profile of the gear especially in the area of the net where the tie downs were located. Loggerheads were also spotted swimming at the surface during the first few hauls.

Hauls made for Trip 007 resulted in two Kemp's ridley turtles and two Atlantic Sturgeon being captured in the control gear, as well as one Kemp's ridley turtle in the experimental gear (all alive and well). Captain Locke mentioned that he finds the Kemps tend to swim lower in the water column and that this behavior likely affected the rate at which they were captured in the state waters. Due to strong northerly winds this trip was conducted in state waters and the NC DMF was notified via e-

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

mail by Co-investigator Kerry Lyons that the F/V Salvation would be working under the ESA permit utilizing restricted gillnet gear.

Trip 008 saw only one live loggerhead turtle caught, and it was captured in the experimental gear. This particular individual had a previously amputated flipper but dove out of site when returned to the water, just as the others did. This trip was also completed in NC state waters and proper notification was sent to the NC DMF.

Table 1. Trip Summary Table

Trip ID	Date	Personnel onboard	# of Control Strings Set	# of Nets / String	# of Experimental Strings Set	# of Experimental Nets / String	Comments
006	3/9/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	8	3	8	3	By-catch butterfly rays, southern rays, cownose rays, sand tiger shark
007	3/11/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	6	3 for 3 sets and 4 for 3 sets	6	3 for 3 sets and 4 for 3 sets	On the previous day it was decided to return to 4 panels strings if time allowed. After 3 sets with 3 panel strings, one more panel was added to both treatments. By-catch angel sharks, cownose ray, clearnose skate, sand tiger shark. 2 Atlantic Sturgeon were caught on haul # 05
008	3/12/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	3	4	3	4	By-catch angel shark, southern ray, cownose ray, black drum (large catch of large black drum)

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Table 2. Incidental Take Table

Release Location														
Date	Trip ID	Haul #	Species	Length (cm)	Condition	Latitude	Longitude	Bio Sample ID	Comments	Control	Experimental	Released Alive	Retained in Freezer	Discarded Dead
3/9/2017	006	1	Loggerhead	n/a	Alive	n/a	n/a	N/A	fell out of gear, didn't come aboard, dove and swam	1		1		
3/11/2017	007	1	Kemps Ridley	37.9	Alive	3510.7	7542.8	LK14	dove and swam	1		1		
3/11/2017	007	11	Kemps Ridley	42.5	Alive	3510.2	7544.5	LK15	dove and swam		1	1		
3/11/2017	007	12	Kemps Ridley	53	Alive	3510.6	7544.3	LK16	dove and swam	1		1		
3/11/2017	007	5	Atlantic Sturgeon	156.2	Alive	3511.7	7542.4	AOO1	swam away	1		1		
3/11/2017	007	5	Atlantic Sturgeon	n/a	Alive	3511.6	7542.4	N/A	fell out of gear, didn't come aboard, swam away	1		1		
3/12/2017	008	2	Loggerhead	77	Alive	3510.6	7542.6	CC17	dove and swam		1	1		

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

PROGRESS REPORT 03/16/17 – 3/31/17

Reduction of Turtle By-catch in the Bottom-Set Gillnet Fisheries Gear Study



Submitted Via E-mail to: **Henry Milliken**
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543
Phone: 508-495-2294
Email: henry.milliken@noaa.gov

Submitted by: **Kathryn Roy and Rick Usher**
A.I.S., Inc.
14 Barnabas Road
Marion, MA 02738
Phone: 774-392-7127 / 774-200-0563

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Weekly Overview

Other than a few weather days and cooler air and water temperatures, the final reporting period was very productive. We were able to continue utilizing four net strings for all of the sets, and efforts were made to maintain the one-hour soak time in order to avoid large catches of elasmobranchs and reduce the potential for mortality to sea turtles.

On 03/24/17 the final 12 of 120 sets were completed and the team de-mobilized on 03/25/17. Kerry Lyons delivered the equipment to the A.I.S. Inc. Marion, MA office on 03/27/17. Kathryn Roy met up with Henry Milliken on 03/29/17 to return the gillnet gear to the storage facility at OTIS. A post project, follow-up meeting is scheduled for 03/31/17 with Kathryn Roy, Rick Usher, Captain Charlie Locke, Kerry Lyons, Henry Milliken and Eric Matzen to discuss general observations during the study, final results, lesson learned, data format summary, and potential improvements for any future studies.

Project Progress

Four trips (009, 010, 011, and 012) were made between 03/17/2107 and 3/24/17. Table 1 is a summary of each trip. The table includes the trip id, personnel onboard, the number of strings set for each treatment, the number of nets in each string and relevant comments. The incidental take data for each trip is summarized in Table 2.

The majority of the by-catch for these four trips consisted of cownose rays, southern rays, angel sharks, sand tiger sharks, clearnose skate, butterfly rays, a false albacore, and a tiger shark, which was kept, processed, and sold to market. There were no Sturgeon captured during this reporting period and there were eleven sea turtles captured between these dates.

On trip 009, a single loggerhead turtle was captured in the experimental gear. The live turtle had only a flipper entangled through one mesh; it fell out of the gear due to its size and swam away, visibly unharmed. It appeared to be entangled near a tie down in the gear. Kemps Ridley turtles were spotted swimming at the surface prior to haul 005 and loggerheads prior to hauls 007 and 009 through 012. The GoPro was secured to the gillnet end line on hauls 11 and 13.

Hauls made for Trip 010 resulted in three loggerhead turtles being captured, two in the control gear and one in the experimental. All turtles were barely tangled in a mesh, and fell out of the gear prior to coming aboard. Turtle CC21 appears to have been tangled near a tie down. All turtles swam away without any visible issue. On the fourth and seventh hauls, the net became hung up and a tear was produced in part of the net. Loggerheads were seen swimming at the surface prior to all but the last haul.

Trip 011 was an overcast day, with poor water visibility and five loggerhead turtles were captured, four in the experimental gear and one in the control. All turtles were barely tangled in a

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

mesh, the second and third came aboard but the rest fell out of the gear prior to coming aboard. All turtles swam away without any visible issue. Loggerheads were seen swimming at the surface prior to the first two hauls. Turtle CC26 appears to have been caught in the gear near a tie down. The team brought up a tiger shark on the first haul which was retained, processed and sold to market (dressed weight 47lbs). Upon processing the shark, Captain Charlie Locke found the remains of what appears to be a piece of turtle plastron (species unknown).

On Trip 012, the water visibility remained poor. Loggerheads were seen at the surface prior to setting all but the fourth and sixth haul. Two loggerheads were captured, one in each gear type, neither of which came aboard, falling from the gear during the hauling process. Both turtles dove and swam away, visibly unharmed. The GoPro was secured to the headline on the second net of the seventh and ninth haul.

Overall, none of the trips during this reporting period took place in state waters and the surface temperatures dropped 6° Celsius from the beginning of study. If NMFS is interested in potentially tagging more of the sea turtles that fell from the net while being hauled, we could potentially retrieve them a large dip net when we observe them beginning to fall out of the gillnet.

Table 1. Trip Summary Table

Trip ID	Date	Personnel Onboard	# of Control Strings Set	# of Nets / String	# of Experimental Strings Set	# of Experimental Nets / String	Comments
009	3/17/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	7	4	7	4	By-catch angel shark, southern ray, cownose ray, sand tiger shark, butterfly ray
010	3/20/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	4	4	4	4	By-catch angel shark, sand tiger shark, southern ray, butterfly ray, cownose ray
011	3/21/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	4	4	4	4	By-catch tiger shark, sand tiger shark, angel shark
012	3/24/2017	Charlie Locke, Rhomsey Alwar, Kerry Lyons	6	4	6	4	By-catch angel sharks, sand tiger sharks, false albacore, cownose ray, clearnose skate
Totals			60		60		

A.I.S., Inc.

Final Report for Contract Number EA-133F-14-SE-3694

Table 2. Incidental Take Table

Date	Trip ID	Haul #	Species	Length (cm)	Condition	Release Location		Bio Sample ID	Comments	Control	Experimental	Released Alive	Retained in Freezer	Discarded Dead
						Latitude	Longitude							
3/17/2017	009	9	Loggerhead	n/a	Alive	n/a	n/a	N/A	fell out of gear, didn't come aboard, swam away		1	1		
3/20/2017	010	4	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away	1		1		
3/20/2017	010	4	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away	1		1		
3/20/2017	010	7	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away		1	1		
3/21/2017	011	2	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away		1	1		
3/21/2017	011	3	Loggerhead	74.5	Alive	3506.7	7531.4	CC23	dove and swam		1	1		
3/21/2017	011	5	Loggerhead	74.6	Alive	3506.6	7539.2	CC24	dove and swam	1		1		
3/21/2017	011	6	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away		1	1		
3/21/2017	011	7	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away		1	1		
3/24/2017	012	5	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away	1		1		
3/24/2017	012	10	Loggerhead	n/a	Alive	n/a	n/a	n/a	fell out of gear, didn't come aboard, swam away		1	1		