Understanding Impacts of the Sea Scallop Fishery on Loggerhead Sea Turtles through Satellite Tagging

Application for 2011 Sea Scallop
RSA Program

Start Date: March 1, 2011
End Date: February 28, 2012

By

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In Collaboration with

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Research Priority

3. Research focused on reducing sea turtle bycatch in scallop fisheries, including oceanographic conditions, geographic locations or other identifiable factors that may contribute to sea turtle interactions during scallop fishing. This will entail data collection and analysis of sea turtle distributions and behavior to identify spatial and temporal "hot spots" on the fishing grounds and turtle behaviors that impact bycatch rates. The information collected will aid in evaluating harvesting strategy options to minimize harm to sea turtles.

Project Summary

We propose to purchase and then attach ten satellite tags on ten juvenile loggerhead turtles during ten days at sea. The vessel will also conduct turtle sighting surveys for the duration of field operations. In addition, the vessel will be equipped with a Benthos Teledyne Stingray ROV system. Its primary tasks will involve tracking, observing and filming loggerhead turtles to elucidate their *in situ* behaviors (e.g. feeding, diving, and breathing). The ROV has proven itself as an excellent tool for validating the location and quantity of sea turtle prey species in the water column and on the sea floor as well as interpreting tag data. The observed turtle behavior, from the tags and the ROV, will be analyzed in context with oceanographic and weather data .

The proposed work represents a continuation and evolution of projects conducted since 2004 under RSA funding and NMFS contracts. These projects, besides developing sea turtle excluder gear, have advanced the ability to locate, track and observe loggerhead sea turtles through innovative use of dredge and ROV mounted video cameras, side-scan sonar, aerial surveys, and satellite tags. Recent field work demonstrated exceptional success in tracking and observing sea turtles throughout the water column with an ROV including bottom feeding and social aggregations. Also, during this time period, a series of oceanographic stations were occupied and aerial over-flights conducted in order to establish the localized oceanographic features associated with turtle distributions. On August 24, 2009, Cfarm and NMFS staff successfully attached two Fastloc Argos satellite tags to two juvenile loggerhead turtles (63 & 78 cm CL) in the HCAA. The tags are transmitting turtle location, time at depth, and water temperature data. This data will be incorporated with all the other data collection efforts to evaluate juvenile loggerhead behaviors on the scallop grounds. In August, 2010, Cfarm and NMFS staff successfully placed similar tags on seven additional loggerheads and they are transmitting. The two 2009 tags transmitted data for almost one year and followed a complete migratory cycle of the loggerheads.

The proposed work will continue to build this unique set of observational records and use them to assess ideas regarding the factors that govern sea turtle distributions and behavior in the Mid-Atlantic Bight (MAB) shelf region. While past studies have focused mainly on sea surface temperature and bathymetry as controlling and/or predictive factors (e.g. Hawkes et al., 2007; Murray, 2007), we postulate that on time scales of days to weeks, sea turtle "hot spots" are more closely tied to the geography of oceanographic fronts associated with water mass and chlorophyll gradients driven by wind stress and buoyancy (density) contrasts.

In the analysis phase of this proposal, maps of surface and subsurface oceanographic properties (temperature, salinity, density, velocity and chlorophyll), turtle distributions and biology assemblages will be constructed to assess linkages amongst them (i.e. where the turtles are and are not in relation to

primary productivity, distinct water masses and frontal features). Remotely sensed properties spanning the period of past and proposed field operations (ocean surface winds from QuikSCAT plus sea surface temperature and chlorophyll-a from MODIS-Aqua satellite products) will be utilized to provide larger scale physical context for the *in situ* observations. This will include characterizing the wind conditions that influence the observed ocean property distributions (e.g. horizontal gradients and vertical stratification) and assessing the relationship between remotely sensed chlorophyll concentrations, ocean currents and water mass distributions. If spatial and temporal relationships between turtles and these oceanographic properties can be identified, then remotely sensed winds and sea color (chlorophyll) have the potential to provide a basis for modeling and predicting sea turtle "hot spots" on the fishing grounds. The video component will help to establish the behavioral rationale for MAB turtle distributions (where in the water column and on what are they feeding?) in addition to providing unique insights regarding the ecology of loggerhead sea turtles.

There is a major government agency effort underway to assess the in-water population status of loggerheads using aerial survey techniques. A fundamental question that needs to be answered to assess the loggerhead population is the amount of time loggerheads spend at or near the surface within aerial sighting range. The satellite tag data is invaluable in providing answers to this question. Decisions on whether or not to uplist the loggerhead to endangered status may rest on the population status. An uplisting to "Endangered" can have severe repercussions to the sea scallop fishery and all other Mid-Atlantic fisheries.

Project Participants (Tasks)

Ronald Smolowitz, Matt Weeks,	**Coonamessett Farm Foundation, Inc** (Operations)
Ruth Curry	(hydrographic analysis and interpretation)
Rhonda Moniz	**Benthic Explorations** (ROV operations)
Jim Gutowski	**Viking Village Fisheries** (Vessel coordination/operations)

Project Description

The purpose of this project is to collect further information on turtle behavior and distributions -- temporally, horizontally, and vertically in the water column – and to assess linkages to oceanographic property distributions and fronts using both *in situ* and remotely-sensed measurements. To accomplish this task the project will place satellite telemetry tags on ten juvenile loggerhead turtles (50-90 cm carapace length) in the offshore Mid-Atlantic scallop fishing grounds during the known periods of turtle interactions. This tagging study will be conducted in conjunction with, and integrated into, the ongoing Cfarm turtle ecology research program that utilizes a remotely operated vehicle (ROV) to directly observe loggerhead behavior; as well as an ongoing oceanographic analysis aimed at predicting turtle distribution and behavior on the scallop fishing grounds. The proposed work builds upon a lengthening timeline of studies using video to investigate and document aspects of turtle and scallop dredge behavior and interactions. These studies have been motivated by a quest to better understand, quantify and mitigate interactions between sea turtles and the scallop fishery and to provide a factual basis for crafting policies that are mutually constructive to both groups.

A. Background Information and Past Accomplishments

Previous work by Coonamessett Farm Foundation (CFF) led to the development of the Cfarm turtle excluder dredge and chain mats which greatly reduced the risk of injury and mortality to loggerhead sea turtles in scallop dredges (Dupaul et al., 2004; Milliken et al., 2007; Smolowitz et al., 2008). There is a need to quantify this reduction of injury and mortality which requires a detailed understanding of how and where turtle-dredge interactions occur.

Since 2007, a remotely operated vehicle (ROV) has been used by CFF's RSA projects. With video and sonar equipment mounted on the ROV, efforts are directed toward observing turtles in the water column and on the sea floor. During these trips, over 250 turtles have been observed from the vessel and over 50 tracked with the ROV, capturing their feeding, diving, swimming, and social behaviors. Analysis of that video footage is now providing novel insights into sea turtle behaviors: e.g. the depth ranges occupied, frequency of surfacing, feeding behaviors and prey species, shark and predator avoidance, intra-species behaviors, and much more. A number of turtles have been followed to the bottom to depths of 60 m and water temperatures of 7.5° C, remaining in excess of 30 minutes without exhibiting visible signs of stress. Tag data has confirmed this behavior as routine during the foraging period. Turtles were also observed by the ROV to be feeding on jellyfish in the water column and benthic crustaceans on the sea bed. The ROV has also been towed behind actively fishing scallop vessels and have physically encountered a turtle at 10 m depth in the discard stream of a scalloper. These methods, which we continue to improve and refine, will constitute the basis for observations of sea turtles in 2011.

In 2009 and 2010 oceanographic sampling from a second vessel was incorporated into the project design. Oceanographic and plankton stations were occupied on a series of cross-shelf transects. To correlate oceanographic data with turtle distributions a spotter aircraft was hired with a trained pilot and a second trained observer, which in 2009 flew four times over each of eight transects (32 runs) recording more than 200 turtle sightings. This was intended to provide a "presence" survey of turtles, as opposed to a detailed species assessment. The first survey, conducted in July 2009 established that sea turtle distributions at that time of year were strongly associated with the geography of the "cold pool" – a highly oxygenated water mass of temperatures 6-10°C that originates further north on the Scotian Shelf (Houghton et al., 1982). The ROV video confirmed that loggerheads were bottom feeding on crabs and mollusks in those waters, spending as much as 30 minutes in a single dive, and possibly using the warm surface waters (20-22°C) to adjust their body temperature between dives. Having demonstrated success in acquiring these various data and their value as a means of establishing a factual basis for understanding sea turtle ecology, we anticipate learning and documenting a great deal of new information, e.g. about variability in turtle distributions and behavior on monthly timescales, and the role of ocean currents in determining that variability.

B. Scientific Justification

In their juvenile to adult stages, loggerhead turtles are known to migrate annually into the Mid-Atlantic shelf region and forage there between June and November when sea surface temperatures (SST) warm to above 20°C (Shoop and Kenney, 1992; Hawkes et al., 2007). Beyond the seasonal relationship between temperature and turtle distributions, however, only moderate progress has been made in determining the environmental factors that may co-vary with or control these turtle distributions. For example, attempts to parameterize western North Atlantic turtle distributions have yielded some broad linkages to SST,

Gulf Stream position, and bathymetry (e.g. Hawkes et al., 2007). Post-hatchling loggerheads have been closely associated with floating Sargassum mats in downwelling fronts on the shoreward side of the Gulf Stream (Witherington, 2002) and have been found far from land in the central and eastern Atlantic (Bolten et al. 1992). In the central North Pacific, juvenile loggerheads have been strongly linked to oceanographic fronts characterized by distinct sea surface height, temperature and chlorophyll gradients determined from satellite data (Polovina et al., 2000). A generally accepted model is that hatchling loggerheads in both the Atlantic and Pacific spend a pelagic stage of life in the mid ocean gyres, where convergent oceanic fronts provide zones of enhanced food supplies (Carr, 1986; Olson et al., 1994; Bolten, 2003). The end of the pelagic phase is marked by entry into the continental shelf regions – along the U.S. Atlantic coast and Japan -- where foraging occurs in neritic and benthic environments.

Within the last decade, incidental takes of turtles by the Mid-Atlantic scallop fisheries have been perceived to pose a threat to loggerhead populations, and therefore increased priority has been assigned to sorting out the factors that create overlap between the turtles and scallop fishery. Our 2009-10 field work leads us to postulate that ocean salinity and chlorophyll may be practical predictors of turtle distributions – more so than SST and bathymetry -- through their strong association with horizontal density gradients and hence regional currents and water mass fronts.

The physical oceanography of the MAB region has been well described in a variety of studies (Wright and Parker, 1976; Beardsley and Winant, 1979; Chapman and Beardsley, 1988; Flagg et al., 2002; Johnson et al., 2001). On the shelf, salinities range from >36 psu seaward of the shelf edge to <30 psu near shore and are the dominant factor creating and maintaining strong frontal features trending northeast to southwest along the entire shelf . Such fronts are not only sites of enhanced biological productivity transcending multiple trophic levels, but they may also act as boundaries creating distinct species transitions (Olson et al., 1994). Salinity gradients are aligned with chlorophyll concentrations, a metric of biological productivity. We speculate that abundance of turtle food (i.e. jellyfish and Sargassum weed communities) may also align with these fields creating areas where sea turtles congregate – and areas where they do not. In short, we postulate that while temperature primarily controls the seasonal turtle distributions and migration, the structure of ocean currents and availability of food govern those distributions during the warm months. The ROV work to date, for example, indicates that the presence/absence of jellyfish may influence how much time loggerheads spend feeding on the seafloor where they are at risk to dredge encounters. The proposed project will test the hypothesis that sea turtle distributions align with hydrographic properties (velocity, density, salinity, and chlorophyll) associated with water masses and frontal zones in the Mid Atlantic shelf region.

C. Results from 2009

The postulated link between turtle distributions and oceanography is supported by CFF's 2009 on the MAB shelf. A hydrographic survey was conducted July 7-12 2009 aboard the *F/V Diligence* utilizing a CTD, fluorometer and ADCP (compass problems rendered the velocity data unusable for that trip). Along six lines (B-E, G and H) crossing the shelf between the 20 and 100 meter isobaths (Fig. 1), 56 stations were occupied at nominal 10 km spacing. Underway sampling of surface temperature and salinity was accomplished by continuously pumping water through a small holding tank containing a second CTD. At 3 stations along transect B, plankton tows were conducted with 60-cm paired bongo nets to assess biomass and species assemblages. Over the sampling period, aerial surveys of turtles were conducted along 8 transects (A-H) from shore to the shelf break. Aboard the *F/V Kathy Ann,* ROV and

video operations were simultaneously undertaken. Addendum A contains the figures referred to in this section. Figure 1 shows the aerial and shipboard tracklines with respect to bathymetry and locations of sea turtle sightings.

Figure 2 depicts the surveys and turtles relative to satellite-derived maps of chlorophyll-a and sea surface temperature (SST) for the period of field operations, plus shipboard measurements of salinity at the sea surface and seafloor. Turtles were concentrated in a broad band where seafloor depths ranged 30 – 60 m. Of ~270 sightings, none occurred seaward of the 70m contour, and < 10 were shoreward of the 30 m contour. Chlorophyll exhibited strong cross-shelf gradients: < 0.4 mg/m^3 along the offshore edge to values > 10 mg/m^3 inshore of 10 m. Turtles were distributed almost exclusively in regions for which surface chlorophyll was in the range 0.4 – 1.0 mg/m3: fewer than 10 turtles occupied regions where chlorophyll exceeded 1.0 mg/m^3 and none where chlorophyll > 2.0 mg/m^3. SST and SSS exhibited little cross-shelf structure or obvious relations to the turtle sightings, except that no turtles were found where SSS > 34 psu – which was always offshore of the 70 m isobath. SST was in the range 19-22°C everywhere across the survey region; salinity ranged from < 30 psu inshore to > 35 psu near the edge of the shelf throughout the water column. Below the seasonal thermocline, salinity exhibited a more structured and monotonic cross-shelf gradient.

Although turtle distributions could be characterized as broadly aligned with bathymetry and surface chlorophyll, a more compelling association is the presence or absence of a particular subsurface water mass – known as the "cold pool" – identified by the yellow colors in the bottom salinity map (Fig 2D). Three distinct water masses were evident in sections of temperature, salinity and chlorophyll (Fig. 3), each with separate origins and T-S characteristics (Fig. 4):

- Warm, fresh waters (T > 10°C, S < 32 psu) occupied the upper water column (to 20 m) with shoreward intensification. These waters are strongly influenced by continental runoff from coastal estuaries along the shelf and are generally associated with strong frontal regions and alongshore currents.

- Warm, saline waters (T > 10°C, S > 34 psu), commonly known as "slope waters", originate in the region between the continental slope and Gulf Stream, and intruded onto the offshore side of the shelf.

- The "cold pool" (6 - 10°C, 32.5-33.5 psu, red boxes in Fig. 4) occupied the mid-shelf region below 20 m. These waters originated to the north on the Scotian Shelf and were advected to the MAB shelf with a travel time of approximately 3-4 months (Houghton et al., 1982). Having been ventilated in winter, they are enriched in oxygen and are well-mixed with moderate levels of nutrients.

The close association between turtles and the location of the cold pool is exceptionally clear (Fig. 2D and Fig. 4). The presence of cold pool waters virtually guaranteed that turtles were sighted regardless of how fresh the surface layers were. However, turtles were distinctly absent in places where saline waters (> 34 psu) intruded onto the shelf –even in a few places where cold pool waters were situated beneath the salty intrusions (e.g. stations 3 and 21, Fig 3).

We speculate that the cold pool waters are favorable to producing turtle food – they were observed by the ROV-mounted camera to be feeding primarily on crustaceans along the seafloor on this survey – *and* that the inshore (warm, fresh) and offshore (warm, salty) water masses are not. Large cross-shelf gradients in biomass were measured and superficially different species (ctenophores and copepods inshore, no jellies offshore) were apparent in three separate plankton tows conducted along transect B: inshore (CTD station 49), mid-shelf (station 53) and offshore (station 56). Detailed analysis of species assemblages is presently underway, and will confirm or deny those preliminary assessments. One implication is that the physical properties and dynamics of the MAB shelf support distinct trophic boundaries that profoundly influence the ecology of the region, including sea turtles. A logical research strategy is to build the timeline of observations to obtain statistically meaningful records and use them to investigate the geography and dynamics of those boundaries.

The shelf circulation along the MAB is broadly characterized by frontal structures associated with near-coastal currents, the sub-thermocline "cold pool" and a strong baroclinic jet at the shelf-break (Gawarkiewicz et al., 1996). These currents vary on timescales of weeks, months, seasonally and interannually and likely exert strong influence on the ecology and distribution of sea turtles. From the physical and dynamical perspective, two particular questions arise:

1) Do frontal jets along the coast and shelf-break affect sea turtle distributions and behaviors?
2) How do these fronts and behaviors change in the June-November time frame when turtles inhabit the MAB shelf?

Conducting repeated regional surveys, such as was done for the RSA 2009 and 2010 projects, constitutes a relatively cost-effective means to address these questions. Although chlorophyll and velocity measurements were not part of the above discussion of results, when combined with CTD subsurface measurements, they constitute powerful tools for investigating the shelf circulation. ADCP velocity measurements are integral to the overall sampling strategy of the proposed work. (Compass problems on the July survey will be remedied using multiple GPS streams in subsequent operations.) Chlorophyll – remotely sensed and *in situ* – provides a convenient and reliable tracer of fronts. The steep chlorophyll gradient inshore (Fig 5) is associated with along-shore coastal currents (Johnson et al. 2001), offshore, the 0.4 contour delineates the shelf-break front. Turtles seem to avoid high chlorophyll waters: the density of turtles is significantly reduced in the tongue of elevated chlorophyll protruding southeast across the shelf along transect "C" and everywhere shoreward of the 1.0 mg/m^3 contour (Fig 2A). This was also generally noted when CFF 2008 ROV surveys were mapped against satellite chlorophyll. Are turtles keying on the chlorophyll concentration, or some other parameter such as a frontal current associated with the chlorophyll gradient?

Project Design and Work Plan

We propose that in this 2011 turtle ecology proposal that we focus on getting ten more juvenile loggerheads tagged. The tags provide a wealth of data but only transmit for about one year. We will depend on remotely gathered oceanographic and weather data for our analysis in 2011. NOAA plans to conduct an aerial turtle survey and we plan to use that data as well.

Tag Design/Data Analysis

The tags to be utilized for this study will be Sea Mammal Research Unit's Satellite Relay Data Logger (SRDL) with Argos Fastloc GPS. Specifications for the SRDL tags are provided in Addendum B. Fastloc GPS offers the possibility of attempting a location at every surfacing. Less than a second is needed to acquire the information required for a location. The tag also uses precision wet/dry, pressure and temperature sensors to form detailed individual dive (max depth, shape, time at depth, etc) and haulout records along with temperature profiles and more synoptic summary records as in standard SMRU SRDLs. Both location and behavioral data are then stored in memory. Data relayed, and locations computed using the global Argos satellite system. The SRDL tags will relay an unbiased sample of detailed individual dive records. A lithium "D" size cell provides approximately 85,000 full length Argos data transmissions. Cfarm currently has an active account for Argos transmissions with these tags.

Temperature and depth polling rates will be most frequent during the first 4 months of deployment so as to allow for the high resolution of data possible during the time when the turtles will be present on the scallop fishing grounds. This will also allow for more precise correlations with the oceanographic and ROV data collection. After 4 months, the polling rate will reduced, so that battery life can be extended to include sampling during the southern or offshore migration in the fall.

Based on CFarm's past tagging experience, SMRU has an excellent record of customer service, data quality, software, and analytical assistance. These tags have been successfully deployed by Cfarm and NEFSC staff on juvenile loggerheads. 3D graphics illustrating these data currently being collected by CFarm's tags are provided in Addendum B. These data (from currently active deployments) are preliminary and will be analyzed during the winter of 2010-11 using R and ArcGIS. Data will be stored on CFarm's server in a Microsoft Access Database. Frequent checks of each turtle's status will be conducted using SMRU's webpage and MamVisAD software. Cfarm currently owns all the necessary hardware and software necessary for data analysis, storage, and dissemination.

The project will utilize ten days at sea during the 2011 summer season (exact dates to be determined from ongoing data analysis). One commercial vessel, the F/V Kathy Ann, will be utilized for tagging and ROV operations. Jim Gutowski (Viking Village Fisheries), with whom CFF has successfully interacted in past years' RSA work, will oversee vessel coordination and operations. All our tagging procedures are defined in Addendum B. The ROV, equipped with video camera, sonar, and a time-depth-temperature sensor, will acquire and follow individual turtles, recording behaviors associated with breathing, feeding, swimming and location in the water column. Ronald Smolowitz and Matthew Weeks, Coonamessett Farm Foundation scientists, will oversee operations, assisted by Rhonda Moniz, a technician from Benthic Explorations. The video and data recordings will be analyzed onshore to address the questions listed above.

Ruth Curry, a scientist at Coonamessett Farm Foundation and Woods Hole Oceanographic Institution will take the lead in analyzing and interpreting the oceanographic data. Past hydrographic surveys produced 3-dimensional maps of temperature, salinity, density, velocity and chlorophyll concentrations which will be analyzed with respect to positions of sea turtles that are sighted and logged. As in July 2009, the T-S characteristics will be used to distinguish regional water masses and their origins (i.e. slope water, Gulf Stream water, coastal waters, and cold pool waters). Particular focus will be placed on

assessing turtle distributions with respect to temperature- salinity -chlorophyll (T-S-C) relationships, density-velocity-chlorophyll frontal zones and boundaries, presence of Sargassum communities, and water column species composition.

We will maintain a record of commercial scallop vessel fishing activity while at sea. Additional data will be acquired from NMFS based on their Vessel Monitoring System (VMS) upon the completion of the project field phase to determine any relationship between scallop fishing effort and turtle presence.

Results and their analysis will be published in a peer-reviewed journal and a final report shall be submitted to NEFSC on completion of this project as specified by the RSA program guidelines. The final reports shall be delivered electronically in journal format to the NEFSC. If the data supports our hypothesis, we will work with NMFS scientists to develop the research needed to validate and model the distributions of sea turtle "hot spots" on the scallop fishing grounds. Any information of use to the commercial scallop fleet in reducing possible takes will be disseminated through the Fisheries Survival Fund's (FFF) communications with its membership by Ronald Smolowitz, their technical advisor. The FFF represents the vast majority of the sea scallop fleet.

Sea Turtle Handling

All field operations on this project will be operating under the terms of the Coonamessett Farm Foundation **ESA Permit No. 14249**. Ronald Smolowitz and Mathew Weeks are PI's on this permit and have undergone NMFS training on handling and sampling sea turtles**.** Any sea turtles brought aboard that are comatose or inactive turtles shall be handled in accordance with Sea Turtle Resuscitation Regulations at 50 CFR 223.206(d)(1). Sea turtles that are actively moving shall be released by the crew of the vessel over the stern of the boat when gear is not deployed and engine gears are in neutral position, in areas where they are unlikely to be recaptured or injured by vessels. When possible live injured turtles will be transferred to a cooperating U.S. Coast Guard Vessel and delivered to an authorized rehabilitation facility. Loggerhead turtles injured within 36 hours of anticipated return will be brought in to the dock, unless arrangements can be made for a U.S. Coast Guard vessel to pick up the animal.

Project Duration

The period of performance shall be March 1, 2011 through February 28, 2012. A final report will be completed before the end of the performance period.

Project Budget:

A budget table is provided below.

Coonamessett Farm Foundation

Understanding Impacts of the Sea Scallop Fishery

on Loggerheads through Satellite Tagging

	Cost
Personnel:	
Cfarm Scientists 3 x 10 DAS @ $400/day	$12,000.00
Video Review/analysis 200 h @ $40/hr	$8,000.00
Data Analysis/Report Writing 300 h @ $40/hr	$12,000.00
Total Salaries	**$32,000.00**
Travel	
Mileage and food 2 rnd trips MA to VA for 5 people	$2,000.00
Total Travel	**$2,000.00**
Supplies	
SMRU Fastloc GPS tags (10 ea)	$50,000.00
Tag application supplies	$4,000.00
Misc supplies (logs, gloves, etc)	$1,000.00
Total Supplies	**$55,000.00**
Contractural	
Vessel Time 10 DAS @ $3000/day	$30,000.00
ROV Charter 5 DAS @ $2000	$10,000.00
Video Editing	$6,000.00
SMRU/ARGOS Tag monitoring $400/month x 12 months	$4,800.00
Total Contracts	**$50,800.00**
Other	
Administration Record Keeping	$5,000.00
Communications & Utilities	$1,000.00
Publications/copying	$1,000.00
Total Other	**$7,000.00**
Total Research Cost	**$146,800.00**
Compensation Collection @ 20/80 split	**$587,200.00**
Total Compensatio Required	**$734,000.00**

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Addendum A: Oceanography and Turtle Distribution

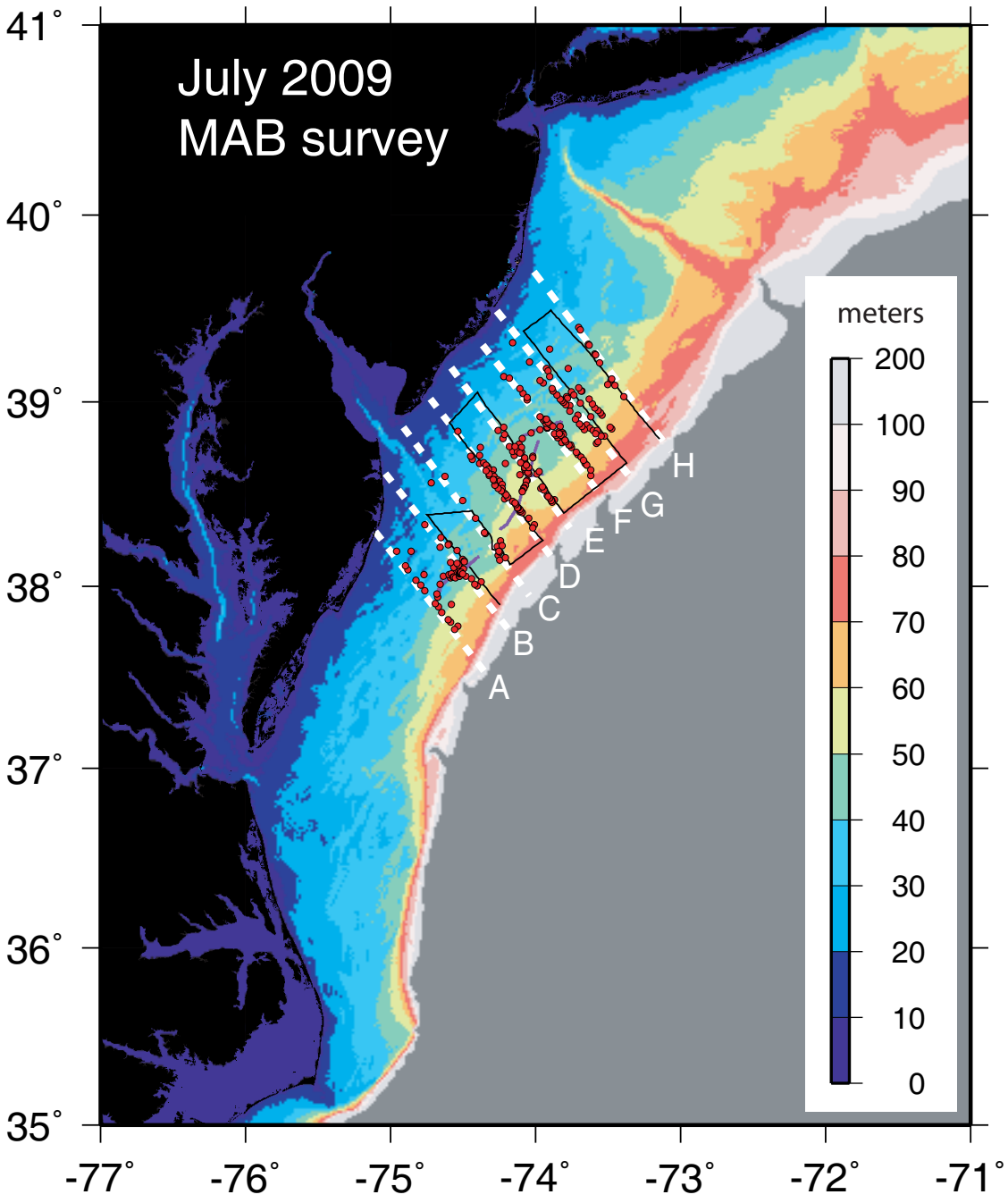


Figure 1. July 2009 MAB survey: turtle sightings red circles, spotter plane tracks (white dashed lines), hydrographic tracklines (black lines), and vessel conducting ROV operations (purple lines oblique to survey tracks).

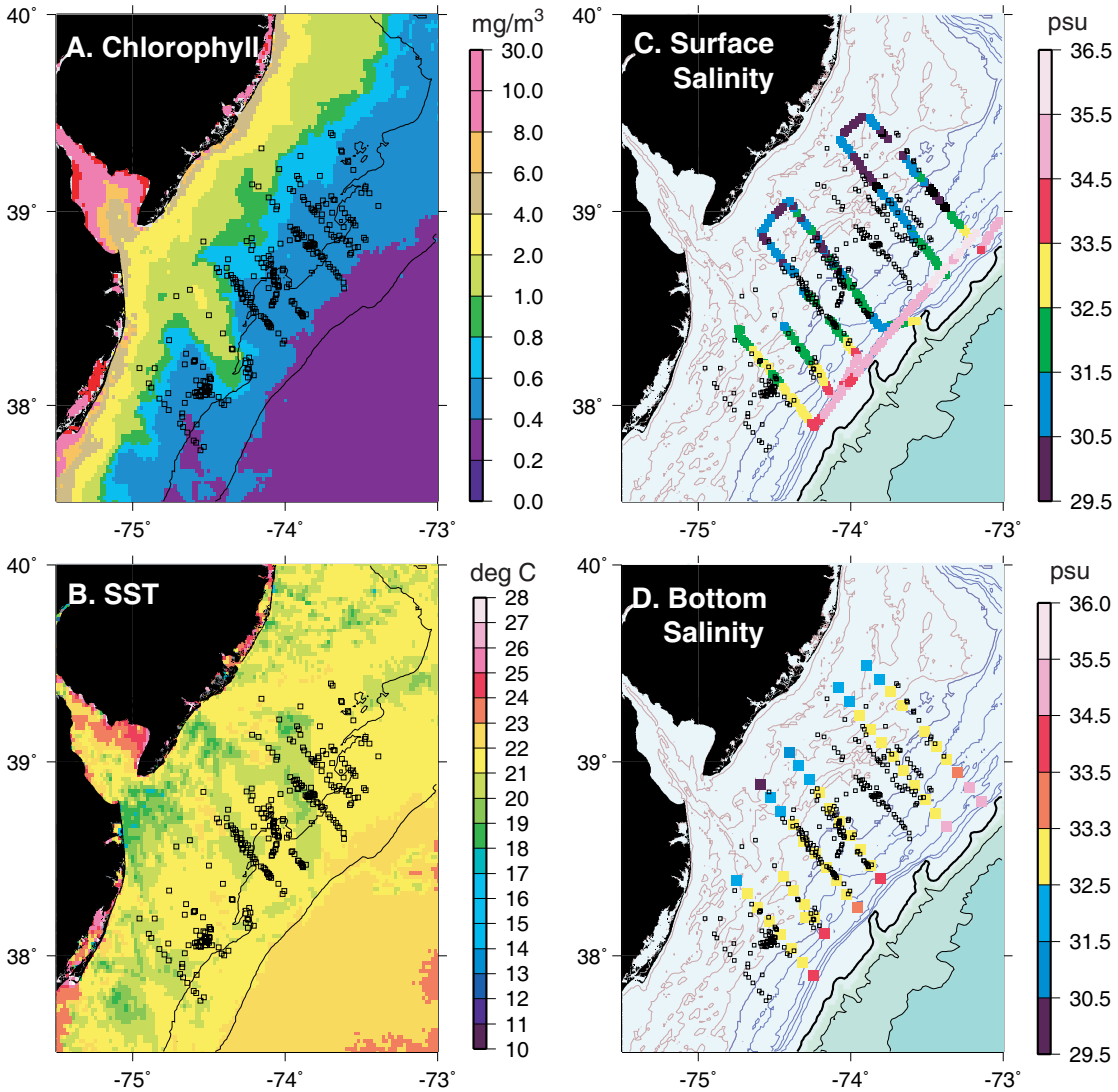


Figure 2. Maps of ocean properties and turtle positions (black squares) during the July 2009 survey. **A**) Surface chlorophyll-a and **B**) SST both from MODIS-Aqua (1km resolution, provided by Rutgers University Coastal Ocean Observing Lab); **C**) Surface salinity and **D**) bottom salinity along the hydrographic survey. In **A** and **B**, bathymetry contours at 50m and 100m are shown. In **C** and **D**, contours are at 10m intervals out to 100m, then at 200m, 1000m and 2000 m.

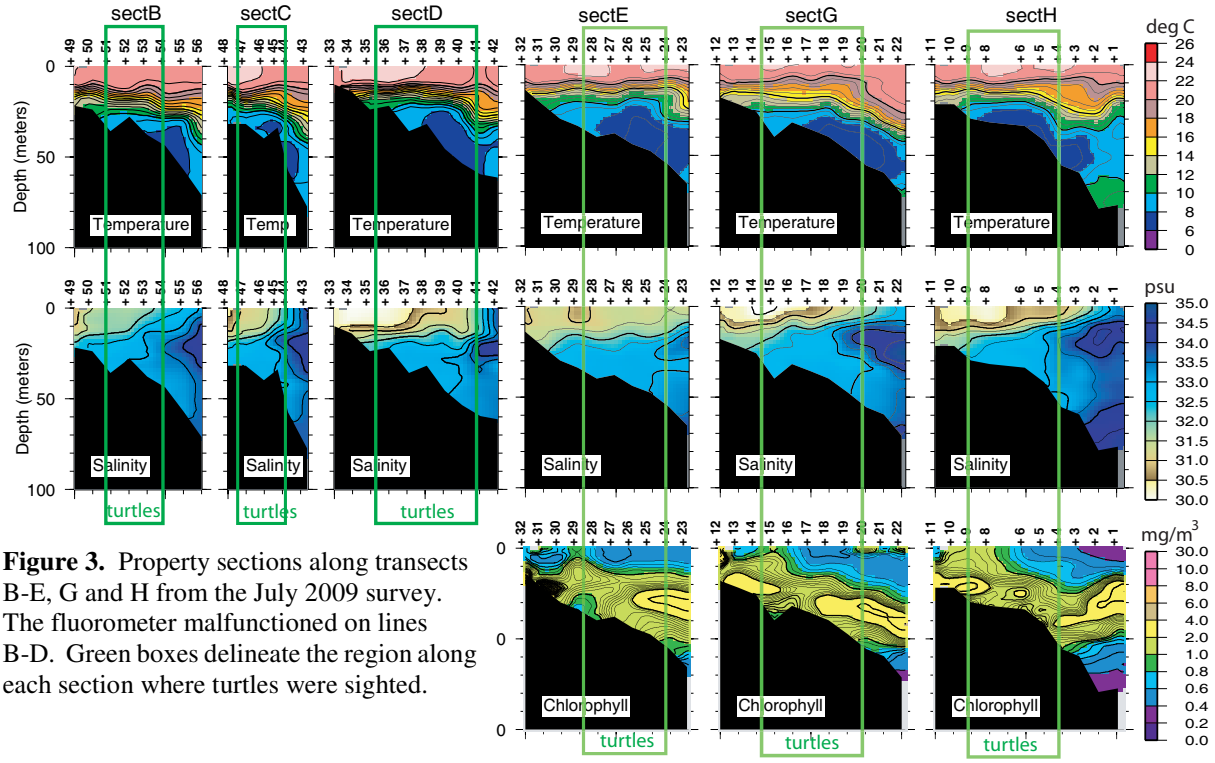


Figure 3. Property sections along transects B-E, G and H from the July 2009 survey. The fluorometer malfunctioned on lines B-D. Green boxes delineate the region along each section where turtles were sighted.

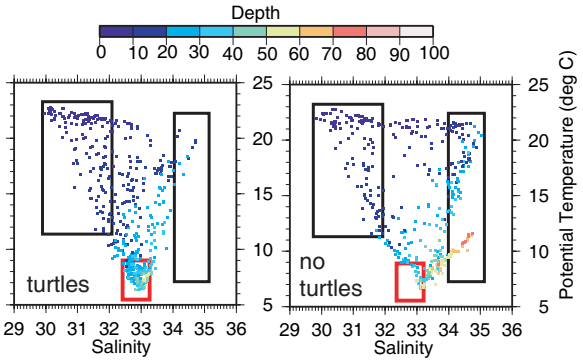


Figure 4. T/S of 56 CTD profiles with depth of the observations depicted by color.
Left: profiles where turtles were located (i.e. inside the green boxes of Fig. 3),
Right: all other profiles (not co-located with turtles)
Rectangles show three distinct water masses described in text, the red boxes correspond to the "cold pool".

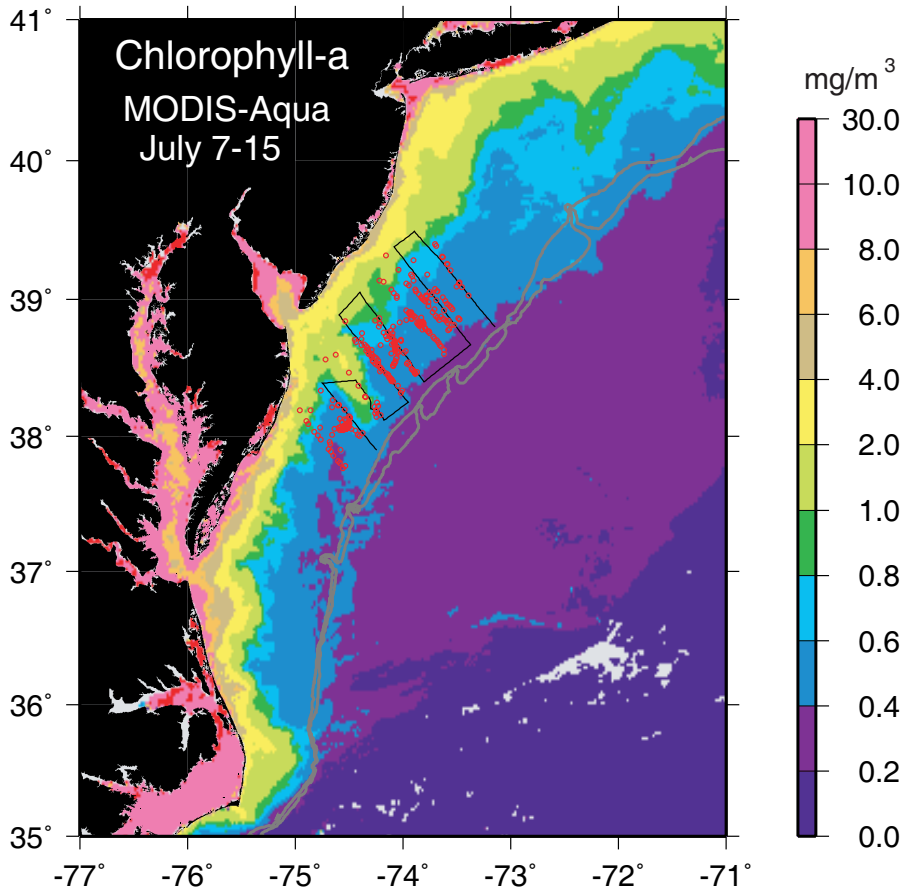
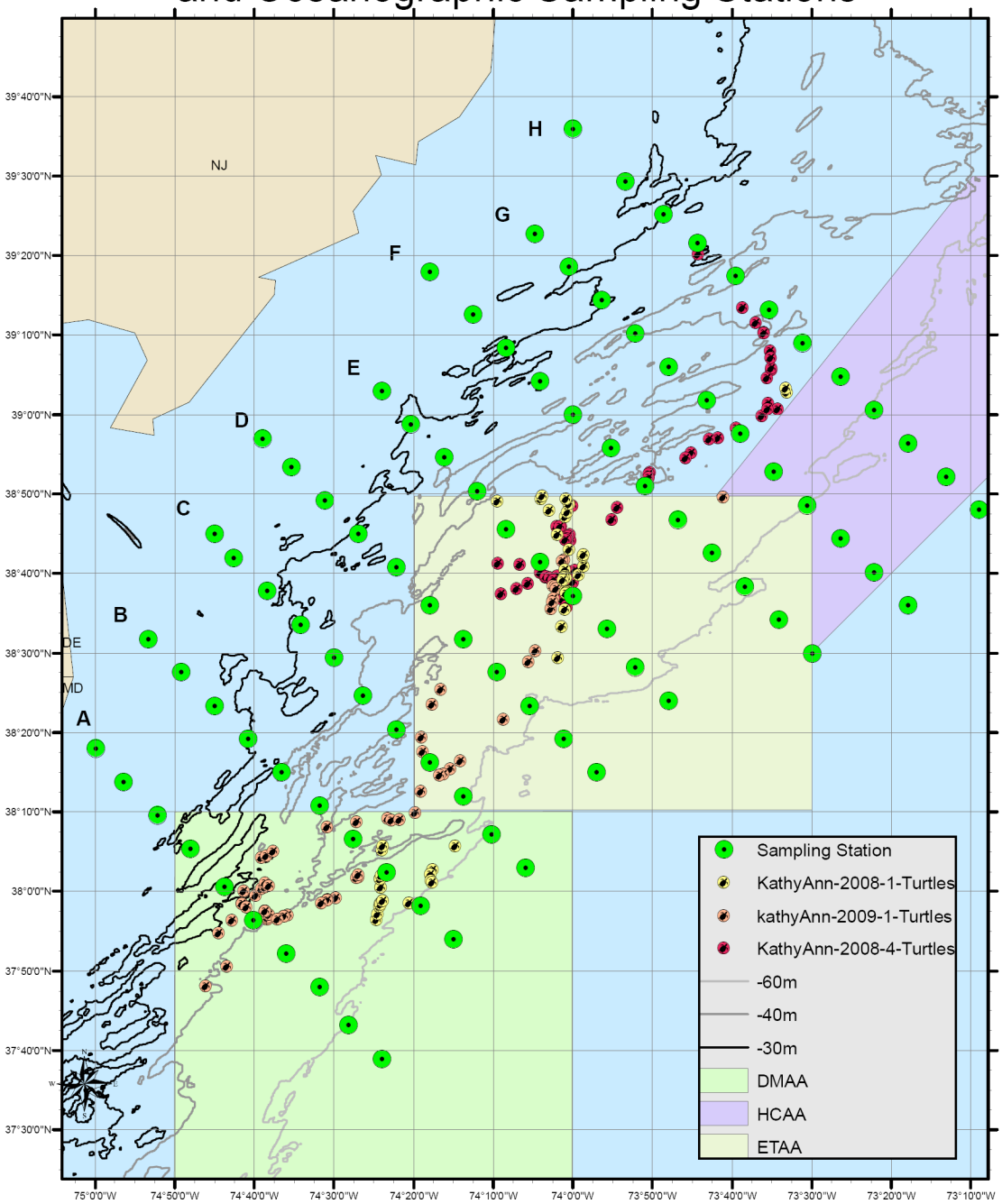
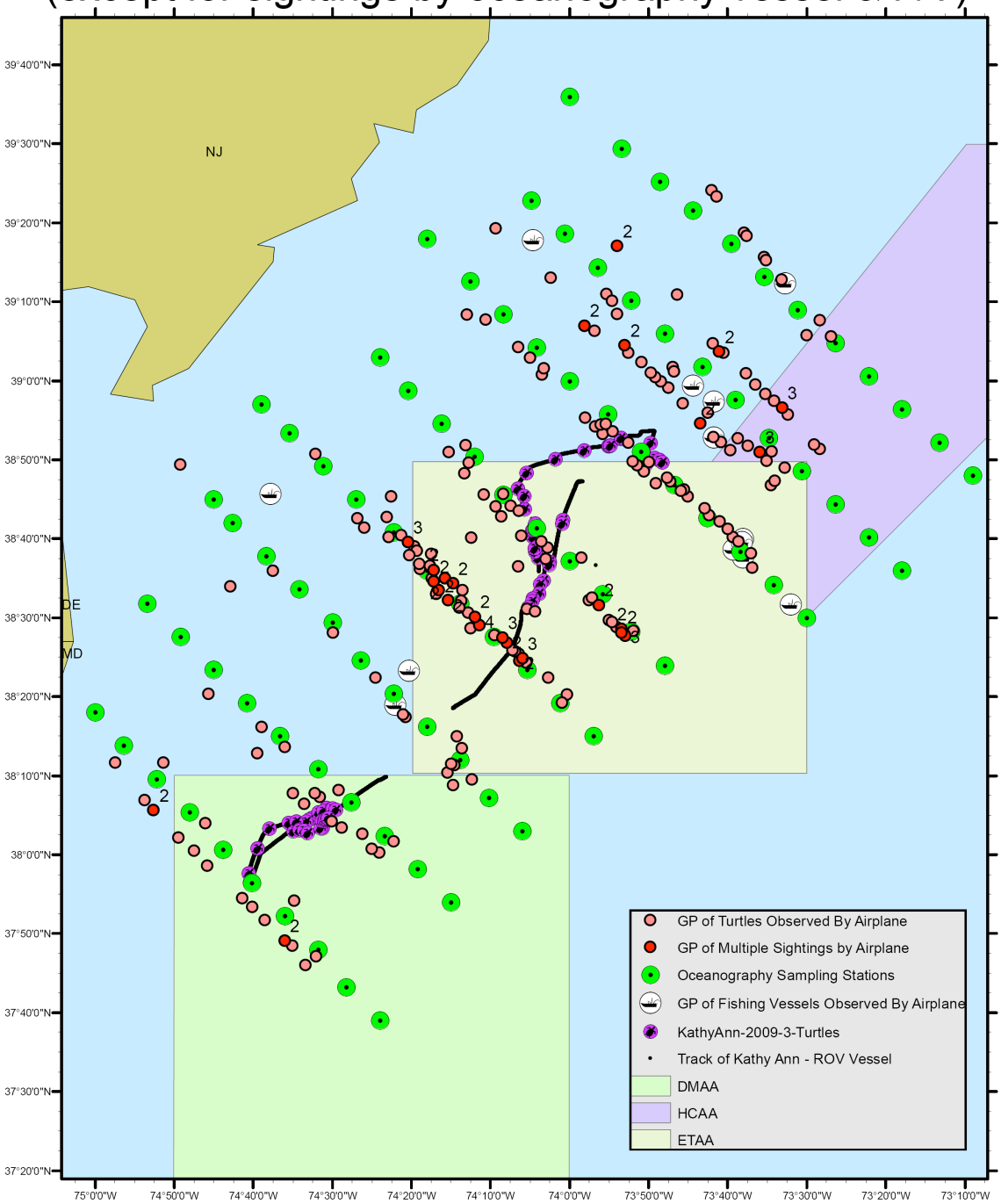


Figure 5. Chlorophyll-a derived from MODIS-Aqua sea color averaged for the period July 7-15 (as in Fig. 2, but for the entire MAB region.

Turtle Sightings from Past ROV Trips and Oceanographic Sampling Stations



All Turtle Sightings from C-Farm July 2009
(except for sightings by oceanography vessel & F/V)



Addendum B: Satellite Tag Deployment

Acquiring Juvenile Loggerhead Sea Turtles:

The F/V Kathy Ann, will be chartered for 10days at sea starting in mid-June 2010 to conduct one or more trips solely dedicated to finding and tagging 10 juvenile loggerhead turtles in the Mid-Atlantic scallop access areas. The F/V Kathy Ann is a 95' scallop vessel with enough berthing for the captain, mate, 2 crewmembers, and a scientific party of 5. The vessel will sail without dredges or other fishing gear onboard, as to allow the entire work deck to be utilized for the small boat, tagging equipment, and tagging workstation. The vessel is also rigged with a "crow's nest", rising 60' above the waterline, with enough room for 3 scientists to stand lookout for turtles. The F/V Fathy Ann and its crew have experience with the techniques used for turtle capture, transfer, sampling, tagging, and return to the sea. The vessel and crew have been very cooperative and have directly participated in past loggerhead turtle tagging effort, dredge comparison trips, and ROV observation work. Past tagging experience has proven that the crew and vessel are capable of locating turtles, approaching turtles undetected, quickly launching the small boat, safely transporting captured turtles back to the Kathy Ann, and safely returning the tagged turtle to the sea.

The general location of groups of turtles on the scallop fishing grounds will be done before sailing by querying the scallop captains as to recent observations of turtles while at sea. Experience from past Cfarm turtle sighting locations will also be utilized in determining what areas are likely to have juvenile loggerhead turtles present. Past Cfarm turtle ROV studies have proven that Cfarm staff can routinely spot over 50 juvenile loggerhead sea turtles on the scallop fishing grounds within a 7 day period. In addition, other Cfarm projects going on in conjunction with the tagging work will be providing turtle location information. This will include sightings from Scallop RSA funded aerial surveys, oceanographic surveys, as well as from observer onboard dredge comparison fishing trips.

The F/V Kathy Ann will sail during the evening to make the approximately 4 hour transit to the scallop access areas overnight, thus allowing for a full day of work to being the following day. Scouting for loggerhead sea turtles will being at 0800 and end at 1900, thus allowing for appropriate ambient light conditions for spotting and tagging. While in initial scouting mode, the vessel while steam at approximately 6 knots on the heading that allows for the best sighting conditions. Once a location is determined to have loggerhead sea turtles present, the vessel's speed will be reduced to 4 knots and the zodiac deployed and towed unmanned behind the vessel. This will allow for better response time once a candidate sea turtle is found. If a high density of turtles is encountered the vessel will steam at 1-2 knots with the manned zodiac following in radio contact.

The watch for turtles will be conducted by all hands, except for the mate who will be off watch. The crows nest will be manned by 3 scientists experienced with spotting turtles on the open ocean. Two scientist will searching for turtles, one for turtles on the port and one on the starboard, in the distance with 10x35 image stabilized binoculars. The third scientist will be searching, with the naked eye, for turtles the immediate vicinity as well as manning the radio for communications with the wheelhouse, deckhands, and zodiac. The third scientist will also be responsible for manning the cameras, GPS, and range finder equipment used in the crow's nest.

Two scientist, two crew members, and the captain will also be responsible for sighting turtles while on watch. The scientists will rotate responsibilities to allow for breaks. One chief scientist will be responsible for recording all data (sighting positions, observations, weather conditions) in the wheelhouse as well as making decisions in collaboration with the captain.

Capturing and Boating:

Once in an area of high turtle density, one scientist from the masthead and one crewmember will man the zodiac. The zodiac (currently owned by the F/V Kathy Ann) to be used is a open 14' Achilles soft bottom equipped with a 25 horsepower tiller operated motor. This zodiac has been used successfully to capture and transport turtles during past Cfarm tagging work. The boat will be equipped with all the required Coast Guard safety/emergency equipment as well as a 5 gallon fuel tank and VHF radio. The zodiac's captain will man the VHF radio in direct contact with the crow's nest and wheelhouse. The scientists positioned in the crow's nest will direct the zodiac to the position of the targeted turtle. The zodiac will initially be moving a low speed until the turtle is visually acquired by both its captain and scientist. Upon sighting the turtle, the captain will increase the speed the zodiac on a heading directly towards the targeted turtle.

The Cfarm scientist onboard the zodiac, Matthew Weeks, will be responsible for manning the net and capturing the targeted turtle. The net to be used is a NMFS approved ARC 12 ft. Model DN6P dip net constructed of a lightweight, durable aircraft aluminum; Hexagon frame with 97" circumference / 38" bag depth / 2 1/2" (square) seamless anti-abrasive knotting (dipped and coated). This net complies with NMFS approved design specifications; 12' x 1" aluminum breakdown (3-4' sections)anodized pole with sure grip handles. Cfarm currently owns and has experience utilizing this net. In addition, the F/V Kathy Ann owns an idential net that could be used as a backup if necessary. During the capture, the net will be attached to the zodiac's bow via a 5 foot tether.

Using the guidance from the scientists in the crow's nest, the collection boat will be directed to approach the turtle from behind with the turtle facing away from the boat. The netter will be positioned low on the zodiac's bow with net in hand and turtle acquired visually. Once within 6 feet of the turtle, the netter will quickly place the net immediately in front of the turtle and capture the turtle. Once the net is deployed, the boat operator will try to put the boat into a hard reverse, which will help propel the turtle into the net. The netted turtle (still in the water) is then carefully brought alongside the boat and then lifted on board with the help of the crew member. Care will be taking during the boating process as to not put pressure on the head/eyes, nor to allow the turtle to bight the crewmembers or inflatable vessel. The captured turtle will be kept safely inside of the net and on the deck of the zodiac during the immediate transit back to the Kathy Ann.

The captured turtle once brought onboard the collection boat will be transferred to the deck of the F/V Kathy Ann using the dip net. The handle of the dip net will be removed and the net attached (as a brialer) to a specially rigged winch and boom. This exact process has been successfully performed by Cfarm staff and the Kathy Ann crew multiple times without incident.

Tagging and Release:

Tagging will take place on the F/V Kathy Ann, at a specified tagging workstation. The exact location of

the workstation will be dependent on weather conditions. If it is a rainy or a hot sunny day, the workstation will be located under cover near the wheelhouse. If it is a cool day, the workstation will be set up out on the open work deck. The taggin workstation and all tagging supplies will be prepared at the start of each day, before the scouting for turtles commences. The station will be carpeted on the deck and around all objects in the immediate vicinity (walls, gear, ect) so as to protect the turtle from injury during the tagging process. A carpeted and padded tub will be used to safely retain the turtle on deck.. A moist towel will be loosely placed over the turtle's head in order to reduce stress and prevent injury.

Upon the boating of the turtle on the Kathy Ann, the scientific crew will assess the status of the turtle to ensure that: positively identified as a loggerhead sea turtle, it has not incurred any injuries, is not in extreme distress or shock, is conscious, within the size range sought for this study (60 – 90 cm) and has a carapace that is in suitable condition for tag application. If the animal does not meet these criteria, it will be immediately and safely released in the same area where it was captured.

If the animal is determined to be suitable for tag application, it will immediately be moved to the tag application station. Once secured at the station the scientific crew will: photograph, note physical and identifying characteristics, record curved carapace length (notch to notch and notch to tip) and width, scan for PIT tags, take biopsies, record any Inconel tags, and apply Inconel tags. All of these tasks will be done according to the NEFOP Observer protocols and NEFOP Observer Logs will be used to record all information. After these initial tasks are complete, application of the satellite tag will commence.

Epoxy Attachment for Satellite Tags on Hardshell Turtles:

The following procedures will be used to attach the satellite tags to each juvenile loggerhead turtle. (techniques based off of Godley et al. 2002) Cfarm has been trained to properly apply these techniques by Jeffery Seminoff of the NMFS SWFS. Cfarm and the crew of the Kathy Ann have successfully applied these procedures to juvenile loggerhead turtles captured on the scallop fishing grounds.

Tag Preparation – Tags will be prepared for deployment prior a turtle's capture. A complete tagging kit with all the necessary supplies for each turtle will be prepared before the vessel sails. Programing and testing of transmitters will be completed on land prior to sailing. Tag preparation tasks will include: covering saltwater switches and sensors with orange electrical tape; writing the unique tag number (located on the bottom) on the piece of tape covering the GPS sensor; sand the entire tag lightly (being careful not to include switches and sensors), photographing each tag, and double checking that the tag is signaling that it is functioning properly.

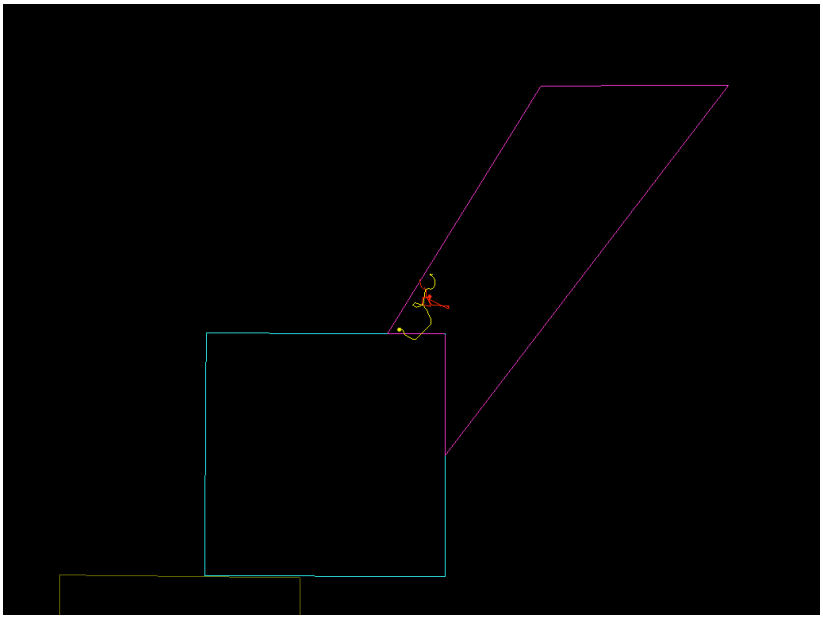
Holding – A circular tub will be used to safely hold the turtle in a natural prone position while attaching the transmitter. A foam pad and carpet will be placed on the bottom and sides of the tub to cushion the turtle. A wet cloth will be draped over the turtle's eyes to completely block vision often reduces the turtle's desire to move. The turtle will be sheltered from direct sunlight, wind, and rain during the attachment procedure.

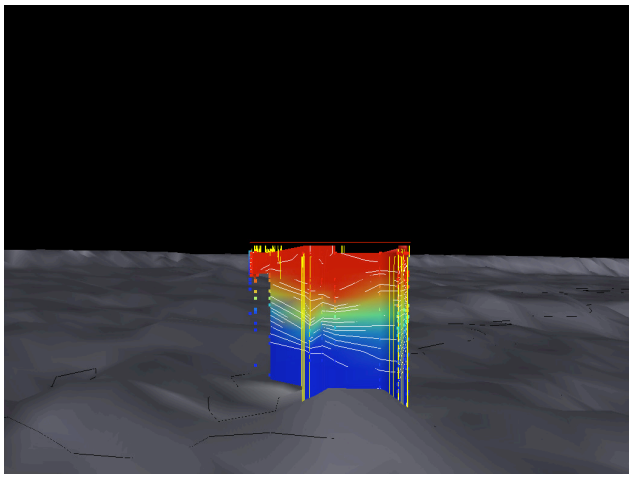
Preparing the carapace – Trained Cfarm staff will carefully remove epibionts (barnacles, algae, etc.) from the carapace at the mounting and bonding site of transmitter. A plastic paint scrapper will be used to carefully remove heavy growth on the carapace. The transmitter will be placed with the antenna

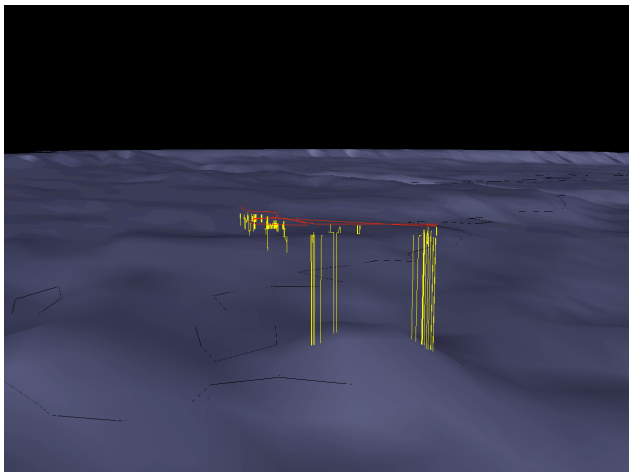
oriented forward, at the point where the first and second vertebral scutes meet. This section of the carapace rises to a maximum point above the sea surface each time the turtle breathes, and the base antenna on the transmitter will break the plane of the water's surface. The attachment media, quick set epoxy, will also encompass sections of the first and third vertebral scutes, as well as the first and second costal scutes. These areas will be thoroughly cleaned with a scrub brush, rinsed with alcohol, wiped with a towel, and then lightly sanded with sandpaper. When the tag application area of the carapace is smooth, it will be wiped with acetone with care made not to touch the carapace or allow the solvent to touch any other area of the turtle. .

Mounting the transmitter on the carapace – The tag and attachment materials will not exceed 5 % of the turtle's body weight. Use a two-part cool setting epoxy (Sika Anchorfix 1®) to secure the transmitter on to the carapace. The epoxy components are discharged from the cartridge in equal amounts via a caulk gun, and are incorporated in a specialized mixing nozzle so no modification of amounts is required. There is no danger of setting too quickly. Use a small amount of epoxy (< 50 g) to create an even base for the transmitter to rest and to secure it to the carapace. Smooth out the epoxy and envelope the sides of the tag with epoxy, being careful not to cover any sensors or switches. Once the epoxy has set it will be sanded to remove any rough edges. The entire animal with tag applied will be photographed prior to release. The turtle will be release at or near the point of capture from the side of the boat while it is motionless and out of gear. All turtles will be tagged on the boat and held no longer than 1.5 hours.

These pictures show the capture, tagging and release of a loggerhead during a Cfarm tagging trip.







The above pictures show a representative data presentation from one of the Cfarm turtles being tracked by satellite over the Hudson Canyon Scallop Access Area showing dives and temperature profiles.

SEA TURTLE SAMPLING PROTOCOLS

SAMPLING REQUIREMENTS (all turtles)

1 Identify, noting immediate observable characteristics
2 Photograph
3 Describe any new and/or healed wounds
4 Body Measurements (3, curvilinear)
5 Identification Criteria (6)
6 Biopsy/tissue (genetic) sample
  Live Animals: Turtle must be > 25 cm notch to tip carapace length
  Dead Animals: Retain animals whole. If not possible then obtain biopsy/tissue sample
7 Tag with inconel tag(s) on rear flipper(s): 1 for dead sea turtles, 2 for live sea turtles > 26 cm notch to tip carapace length
8 Scan for PIT tags on flippers and all soft tissues

Inconel Tag Location: Proximal to the first scale (closest to the body) on the trailing edge of each rear flipper for all turtles except Leatherback. For Leatherback turtles, tag along the trailing edge of the rear flipper approximately 5 cm (~2 inches) out from the base of the tail (they do not have flipper scales). Position the tag so there will be adequate overhang (approx. 1/3 length of tag) after it is attached. See Figures 39 and 40.

Biopsy Location: Posterior trailing edge of the rear flipper and

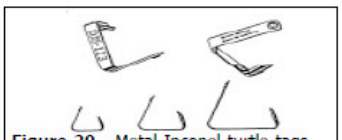
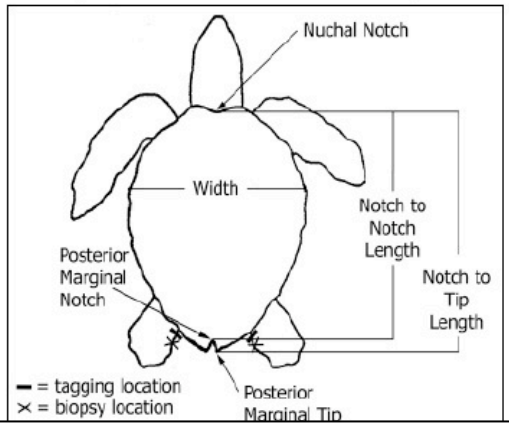


Figure 39. Metal Inconel turtle tags.



OBBTU 01/01/07

NMFS FISHERIES OBSERVER PROGRAM

SEA TURTLE BIOLOGICAL SAMPLE LOG (Front)

OBS/TRIP ID	
DATE LAND mm/yy	/
PAGE #	OF

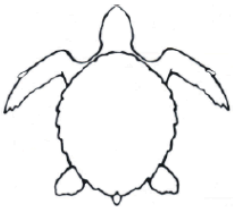
PSID #	SPECIES NAME	TAGS		MEASUREMENTS (Curv)			IDENTIFICATION CRITERIA						NUMBER OF SAMPLES		
		Scan? 0=N 1=Y	Pit Tag Number	Notch-to-Tip Length cm	Notch-to-Notch Length cm	Width cm	Vertebral Scute Count	Lateral (Costal) Scute Count	Infra-marginal Scute Count	1Pair Pre-Frontals? 0=N 1=Y	Overlap Scutes? 0=N 1=Y	Dorsal Color Code	Whole	Biopsy / Skin	Other list in comments
				.	.	.									
				.	.	.									
				.	.	.									
				.	.	.									

General Comments

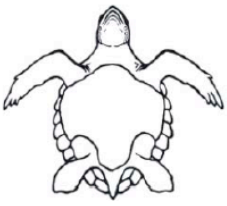
DORSAL COLOR CODES:
01 = Black
02 = Gray-Green
03 = Orng/Red-Brown
04 = Brown
99 = Other
00 = Unknown

Sketch and describe ID characteristics, overall condition of carapace, plastron and soft tissues, note any scavenger damage and/or decomposition, new and/or healed wounds, tag and biopsy location, any gear on the animal, etc.

PSID # _____



Dorsal View



Ventral View

322

OBINC 01/01/08

NMFS FISHERIES OBSERVER PROGRAM

MARINE MAMMAL, SEA TURTLE, AND SEA BIRD INCIDENTAL TAKE LOG (Front)

OBS/TRIP ID	
DATE LAND mm/yy	/
PAGE #	☐ OF ☐

PSID #	HAUL NUM	GEAR NUM	NET NUM/ DREDGE/NET POSITION (p/s/u/a)	TIME 24 hours	ADD COND CODE	SPECIES NAME	SPECIES CODE	TAG NUMBER(S) (Record the most recent tag first.)	TAG CODE(S)	ENTANG SITU CODE	ANIMAL COND CODE	ANIMAL ONBRD? 0 = No 1 = Yes	PHOTO TAKEN? 0 = No 1 = Yes	SAMPLE LOG? 0 = No 1 = Yes	ESTIM LEN cm (if no actual) (no birds)
___1				:											
2				:											
___3				:											
4				:											
___5				:											
6				:											
___7				:											
8				:											
___9				:											
0				:											

COMMENTS: List identifying characteristics, describe in detail the entanglement situation, include a description of the overall body condition of the animal, behavior on deck and upon release and any other related information. Use back of log if more room is needed.

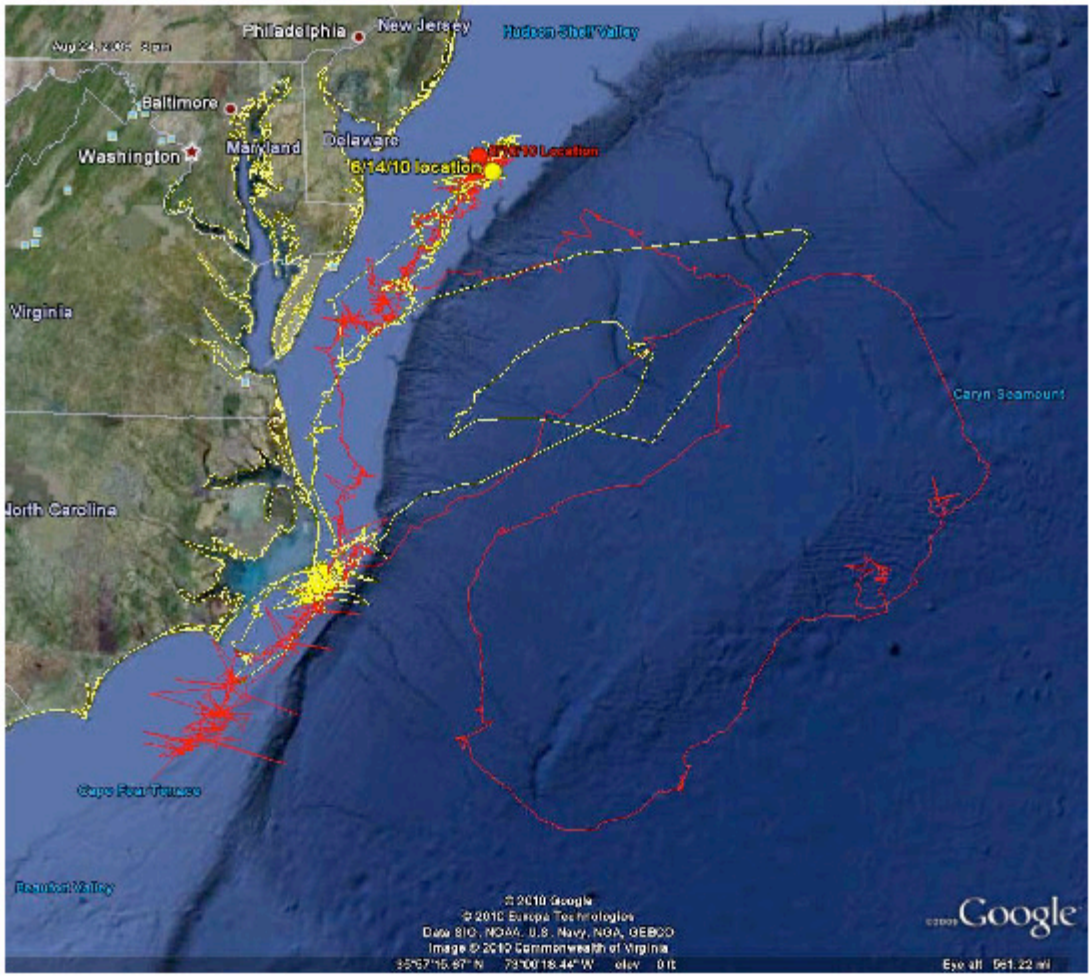
252

Specifications for SMRU's SDLR with Agros FastLoc GPS

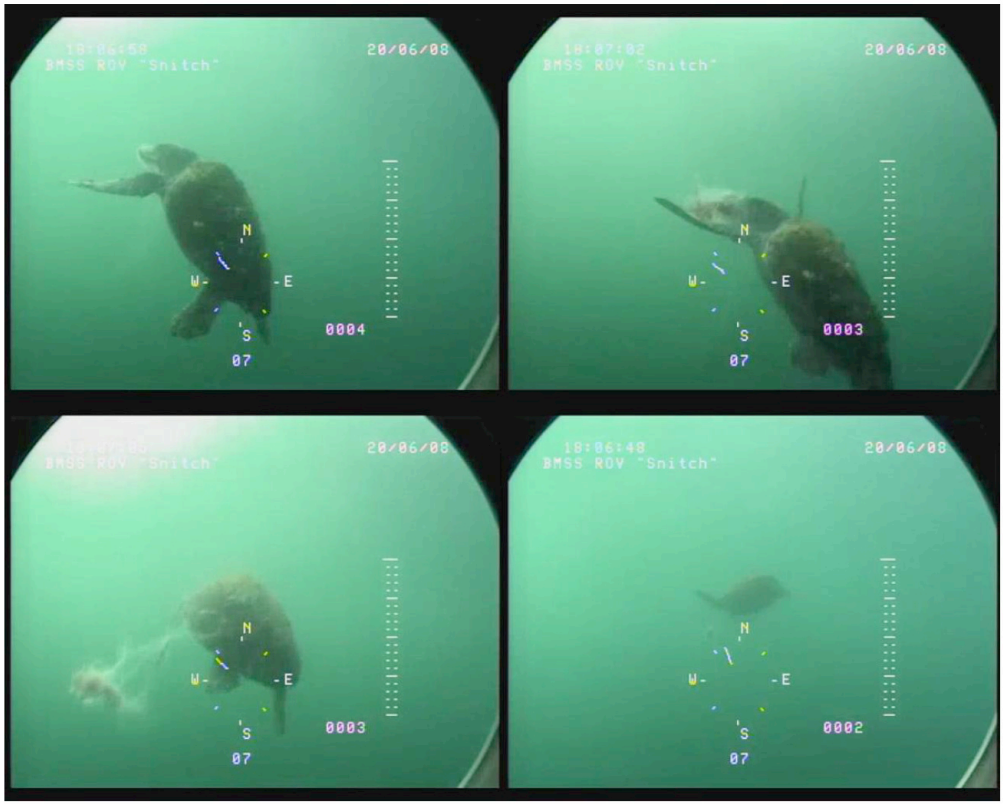
Transmitter: 0.5W Argos Transmitter
Sensors: 2000m depth transducer
0.5m resolution
Water temperature accurate to 0.1ºC
Tag Dimensions and Weight: 10.5cm x 7cm x 4cm, 370 grams
Power: Lithium "D" size cell provides up to 85,000 full length, Argos data transmissions. Longevity approximately 1 year, depending on polling rate

List of Items to be Included in Turtle Kits:

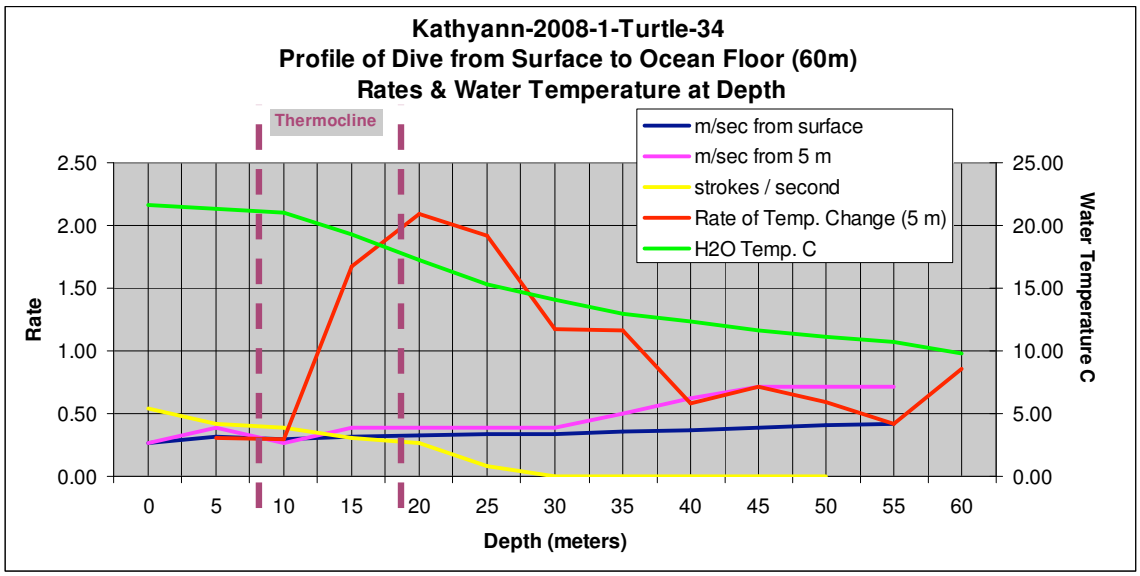
Pit Tag Scanners
DMSO
Parafilm
Tongue Depressors
Clean Towels
Acetone
Denatured Alcohol
Sand Paper
Plastic Paint Scraper
Orange Electrical Tape
Tubes of Sitka Quick Set Epoxy
Caulk Gun
Knife
Latex Gloves
Iodine
Vilas for Biopsy
Black Sharpies
Sterile Biopsy Punch
Alcohol Swabs
Dive Slate
Tooth Picks
Inconel Tags
Inconel Tag Applicator
Write in the Rain Notebook
Water Proof Logsheets
Measuring Tape
Camera
Sea Turtle ID Guide



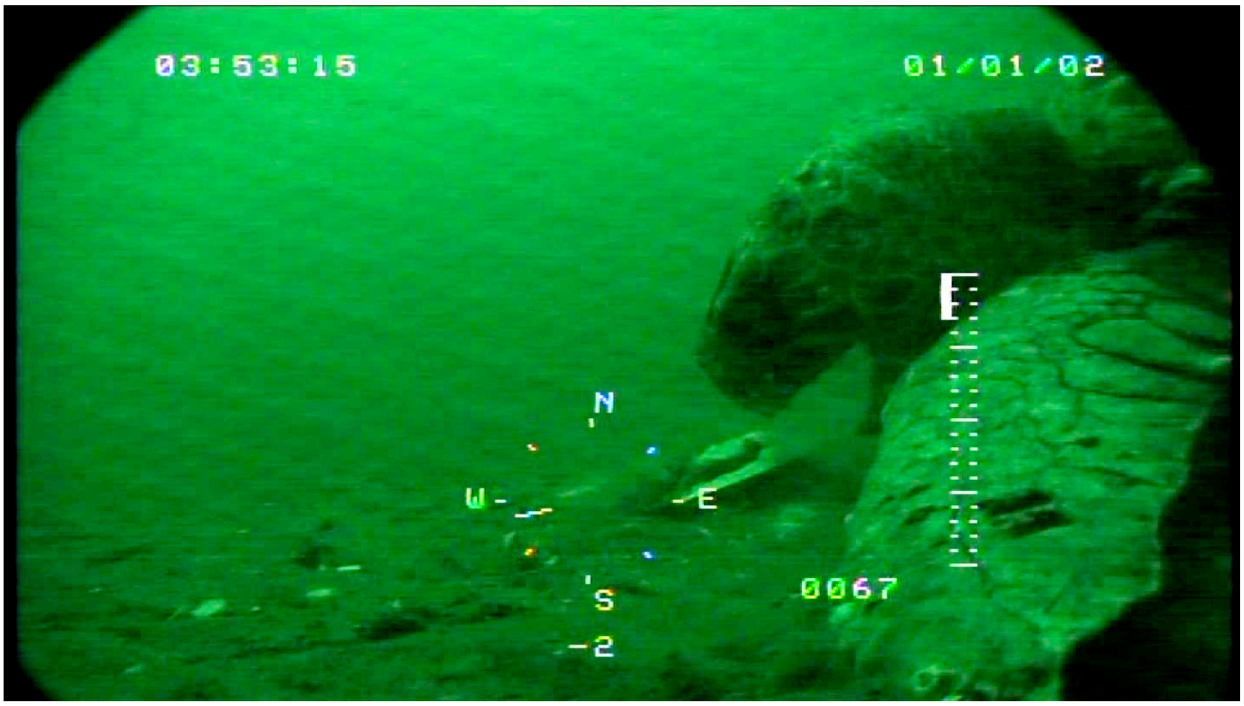
Tracks of the two juvenile loggerheads tagged by Cfarm in 2009 showing their southern migration on the shelf and their northern migration using the Gulf Stream.



ROV video of loggerhead eating a lion's main jelly fish



Data profile from an ROV mounted TDR taken while following a turtle.



ROV images of a loggerhead feeding on sea scallops at 67 meters.

Ruth G. Curry

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Tel: 508-289-2799 Fax: 508-457-2181
Email: rcurry@whoi.edu
Education: B.S., Brown University (geology) 1980
Post-Graduate Education: The lack of a formal graduate degree belies a high level of analogous training acquired through two decades of oceanographic work experience and exposure to a first-rate academic environment. This includes extensive knowledge of hydrography, substantial experience with analysis and interpretation of large data sets, and a clear understanding of GFD principles – demonstrated through first authorship on recent papers..
Employment: Geologic Field Assistant, 1980, U.S. Geological Survey, Woods Hole Branch
Research Assistant, 1981–1991, Information Systems Associate, 1992–1997, Research Specialist, 1997–2007, Senior Research Specialist, 2007-present, Woods Hole Oceanographic Institution.
Publications
McCartney, M. S., and R. Curry, 1993. Trans-equatorial flow of Antarctic Bottom Water in the western Atlantic Ocean: Abyssal geostrophy at the equator. *Journal of Physical Oceanography*, **23**, 1264–1276.
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Curry, R., R. R. Dickson and I. Yashayaev, 2003. A change in the fresh water balance of the Atlantic over the past four decades. *Nature*, **426**(6968), 826-829.
Dickson, R. R., R. Curry and I. Yashayaev, 2003. Recent changes in the North Atlantic: In: *Proceedings Royal Society* meeting on Abrupt Climate Change: Evidence, Mechanisms and Implications. *Philosophical Transactions of the Royal Society, London, Physical and Engineering Sciences,* **361**(1810), 1917-1934.
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WEBSITES:
http://www.whoi.edu/science/PO/people/rcurry
http://www.whoi.edu/science/PO/linew
http://www.whoi.edu/science/PO/hydrobase
Awards: *James E. and Barbara V. Molz Research Fellow* of the Ocean and Climate Change Institute at WHOI for years 2006-2009.

James Gutowski

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Present Position

James Gutowski presently owns and manages two sea scallop vessels in Barnegat Light New Jersey. He also coordinates daily operations and scheduling for five other vessels at Viking Village Fisheries. He has worked successfully with Coonamessett Farm on several turtle projects.

History

Graduated Seton Hall Prep 1979
University of Rhode Island –Commercial Fisheries and Marine Technology 1979-1980.
Scallop vessel Captain 1981-1995
Scallop vessel Owner 1988(F/V Kathy Ann) Kathy Ann Corp
Scallop vessel Owner 2000(F/V Elizabeth) Thirty Fathom Fish Corp
New Jersey Agricultural Leadership Development Program Class IV graduate 2003
Mid Atlantic Fisheries Council Nominee 2005
A/R Manager/ Sales Manager Viking Village 1996-2007
Mid Atlantic Fisheries Council Nominee 2005
Attended Marine Resource Education Program Fall 2004
Sea Scallop advisory panel February 2008
Fleet manager of operations and coordination at Viking Fisheries 2008-present

Affiliations

Member Barnegat Light Planning Board
Member New Jersey Agricultural Society
Coach Stafford Hockey League Manahawkin New Jersey

Ronald Joel Smolowitz
Coonamessett Farm
277 Hatchville Road
East Falmouth MA 02536

Phone: 508-564-5516
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Present Position: Owner and Operator, Coonamessett Farm

Coonamessett Farm is a twenty acre farming and research enterprise located on Cape Cod. Crops include small fruit, vegetables, and flowers. Consulting, research, and writing services are offered in small scale agriculture, aquaculture, and fisheries. The *Research Division* conducts multi-disciplinary field projects on land and at sea in a variety of areas. Our fisheries work has entailed exploratory fishing and conservation engineering/technology development. Field work also includes the video taping of fishing gear using gear mounted and towed underwater gear observation systems.

Selected Publications:

Twohig, P. and R. Smolowitz 1980. The application of an underwater color video system to fishing gear research. Proc of Symp on Sci and Tech. Applications of Underwater Photography

Serchuk, F. M. and R. J. Smolowitz 1980. Size selection of sea scallops by an offshore scallop survey dredge. ICES C.M. 1980/K:24. 38pp.

Smolowitz, R. J. and F. M. Serchuk, J. Nicolas, and S. E. Wigley 1985. Performance of an offshore scallop survey dredge equipped with rock chains. NAFO SCR DOC 85/89 Serial No N1064. 29pp.

Smolowitz, R. J. and F. M. Serchuk, 1987. Current technical concerns with Sea Scallop management. OCEANS 87 Proceedings. p639-644.

Smolowitz, R. J. and F. M. Serchuk, 1988. Developments in sea scallop gear design. Proc World Symposium on Fishing Gear and fishing vessel design. p531-540.

Serchuk, F. M. and R. J. Smolowitz. 1990. Ensuring fisheries management dysfunction: the neglect of science and technology. Fisheries 15(2):4-7.

Smolowitz, R. J. and D. N. Wiley. 1992. A model for conflict resolution in marine mammal/fisheries interactions: The New England Harbor Porpoise Working Group. MTS 92. pp 354-360.

Dupaul, William D., David B. Rudders, and Ronald J. Smolowitz. 2004. Industry Trials of a Modified Sea Scallop Dredge to Minimize the Catch of Sea Turtles. VIMS Marine Resource Report No. 2004-12. 31pp.

Henriksen, S., E. Welch, S. Therrien, R.J. Smolowitz, P.J. Struhsaker, C.A.Goudy, and H. Kite-Powell. 1997. Results of Gear Modification Tests to Reduce Bycatches of Commercial Finfish in Sea Scallop Dredges. August, 1997. Final Report, NOAA Award No. NA66FD0026, NMFS, NE Region Office, Gloucester, MA.

Milliken, H. O., L. Belskis, W.DuPaul, J. Gearhart, H. Haas, J. Mitchell, R. Smolowitz, and W. Teas. April 2007. Evaluation of a Modified Scallop Dredge's Ability to Reduce the Likelihood of Damage to Loggerhead Sea Turtle Carcasses. Northeast Fisheries Science Center Reference Document 07-07, Woods Hole, MA.

Smolowitz, R. J., C. Harnish, and D. Rudders. 2005. Turtle-Scallop Dredge Interaction Study. Project Report. Coonamessett Farm, Falmouth, MA 83 pp.

Smolowitz, R. J., D. Rutecki, P.J. Struhsaker, and W. Dupaul. 2004. Comparison of Ten Inch vs Six Inch Twine Tops to Reduce Discard of Bycatch in the Sea Scallop Fishery. 2003 Final Report. Coonamessett Farm, Falmouth, MA.

Smolowtz, R.J., P.J. Struhsaker, and W.D. Dupaul. 2002. An Experimental Fishery to test fishing gear for bycatch reduction in the Sea Scallop fishery of Georges Bank. Coonamessett Farm, Inc. East Falmouth, MA 02536.

Smolowitz, R.J., P.J. Struhsaker, and W.D. Dupaul. 2001. Dredge modifications to reduce incidental groundfish catches in the Northwest Atlantic Sea Scallop fishery. NOAA Award No. NA16FM1032. Coonamessett Farm, East Falmouth, MA 02536

Matthew V. Weeks

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Falmouth, MA 02540

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Education

Indiana University 1999 – 2001
Master of Science in Environmental Science

Indiana University 1999 – 2001
Master of Public Affairs
Concentration in environmental policy analysis

Louisiana State University 1994 – 1999
Bachelor of Science in Environmental Management Systems
Minors in chemistry and philosophy

Employment History

To Hell with the Box Consulting December 2005 – Present
Falmouth, Massachusetts
Self Employed Consultant
Provide support to the northwest Atlantic Sea Scallop industy and Coonamessett Farm in regard to research, writing, and technical needs

- Lead technician and analyst on a varitety of Scallop RSA funded research projects
- Provide support for video work, GIS, observer data request and computer needs of scallop industry participants

NOAA's Cooperative Research Program August 2006 – June 2007
Woods Hole, Massachusetts
Lead Techicain for the Study Fleet Project
Provided field and technical support for the development of a New England groundfish study fleet

- Assisted researches in the development of software used to collect data by fishers at-sea
- Responsible for the creating sampling protocols to be applied by fishers
- Assisted in the development of databases used to store fisheries data
- Provided training and technical support to fishers regarding catch quatification, VMS, GPS, and PC use
- Performed data quality audits and rectified data issues with fishers

NOAA's Northeast Fisheries Observer Program September 2004 – August 2005
Woods Hole, Massachusetts
Assistant Program Lead for the Northeast Region
Collaborated with National Marine Fisheries Service staff to plan, coordinate, and execute observer coverage in commercial fisheries throughout New England

- Lead the development of an electronic data reporting system to be used by fisheries observers
- Responded to data requests by querying Oracle databases, compiling data, and distributing reports
- Provided information to the Fisheries Sampling Branch Chief concerning substandard data collection issues
- Addressed concerns from the fishing industry relating to the Observer Program's policies and protocols
- Provided Branch Chief and Northeast Area Lead with monthly summaries of observer coverage and data issues
- Briefed observers and staff on changes in fishing regulations and sampling protocols meet new regulatory requirements
- Acted as Observer Program liaison to New England Fisheries Management Council meetings

NOAA's Northeast Fisheries Observer Program November 2003 – September 2004

Woods Hole, Massachusetts
Assistant Observer Training Coordinator
Coordinated and conducted 3 week long observer training courses for 15 – 30 fisheries observer candidates

- Instructed observers in general program protocols, sampling protocols and priorities, fish identification, commercial fishing gear, history of New England fisheries, and current fisheries issues
- Evaluated trainee performance and debriefed observers after data collection trips
- Worked with fishers to train observers onboard commercial fishing vessels
- Observed various commercial fishing gear types and assisted with the development of sampling protocols

- Worked as a scientist onboard NOAA research vessels collecting fishery and oceanographic data

NOAA's Northeast Fisheries Observer Program August – November 2003
New England