Sea Turtle Oceanography Study

Final Progress Report
for 2009 Sea Scallop
RSA Program
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By

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Project Summary

This 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 (*Carretta carreta*) through innovative use of dredge and ROV mounted video cameras and side-scan sonar. The project continues the observing and cataloguing loggerhead distributions and behavior and includes an oceanographic component which l assesses 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 timescales of days to weeks, sea turtle "hot spots" are more closely tied to the geography of oceanographic fronts associated with salinity and chlorophyll gradients driven by wind stress and buoyancy (density) contrasts. These linkages were investigated by conducting regional hydrographic surveys with shipboard CTD (conductivity/ temperature/ depth), fluorometer and ADCP (Acoustic Doppler Current Profiler) measurements in conjunction with sea turtle sighting and video tracking surveys. We have also added an aerial survey component to sight loggerheads in conjunction with the oceanographic surveys.

The field program, which is now completed, was carried out in four separate weeks of the 2009 turtle season and employed two vessels. Both vessels conducted turtle sighting surveys for the duration of field operations. The first vessel was equipped with a Benthos Teledyne Stingray ROV system. Its primary tasks involved tracking, observing and filming loggerhead turtles to elucidate their *in situ* behaviors (e.g. feeding, diving, and breathing). The second vessel separately carried out a hydrographic survey consisting of CTD and ADCP casts at spacing which is appropriate to map the regional temperature, salinity, density and velocity fields shoreward of the shelf/slope break. At discrete intervals, the water column was sampled for biological species composition (i.e. what the turtles are eating) in order to assess covariance with oceanographic properties. The ROV has been found to be an excellent tool for assessing the location and quantity of sea turtle prey species in the water column and on the sea floor. In addition, we placed satellite tracking tags on two juvenile loggerheads that transmitted position, time, depth, and temperature data.

In the analysis phase which is now underway, maps of 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 field operations (ocean surface winds from QuikSCAT plus sea surface temperature and chlorophyll-a from SeaWiFS and/or 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 and ocean salinity/density 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 loggerhead "hot spots" on the fishing grounds.

Take Summary for Project:

Kathy Ann 2009-3 18 ROV takes
Kathy Ann 2009-5 2 Tagging takes
Kathy Ann 2009-6 5 ROV takes

Financial Summary (Note: Analysis and publication writing still underway so expenses are not final**):**

Date	Description	Amount	Scallops
			pounds
6/11/2009	F/V Araho	$24,872.16	22531
6/26/2009	F/V Celtic	$24,206.10	21662
6/29/2009	F/V Generation	$27,309.14	22198
7/6/2009	F/V Kathy Ann	$27,613.16	21570
7/17/2009	F/V Generation	$26,958.48	21818
8/13/2009	F/V Kathy Ann	$33,635.98	23183
	Total:	$164,595.02	132962
	Less Expenses:	$214,803.04	
	Balance:	-$50,208.02	

Introduction

In 2007, a remotely operated vehicle (ROV) was introduced into the research program. With video equipment mounted on the ROV, efforts were directed toward observing turtles in the water column and on the sea floor. In 2007, more than two dozen turtles were recorded at or near the surface, although none on the sea bottom; but operational difficulties with the ROV impaired the ability to acquire video footage of those turtle sightings. Working with the ROV contractors, improvements were made to the vehicle and operational procedures which greatly enhanced its maneuverability and control characteristics. These were successfully tested and utilized in June 2008, August 2008, June 2009, and July 2009. During these trips, over 200 turtles were 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. Turtles were also observed 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 2010.

In 2009 oceanographic sampling from a second vessel was incorporated into this 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 flew four times over each of eight transects (32 runs) recording more than 200 turtle sightings. This was intended to provide a presence/absence survey of turtles, as opposed to a detailed species assessment. The first survey, conducted in July and discussed below, 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 using the warm surface waters (20-22°C) to adjust their body temperature between dives. A second survey was conducted in September that repeated the July surveys. 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.

Methods

The project conducted four separate 1-week surveys of sea turtles (ROV) and oceanography during the 2010 summer season (two were conducted on July 7-15; one September 10-15; and one September 19-25). A fifth trip (August 22-25) was utilized to capture and tag two sea turtles. Two commercial vessels were utilized, one to operate the ROV and the other to conduct hydrographic sampling. Both vessels conducted turtle sighting transects in addition to these operations. The ROV vessel on each trip proceeded to an area of reported turtle sightings on the scalloping grounds to conduct operations; the hydrographic vessel occupied predetermined oceanographic stations. During the oceanographic trips, aerial surveys were conducted to log the location of sea turtles.

The ROV vessel, equipped with video camera, sonar, and a time-depth-temperature sensor, acquired and followed individual turtles, recording behaviors associated with breathing, feeding, swimming and location in the water column. The video and data recordings are still being analyzed to address the questions listed above.

CR Environmental, Inc. (CRE) of Falmouth, MA, an ecological and oceanographic consulting firm, provided technical support to Coonamessett Farm Foundation (CFF) in the collection of physical oceanographic measurements and biology. For this study, CRE provided oceanographic equipment, rig the scallop vessel for profiling operations, and assist Coonamessett Farm scientists with the CTD/ current profiling, zooplankton tows, initial data processing and quality assessment of the oceanographic data. CRE outfitted one of the vessel's boom mounted Pullmaster winches with a 500 ft length of 3/8" Sampson braid line and suspended a sheave from the boom to raise and lower the CTD and current meter cage. The winch is capable of 100 ft per minute. CTD profiling was performed with a Seabird Electronics Seacat Model SBE 19 CTD. The Seacat CTD has standard conductivity, temperature, and pressure sensors. In addition, the Seacat is outfitted with a Turner Designs Cyclops Fluorometer for *in situ* measurements of chlorophyll-a. During the CTD profile, data was stored internally and downloaded during transit to the next station.

Hydrographic survey lines were conducted between the shelf break (200 m isobath) and the 10 m isobath, perpendicular to bathymetric contours and crossing both the inshore and shelf-break jets. Three times each day, a profile of water samples was acquired with Niskin bottles to calibrate the fluorometer. A known volume of water was filtered and the samples were frozen for analysis of chlorophyll concentration onshore at Woods Hole Oceanographic Institution.

At selected CTD stations, plankton tows were also be performed with 60 cm paired bongo nets for two replicate samples at each station. The purpose of the sampling is to acquire an assessment of the water column organisms available for foraging by loggerhead turtles, and to determine if the biological community is different in areas where turtles are observed compared to areas where they are not observed. Nets were towed slowly (~1.6 knots) to maintain a 45 degree angle of the towing warp, and were fished to a maximum depth of ~100 meters or within 2 meters of the bottom in depths less than 100 meters. Onboard, the net content was transferred to trays, photographed and the classes of organisms identified and numbers noted for larger macro-invertebrates that can be hand sorted. The settled volume was be measured for the remaining zooplankton. Type specimens from the qualitative sampling and the six remaining replicates were be preserved for onshore analysis. The assessment of the bongo net tows will include quantitative sub-sampling, and identification of zooplankton (i.e. all adult copepods, cladocera, mysiids, eupausids, ctenophores, etc.) to species level whenever possible.

The hydrographic surveys will produce 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. 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,
- water column species composition.

The goal is to identify the characteristics (T-S-C, ocean currents, availability of particular food species) that govern where turtles are found – and where they are not found – on synoptic timescales and at various phases of the seasonal cycle (the latter as our timeline of measurements continues). In addition to *in situ* measurements, remotely sensed data (from MODIS-Aqua) will be incorporated into the analysis. Our hypothesis is of a strong link between water mass distributions, frontal jets and sea turtle behavior and ecology. We anticipate that each survey will provide adequate information to test this hypothesis, and that the details of these linkages will vary from month-to-month (and perhaps interannually as well). Satellite chlorophyll maps exhibit large regional changes between early and late summer, and the properties of the cold pool evolve on monthly timescales. Acquiring these synoptic observational datasets is, in our opinion, the best way to build a factual understanding of the range and breadth of variability that influences sea turtle ecology.

Flight operations were incorporated into our research plan. We followed the general strategy of flying transects in conjunction with the oceanographic work.

Both survey vessels involved in this project maintained 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 final scientific results to determine any relationship between scallop fishing effort and turtle presence.

Results

The postulated link between turtle distributions and oceanography is supported by CFF's most recent work on the MAB shelf. A hydrographic survey was conducted July 7-12 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. 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).

ROV Results

Trip: Kathyann-2009-3

(TC = Time Code from ROV video display, not actual time)

T43 – Summary

T43 was observed feeding on hermit crabs 8 times and a rock crab once during a single 20-minute dive to the seafloor at a depth of 57 meters (figure 13 thru 20). The turtle actively chased crabs on several occasions and spent more time actively swimming along the seafloor in search of prey than other turtles observed. The turtle feed approximately once every minute.

The bottom characteristics included large pieces of sulfur sponge, scallop shell, clam shell, anemones, and live sea scallops. On three occasions during its search on the seafloor; T43 spent a few second inspecting the area underneath pieces of sulfur sponge in search of prey. On At TC 3:45:39 the turtle was observed capturing and feeding on a large crab as shown in figure 21. Visual of T43 was lost during its ascent from the seafloor at TC 3:51:22.

T59- Initial Behavior

T59 was acquired by the ROV at TC 1:18:16 within 1 meter of the surface. The turtle had heavy algal growth on parts of its carapace (figure 22). T59 never showed any signs of apprehension of the ROV's presence, however it was spooked by the vessel on one occasion. Around TC 2:11 the turtle began to act normally swimming slowly east at 1-3 meters until its first dive to the seafloor.

T59 –Dive #1

T59 began its first pre-dive at TC 2:21:10 directly next to a discarded scallop glove floating on the surface (figure 23). It was never observed in contact with the glove or attempting to feed on the glove. At TC 2:24:46 it begins its first dive to the seafloor. At 22 meters it becomes negatively buoyant and speeds increases dramatically at 32 meters at which point the ROV temporarily lost visual of the turtle.

The turtle was reacquired walking on the seafloor towards the ROV at a depth of 51 meters (TC 2:30:10) (figure 26). The water temperature at this depth was 7.5 C. The bottom characteristics at this location included: small starfish, many sand dollars, sulfur sponge, cut scallop shells, live scallops, and flat sand. At TC 2:30:50, T59 is first observed feeding on the seafloor (figure 27). This prey as well as the prey during the rest of the dive was not identifiable due to its small size and the camera's distance from the turtle. However, on several occasions it appears that the turtle was chasing and feeding on small hermit crabs. It often feed directly next to large pieces of sulfur sponge, perhaps where the crabs were hiding. The turtle rarely spends more than a few seconds feeding on a single crab, often ingesting it as it continues searching for the next prey. While foraging the turtle can be seen ingesting copious amount of sand along with its prey. It fed or attempted to feed on average at least once every 30 – 60 seconds, often only taking a few steps before feeding again. In total it was observed feeding or attempting to feed 35 times during dive 1. The turtle often missed or had to chase it's prey down on 5 feeding attempts. It showed no interest in red hake, small scallops, or skate egg cases all of which is swam directly over in several instances. T59 was last observed feeding during dive one at TC 2:47:34. Bottom temperature at this depth

At TC 2:49:31, T59 begins its ascent immediately after searching around several pieces of sulfur sponge. The ascent begins slowly but directly upwards, taking several power strokes to initiate (figure 28). The ROV lost the turtle as it picked up speed at 46 meters at TC 2:49:50, but regained it at TC 2:57:10 when the turtle was swimming at 1meter. The turtle then begins swimming slowly east again at one meter, taking a breath at TC 3:13:14.

T59 – Dive #2

After swimming east at a depth of 3 meters for almost an hour, T59 surfaces and starts pre-dive #2 next to a piece of sargassum weed (figure 30). Dive 2 begins at TC 3:52:20 (figure 31). Within 30 seconds T59 reaches 10 meters and starts to slow its stroke rate at 20 meters (TC 3:53:23) then becoming completely negatively buoyant at 30 meters (TC 3:54:00) (figure 32) and rapidly picking up speed at 40 meters. It is observed coming in for a landing on the seafloor at TC 3:54:42 (figure 33).

The bottom characteristics, depth, and water temperature during dive 2 were the same as during the previous dive. Feeding behavior was also similar as with that previously observed with T59. The turtle was observed feeding or attempting to feed 41 times while on the seafloor. Visual was lost due to a short tether at TC 4:28:00 while the turtle was still foraging on the seafloor. It was

reacquired at TC 4:37:47 swimming 1 meter below the surface, again heading towards the east. At TC 4:44:30 it is observed taking a breath.

T59 – Dive #3

T59 engages in the typical pre-dive behavior for the 3rd time at TC 5:37:40 (figure 38). Dive #3 begins at TC 5:40:40 (figure 39), reaching 10 meters at 5:41:16. This time the turtle starts to become negatively buoyant at 15 meters (figure 40) and picks up speed at 25 meters. It reaches 30 meters at TC 5:42:20 and visual is lost at 40 meters. The turtle is soon found feeding on the bottom at TC 5:44:12, at a depth of 49 meters.

The same bottom features, temperature, and foraging behavior is repeated again during dive 3. It feeds or attempts to feed 49 times during dive 3. T59 swims directly over 3 different scallops without showing interest. At TC 6:14:07 it begins the ascent back to the surface (figure 43) but is soon lost by the ROV at 40 meters. It is reacquired at TC 6:15:25 at 23 meters. It does not appear to be in a rush to reach the surface, instead floating up the last 7 meters without taking a stroke.

At TC 6:17:33 it reaches the surface and floats motionless until TC 6:22:06 (figure 45) taking breaths approximately every 30 seconds. At the end of this post dive behavior, it again starts swimming at a depth of 0-3 meters heading to the east taking a quick breath every 5 – 10 minutes.

T59 – Dive #4

The pre-dive for dive #4 starts at TC 6:47:43 (figure 46) with the dive starting at TC 6:53:29 (figure 47). It reaches 10 meters at 6:54:06, 20 meters at 6:54:43, 30 meters at 6:55:20 where it becomes negatively buoyant (figure 48), dramatically picks up speed starting at 37 meters and reaches the bottom at TC 6:55:50 where the depth is 50 meters (figure 49).

Again, bottom characteristics and general foraging behavior is similar for this dive as the previous 3. Although the turtle seems to miss its prey more often, requiring it to put more energy in chasing down prey. It also occasionally mistakes non-prey animals (sponge, sea urchin, shell) initially, as prey but does not consume them. It encounters sea scallops 4 times without showing any interest. It also spooks a skate without attempting to feed on it. In total it feeds 43 times while on the bottom during dive 4.

It begins the ascent from this dive at TC 7:33:50 (figure 43). It is lost at 40 meters as it gained speed. It is reacquired just below the surface at TC 7:37:52. It goes into a post dive behavior at 7:38:00, floating motionless on the surface until 7:39:28 when it begins swimming east at 1 -2 meters.

T59 – Jellyfish

After Dive #4, T59 slowly swims east at 1-2 meters taking breaths approximately every 5 minutes. At TC 7:58:00 T59 suddenly looks down and glides to 5 m to eat a single small white

jellyfish (figure 60) at TC 7:58:17. The entire jellyfish is consumed immediately and the turtle quickly returns to swimming east at 1-2 meters. Until this point no jellyfish had been observed in the water column.

The turtle surfaces at TC 8:08:43 to take breaths until 8:09:17 when it takes a sharp angle dive (much like when diving to the seafloor) then glides to another jellyfish, a single small lion's mane (figure 61), at a depth of 1 meter. It appears to be prepared to eat the jellyfish that is directly in front of it, however it then glides past it and returns to swimming eastward at 1 meter. At TC 8:31:42 the turtle passes by another jellyfish like the one it had consumed previously.

T59 - Dive #5 62 - 68

The pre-dive for T59's fifth dive to the seafloor began at TC 9:18:29 and lasted until TC 9:22:10 when it began diving to the seafloor (figure 62 and 63). The turtle reaches 10 meters at TC 9:22:41, 20 meters at TC 9:23:15, began its dive at 28 meters, made 30 meters at TC 9:23:54, 40 meters at TC 9:24:18, and lands on the bottom 53 meters deep at TC 9:24:36 (figures 64 and 65).

The bottom characteristics and water temperature were similar to that of previous dives. The turtle's feeding behavior was also similar. It was observed feeding 20 times before visual was lost at TC 9:41:20. T59 missed one hermit crab 4 times before finally chasing it down and eating it. The turtle was also observed investigating under shells, sulfur sponge, and starfish but not attempting to eat them. The ROV lost the turtle while on the seafloor because of being pulled away by the vessel. T59 was not observed again after this point.

Trip: Kathyann-2009-6

T3 - Summary

Kathyann-2009-6-T3 was initially sighted on 6/12/2009 at 12:33, 60 meters from the vessel at position 3820.5 7406.8 where the depth was 58 meters and water temperature 23.1 C with partly cloudy skies and seas of 1-2 meters. T3's sighting occurred 13 minutes after loosing ROV contact with T2. No fish were observed associated with T3 as had been with T2. Small pieces of sargassum weed and other debris were observed around T3. Two other turtles, T4 and T5, were sighted while tracking T3. T3 was observed briefly interacting with T5.

The turtle was acquired by the ROV at time code 2:29:56 (approximately 12:46 EST) and lost at TC 6:34:30 (approximately 16:30 EST) for a total tracking time of approximately 4 hours. During the tracking time T3 was observed diving to seafloor 3 times, feeding on a sea scallops 9 times, and interacting with other turtles on 2 occasions. The longest observed bottom time with the turtle was during dive #1 of approximately 30 minutes at a depth of 65 m and a temperature of 11.5 C.

The carapace had some small barnacle growth on the marginal scutes and down the middle of the vertebral scutes with little or no algal growth. No obvious injuries were observed on T3, although a discoloration of the carapace near the left fore flipper as well as an unsymmetrical stroke that favored the left fore flipper were noted. T3's tail extended slightly beyond the

carapace, however not enough to make to make a definitive determination of sex or maturity (figure 88). A size estimate was not obtained although comparison side by side to the ROV could be possible from photos taken from the masthead.

T3 - Initial Behavior

T3 was first acquired by the ROV 1 meter below the surface along with multiple small pieces of sargassum floating under the surface (figure 89). The water column was also full of macro particles. The turtle was facing away from the in a southerly direction as the ROV approached. T3 then slowly dove to 12 meters (TC 2:30:00 – TC 2:31:31) while eyeing the ROV. Then after reaching 12 meters, slowly swam back towards the surface (TC 2:32:00 - TC 2:38:40) During this dive the turtle occasionally does a kick with its left rear flipper and a "scratching stroke" with its left fore flipper. Its stroke is unsymmetrical, using only its right fore flipper and left hind flipper (figure 86). Turtle seems to favor the left fore flipper, and when using both fore flipper doesn't take full power stroke with left flipper. Some bubbles can be seen slowly coming from its mouth as it surfaced the first time. That the turtle appeared initially to be cautious of the ROV was signified by its constant attempt to keep the ROV within its field of view. The ROV was following directly behind the turtle at a distance of approximately 3-5 meters. The turtle's first breath recorded with the ROV was taken at TC 2:38:40.

Turtle begins to accept the ROV and behavior normally around TC 3:00:00. At this time is starts to maintain a constant northeast heading and constant depth of >1 meter below the surface, taking frequent breaths (approximately every 45 seconds), and slow steady stroke rate. After this introductory time, the ROV is following directly behind the turtles at a distance of 1 - 4 meters without the turtle seeming to pay attention to its presence.

T3 - Dive #1

At TC 3:25:14, T3 begins its pre-dive behavior (figure 70), floating on the surface with the top of its carapace above the water surface, taking frequent breaths, with slow treading water or sculling strokes. This behavior has been observed during previous turtles before doing dives to the seafloor. The pre-dive behavior usually lasts 5-10 minutes, in this case approximately 6.5 minutes, before going directly into a dive to the seafloor.

At TC 3:31:56, T3 begins its dive to the seafloor (figure 71). The dive angle is steep and stroke rate rapid power strokes. Unlike other turtle, it uses its hind flippers in addition to its fore flippers. The stroke rate slows dramatically around 20 meters and continues to slow until 35 -40 meters when it becomes negatively buoyant (figure 72). At 40 meters it no longer takes strokes and its decent speed increases enough that the ROV has trouble keeping up. The turtle is momentarily lost the last 5 meters but immediately reacquired on the seafloor at a depth of 65 meters. At TC 3:34:31, the ROV has the turtle lying still on the seafloor facing away from the ROV (figure 73). The turtle may have been feeding immediately upon arriving on the bottom. The bottom temperature logged at this point was 11.5C.

At TC 3:35:16 the turtle starts to walk along the bottom. Its head orientation and movement suggesting it is foraging for prey. The ROV follows the turtle at a distance of 1-2 meters. At TC

3:36:18 it turns quickly and attempts to eat a sea scallop, which immediately swims away and escapes the turtle. It appears to have visually picked out the scallop (which was not initially visible to the camera). It takes the turtle a few seconds to realize the scallop is no longer there. It then continues on in search of prey with the ROV following alongside 1 meter away. At TC 3:36:52 the turtle stops to eat, although that can't be confirmed due to the camera angle and poor visibility. There are several sea anomies around the immediate vicinity of the turtle.

At 3:37:23 the turtle is observed feeding on a sea scallop. A red hake is directly next to the turtle as it feeds on the scallop. It uses its fore flippers to pull the viscera off the shell and appears to ingest much sand while feeding on it. It is done eating the scallop at TC 3:41:35 and immediately continues to walk along the seafloor for a distance of >1 meter before starting to feed briefly on an unknown prey at TC 3:41:39. It then walks another meter and feeds again on another scallop from TC 3:42:29 until TC 3:45:58. At 3:46:05 it attempts to eat another scallop but doesn't appear to crack the shell. TC 3:46:58 it quickly bites at another prey and continues along the seafloor.

At 3:47:28 it runs into the ROV's tether and seems to attempt to bite it or something near it. It continues to forage with the tether caught on its carapace until 3:48:06 when the tether comes off the turtle. It did not appear to pay much attention to the tether or ROV. At 3:49:15 after not finding prey for almost a minute, it starts to walk/swim and pick up speed along the bottom. At 3:49:39 it finds and eats another scallop until 3:51:44. When it is in search for prey the turtle moves on an erratic heading moving its head back and forth and quickly turning when it spots prey. It finds the 6th scallop at TC 3:52:28 and feeds on it until TC 3:54:37. The 7th scallop is found 1 meter away at TC 3:54:46 but the scallop swims away and escapes at TC 3:55:02 as the turtle dropped it while trying to break the shell. After loosing the last scallop T3 then starts to ascend to the surface at TC 3:55:23 (figure 76).

The ROV looses the turtle on the way up at TC 3:55:38 because of its rapid ascent, but recovers it at TC 4:00:04 when the turtle is at depth of 2 meters and swimming slowly down. It is followed down to a depth of 25 meters at TC 4:03:10 where it swims with the slow unsymmetrical stroke as before. At TC 4:03:20 it begins slowly swimming upwards. It is temporarily lost again at TC 4:06:32 while at a depth of 15 meters. The turtle is then recovered floating on the surface at TC 4:15:54.

T3 - Dive #2

Starting at TC 4:16:43, T3 resumes swimming towards the northeast a 1 meter or less taking slow unsymmetrical strokes and not using its left fore flipper. At TC 4:21:16 the turtle surfaces and once again displays typical pre-dive behavior. While in pre-dive mode, the turtle defecates several times starting at TC 4:23:58. It remains oriented to the northeast the entire time. Its next dive begins at TC 4:30:53.

The turtle again becomes negatively buoyant at 35 – 40 meters. Water clarity decreases dramatically around the same depth. It is lost at TC 4:32:32 at a depth of 45 meters due to its increased speed and the ROV's inability to keep up. Depth at this dive location was 70 meters with a bottom temperature of 11.5 C. The ROV searches for the turtle on the bottom until TC

4:38:10 without success, then returns to the surface. It recovers the turtle floating on the surface at TC

During the tracking time T3 was observed (diving to seafloor how many times, eating scallops how many times, socializing). The carapace had some small barnacle growth on the marginal scutes and down the middle of the vertebral scutes with little or no algal growth nor injuries. The turtle's tail extend slightly beyond the carapace but not enough to make a definitive determination as to being a mature male (figure ___). A size estimate was not obtained although comparison side by side to the ROV could be possible from photos taken from the masthead.

T3- Social Interactions with T4 and T5

When reacquired at TC 5:06:13, T3 was floating just under the surface facing the ROV. As the ROV approached the turtle slowly turn side ways while floating beneath the surface taking slow treading strokes. During this time the ROV followed behind or to the side of the turtle at a distance of approximately 1-3 meters. Many small pieces of sargassum were seen scattered and floating on the surface around the turtle. At TC 5:20:58, with the ROV 2 meters behind and less than 1 meter below the surface, T3 suddenly turns its carapace away from the ROV (showing its plastron) and looking away from the ROV as if it had perceived a threat coming from ahead. Around this time T4 had been spotted from the masthead 100 meters away from the turtle. No direct contact nor close proximity between the turtles was observed. It then does a complete 360 degree turn while on its side. It then quickly returned to floating below the surface.

At TC 6:00:26 T3 starts to float on the surface with its carapace out while doing slow treading down strokes and taking frequent breaths. After 4 minutes of this behavior it stops taking any strokes and floats motionless with all 4 flippers dangling outwards. This "surface basking" behavior has been observed previously with several other turtles prior to diving to the seafloor. However this turtle does something different at TC 6:04:03, it tucks its fore flippers onto the carapace and cups it hind flippers while floating on the surface (figure 90). After 40 seconds of this behavior it starts to swim forward just using its hind flippers while keeping its fore flippers tucked onto the carapace for about 30 seconds. During this time the turtle appears to be looking downward, perhaps at the other turtle, T5. It then takes a breath while (facing directly towards the ROV for the first time) and starts what appears to be a deep dive but instead starts looking around below it while oriented downward.

At this point the ROV spots another turtle (T5) swimming below at approximately 5 meters deep and 15 meters away from T3. At TC 6:04:56, T3 starts swimming down towards T5. At TC 6:05:16, the two turtle are recorded directly interacting with each at a depth of 5 meters for about 30 seconds (figure 91). During this time T3 was facing T5 with almost direct contact while T3 was swimming in circles with its carapace oriented towards T5. T3 appears to be a larger turtle than T5. A TC 6:05:50 the two turtles swim in opposite directions with T3 slowly returning to the surface where the ROV remains tracking it. T3 is not seen again after this interaction. As T3 returns to the surface it again does the cupping with its hind flippers and tucking of its fore flippers. This flipper tucking behavior is observed again on several occasions during the rest of the tracking of T3.

Upon returning to the surface (TC 6:07:25) the turtle briefly takes a breath then floats with minimal movements less than 1 meter below the surface.

T3 - Dive #3

At TC 6:12:20, T3 starts basking on the surface with the top of its carapace above the waterline while taking breaths every 30 seconds. During this time, T3 again does the cupping behavior with its hind flippers. The turtle seems to become more buoyant with each breath causing more of its carapace to be exposed out of the water while facing north. At TC 6:16:26 T3 began its dive to the seafloor suddenly with rapid power strokes and a steep dive angle. The turtle took rapid strokes with its left hind flipper as well, unlike other turtles that only stroked with only the fore flippers. Because of its rapid and sudden descent, the ROV was T3 lost during the dive while the ROV was at 5 meters at TC 6:17:00

The ROV continued to the seafloor without visual of the turtle. At TC 6:19:40, the ROV reached the seafloor at 70 meters. The bottom consisted of a large number of both starfish and sea scallops, fourspot flounder, red hake, shell, crabs, flat sand, anemones, and shell hash. There was low ambient light, so the ROV's lights had to be used. Poor visibility due to large amounts of "ocean snow" in the water caused backscattering from the lights and thus added to the poor visibility. Using the BlueView sonar while searching along the bottom, T3 was reacquired walking along the bottom towards the ROV at TC 6:24:16 from a distance of 2-3 meters.

T3 is recorded feeding on a sea scallop at TC 6:25:41 until 6:26:15. The turtle cracks open the scallop then pulls the shell off with its fore flippers and consumes the viscera. T3 begins walking along the bottom and searching for more prey immediately after finishing the scallop. At 6:28:21 T3 begins swimming with its fore flippers while walking with its hind flippers.

At TC 6:30:17 the turtle is recorded feeding on another sea scallop (figure 85). The turtle seems to initially have trouble cracking the scallop shell and maneuvers the scallop with its mouth to a position to best crack it. At TC 6:31:35 the turtle can be seen eating the scallop, but more detail was not recorded because of the ROV position and poor lighting. At TC 6:32:08 the turtle had finished eating the scallop and immediately continues searching for more food. It walks directly over a scallop without any change in behavior.

At TC 6:33:28 the turtle stops and head movements suggest that it was feeding; however the ROV's position did not allow a visual on its prey. The turtle is lost while feeding on the seafloor at TC 6:34:30 due to the ROV being pulled back away from the turtle by the tether. Visual on the bottom was not recovered and the ROV began its return to the surface at TC 6:39:10. T3 was spotted from the masthead at 16:55 while the ROV was still returning to the surface. This was the last sighting of T3 at position 38-20.7, 7405.2 where the water depth was 70 meters and surface temperature 23.4 C.

T24:T25:T26 - Summary

T24 was first sighted with T25 300 meters from the vessel engaged in the flipper slap social behavior observed during previous trips. The turtles were spotted at 13:01 on Monday September 14 on the surface 300 meters from the vessel approximately 15 minutes after the last sighting of T23. The sighting of T24 and T25 occurred at the position 38-43.7, 73-40.3 where the water depth was 59.5 meters and surface temperature was 23.3 C. This was also the last reported position of one of our satellite tagged turtles.

The ROV briefly recorded T24 & T25 together. T25 swam away as T24 dove and was not seen again after 20 seconds of recording. T24 was tracked afterward by the ROV for a total of 1 hour 25 minutes. T24 did not appear comfortable with the ROV's presence for the first 45 minutes. During the first 45 minutes of tracking, T24's behavior seemed to be influenced by the ROV. The turtle did several avoidance dives, was constantly changing direction, had an inconsistent stroke and breathing rates during this time. One avoidance dive was a free fall decent (no strokes taken) from 5 meters to approximately 25 meters then immediately swam back up to the surface.

After 45 minutes T25 encountered another turtle, T26, which appeared to be much larger that T25. The encounter was also brief, lasting only 15 second and appeared to be affected by the ROV. T26 was recorded swimming near the surface as it came within close proximity of T25 and the ROV. As it approached T25 turned it carapace towards T26 as it passed by, then began swimming to the south. After this interaction, T25 seemed to be less affected by the ROV and maintained a steady southern course at a depth of 3 meters, breathing every 5 minutes, and a consistent stroke rate of 20 per minute. This behavior was observed for the remaining 45 minutes of track until the turtle was lost because of being pulled back by the vessel.

Satellite Tagging

Trip: Kathyann-2009-5

The tags utilized for this study were Sea Mammal Research Unit's Satellite Relay Data Logger (SRDL) with Argos Fastloc GPS. 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 were 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 was 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 2 juvenile loggerheads captured in the southern part of the Hudson Canyon Access Area. 3D graphics illustrating these data currently being collected by CFarm's tags are provided in figures 94 thru 103. 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.

Discussion

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 this project, 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. Subsequent surveys will be sure to cross both of these fronts to assess correlations between flow, chlorophyll and density distributions and their relationships to turtle distributions and behavior. 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?

The work will eventually address multiple questions regarding sea turtle behavior by combining the ROV-mounted video technology with hydrographic sampling.

- Do turtles preferentially forage along frontal zones on the shelf?
- Do they preferentially inhabit waters derived from a particular source region (shelf waters from the north vs. slope waters vs. coastal runoff from the bays and rivers)?
- Why do the larger loggerheads associate with Sargassum mats?
- What and how often are they eating?
- Where in the water column do they feed?
- How often do they surface to breathe?
- How deep do they dive?
- How do turtles behave when startled?
- Do turtles sleep on the surface in the MAB?
- Do turtles migrating in the spring and fall exhibit different behavior from the mid-summer foraging period?

A particular puzzle pertains to where in the water column interactions between turtles and scallop dredges are occurring. Since dredges spend 95% of their time on the sea floor during fishing operations, this would seem the most likely locale of turtle takes. Loggerheads have been caught in bottom-set gill net in the region and observed to feed on the bottom in shallow depths of the Mediterranean and Gulf of Mexico. However, during the Mid-Atlantic turtle foraging months, the areas of overlap with the scallop fishery principally occur where bottom depths range 49-57 m (Murray, 2004). Bottom temperatures in these regions are consistently colder than 10° C, and generally >10° C colder than the surface waters they most frequently inhabit -- i.e. 19 – 24°C (Shoop and Kenney, 1992, Murray, 2004). Because loggerheads are physiologically sensitive to low temperatures (Spotila et al. 1997; Milton and Lutz, 2003), this steep vertical temperature gradient would seem a significant deterrent to bottom feeding. In our most recent ROV studies we have found that most of the loggerheads were diving to the sea floor to feed, some for up to 30 minutes in 7.4° C temperatures. High priority in this project will be given to exploring the depth ranges and depth behaviors of sea turtles on the scallop grounds with respect to oceanographic parameters and prey species availability.

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 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.

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LIST OF TABLES, FIGURES, APPENDICES

Oceanographic Methods & Results

Results from ROV trip Kathyann-2009-3

Results from ROV trip Kathyann-2009-6

Results from tagging trip Kathyann-2009-5

Appendices:

Bongo Net Tow Methods

On the July and September 2009 sea turtle cruises, a limited zooplankton study was conducted. Zooplankton tows were performed at three to four selected CTD stations using 60 cm paired bongo nets to obtain two replicate samples. The purpose of the sampling was to acquire an assessment of the water column organisms available for foraging by loggerhead turtles, seasonal changes in zooplankton composition, and to determine if the biological community is different in areas where turtles are observed compared to areas where they are not observed.

Oblique 15 minute tows were performed from the surface to below the chlorophyll maximum with a towing speed of (~1.5 knots) to maintain a 45 degree angle of the towing wire. When the nets were brought back onboard they were carefully rinsed flushing the organisms to the cod end. Upon retrieval, zooplankton logs were completed with deployment and recovery times, station depths, and flow meter counts. Logs are attached at the end of this Appendix.

Each replicate samples was sieved with a 2mm mesh sieve to remove the comb jellies (Ctenophora) and jellyfish (Cnidaria). These organisms were transferred first to a tray for rough counts, identification, and photographs and then to a graduate cylinder to measure the mesoglea volumes. The remaining zooplankton from each replicate tow was preserved in 10% buffered formalin. These preserved samples were later transferred to 95% ethyl alcohol, and one replicate from each station was analyzed by Ray Gerber, Ph.D., professor emeritus of Biology and Marine Sciences at St. Joseph's College in Standish, ME. His assessment of the bongo net tows included measuring the settled volumes of the zooplankton, and quantitative sub-sampling and identification of the zooplankton (i.e. all adult copepods, cladocera, mysiids, euphausids, ctenophores, etc.) to species level whenever possible. The other samples are being stored at CR Environmental in Falmouth, MA.

CTD Cast Methods

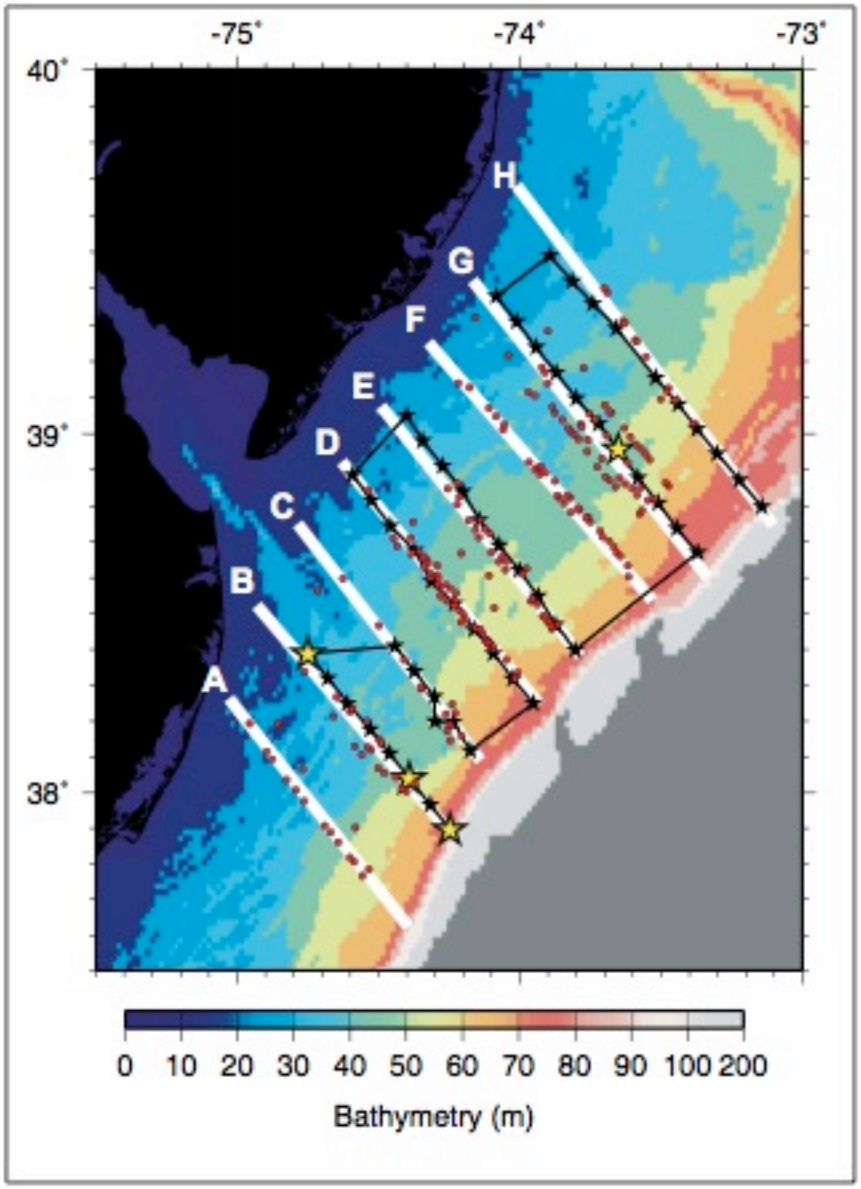


Figure 1. Hydrographic and aerial turtle survey in July 2009. White lines labeled A-H delineate aircraft tracklines, black lines mark the ship track of the hydrographic survey. Stars mark the locations of CTD stations, plankton tows were additionally conducted at locations marked by yellow stars. Red circles locate turtle sightings from the aircraft, *F/V Diligence* and *F/V Kathy Ann*.

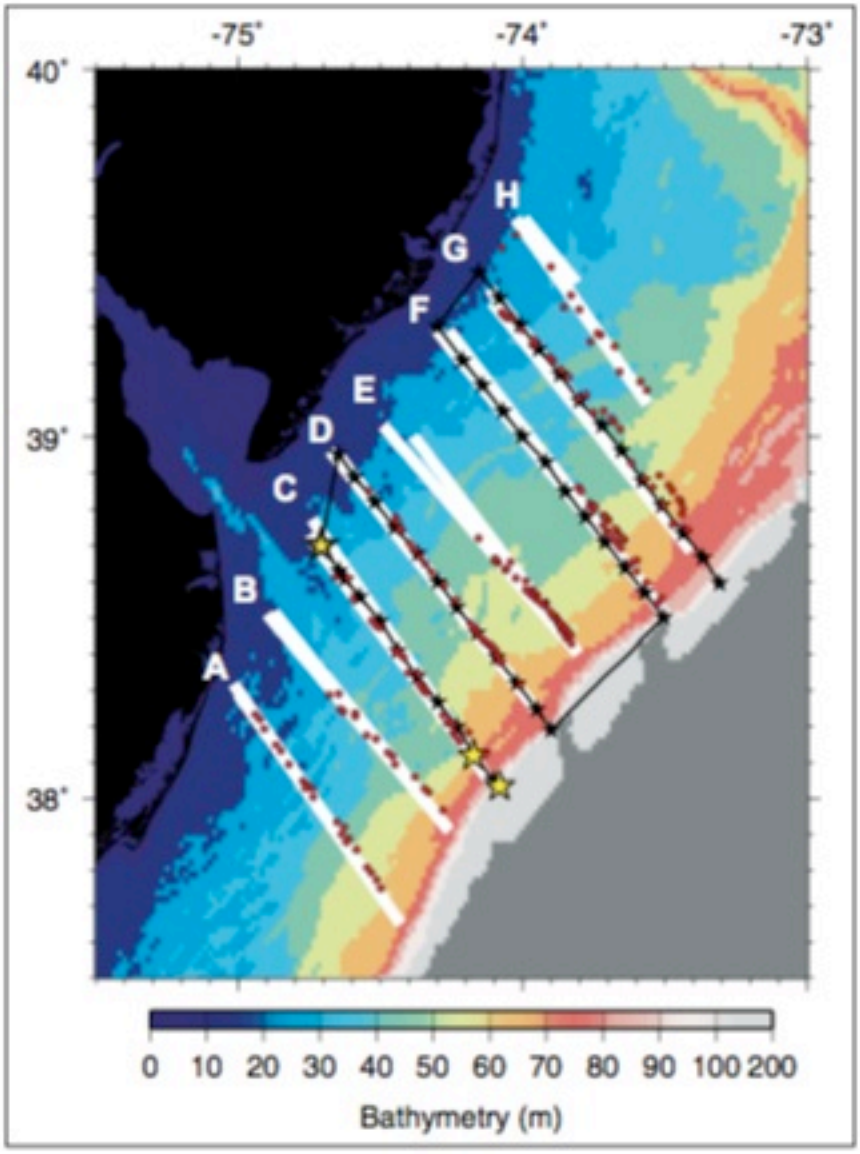


Figure 2. Hydrographic and aerial turtle survey in September 2009. White lines labeled A-H delineate aircraft tracklines, black lines mark the ship track of the hydrographic survey. Stars mark the locations of CTD stations, plankton tows were additionally conducted at locations marked by yellow stars. Red circles locate turtle sightings from the aircraft.

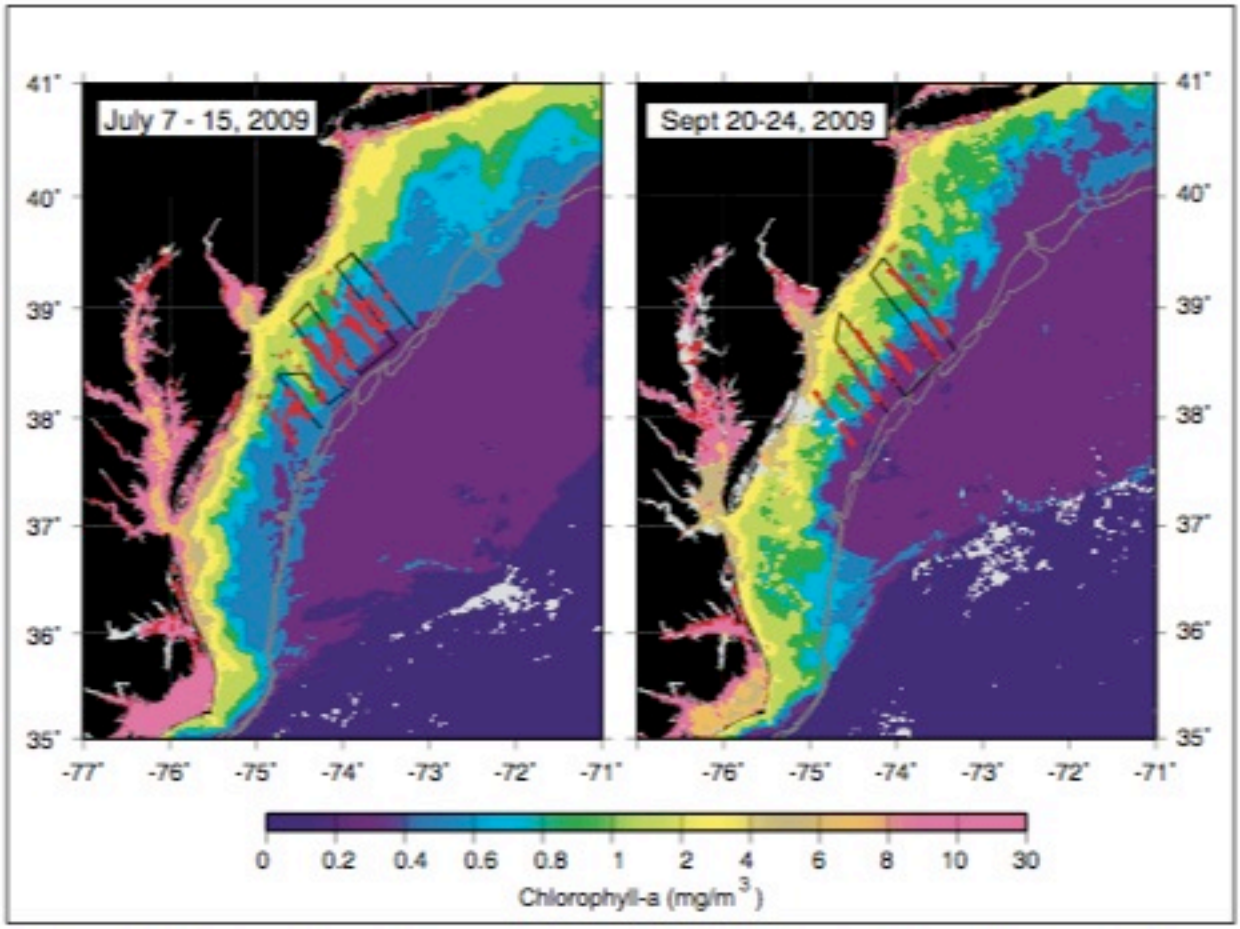


Figure 3. Relative chlorophyll-a concentration from MODIS/AQUA satellite data gridded at 1 km resolution averaged for time periods corresponding to the July and Sept surveys (source: L.Ojanen, Rutgers University Coastal Ocean Observation Laboratory). Red circles are turtle locations, black lines delineate the ship track of the hydrographic survey.

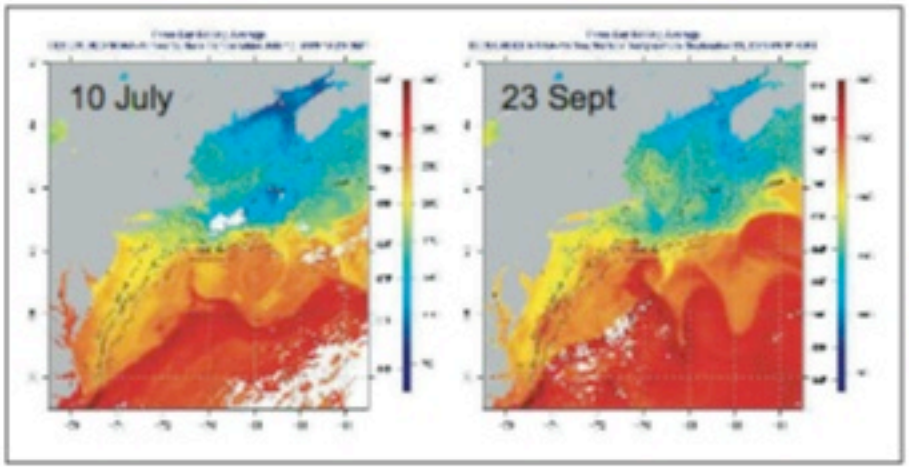


Figure 4. 3-day rolling averages of declouded SST from AVHRR satellite data for each of the two surveys. (Source: http://marine.rutgers.edu/cool/sat_data)

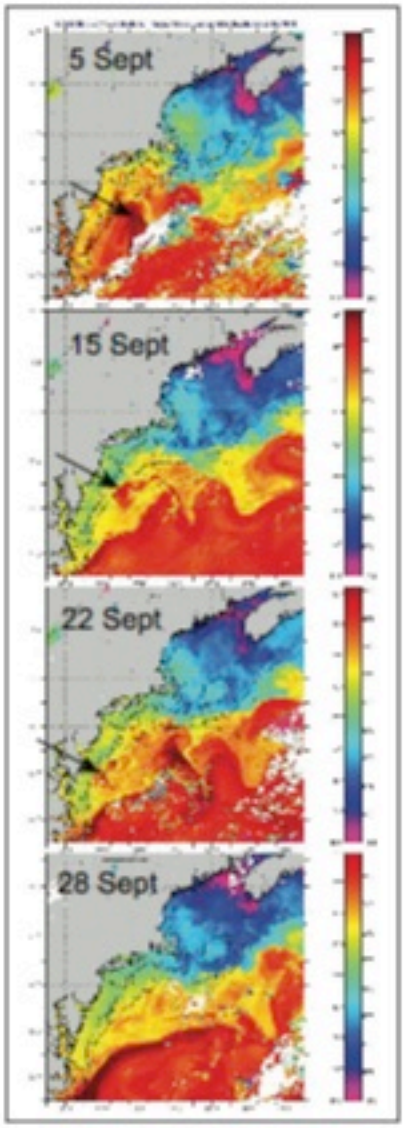


Figure 5. Daily SST composite showing the development and passage of a Gulf Stream ring before, during and after the September survey. Black arrows mark the location of the ring (Source: http://marine.rutgers.edu/cool/sat_data)

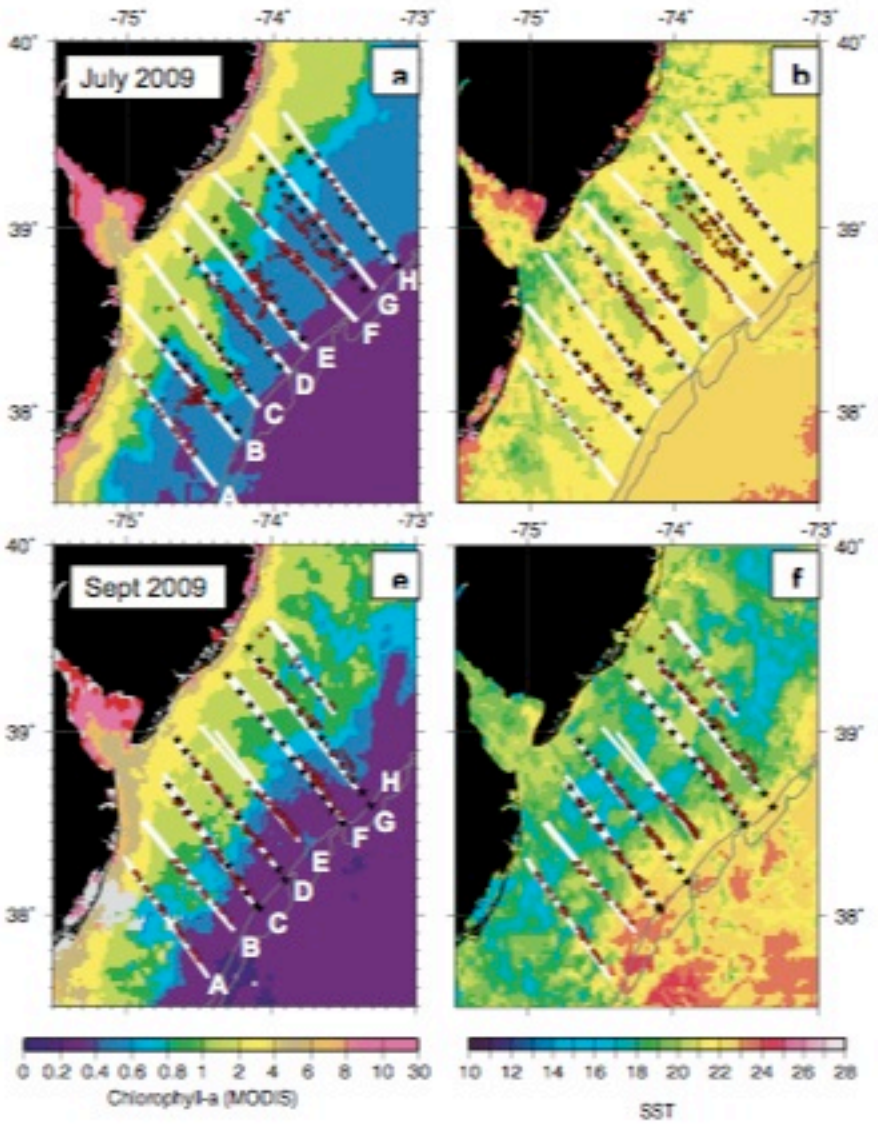


Figure 6 *(cont'd on next page).*

Maps of surface and bottom properties during July (upper) and September (lower) surveys. White lines mark the aerial survey tracklines (labeled A – H), black stars are CTD stations, red circles are locations of sea turtles.

a, e: Chlorophyll-a from MODIS/AQUA satellite imagery.

b, f: SST from MODIS/AQUA satellite imagery.

c, g: Potential temperature at bottom of each CTD cast (colored squares) with bathymetry (contour interval is 10 m) and turtle locations (black squares).

d, h: Salinity at bottom of each CTD cast (colored squares) with bathymetric contours and turtle locations.

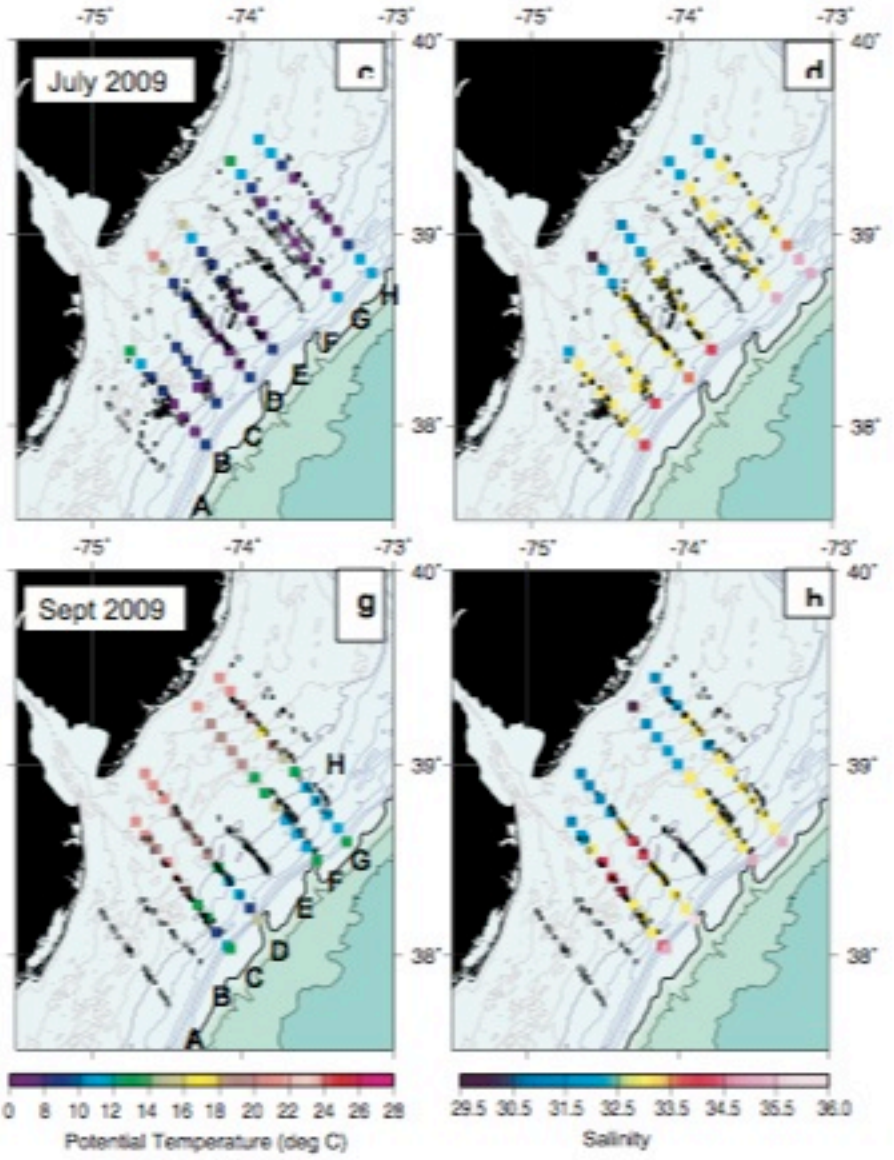


Figure 6 (*cont'd from previous page*).

c, g: Potential temperature at bottom of each CTD cast (colored squares) with bathymetry (contour interval is 10 m) and turtle locations (black squares).
d, h: Salinity at bottom of each CTD cast (colored squares) with bathymetric contours and turtle locations.

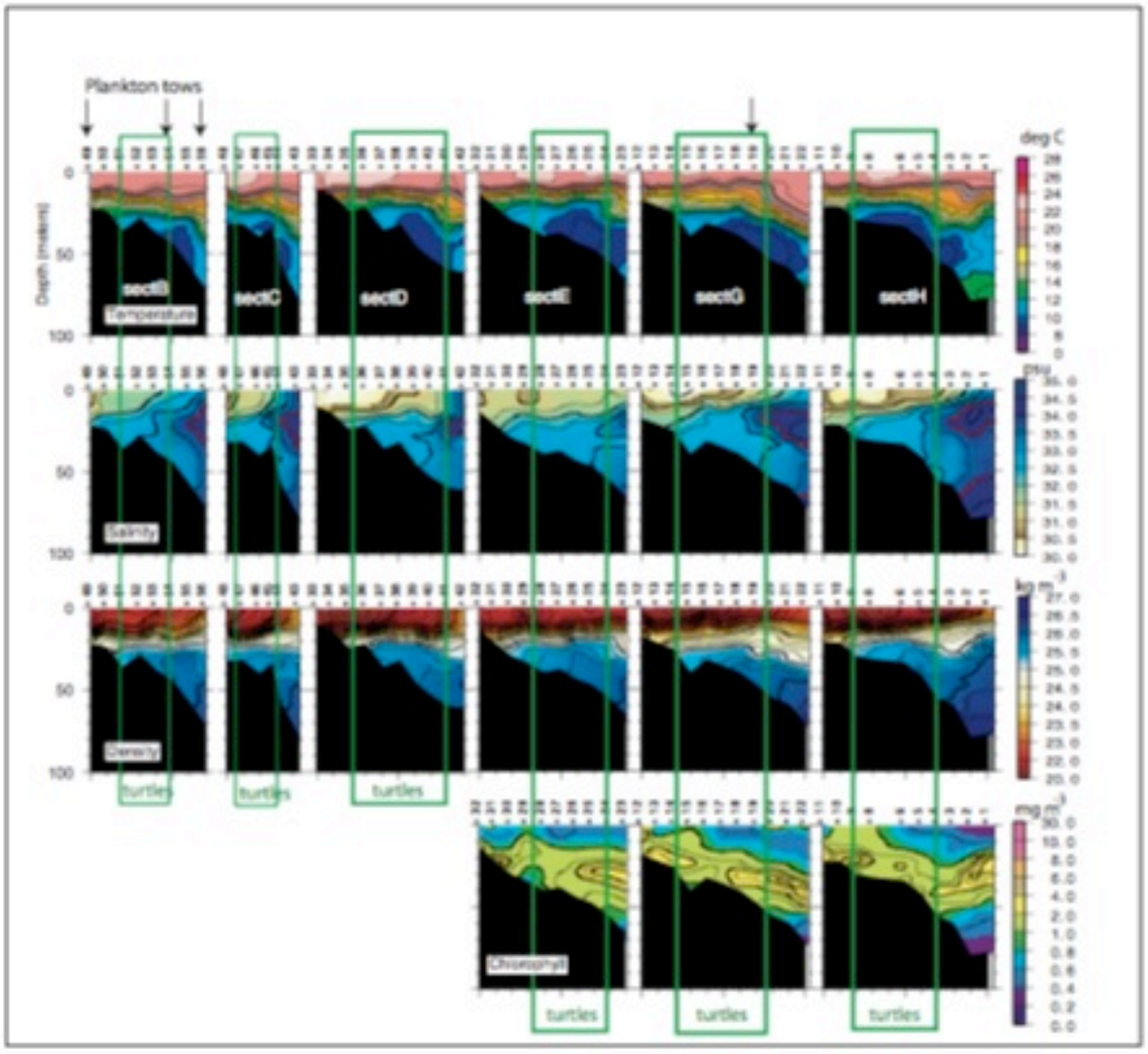


Figure 7. Property sections along hydrographic lines occupied during the July survey. Green boxes indicate where turtles were located along each section. Plankton stations along sections "B" and "G" are marked with black arrows.

Top row: Potential temperature
2nd row: Salinity (red contour is 34.0 psu)
3rd row: Potential density
bottom row: Chlorophyll

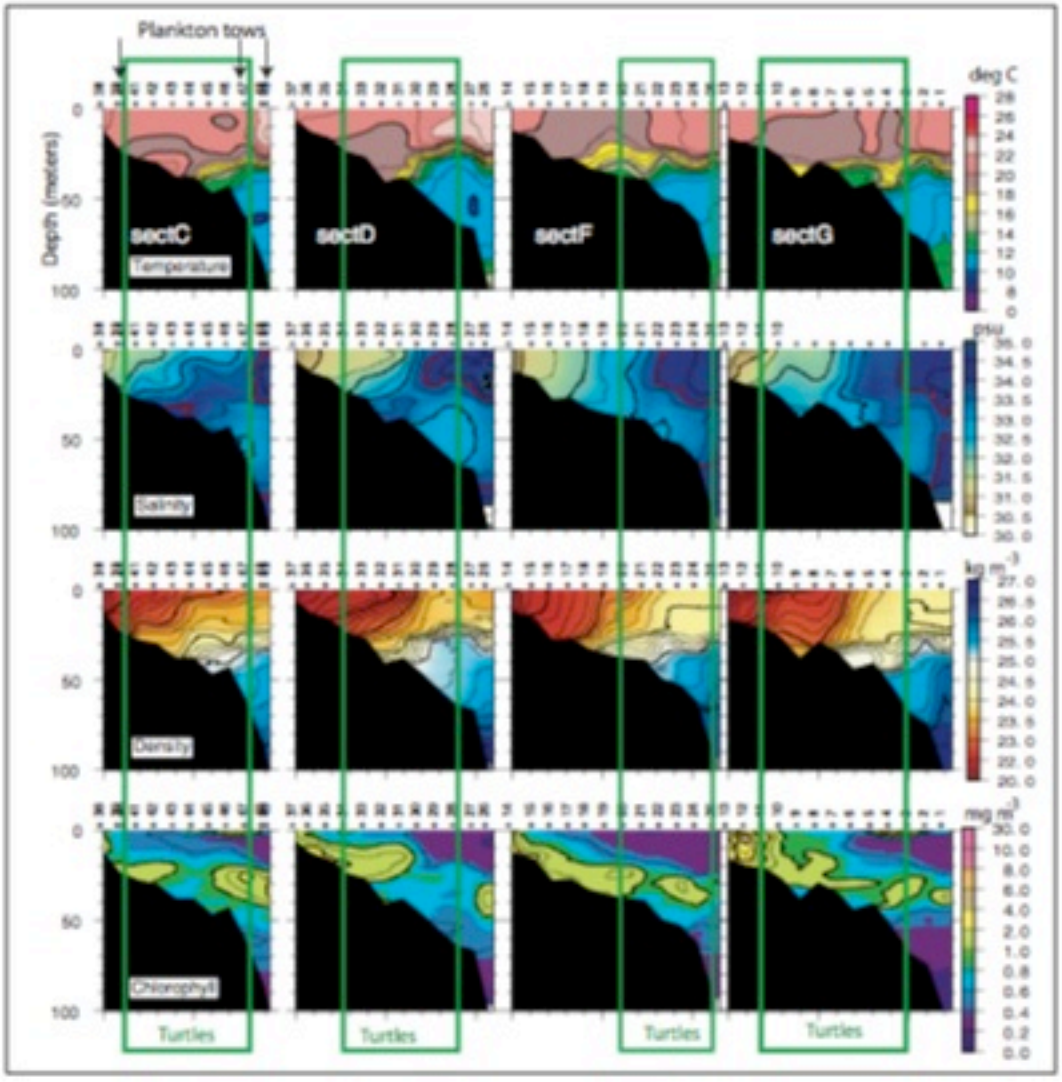


Figure 8. Property sections along hydrographic lines occupied during the September survey. Green boxes indicate where turtles were spotted along each section. Plankton stations along section "C" are marked with black arrows.

Top row: Potential temperature
2nd row: Salinity (red contour is 34.0 psu)
3rd row: Potential density
bottom row: Chlorophyll

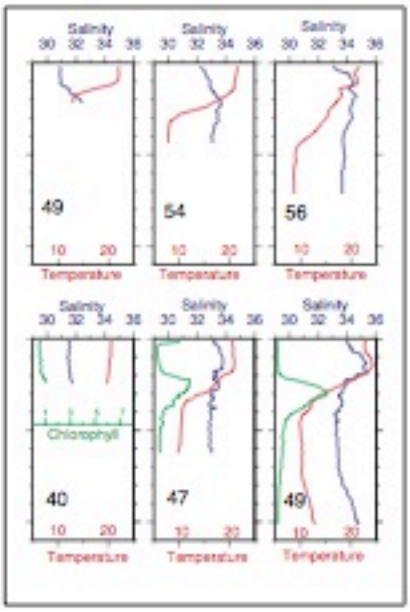


Figure 9. CTD profiles at plankton stations. Upper row is July survey, lowere row is September. Station numbers are marked in lower left of each panel. Temperature (red), Salinity (blue), chlorophyll (green).

Sta / Depth	uM NH4	uM Silicate	uM PO4	uM NO2+NO3
C40 / 3m	2.1	1.3	0.1	2.8
C40 / 9m	0.6	0.8	0.1	<0.05
C40 / 24m	0.9	1	0.1	<0.05
C47 / 3 m	3	1.4	0.1	2.1
C47 / 9m	1.6	1.6	<0.05	0.2
C47 / 24m	0.7	4.1	0.1	<0.05
C47 / 36m	1.7	6.4	0.6	5.8
C49 / 3m	1.1	1.8	<0.05	<0.05
C49 / 15m	0.6	2	<0.05	<0.05
C49 / 24m	0.9	2.8	<0.05	<0.05
C49 / 36m	1.7	12.2	0.4	6.5

Table 1. Nutrient concentrations (micromoles/liter) of water samples acquired along Section C in September (see Fig. 8 for locations).

TABLE 2

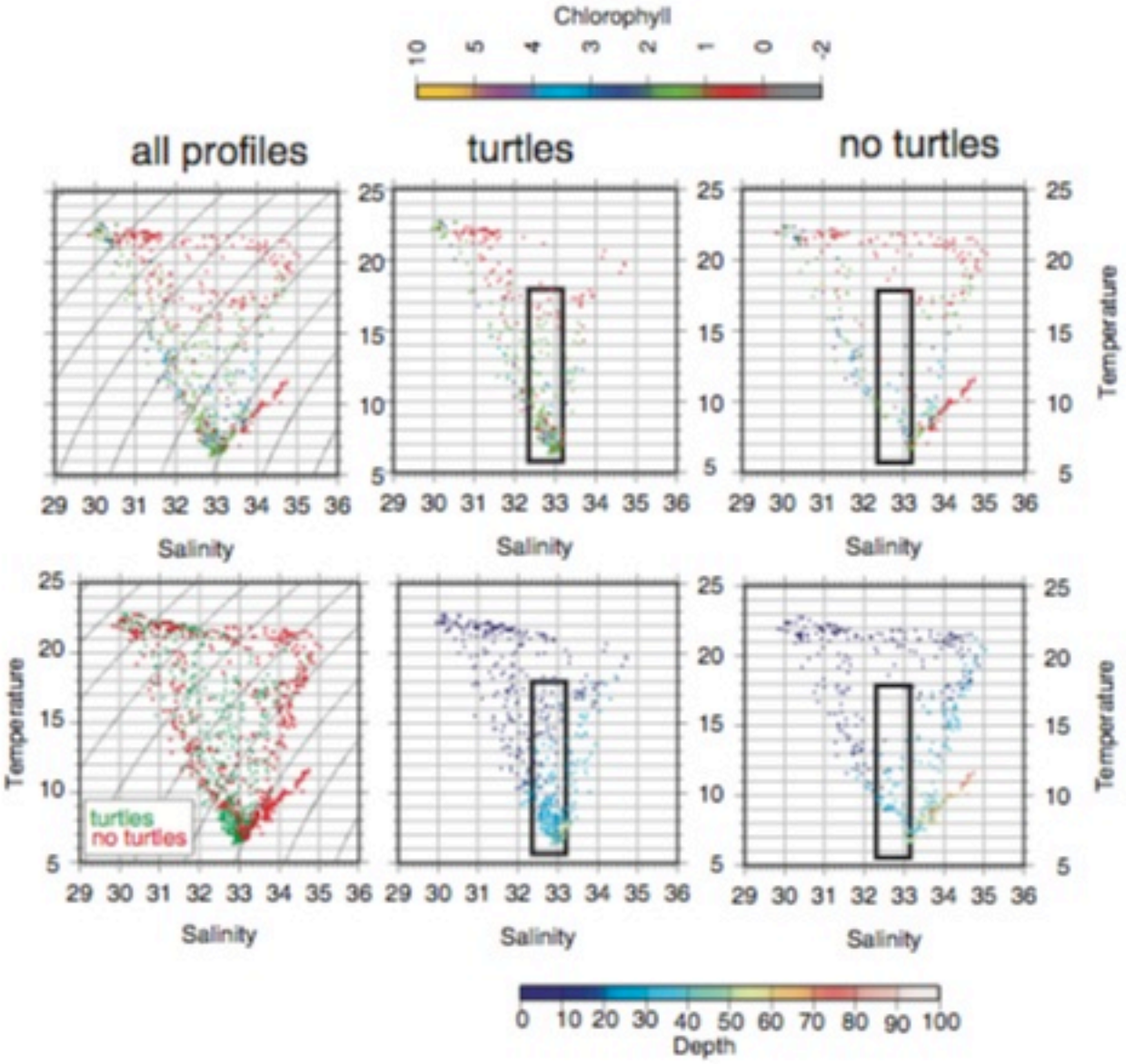
Raw Bongo Net Tow Volumes

July and September 2010

Station/Cruise	Station Depth	Flow Meter Revolutions	Water Volume Passing Through the Net[1]	Composition	Raw Mesoglea Volume Net 1	Raw Mesoglea Volume Net 2	Raw Zooplankton Volume Net 1
G-19/July 2010 Mid	156 ft	17,125 Net 1 16,946 Net 2	143 m^3 142 m^3	Ctenophores	8 mls	9 mls	60 mls
B-49/July 2010 Inshore	85 ft	18,651 Net 1 18,935 Net 2	156 m^3 158 m^3	Ctenophores	158 mls	168 mls	135 mls
B-54/July 2010 Mid	174 ft	18,454 Net 1 18,540 Net 2	154 m^3 156 m^3	Ctenophores	60 ml	64 ml	78 mls
B-56/July 2010 Outer	246 ft	21,773 Net 1 21,216 Net 2	182 m^3 177 m^3	Ctenophores	1 ml	2 ml	102 mls
C-40/Sept 2010 Inshore	90 ft	23,001 Net 1 22,859 Net 2	192 m^3 191 m^3	Water Jellies	(2 individuals) 175 mls	(3 individuals) 100 mls	460 mls
C-47/Sept 2010 Mid	212 ft	27,538 Net 1 26,536 Net 2	230 m^3 222 m^3	None	0	0	430 mls
C-49/Sept 2010 Outer	335 ft	27,249 Net 1 27,455 Net 2	228 m^3 229 m^3	Water Jelly	(1 individual) 30 ml	0	450 mls

[1] Estimated volume of water passing through bongo nets based on calibration at 150 ft showing 1628 revolutions of the flow meter = 13.6 cubic meters

Figure. 10


Chlorophyll
10 5 4 3 2 1 0 -2
all profiles
turtles
no turtles
Temperature
Salinity
turtles
no turtles
0 10 20 30 40 50 60 70 80 90 100
Depth

Appendix B – Results from ROV trip Kathyann-2009-3

Figure. 11

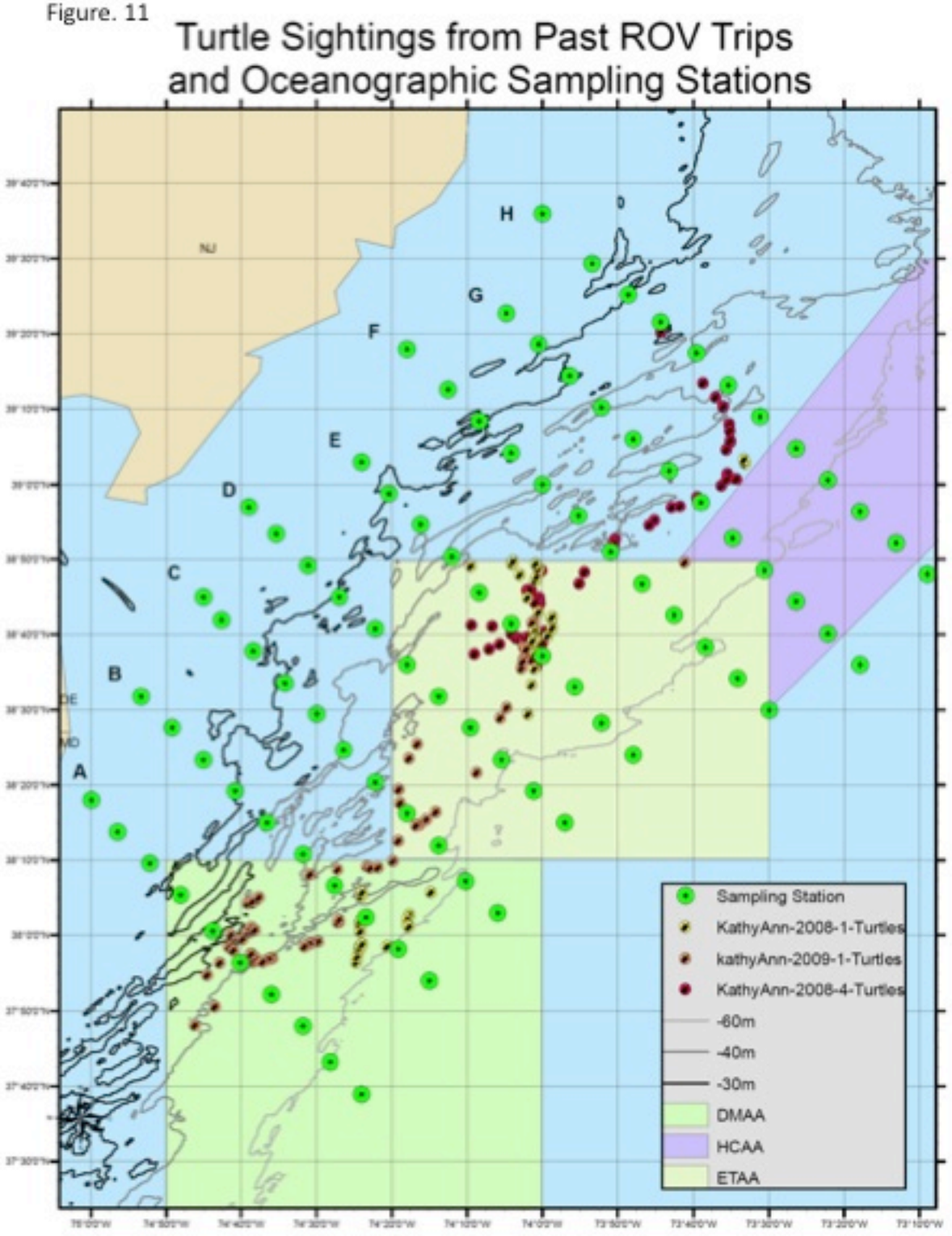


Figure. 12

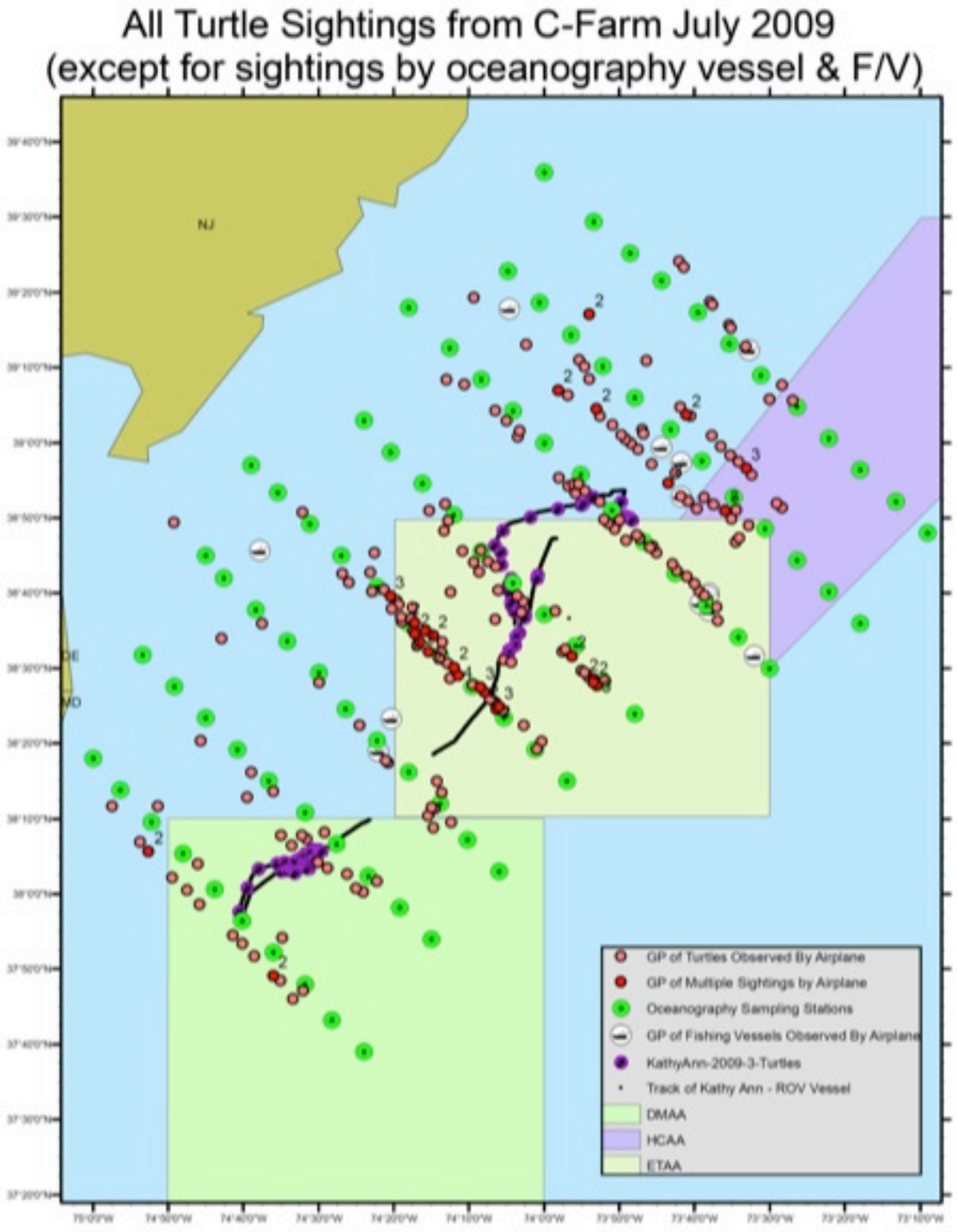

All Turtle Sightings from C-Farm July 2009
(except for sightings by oceanography vessel & F/V)
NJ
GP of Turtles Observed By Airplane
GP of Multiple Sightings by Airplane
Oceanography Sampling Stations
GP of Fishing Vessels Observed By Airplane
KathyAnn-2009-3-Turtles
Track of Kathy Ann - ROV Vessel
DMAA
HCAA
ETAA

Figure 13. T43 Pre-dive #1

Figure 14. T43 Dive begin

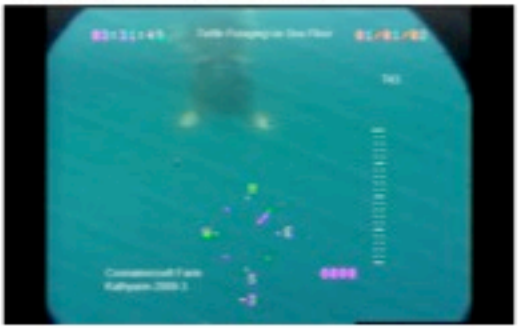


Figure 15. T43 Dive to seafloor

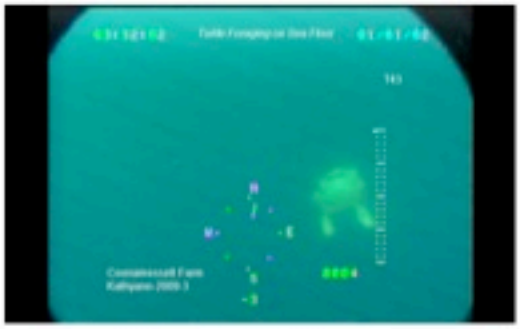


Figure 16. T43 Foraging on Seafloor

Figure 17. T43 Seafloor foraging example

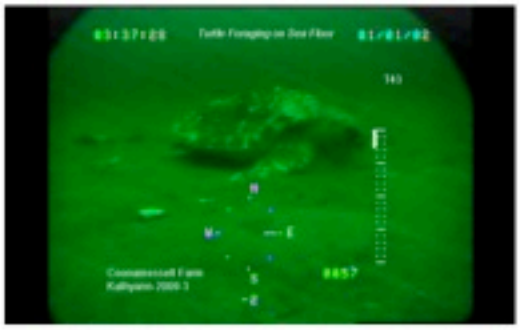


Figure 18. T43 Chasing prey on seafloor

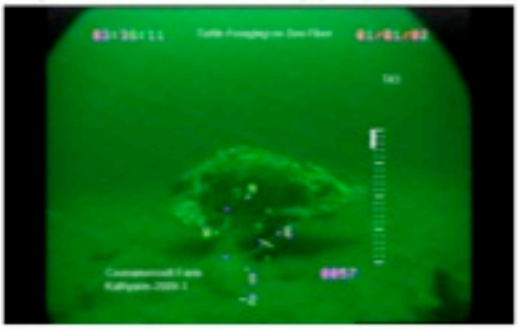


Figure 19. T43 Ascent begin

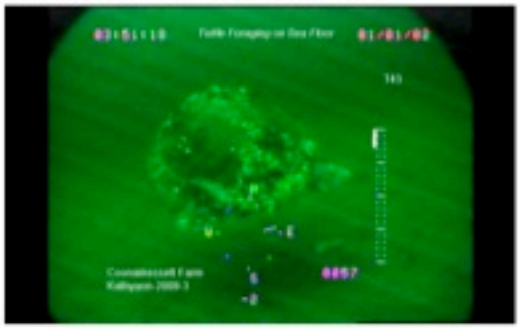


Figure 20. T43 Ascent from seafloor

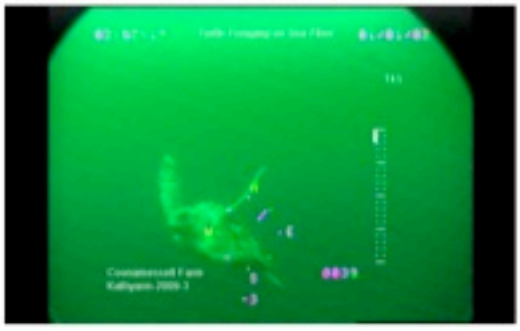


Figure 21. T43 Feeding on large crab

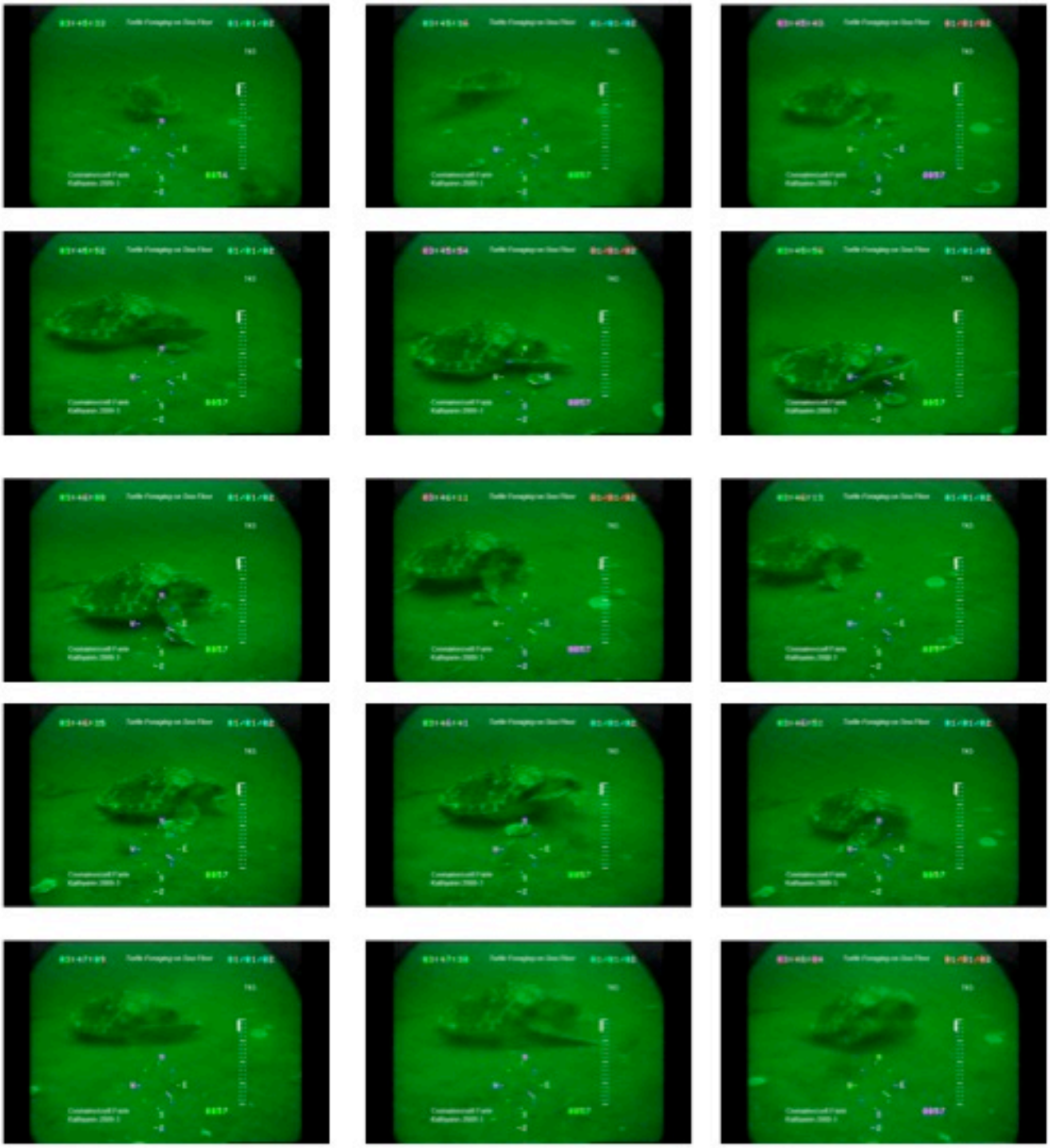


Figure 22. Kathyann-2009-3-T59

Figure 23. T59 Pre-dive #1 (with glove)

Figure 24. T59 Dive #1 begin

Figure 25. T59 Dive #1

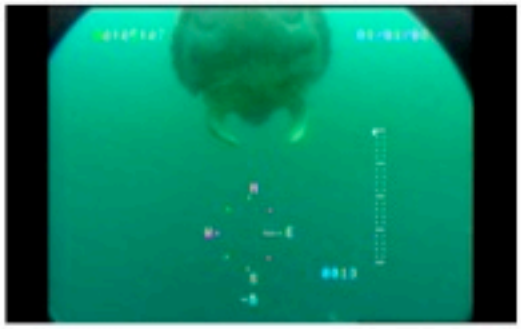


Figure 26. T59 Arriving on seafloor

Figure 27. T59 Foraging example

Figure 28. T59 Ascent begin

Figure 29. T59 Ascent from seafloor

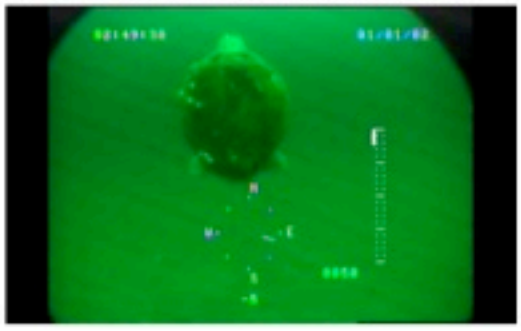


Figure 30. T59 Pre-dive #2

Figure 31. T59 Begin dive #2

Figure 32. T59 Gliding to seafloor

Figure 33. T59 Arrives on seafloor

Figure 34. T59 Foraging on seafloor

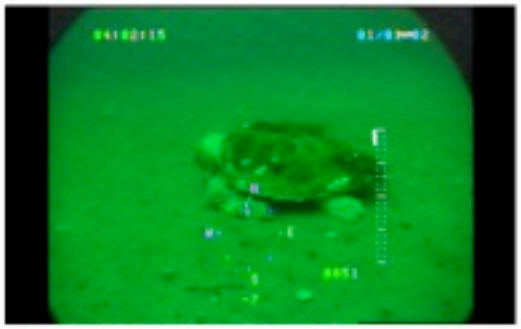


Figure 35. T59 Foraging on seafloor

Figure 36. T59 Foraging on seafloor

Figure 37. T59 Searching for prey

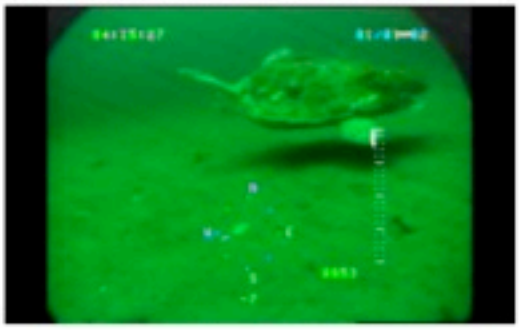


Figure 38. T59 Pre-dive #3

Figure 39. T59 Begin dive #3

Figure 40. T59 Gliding to seafloor

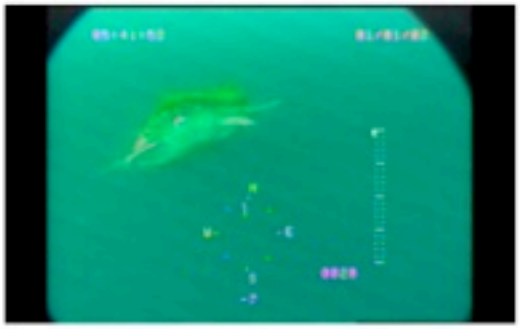


Figure 41. T59 Foraging on seafloor

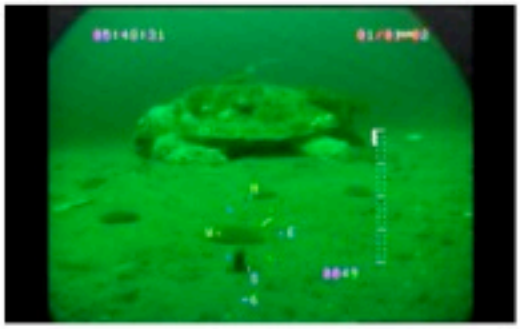


Figure 42. T59 Foraging on seafloor

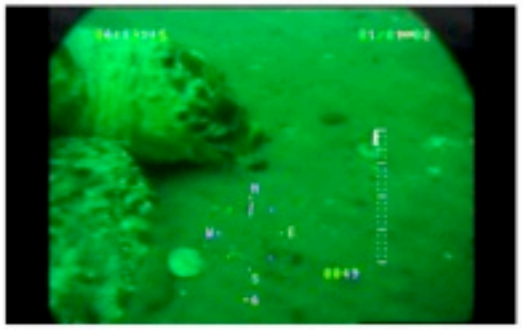


Figure 43. T59 Begin of ascent #3

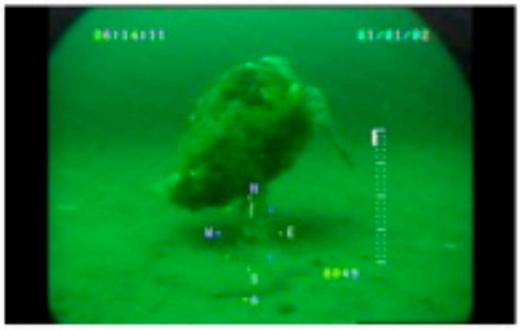


Figure 44. T59 Ascent from seafloor

Figure 45. T59 Post dive

Figure 46. T59 Pre-dive #4

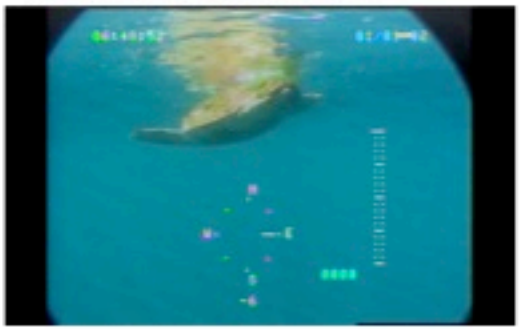


Figure 47. T59 Begin Dive #4

Figure 48. T59 Gliding to seafloor

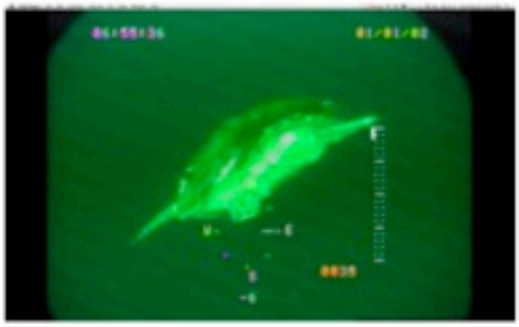


Figure 49. T59 Arriving on seafloor

Figure 50. T59 Chasing prey on seafloor

Figure 51. T59 Foraging on seafloor

Figure 52. T59 Foraging on Seafloor

Figure 53. T59 Ascent from seafloor

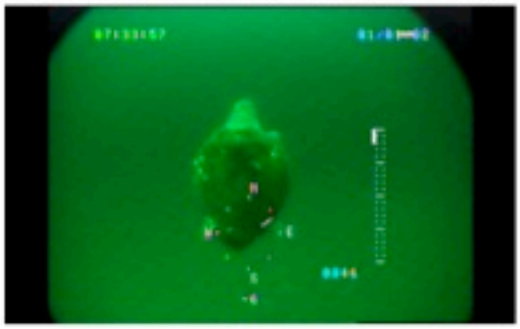


Figure 60. T59 Feeding on jellyfish #1

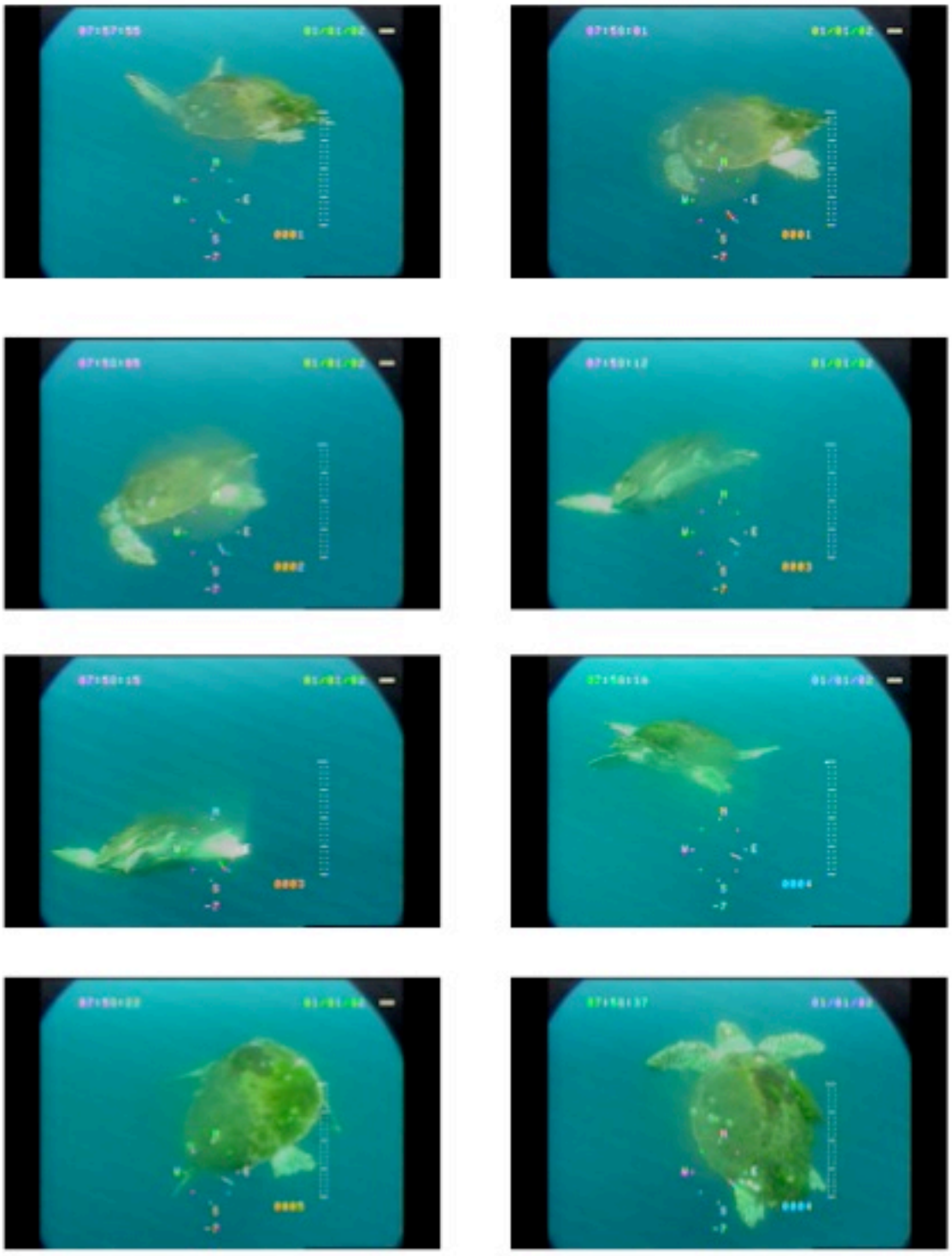


Figure 61. T59 Attempt to feed on jellyfish #2

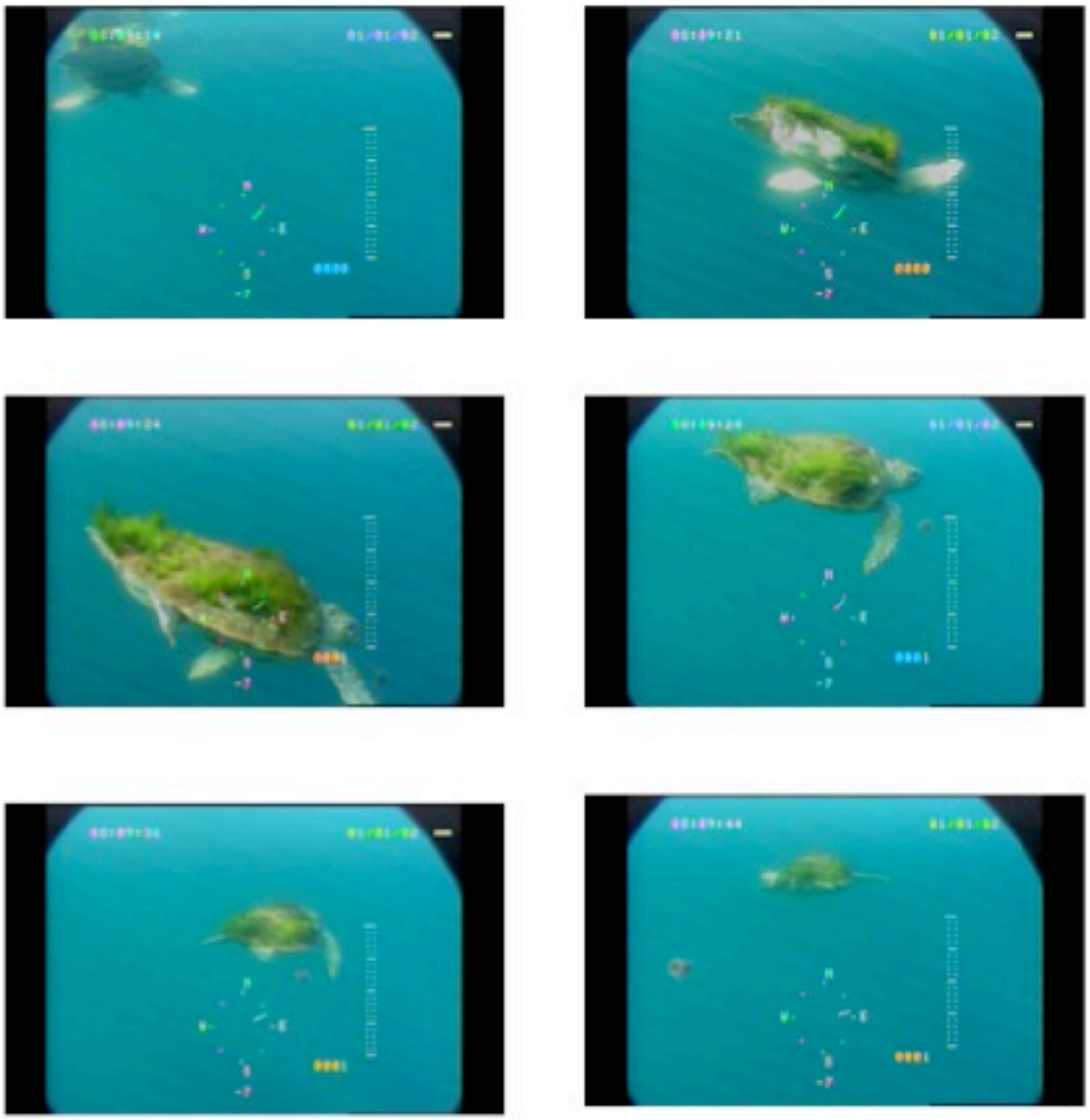


Figure 62. T59 Pre-dive #5

Figure 63. T59 Begin dive #5

Figure 64. T59 Gliding to seafloor

Figure 65. T59 Arriving on seafloor

Figure 66. T59 Chasing prey on seafloor

Figure 67. T59 Foraging on seafloor

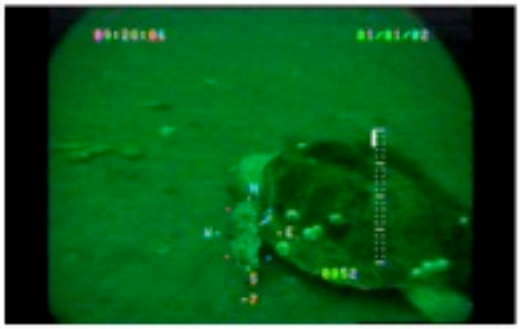


Figure 68. T59 Foraging on Seafloor

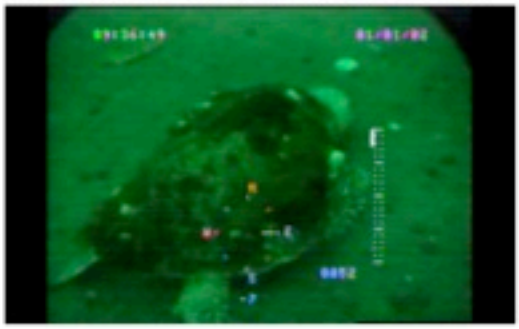
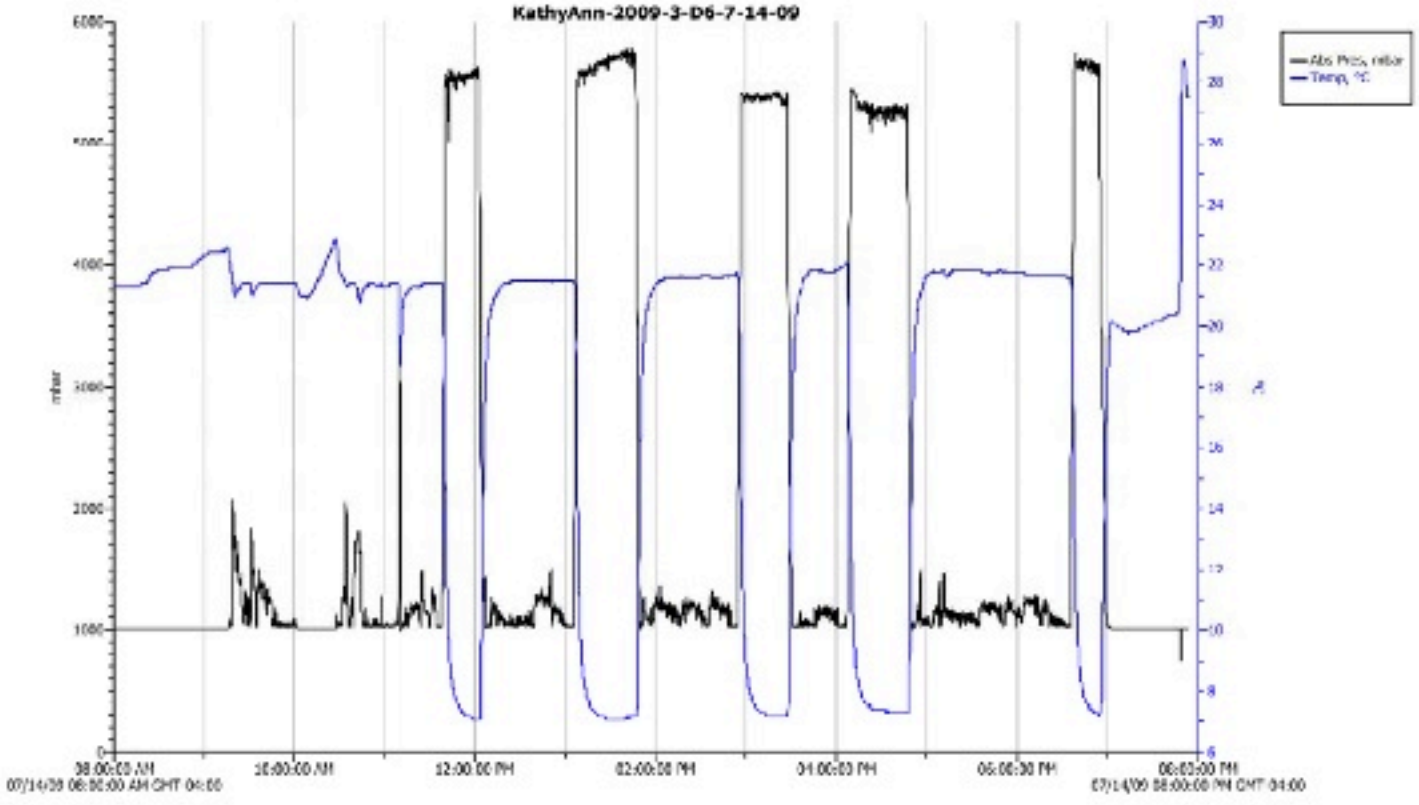


Figure 69. T59 Temperature at depth



Appendix C – Results from ROV trip Kathyann-2009-6

Figure 70. T3 Pre-dive

Figure 71. T3 Begin Dive 1

Figure 72. T3 Gliding to Seafloor

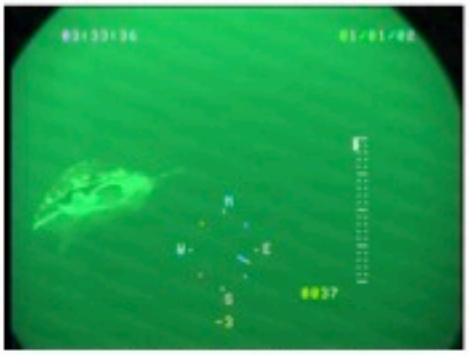


Figure 73. T3 Arriving on Seafloor

Figure 74. T3 Foraging on Seafloor

Figure 75. T3 With ROV tether

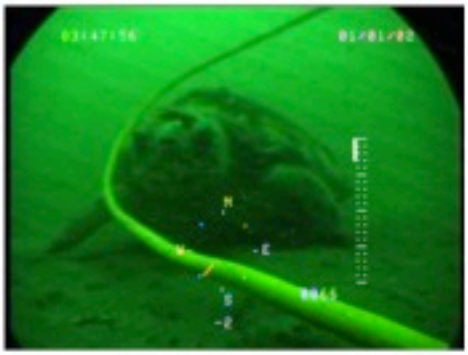


Figure 76. T3 Ascent begin

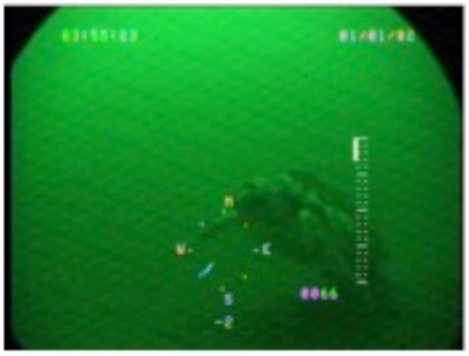


Figure 77. T3 Ascent

Figure 78. T3 Attempting to feed on scallop #1

Figure 79. T3 Feeding on sea scallop #2

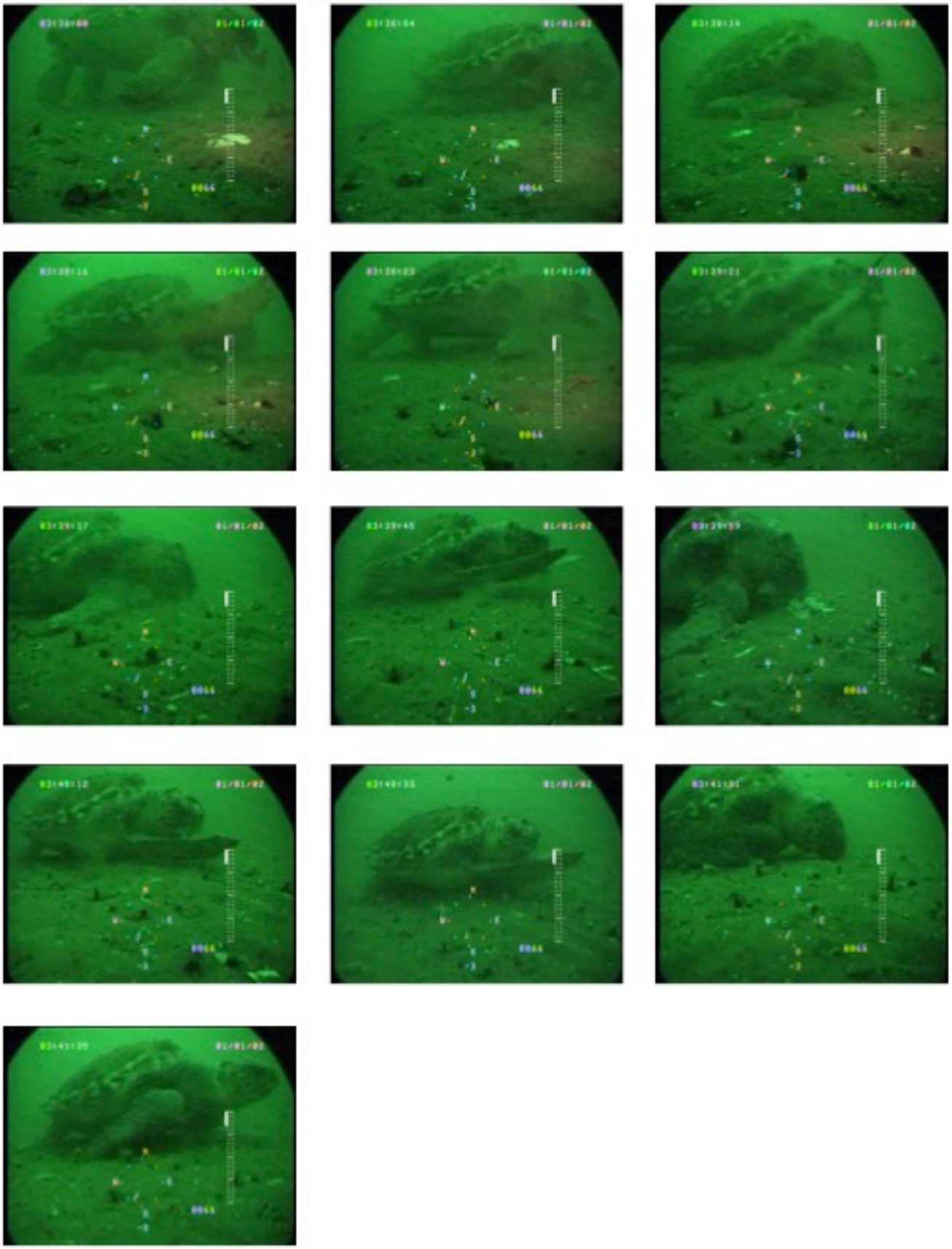


Figure 80. T3 Feeding on scallop # 3

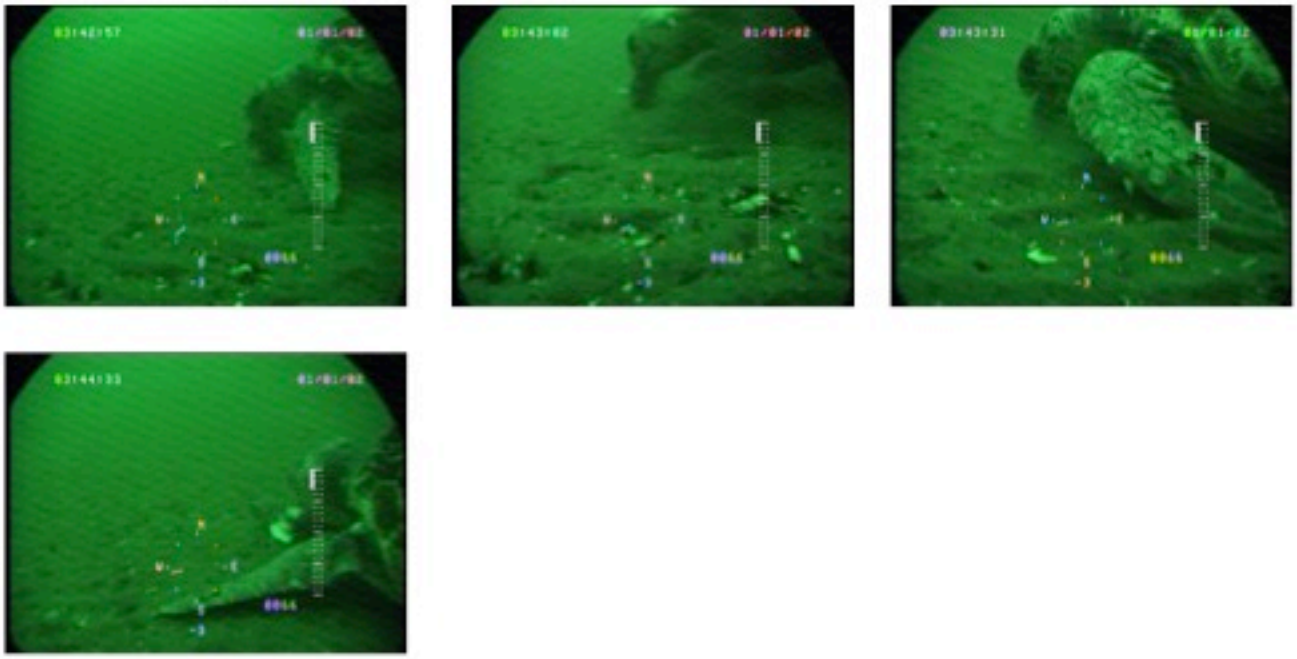


Figure 81. T3 Feeding on scallop # 4

Figure 82. T3 Feeding on scallop #5

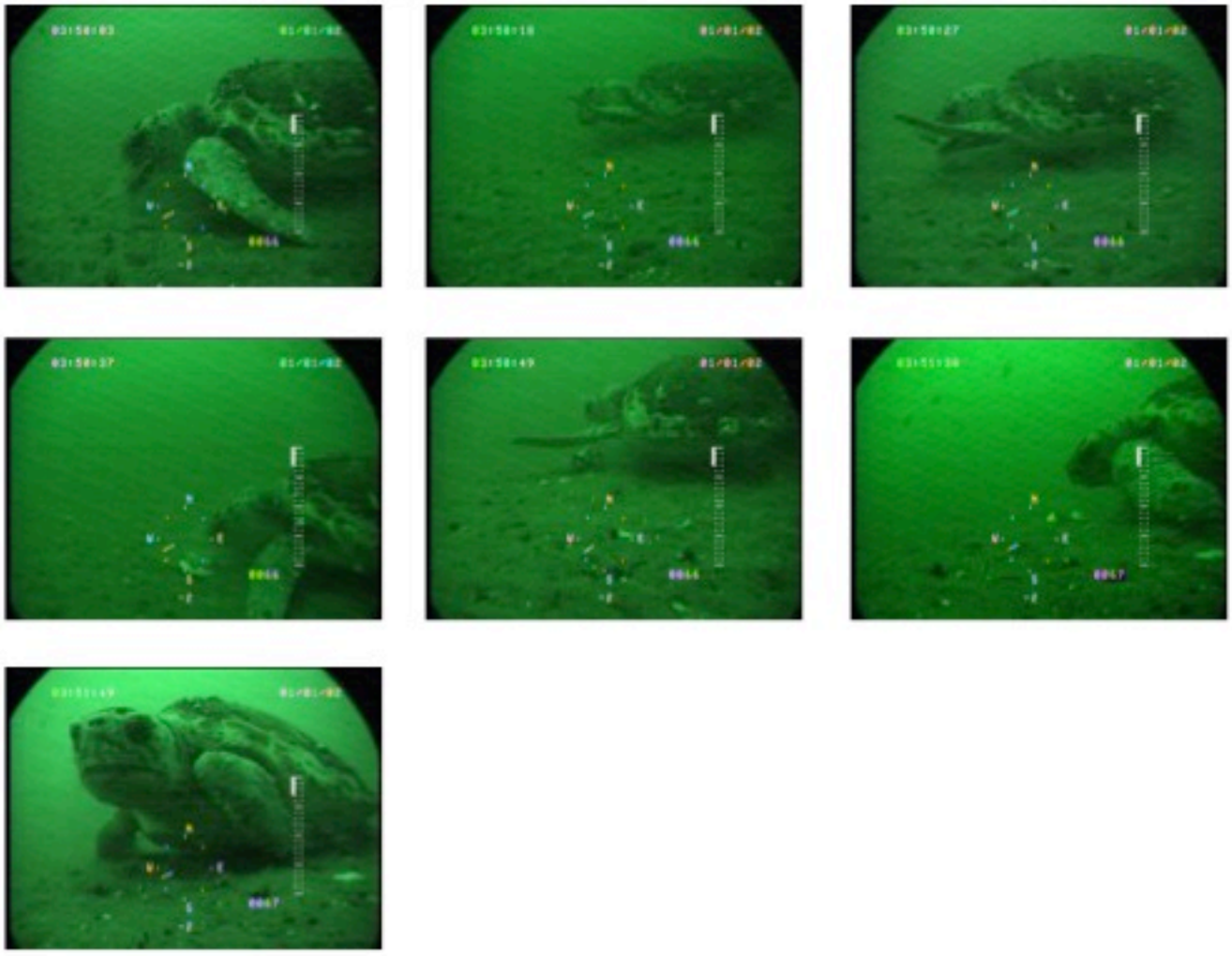


Figure 83. T3 Foraging on sea scallop #6

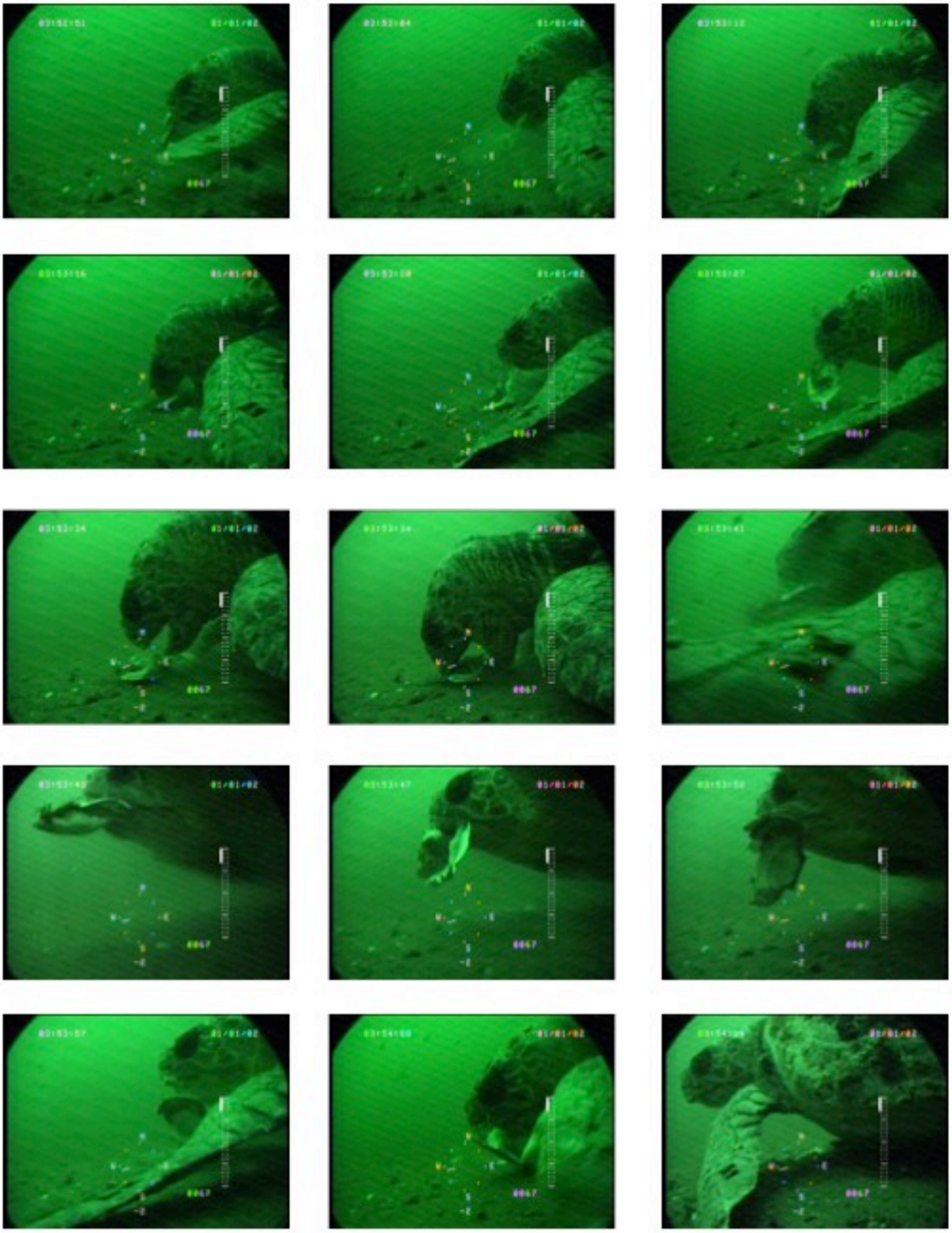


Figure 84. T3 Foraging on sea scallop #7

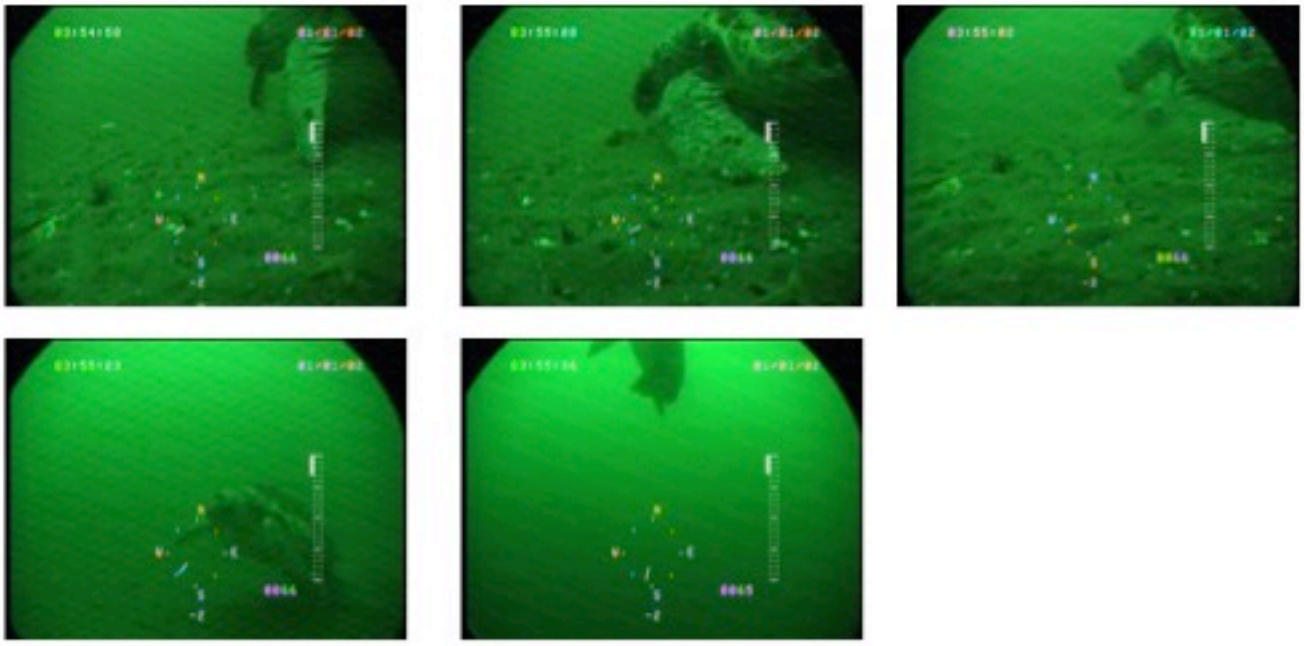


Figure 85. T3 Foraging on sea scallop #9 (taken during T3's third seafloor foraging dive)

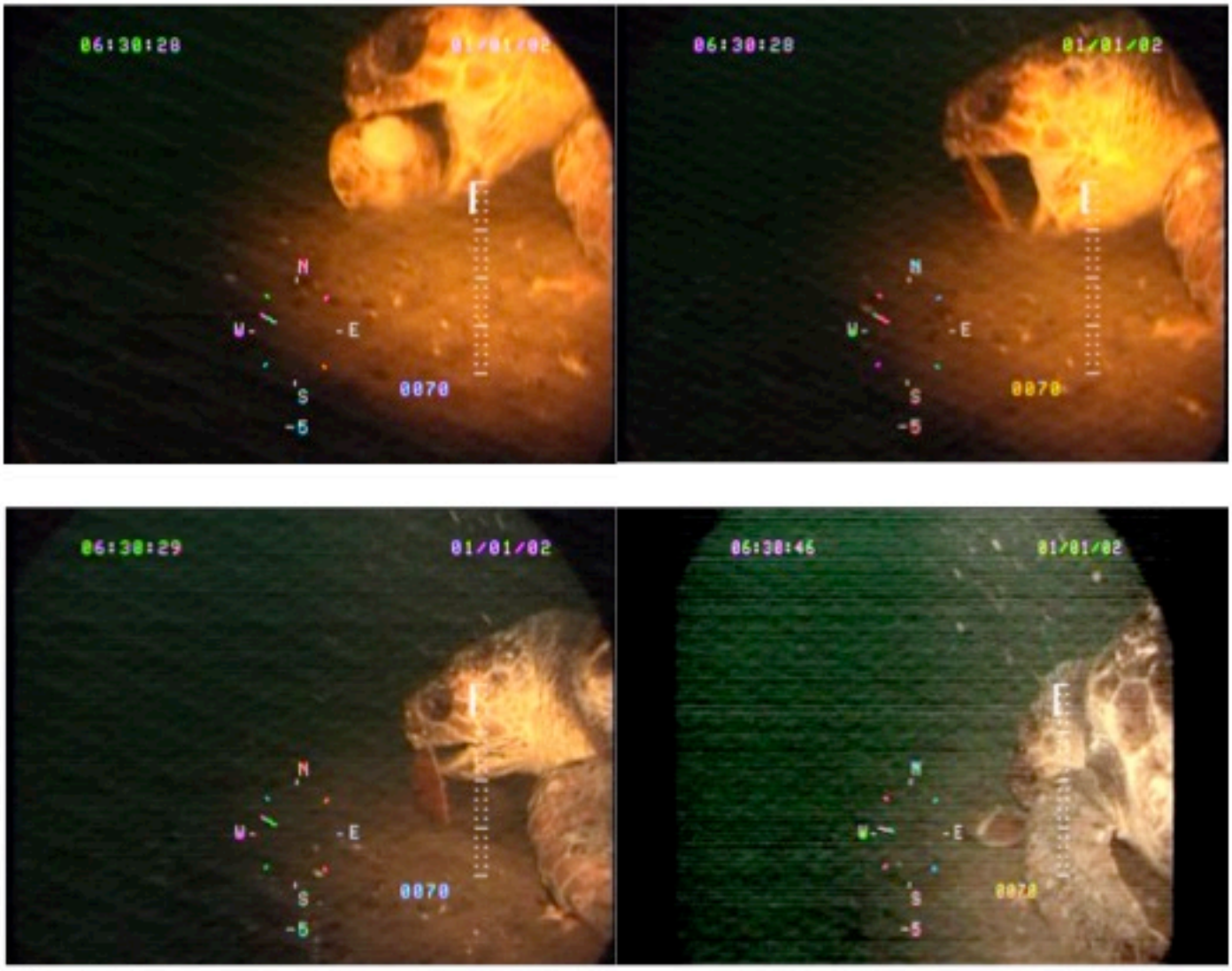


Figure 86. T3 Examples of unsymmetrical strokes

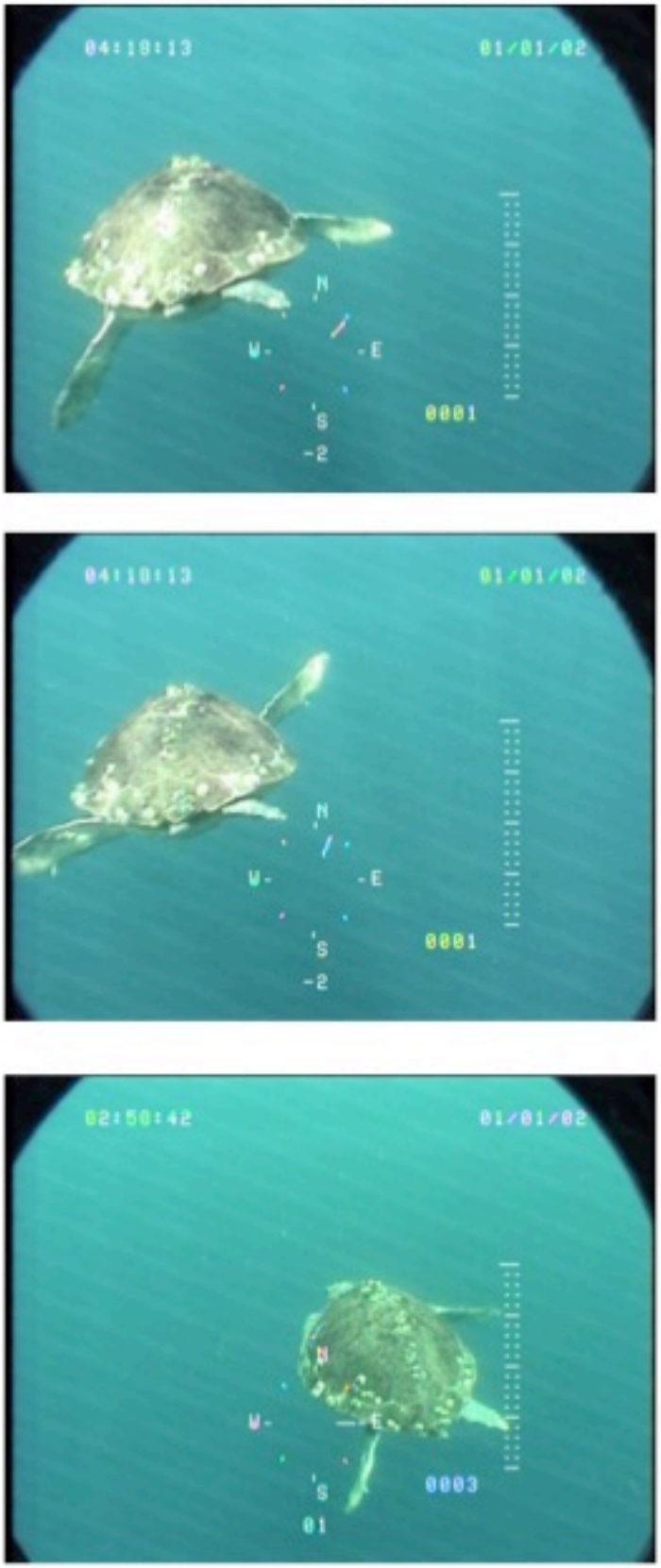


Figure 87. T3 Carapace Markings

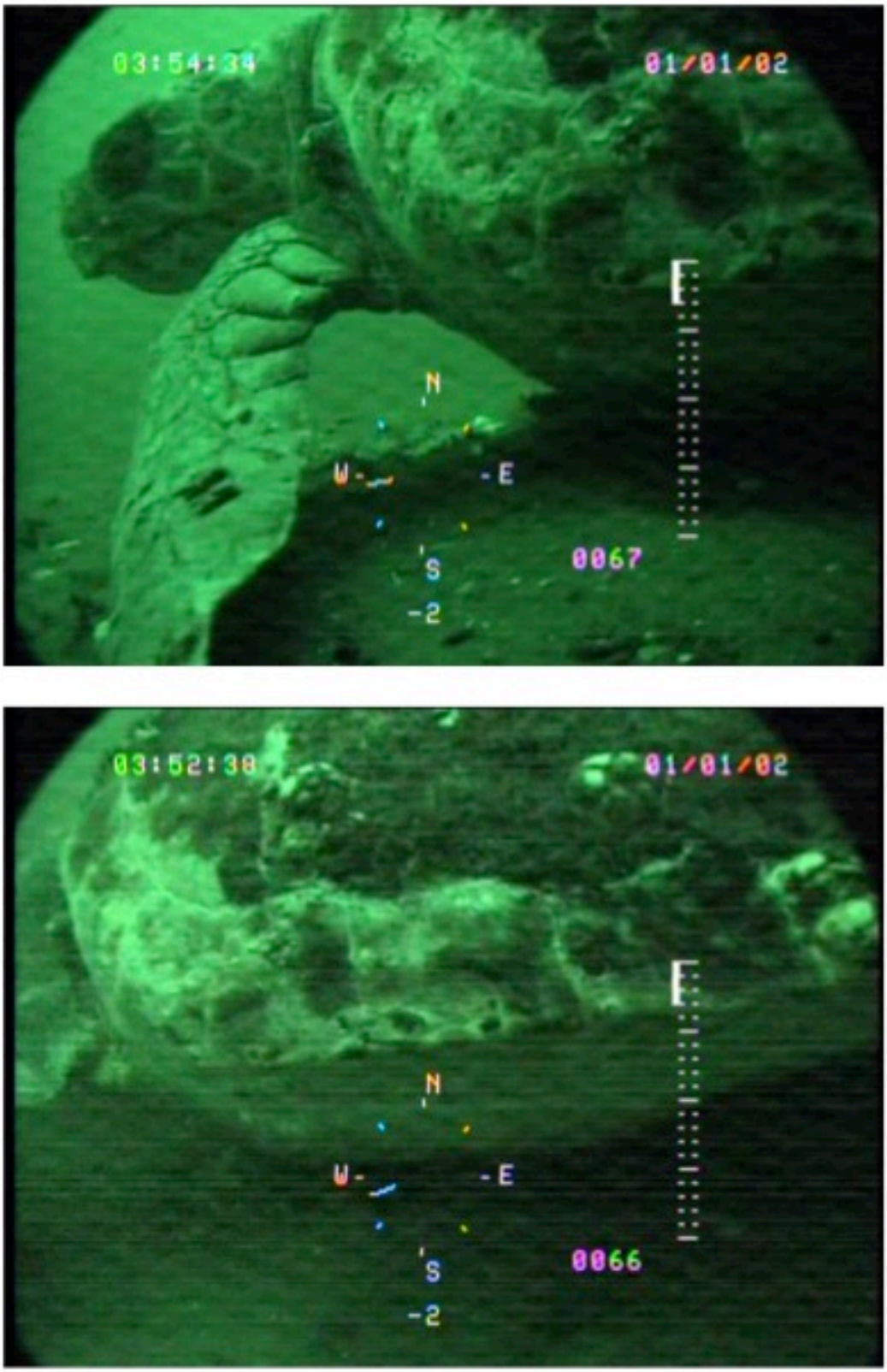


Figure 88. T3 Tail Length

Figure 89. T3 with sargassum

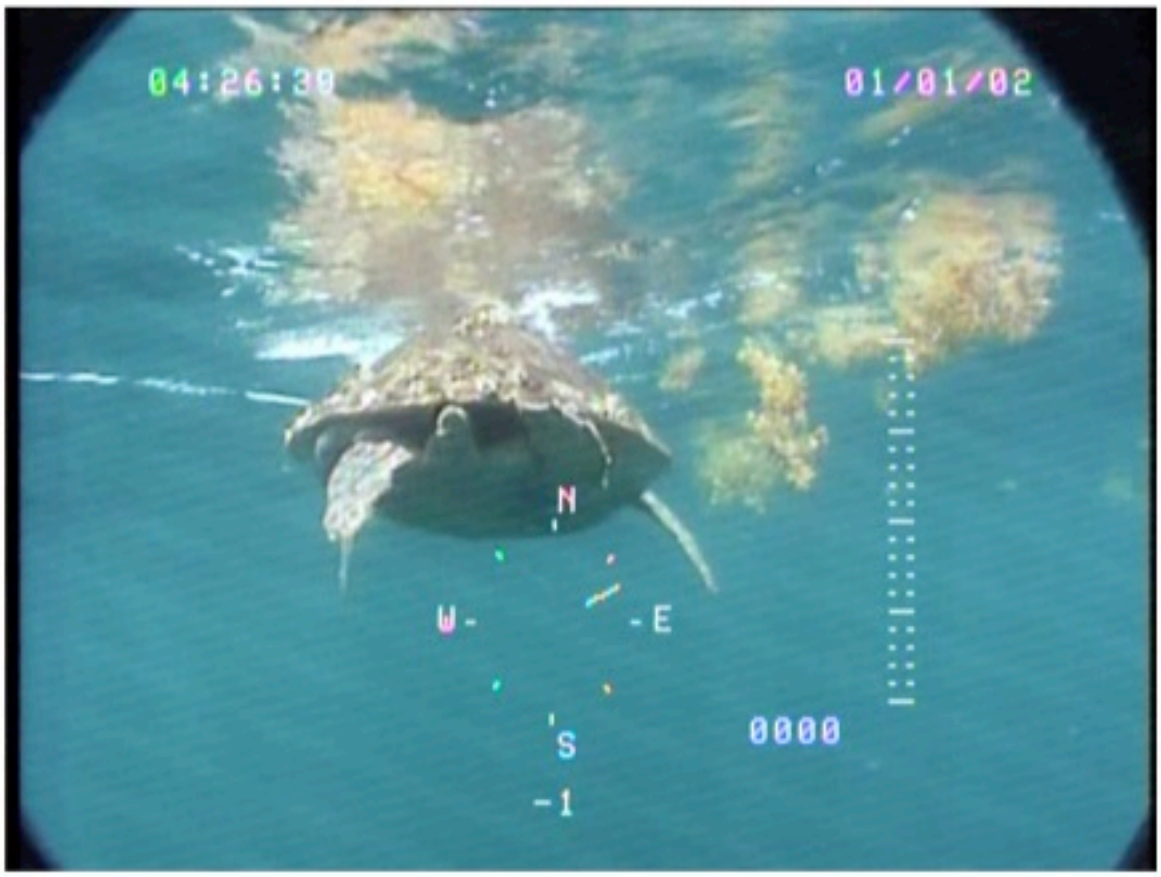


Figure 90. T3 Examples of flipper tucking behavior

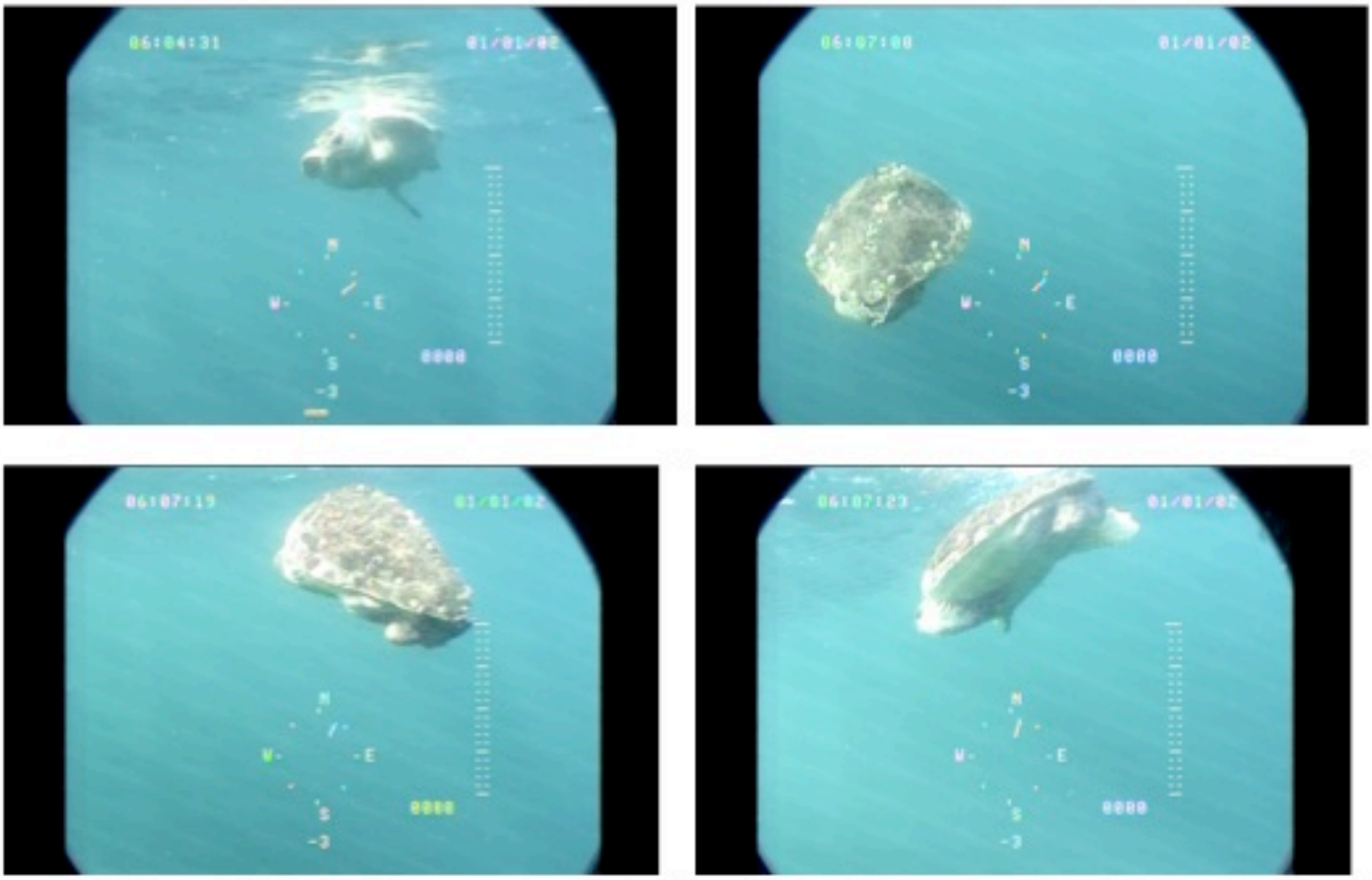


Figure 91. T3:T5 Social interaction

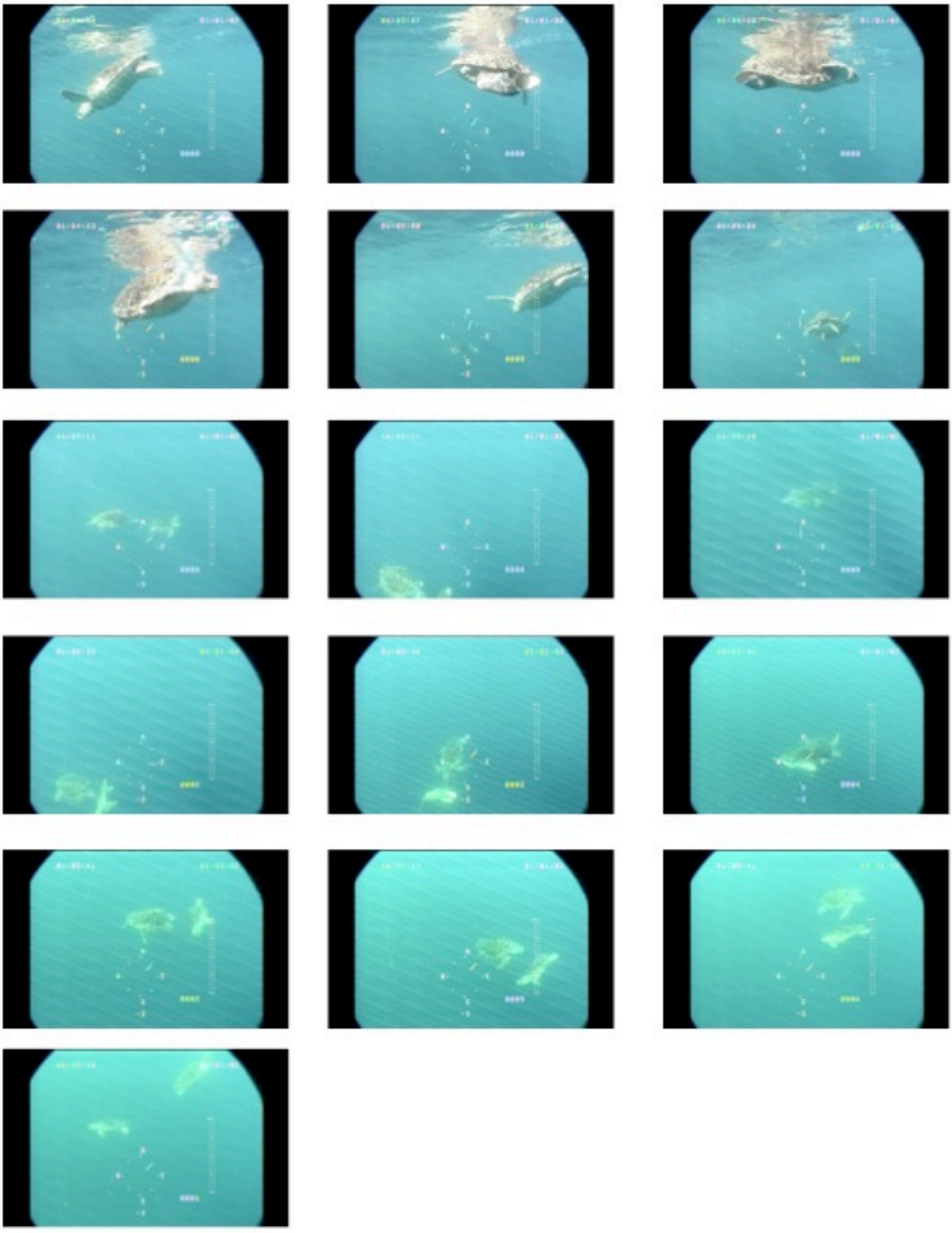


Figure 92. T3 Temperature at depth

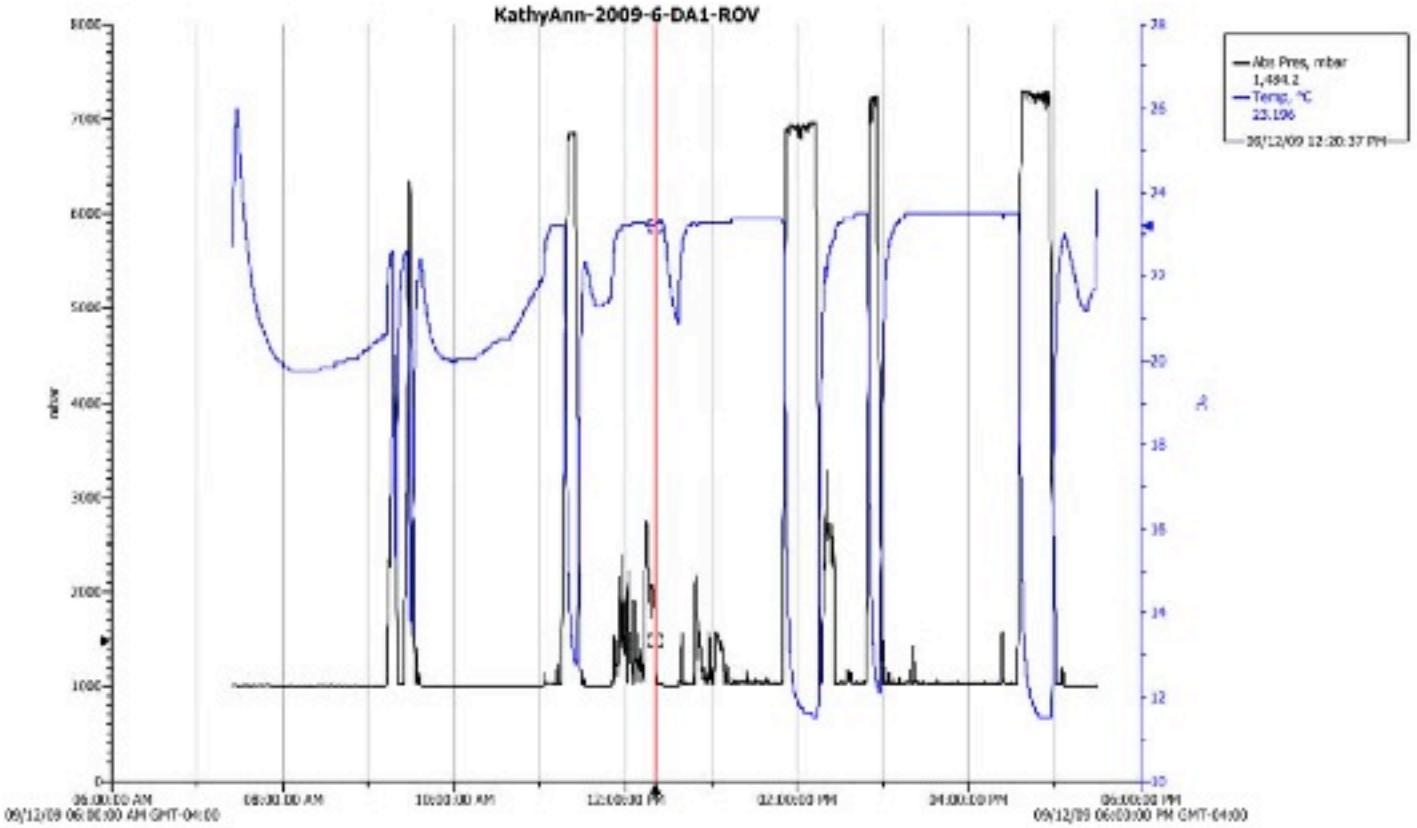


Figure 93. T32 – Adult Male

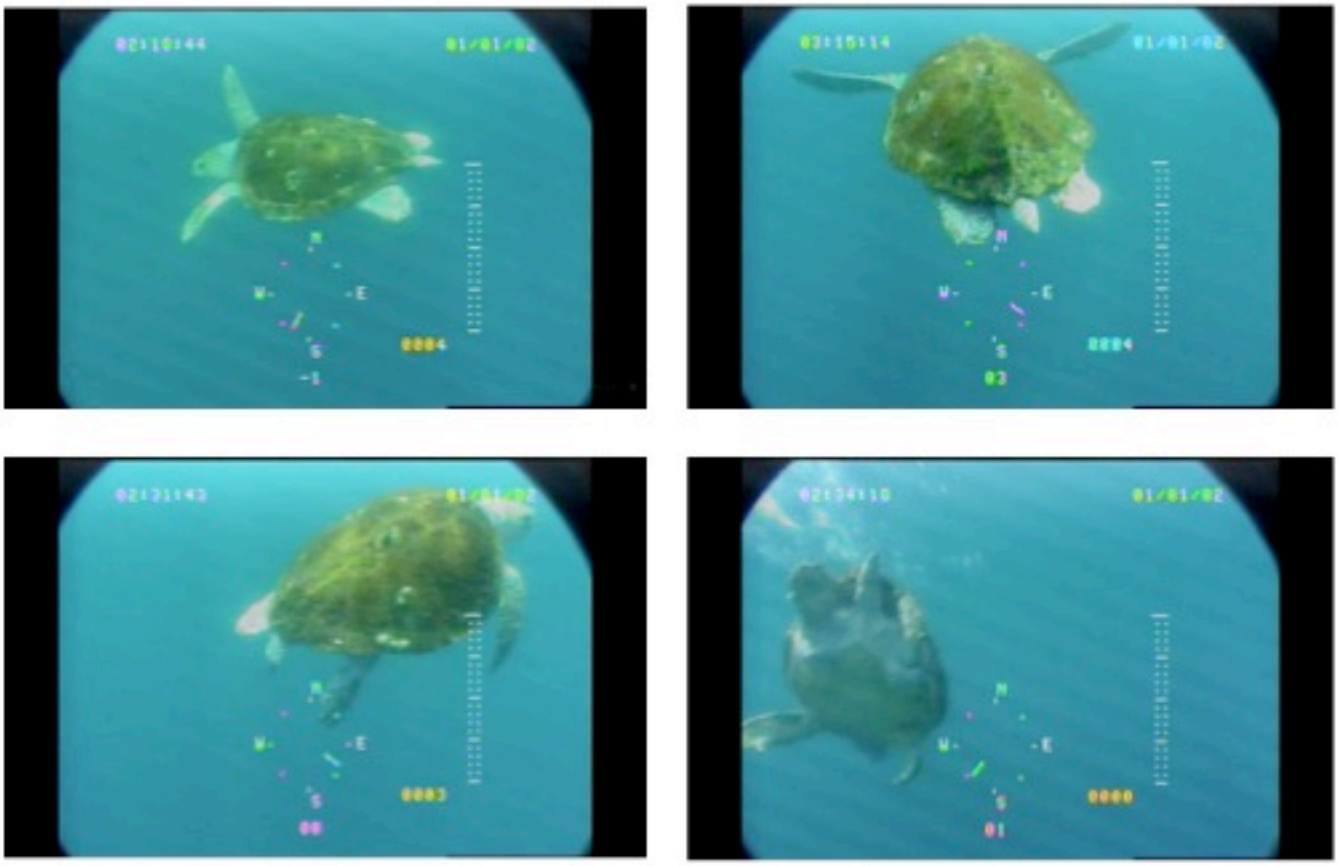


Figure 94. Photos from turtle tagging trip

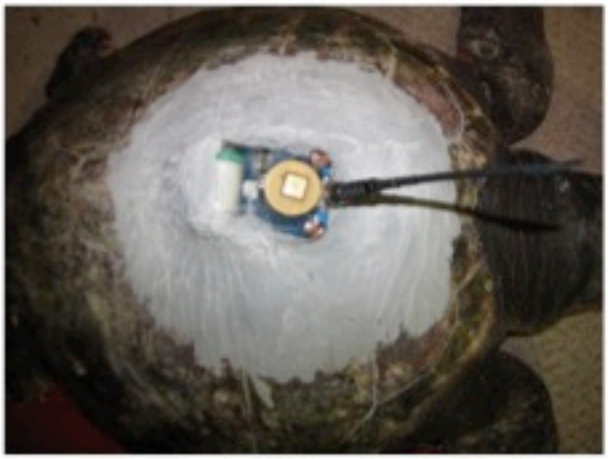


Figure 95. Plot of tagged turtle tracks from 8-25-09 thru 9-4-09

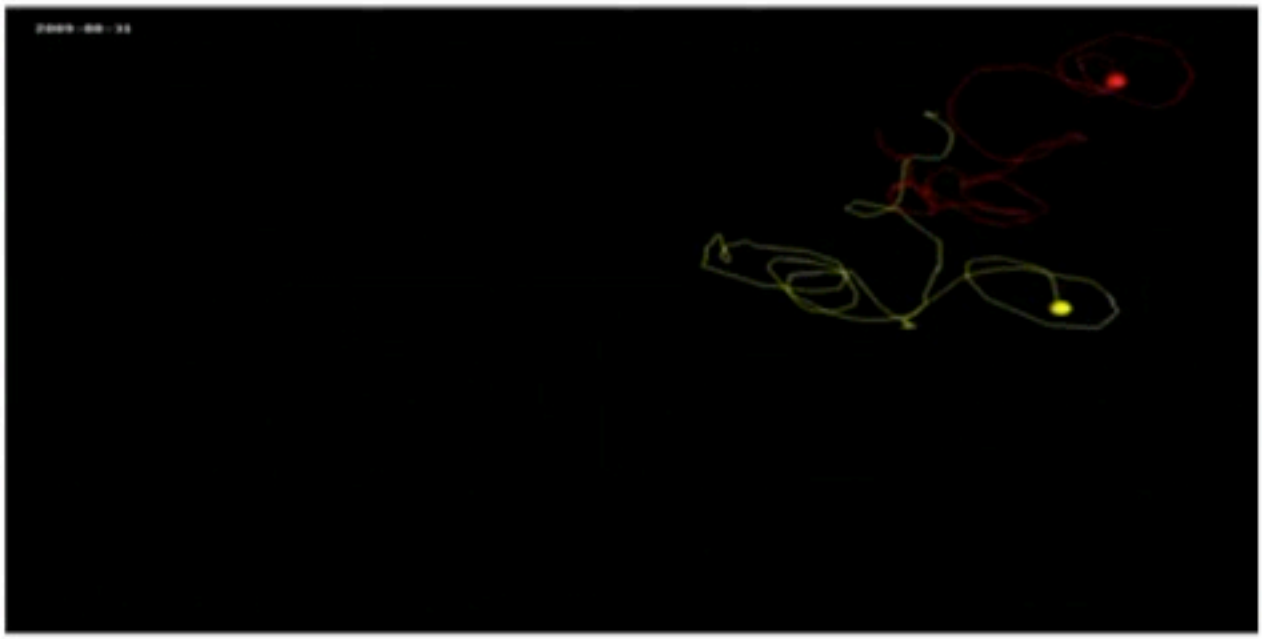


Figure 96. Plot of tagged turtle tracks from 8-25-09 thru 9-6-09

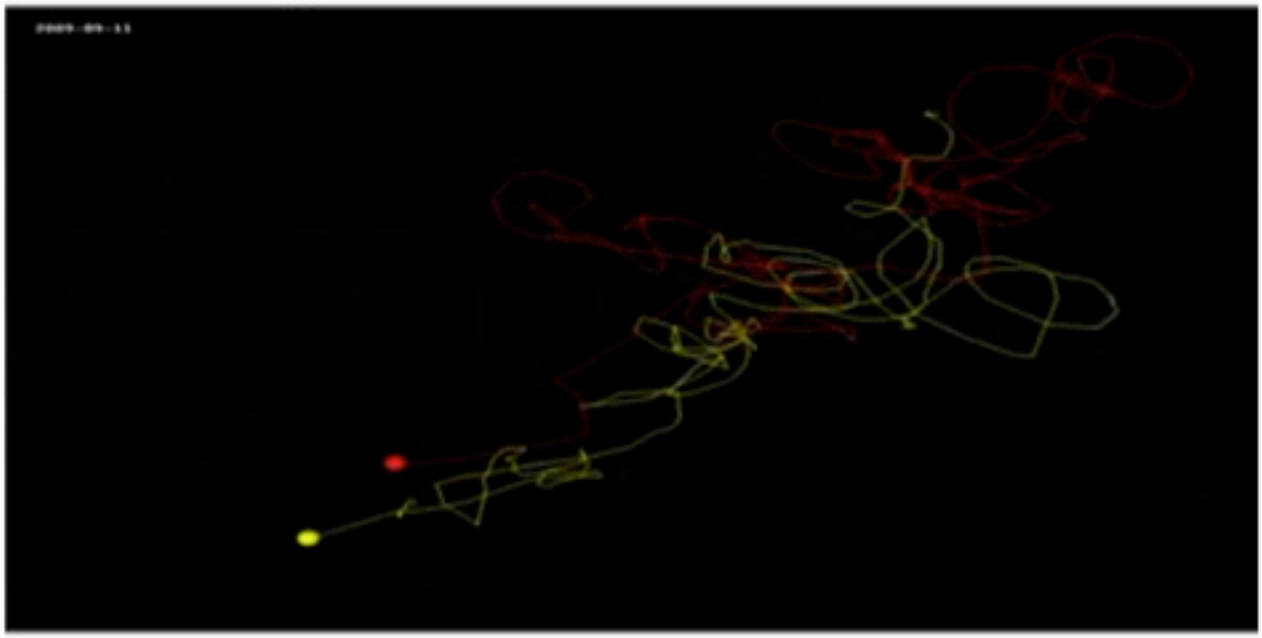


Figure 97. 3D plot of turtle 2's dive profiles and track line. Looking down at an angle

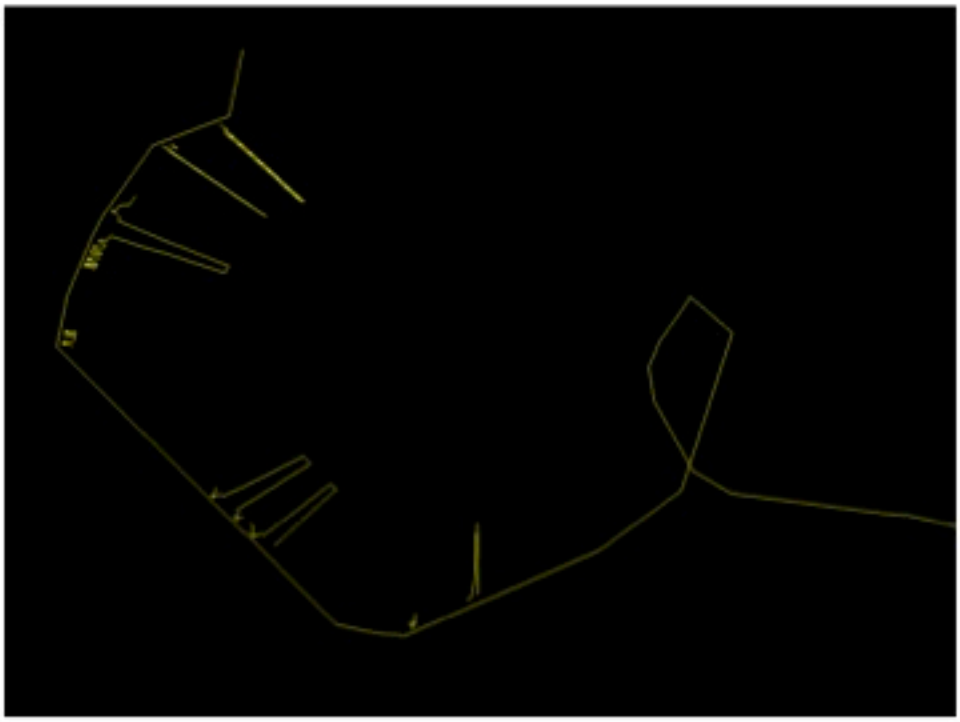


Figure 98. 3D plot of turtle 1's track line, temperature profile, and dive profiles.

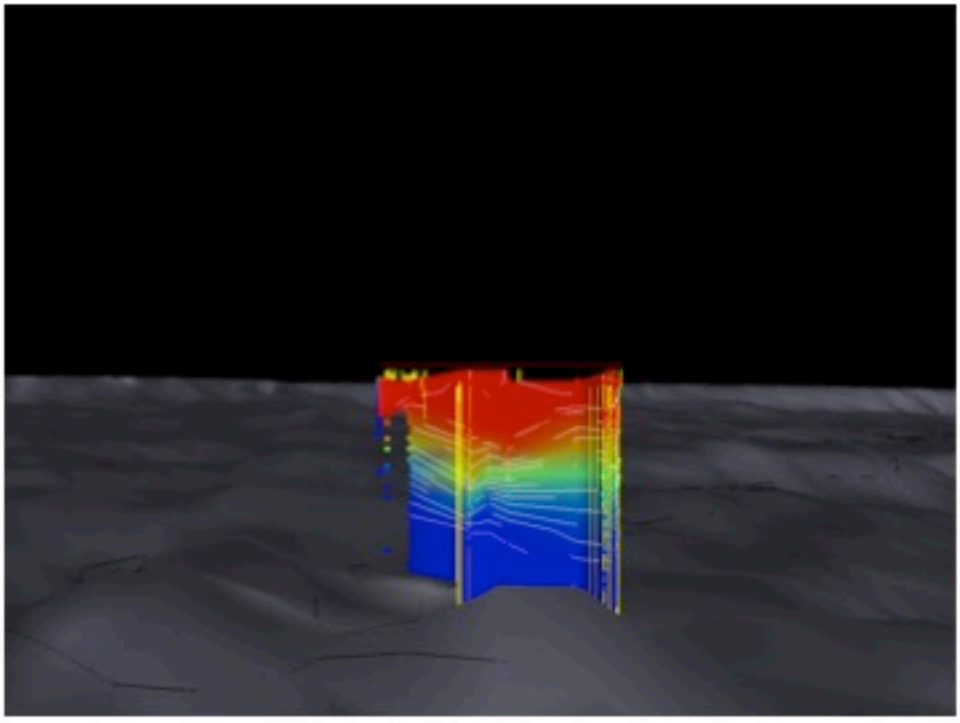
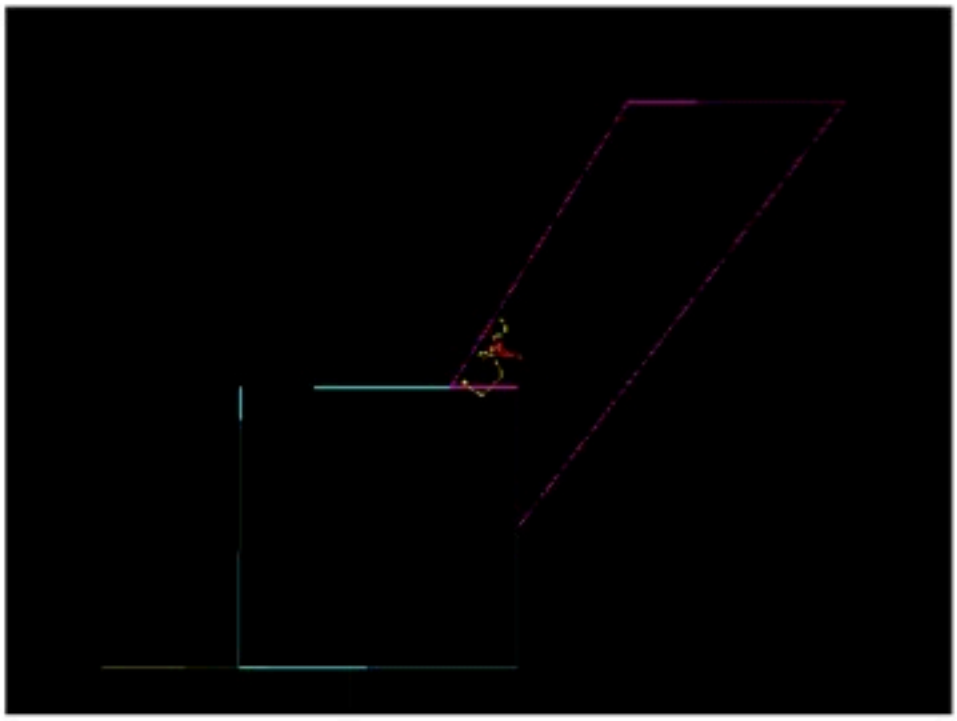


Figure 99. Tracks of tagged turtles during first week with Scallop Access Area boundaries



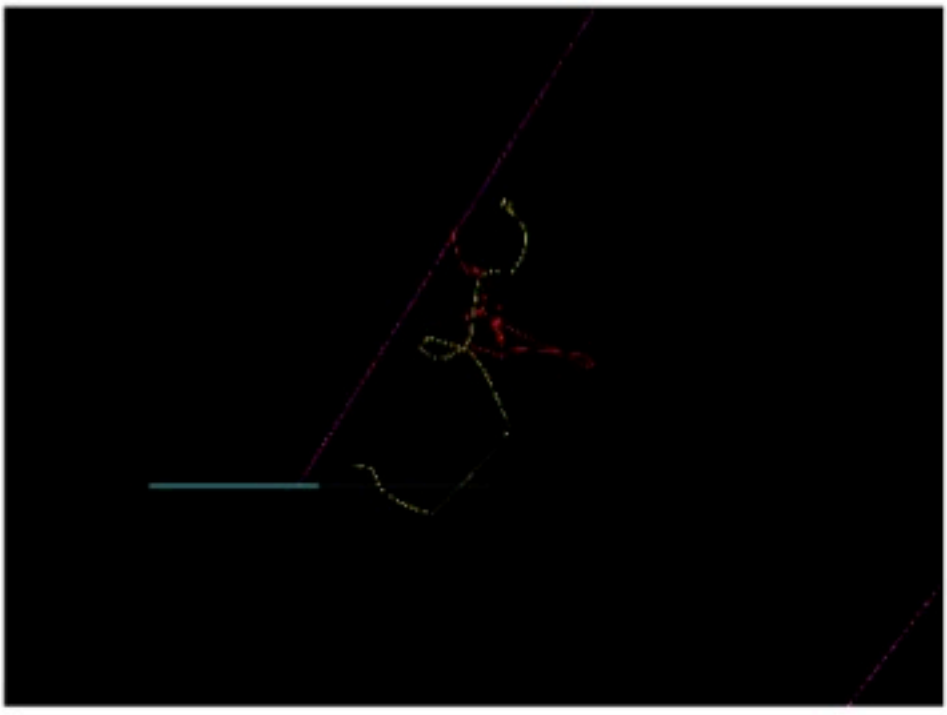


Figure 100. 3D pot of tagged turtle 2's temperature and dive profiles. Looking down at an angle.

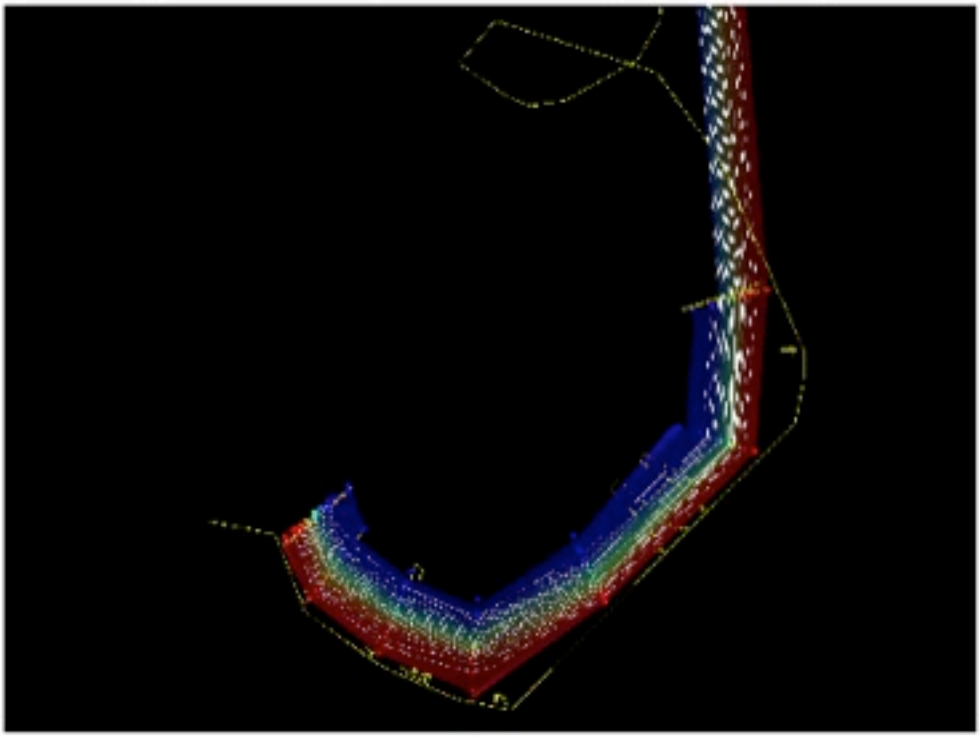


Figure 101. 3D plot of tagged turtle 2's dive profiles. Looking southwest with scallop access area boundaries

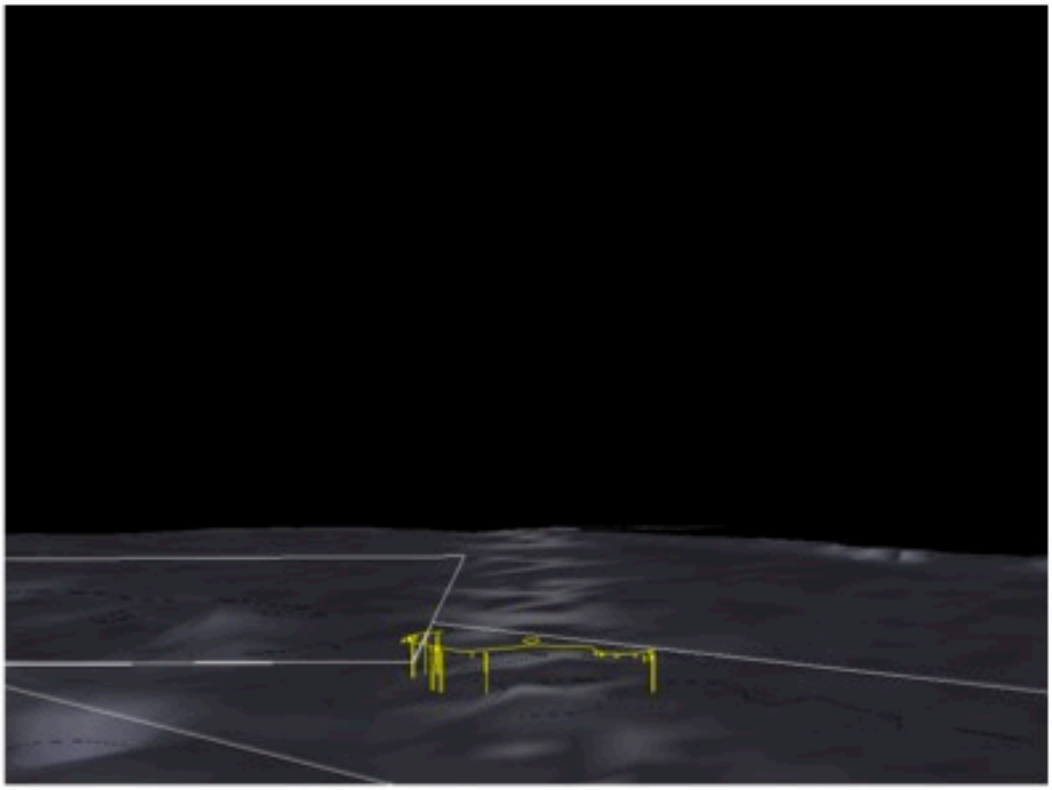
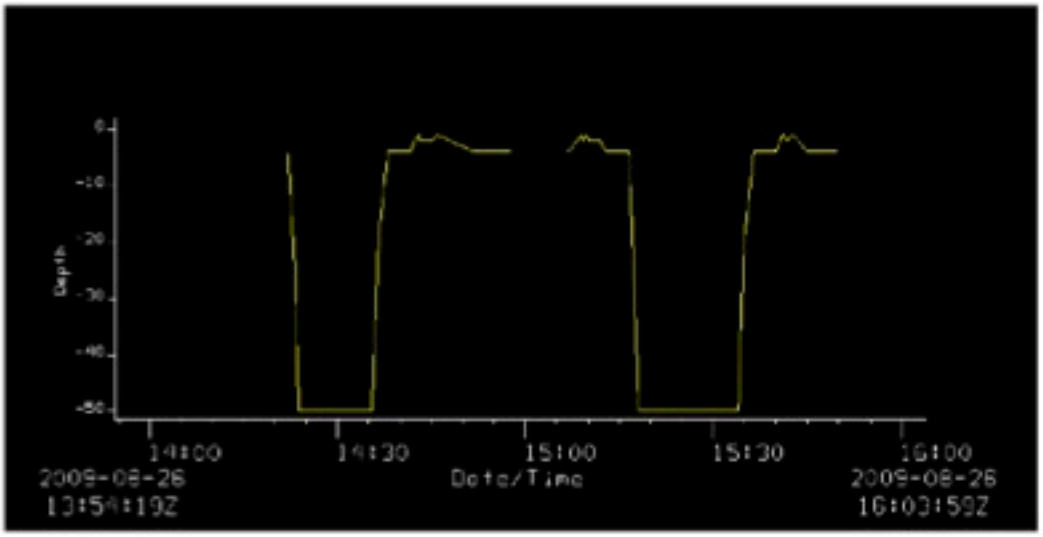
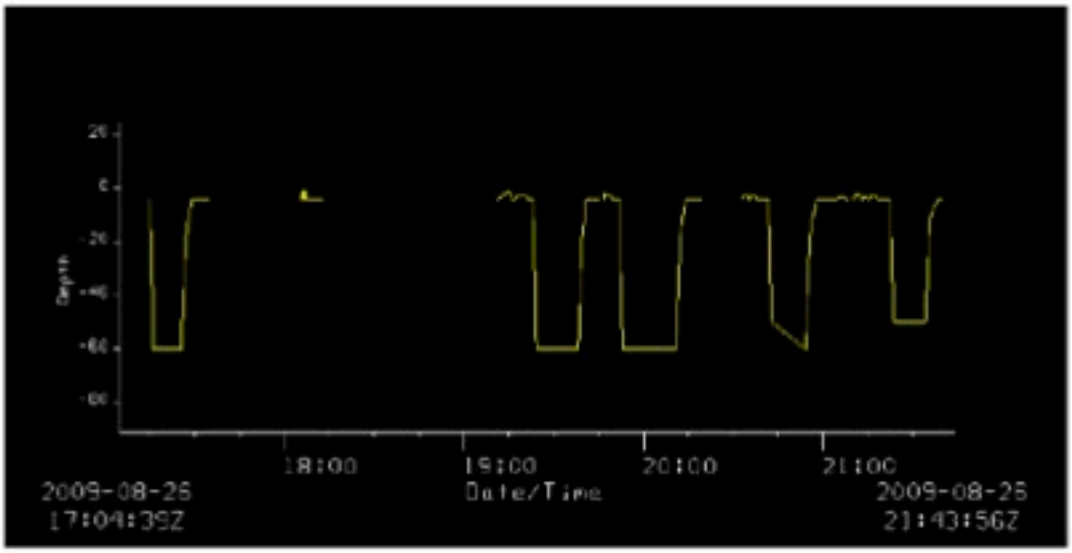
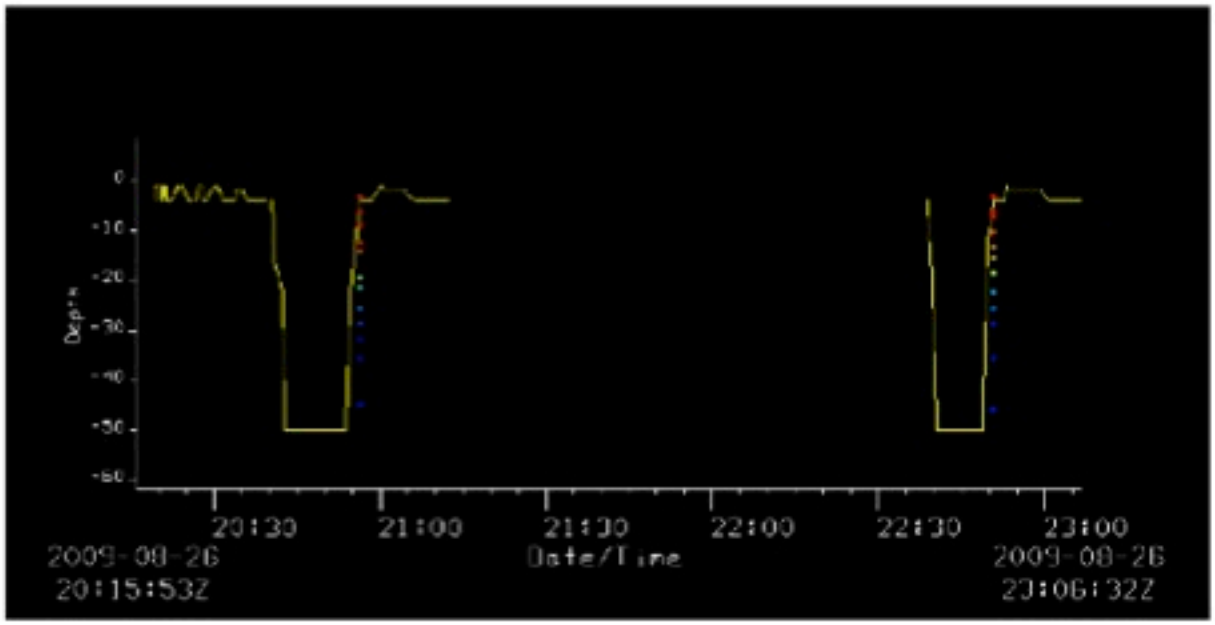


Figure 102. Examples of dive profiles generated from tag data (day/night dive patterns)



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-30
-40
-50
-60
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21:00
21:30
22:00
22:30
23:00
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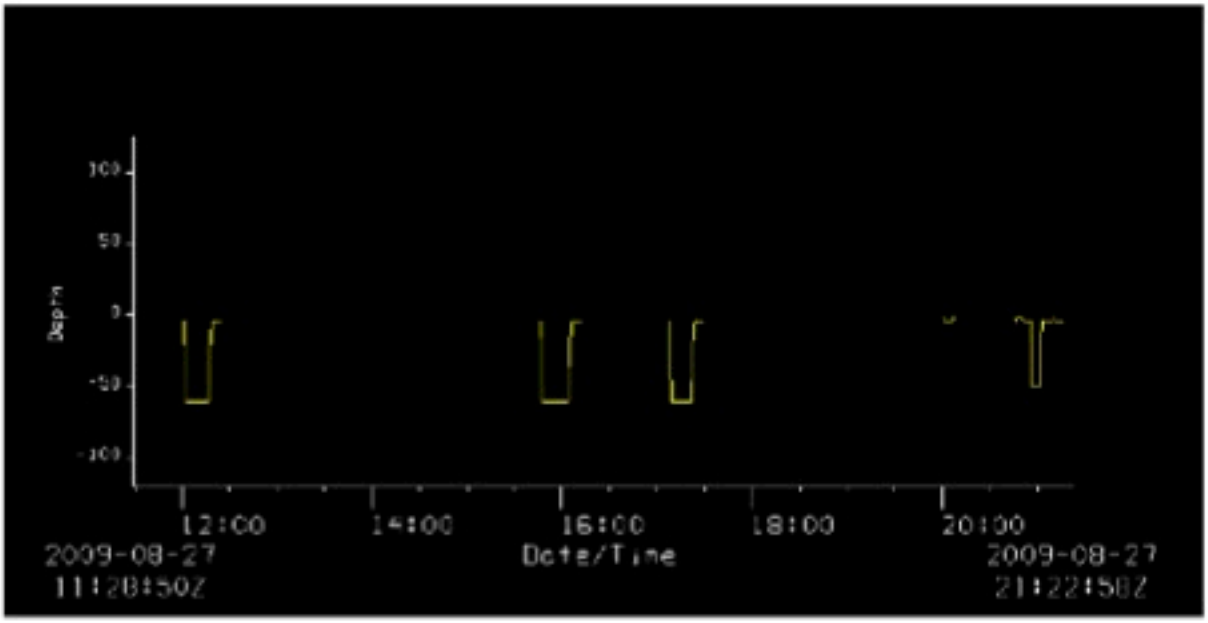
20:15:53Z
Date/Time
2009-08-26
23:06:32Z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-100
Depth
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18:00
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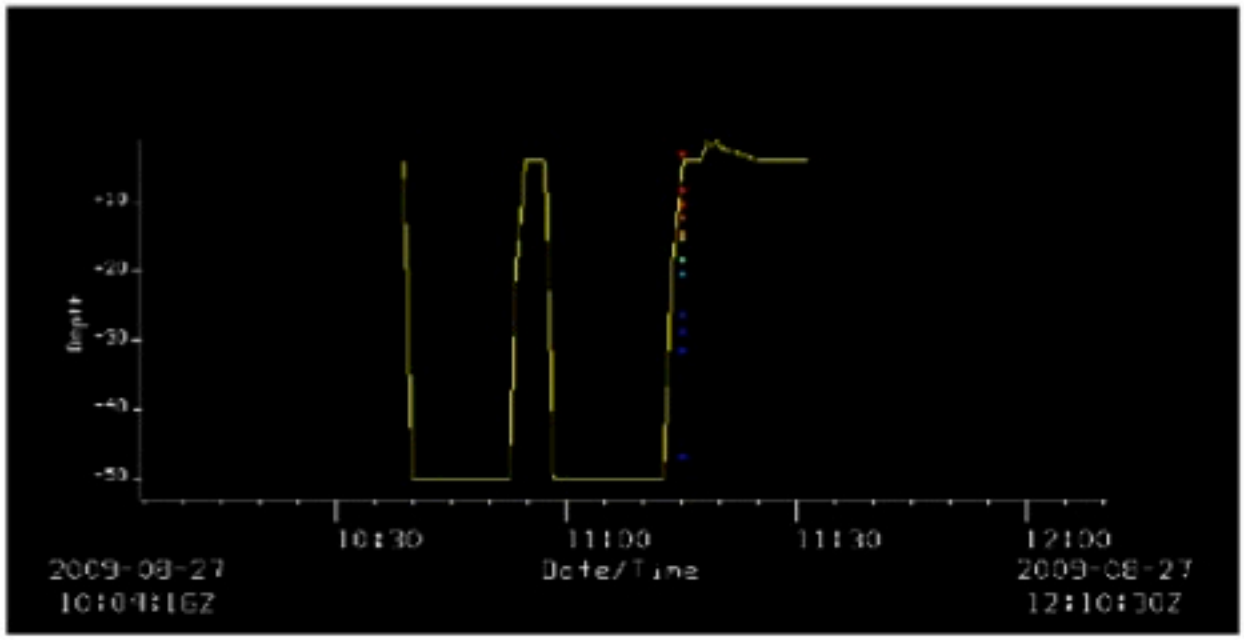
21:22:50Z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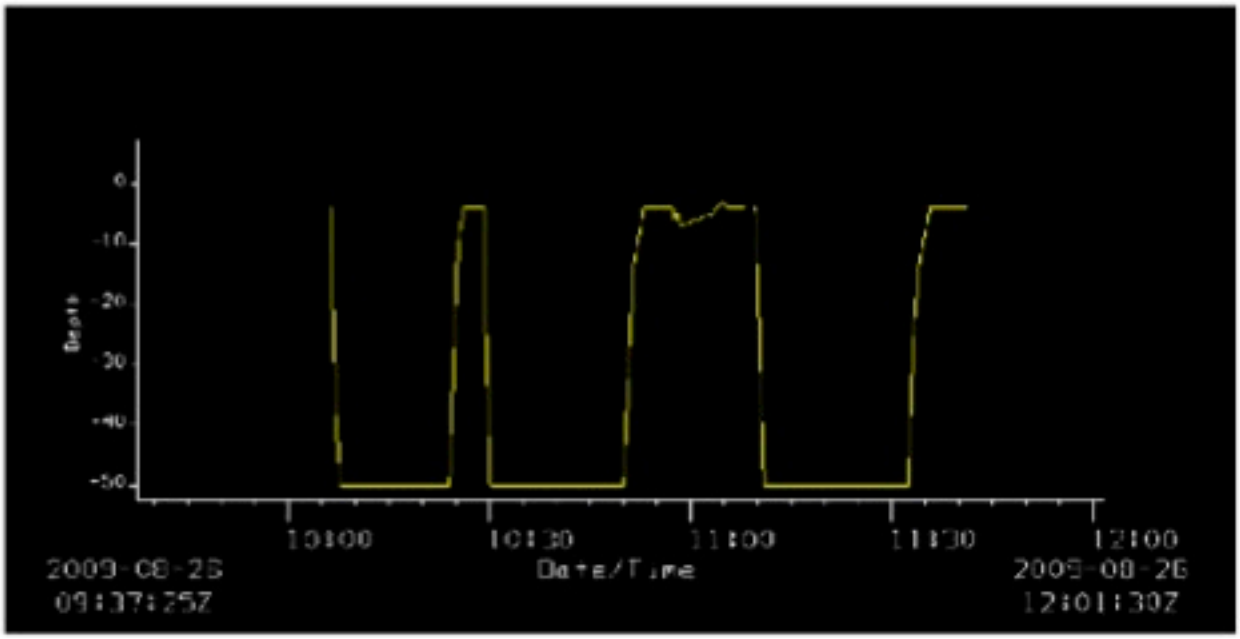
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2009-08-26
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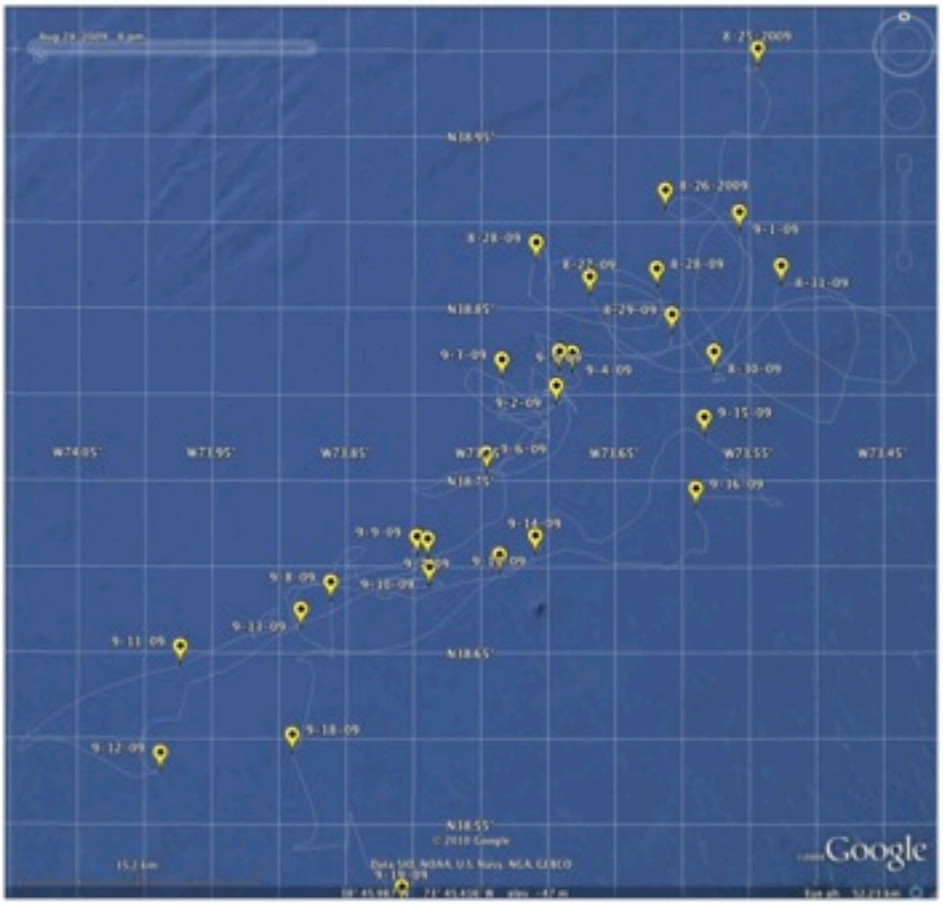
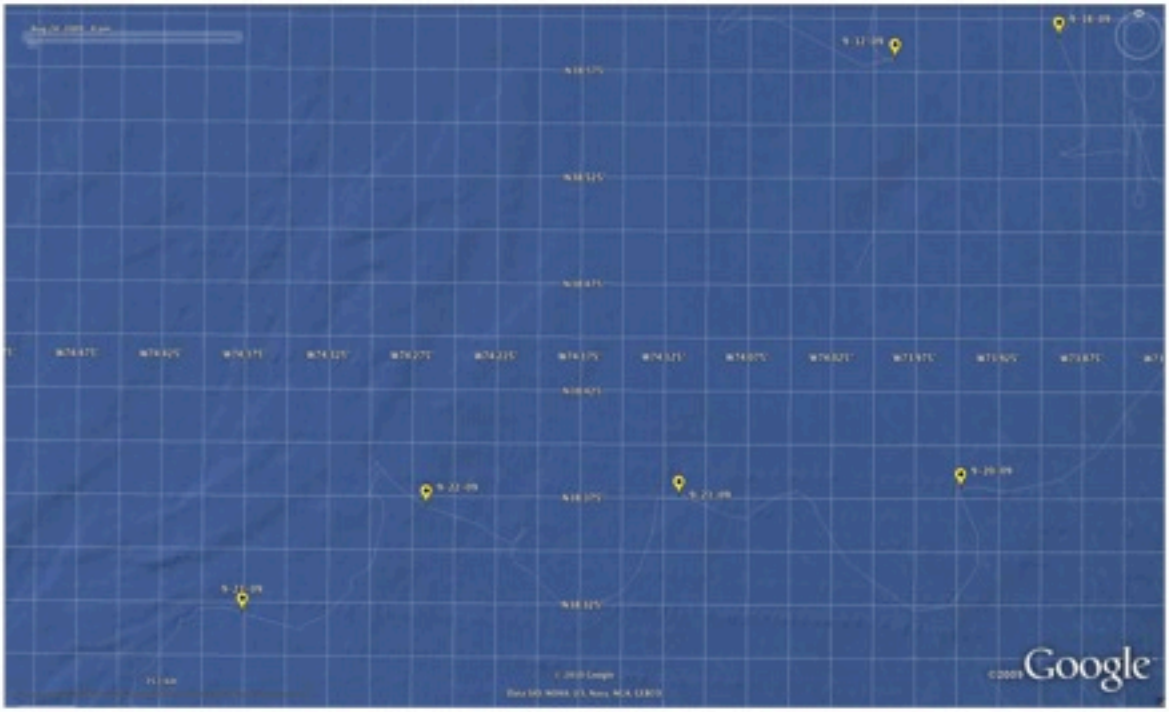
Figure 103. Plots of tagged turtle #2 daily positions



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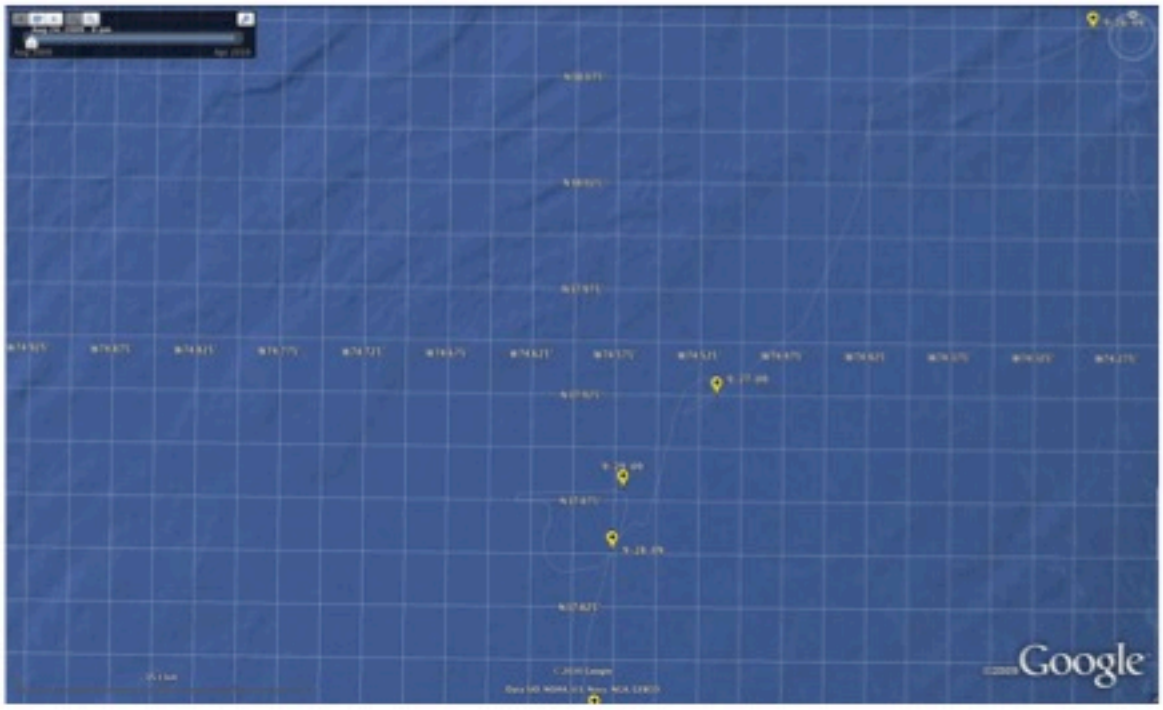
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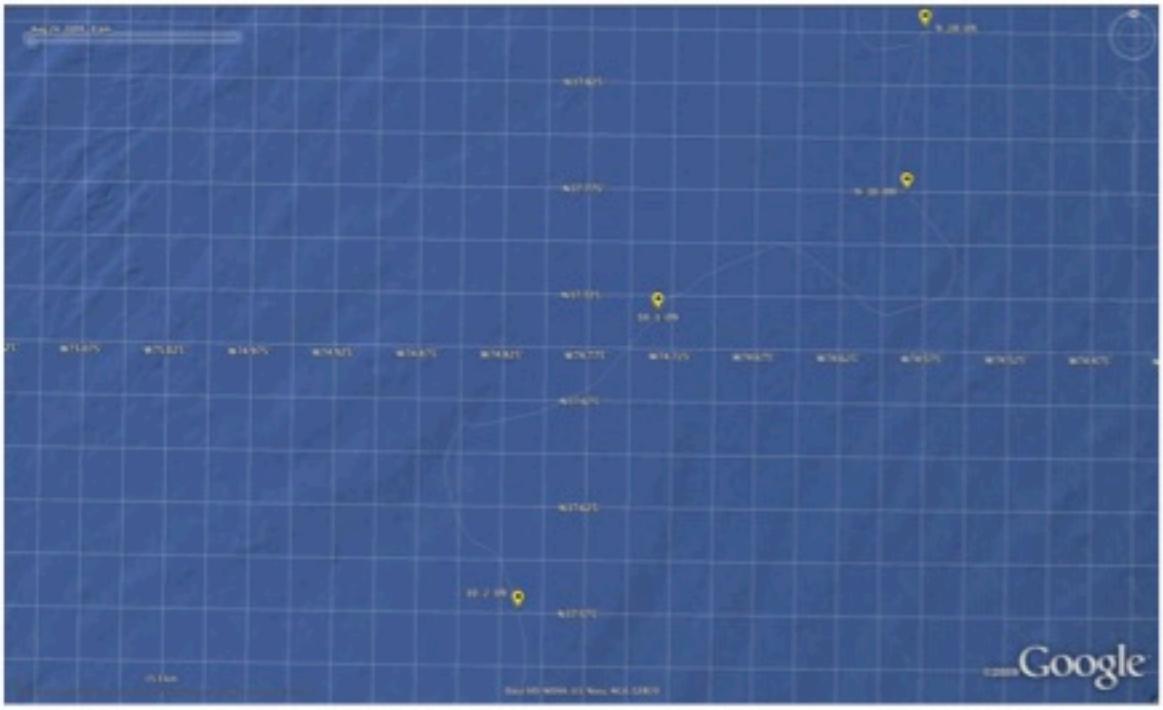
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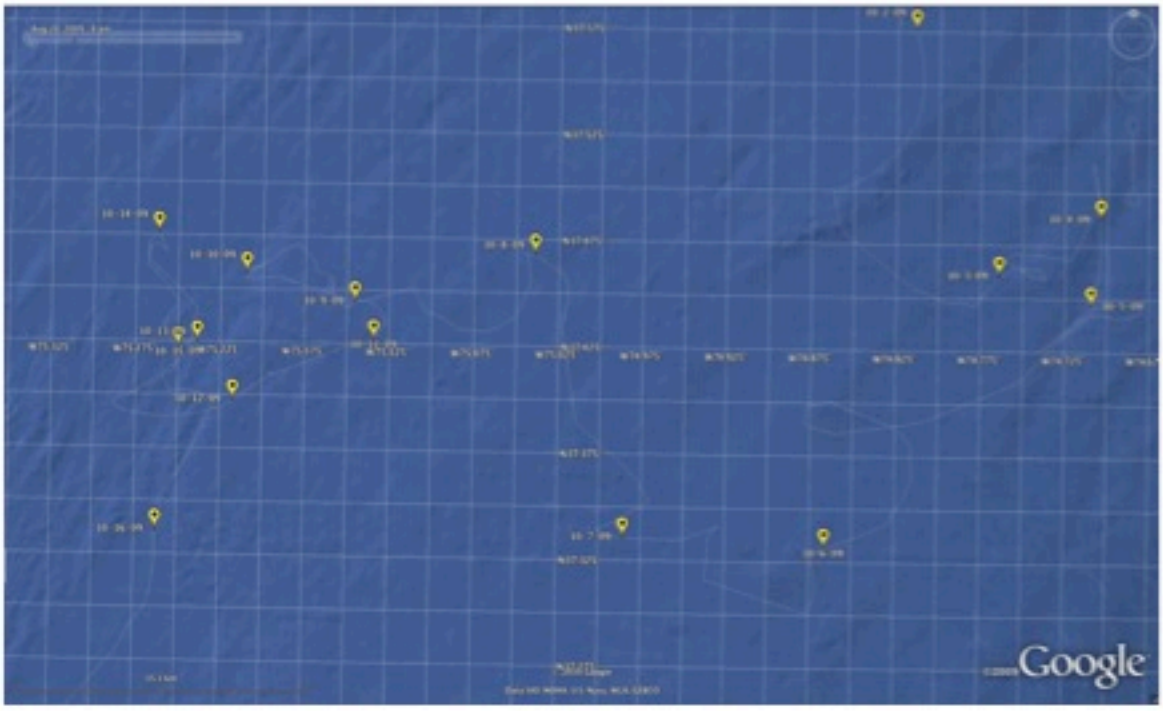
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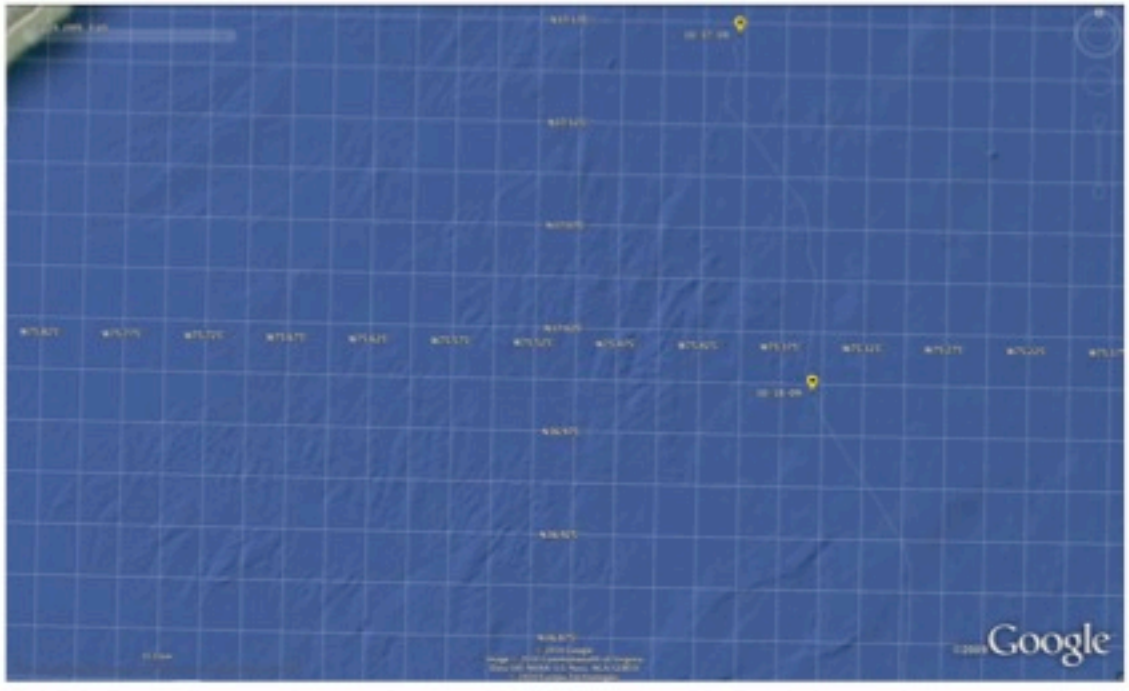
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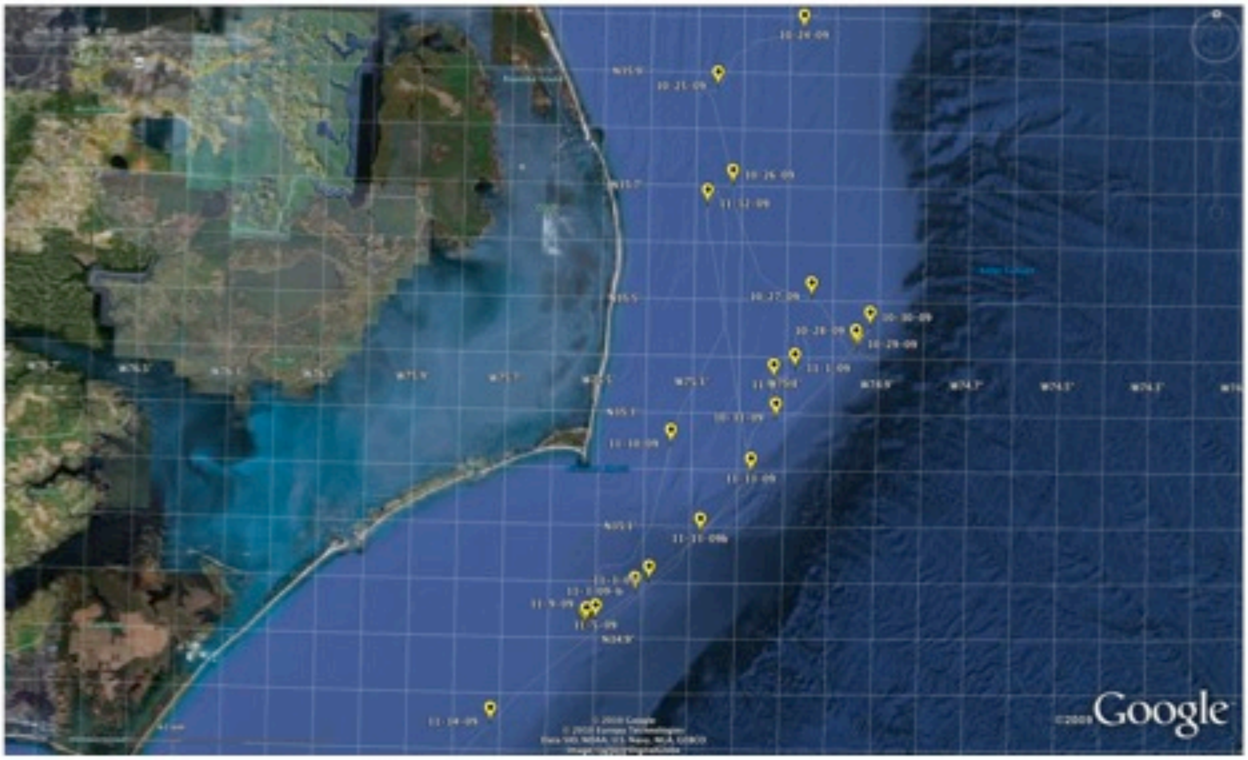
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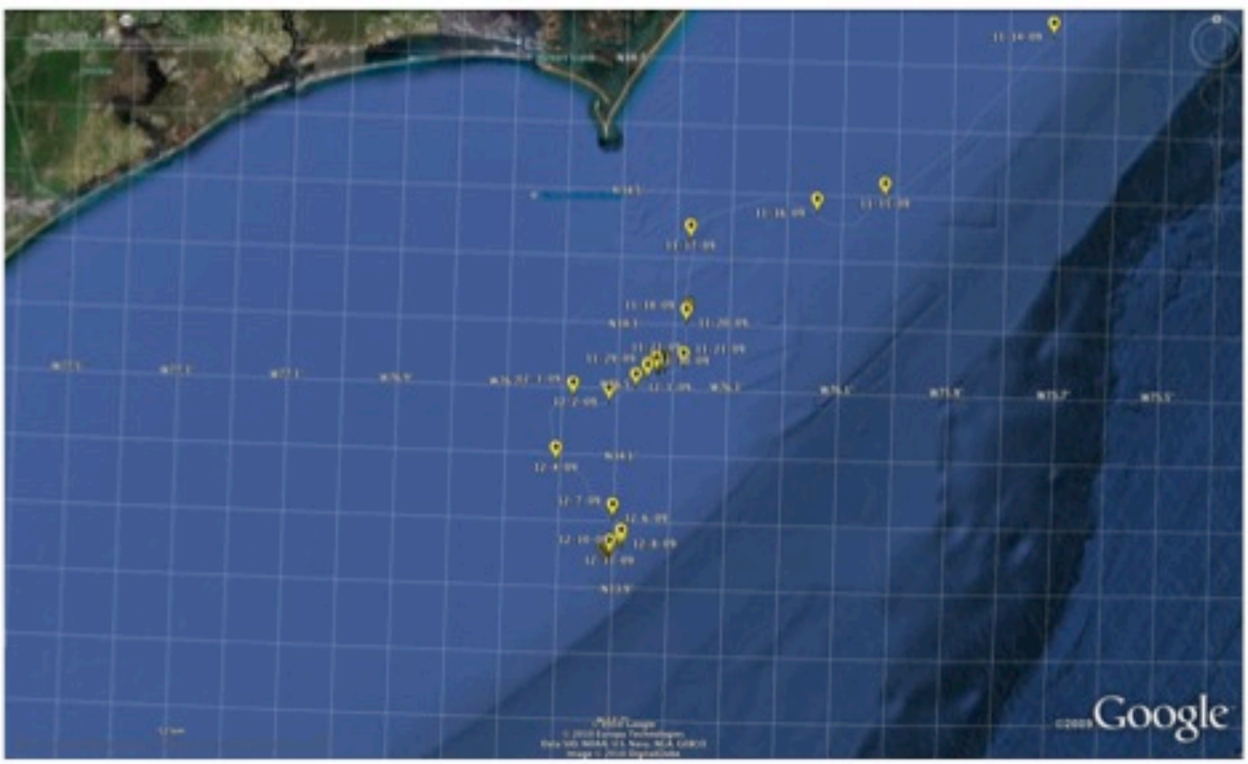
Google


N38.5°
N37.5°
N36.5°
N35.5°
N34.5°
N33.5°
W73°
W72°
W69°
W68°
W67°
5/1/10
4/1/10
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Appendix A: Narrative: F/V Kathy Ann 2009-3

The F/V Kathy Ann departed Barnegat Light, New Jersey at 2200 on Wednesday, July 8, 2009 and proceeded to the northern boundary of the ETAA.

Thursday, July 9, 2009

0800: Laying too (38-47.4, 73-57.7, 46.3 m) Wind NE 10-15 knots, seas 1.0 m, SST 21.4° C, partly cloudy. 0805: Launched **ROV Dive 1**, bottom search. 0844: ROV on deck. 0845: Start Transect 1 (38-47.2, 73-58.9) Heading 180°, speed 4.4 kn, sea choppy. 0955: Sighted **Turtle 1** from masthead on surface 1000 m ahead (38-42.3. 74-00.8, 51 m, SST 22.1° C) lost contact. 1006: Sighted **Turtle 2** from masthead on surface 1000 m off starboard bow (38-41.9, 74-01.4, 55.6 m, 22.2° C) lost contact. Skies totally overcast, wind NE 15-20, seas 1.3 m.

1115: Launched **ROV Dive 2** on thin patch of Sargassum weed (38-37.4, 74-03.3, 53.0 m, 22.2° C). 1135: Masthead sights **Turtle 3** 200 m off starboard side on surface. The ROV is being maneuvered alongside the vessel so vessel can turn (38-37.0, 74-02.6, 53.6 m, 22.4° C). We lost sight of the turtle. 1143: ROV on deck; resumed transect. 1151: Sighted **Turtle 4** 80 m off starboard bow (38-36.6, 74-02.7, 53.6 m, 22.4° C); **Turtle 4** dives and is sighted submerged 2 m down and 20 m out from starboard side. He ROV malfunctions; vessel drifting while the ROV is being repaired. ROV connector was bad. 1215: Resumed transect. 1234: Sighted **Turtle 5**, a large loggerhead, from the pilot house floating on surface 50 m off starboard bow (38-34.7, 74-03.4, 55.4 m, 22.7° C) 1238: **ROV Dive 3** launched.1240: **Turtle 5** acquired (**Take 1**). Surge making it difficult to track; ROV frequently losing contact but turtle visible from vessel. 1300: ROV on deck; resumed track.

1314: **Turtle 6** sighted from pilot house on surface 30 m off port bow (38-34.3, 74-03.7, 57 m, 22.7° C) turtle dives immediately. 1335: **Turtle 7** sighted from pilot house off starboard bow (38-33.1, 74-03.9, 59 m, 22.7° C) Many dolphins around vessel. 1338: **ROV Dive 4** in water but lost visual on turtle; dolphins all over. 1346: ROV on deck; resumed transect. 1357: **Turtle 8** sighted from pilot house 30 m ahead then dove (38-32.4, 74-04.6, 58 m, 22.7° C). 1402: Did not re-sight; resumed track.

1405: **Turtle 9** spotted from pilothouse 50 m off starboard bow on surface then dove (38-32.1, 74-04.7, 60 m, 22.8° C). 1408: Did not re-sight; resumed transect. 1420: **Turtle 10** spotted from pilot house on surface (38-31.3, 74-05.3, 57 m, 22.6° C). 1421: **ROV Dive 5** launched; **Turtle 10** acquired (**Take 2**). 1440: Lost contact at 11 m depth. 1452: ROV on deck (38-31.1, 74-05.6); lying too. 1515: Resumed transect 1820: End transect (38-18.9, 74-14.2, 53.5 m, 22.0 C); Lying too.

Friday, July 10, 2009

0740: Begin Transect 2 (38-06.0, 74-30.6, 44 m, 21.3 C) Wind NE 15-20 knots, seas 1.5 m, partly cloudy, white caps. Heading 230°, speed 5.0 kn. 0742: **Turtle 11** sighted from pilot house on the surface at start of transect, a large loggerhead, took breaths and dove. 0746: Resumed transect. 0755: **Turtle 12** sighted from pilot house 100 m off port bow; dove (38-05.4, 74-31.6, 43 m, 21.3° C) Resumed transect. 0810: **Turtle 13** sighted from masthead submerged passing 30 m out on starboard side (38-04.6, 74-32.1, 41 m, 21.3° C). 0816: **Turtle 14** sighted from masthead 150 m off pot bow; dove before vessel got close (38-04.3, 74-33.1, 41 m, 21.3° C). Resumed transect. 0824: **Turtle 15** sighted from masthead just under surface 100 m ahead (38-04.1, 74-33.5, 39.8 m, 21.3° C) contact loss; resumed transect. 0847: **Turtle 16** sighted from masthead 50 m ahead on surface (38-02.9, 74-35.1, 41 m, 21.4° C) took breath, dove, resurfaced. 0850: **ROV Dive 6** launched; **Turtle 16** hard to spot due to glare and sea conditions. 0913: ROV on deck; resumed track.

1100: Altered course to 020° (37-55.7, 74-40.5, 40 m, 21.8° C). 1114: **Turtle 17** sighted from pilot house on surface (37-56.5, 74-40.4, 40 m, 21.8° C). 1115 **ROV Dive 7** launched. Turtle visible from vessel heading NE just under surface; sea conditions won't allow ROV to keep up with the turtle. 1201: ROV on deck; resumed track. 1227: **Turtle 18** sighted from masthead 40 m off starboard side (37-58.0, 74-40.6, 36.8 m, 21.9° C) dove; resumed track. 1318: **Turtle 19** sighted on surface from pilot house 40 m off port bow (38-00.8, 74-35.9, 35.6 m, 21.6° C) dove; resumed track.

1403: **Turtle 20** sighted from masthead 100 m ahead (38-03.3, 74-37.9, 37.4 m, 21.9° C) Turtle dove. 1420: Altered course to 070°; resumed transect. 1447: **Turtle 21** sighted from pilot house on surface 80 m ahead then dove (38-04.0, 74-35.5, 35.9, 21.9° C). 1501: **Turtle 22** sighted on surface from masthead 200 m ahead (38-04.2, 74-34.6, 40 m, 21.7° C) lost contact. 1543: **Turtle 23** sighted from masthead 50 m off starboard bow; dove (38-05.4, 74-31.7, 42.5 m, 21.5° C).

1559: **Turtle 24** pops up along starboard side 20 m out (38-05.6, 74-31.2, 44.3 m, 21.5° C) dove. 1606: Not re-sighted; resumed track. 1622: **Turtle 25** sighted on surface 100 m ahead; a large loggerhead (38-05.8, 74-30.0, 50.7 m, 21.5° C) 1625: **ROV Dive 8** launched; turtle had dove. **Turtle 26** sighted 100 m off port bow. ROV and vessel lost contact with both turtles; ROV going to bottom for search. 1650: ROV on deck; resumed track. 1730: Altered course to 220°. 1830: End transect; anchoring for night (38-02.8, 74-35.6, 40.5 m, 21.8° C). 2100: **ROV Dive 9**; bottom search. 2200: ROV on deck; end of operations.

Saturday, July 11, 2009

0730: Anchored; wind calm, seas 0.1 m, SST 21.4° C, partly cloudy. 0815: Weigh anchor; start Transect 3, heading 090°, speed 5.0 kn (38-02.8, 74-35.5). 0840: **Turtle 27** sighted from masthead 300 m astern on surface (38-03.1, 74-34.2, 40.1 m, 21.7° C); dove and not re-sighted; resumed transect. 0854: **Turtle 28** sighted from masthead off

0915: **Turtle 29** sighted from pilot house 100 m to starboard; came up, took breath, then dove (38-02.8, 74-33.2, 40.7 m, 21.7° C) continued observation from masthead of submerged turtle until contact lost; resumed track. 0943: Altered course to 030°. 0949: **Turtle 30** sighted from pilot house on surface 100 m off starboard bow (38-03.3, 74-31.3, 47.8 m, 21.8° C). 0953: **ROV Dive 10** launched. 0956**: Turtle 30** acquired on video (**Take 3**). Four to five scallop vessels working 3-4 miles south of our position. 1101: **Turtle 31** sighted from masthead on surface 300 m away bearing 240 (38-03.4, 74-31.5, 4.6 m, 21.8° C). 1110: ROV lost contact with **Turtle 30** during dive at depth of 30 m; turtle dove too fast. 1131: ROV on deck; resumed track (38-03.4, 74-31.6, 44.3 m, 21.9° C) heading 020°.

1149: **Turtle 32** sighted on surface from pilot house 100 m off starboard bow (38-04.3, 74-31.3, 45.1, 22.0° C). 1151: **ROV Dive 11** launched. 1155: **Turtle 32** acquired on video (**Take 4**). 1312: ROV loses contact during turtle dive at 35 m. Wind S at 5-10 kn, seas 0.3 m, sky clear. 1324: ROV on deck (38-04.1, 74-31.2, 44.7 m, 22.1° C). 1325: **Turtle 33** sighted from masthead 400 m to the west; vessel proceeding to that location. 1331: **ROV Dive 12** launched (38-04.3, 74-31.0, 46 m) lost visual. 1336: ROV on deck.

1338: **Turtle 34** sighted from masthead 300 m east; proceeding to that location. 1344: **ROV Dive 13** launched (38-04.5, 74-30.6, 47.4 m, 22.1° C). 1346: **Turtle 34** acquired on video (**Take 5**). 1436: **Turtle 35** sighted on surface off port quarter while **Turtle 34** was being followed by the ROV at a depth of 11 m below that position. 1444: ROV loses contact with **Turtle 34**; while searching acquires **Turtle 35** (**Take 6**). **Turtle 36** sighted off bow; definitely different turtle. 1450: Lost contact with **Turtle 35**. 1500: ROV on deck.

1520: Resumed transect heading 060°. 1525: **Turtle 37** sighted from masthead 100 m ahead on surface (38-04.6, 74-30.5, 47.8 m, 22.2° C); dove then re-surfaced. 1527: **ROV Dive 14** launched. 1530: **Turtle 37** acquired on video (**Take 7**). 1549: **Turtle 38** sighted off starboard bow (38-04.7, 74-30.5). 1610: ROV lost contact with **Turtle 37**. 1623: ROV on deck (38-04.9, 74-30.5, 47.4 m, 22.1° C); resumed track heading 060°. 1800: Ended transect; wind S 10-15, seas 0.5 m.

Sunday, July 12 2009

0730: Overcast, wind SW 10-15 kn, seas 1.5 m, SST 20.9° C (38-36.0, 73-58.6, 50.5 m) Sighting conditions poor; re-positioning vessel waiting for conditions to improve. 0830: Begin Transect 4 (38-33.9, 74-03.8, 57.9 m, 20.7° C) heading 010°, speed 4 kn. Seas flattening, sky is clearing. 0930: **Turtle 39** sighted from masthead on surface 200 m abeam to port (38-37.6, 74-04.2, 52.4 m, 21.6° C); dove before we got close. Now partly cloudy, hazy, seas 1.0 m, wind W at 10-15 kn. No contact; resumed track.

0958: **Turtle 40** sighted from masthead 60 m ahead (38-38.4, 74-04.3, 52.4 m, 21.7° C); dove but masthead maintains visual on the submerged turtle. 1000: **ROV Dive 15** launched. 1002: **Turtle 40** acquired on video (**Take 8**) at a depth of 5 m and is diving fast; lost contact at 25 m depth. 1015: ROV on deck; resumed track.

1025: **Turtle 41** sighted from masthead 300 m off port bow (38-38.8, 74-04.5, 52.6 m, 21.7° C); dove. 1054: **Turtle 42** sighted from masthead 200 m off port bow on surface taking breaths (38-40.3, 74-04.9, 52.4 m, 21.9° C); dove. 1057: Did not re-sight; resumed track. 1103: **Turtle 43** sighted from foredeck 150 m off port bow on surface (38-41.0, 74-04.7, 52.0 m, 21.9° C); dove. 1057: Not re-sighted after diving; resumed track.

1123: **Turtle 43** re-sighted from masthead 40 m off port bow; dives (38-41.2, 74-04.6, 51.5 m, 22.0° C). 1124: **ROV Dive 16** launched. 1126: **Turtle 43** acquired on video (**Take 9**). 1228: Lost contact on deep dive; ran out of tether. 1238: ROV on deck (38-41.2, 74-04.5, 53.3 m, 22.1° C). 1245: **Turtle 43** re-sighted and dove (38-41.3, 74-04.4). 1247: **ROV Dive 17** launched. 1249: **Turtle 43** re-acquired on video. 1420: Followed **Turtle 43** to sea floor and back to surface; lost contact at surface; retrieving ROV to re-position vessel (38-41.6, 74-04.4, 52.0 m, 22.3° C). 1428: Two turtles sighted together 200 m out; one may be **Turtle 43**. 1429: ROV on deck; proceeding to turtle location. 1432: **Turtle 43** alongside; **ROV Dive 18** launched (38-41.7, 74-04.4, 51.6 m, 22.7° C). 1450: **Turtle 43** re-acquired on video; **Turtle 44** not re-sighted. 1810: Lost contact with **Turtle 43** at surface (38-42.4, 74-04.7, 47 m, 23.1° C). 1817: ROV on deck. 1830: Anchored for the night.

Monday, July 13, 2009

0800: At anchor; training alternate ROV pilot; testing small boat for handling and turtle capture with dip net and turtle transfer to vessel using a float. Wind NE 10-15 kn, seas 0.7 m, SST 21.7° C, skies clear. 0900: Weighing anchor. 1000: Start Transect 5, heading 035°, speed 4.5 kn (38-42.7, 74-05.8, 49.6 m, 21.7° C). 1011: **Turtle 45** sighted from pilot house 150 m off starboard bow on surface; took breath and dove (38-43.8, 74-05.7, 51.1 m, 21.9° C); not re-sighted; resumed track on heading 045. 1015: Re-sighted **Turtle 45** submerged from masthead; launched **ROV Dive 19**. 1025: No contact; ROV on deck; resumed track.

1045: **Turtle 46** sighted from masthead 80 m ahead (38-45.4, 74-05.7, 48.7 m, 22.2° C). 1046: **ROV Dive 20** launched. 1047: **Turtle 46** acquired on video (**Take 10**). 1120: ROV loses contact when turtle takes fast dive; retrieving ROV (38-45.8, 74-06.4, 48.0 m, 22.2° C) 1130: ROV on deck; resumed track. 1138: **Turtle 47** sighted from masthead on surface 150 m off port bow (38-46.2, 74-06.5, 47.8 m, 22.3° C); dove before we closed on position. 1143: Resumed track.

1212: **Turtle 48** sighted from pilot house 100 m off starboard bow on surface (38-48.4, 74-05.4, 46.9 m, 22.4° C); takes breaths and travels submerged. 1214: **ROV Dive 21** launched. 1216: **Turtle 48** acquired on video (**Take 11**). 1245: Lost **Turtle 48** on dive; ROV goes to bottom to search. 1249: **Turtle 48** sighted on surface (38-48.7, 74-05.4) 1249: ROV on deck; searching for turtle from vessel. 1302: No re-sighting; resumed track on course 090°.

1341: **Turtle 49** sighted from pilot house on surface 200 m ahead (38-50.0, 74-01.8, 46.9 m, 22.7° C). 1349: **ROV Dive 22** launched. 1350: **Turtle 49** acquired on video (**Take**

13) at depth of 6 m (38-51.2, 74-57.8, 41.6 m, 22.8° C). 1515: Lost contact; retrieving ROV. 1523: ROV on deck; resumed track.

1552: **Turtle 51** sighted from masthead 50 m ahead submerged (38-51.7, 73-55.1, 43.2 m, 22.7° C). 1553: **ROV Dive 24** launched. 1601: **Turtle 51** acquired on video (**Take 14**); two other turtles sighted at same time nearby (**Turtles 52 and 53**). 1605: Tether snags under vessel; lost contact with **Turtle 51**. 1614: ROV on deck; searching area for turtles. 1630: **Turtle 54** sighted from masthead 300 m off port bow on surface (38-52.6, 73-53.6, 39.6 m, 22.6° C). 1632: **ROV Dive 25** launched. 1647: **Turtle 54** not acquired; ROV on deck. **Turtle 55** sighted from masthead 200 m away during ROV deployment but not re-sighted. 1735: Visibility gone; end transect (38-53.6, 73-59.3, 44.1 m, 22.4° C); anchoring for night.

Tuesday, July 14, 2009

0730: At anchor; wind E 5-10 kn, seas 0.3 m, skies clear, SST 21.4° C.)800: Wind coming N 10-15 kn. 0810: Weighing anchor (38-53.6, 73-49.3, 44.7 m, 21.4° C); wind now NW 15-20 kn, seas 0.7 m. Start Transect 6, heading 180°, speed 5 kn. 0831:**Turtle 56** sighted from pilot house 150 m off starboard bow on surface (38-52.2, 73-49.7, 42.0 m, 21.5° C); dove on approach. 0839: Not re-sighted; resumed track.

0905: **Turtle 57** sighted from masthead on surface 80 m abeam to port (38-50.3, 73-50.4, 45.2 m, 21.6° C); dove. 0909: Not re-sighted; resumed track. 0924: **Turtle 58** sighted from masthead on surface (38-49.3, 73-50.4, 46.5 m, 21.6° C); dove when vessel approached. 0927: **ROV Dive 26** launched. 0929 **Turtle 58** acquired on video (**Take 15**). 1003: Tether connector malfunction; lost video; retrieving ROV. Wind NW 20 kn, seas 1.3 m. 1010: ROV on deck. 1037: ROV repaired; **ROV Dive 27** launched. 1042: Re-acquired **Turtle 58**. 1058: Lost contact with Turtle 58; wind too strong; maintaining visual from vessel on **Turtle 58**.

1128: ROV acquires video on **Turtle 59** ( ) while searching for **Turtle 58** (38-49.5, 73-50.9, 46.0 m, 21.6° C). 1216: **Turtle 59** dives to sea floor and was tracked but ROV lost contact on way back to surface. 1219: **Turtle 59** visually sighted from vessel. 1222: **Turtle 59** re-acquired on video. Wind NW 10-15 kn, seas 1.0 m; calming down. 1400: **Turtle 59** tracked to sea floor again but tether went short and contact lost; **Turtle 59** sighted on surface two minutes after contact lost by ROV. 1402: ROV re-acquires **Turtle 59** (38-49.9, 73-50.5, 46.0, 21.9° C); wind N 5-10 kn, seas 0.3 m.

1541: **Turtle 59** had made a third excursion to the sea floor and just returned to the surface with ROV still in contact (38-49.7, 73-50.4. 46.2 m, 21.8° C). 1702: **Turtle 59** completes another bottom dive and just surfaced with ROV in contact (38-49.7, 73-50.2, 45.1 m, 22.1° C). 1906: **Turtle 59** made another dive to sea floor; ROV followed down and tracked until tether ran out; sun too low to see tether from vessel (38-49.3, 73-50.0, 47.0 m, 21.8° C). 1912: ROV on deck. 1942: Anchored (38-49.2, 73-50.0, 47.7 m, 21.7° C).

Wednesday, July 15, 2009

0730: At anchor, wind NW 10-15 kn, seas 0.7 m, partly cloudy, SST 21.4° C. 0755: **ROV Dive 28** to sea floor to get close-up video of where **Turtle 59** was feeding (38-49.2, 73-49.9, 48 m). 0840: ROV on deck. 0900: Anchors aweigh; start Transect 7 (38-49.2, 73-49.9, 48.4 m, 21.6° C); heading 040°, speed 6 kn.

0914: **Turtle 60** sighted from foredeck 50 m to starboard near a floating bucket (38-50.2, 73-49.1, 45.6 m, 21.8° C). 0916: **ROV Dive 29** launched. 0918: **Turtle 60** acquired on video (**Take 17**). 1100: ROV still tracking Turtle 60 (38-50.0, 73-48.8, 46.9 m, 22.1° C). 1111: **Turtle 61** sighted from masthead 300 m bearing due north (38-50.0, 73-48.7). 1115: **Turtle 62** sighted from masthead 300 m out bearing 040° on surface. 1253: **Turtle 60** dove to sea floor; ROV lost contact on sea floor. **Turtle 60** then sighted from masthead coming to surface and the resting on surface; ROV returning to surface.

1313: ROV on deck; repositioning vessel (38-49.5, 73-48.4, 48.0 m, 22.4° C). 1317: **ROV Dive 30** launched. 1318: ROV re-acquires **Turtle 60** and new **Turtle 62**; follows **Turtle 62** (**Take 18**). 1350: ROV following **Turtle 62** to sea floor; losses contact. Then **Turtle 62** sighted on surface (38-49.8, 73-48.4, 47.1 m, 22.4° C); ROV surfacing. 1400: ROV re-acquires **Turtle 60** and then follows to sea floor. **Turtle 60** does not feed and seems to be evading the ROV; ROV returns to surface. 1420: ROV on deck (38-49.9, 73-48.5, 47.8 m, 22.2° C); ending operations and returning to Barnegat Light.

Appendix B: Narrative: F/V Kathy Ann 2009-5 Turtle Tagging Trip

The F/V Kathy Ann departed Barnegat Light, New Jersey at 1600 on Saturday, August 22, 2009 and proceeded to the northern boundary of the ETAA.

Sunday, August 23, 2009

0730: Calm; rain showers, swell 4-5 meters from SE, SST 26.2°C, depth 45 m, speed 4.5 kn, course 220° (38-48.6, 73-54.6). 1035: Laying too for **ROV Dive 1**; a test of the Video Ray Pro 3 (38-39.3, 74-02.6, 51 m, SST 26.5°C). Sky partly cloudy; wind light and variable, heavy SE swell continues. 1120: **Turtle 1** sighted from masthead 110 m off the prot beam during small boat drills (38-39.1, 74-02.8, 53 m, 26.6°C). 1150: Small boat onboard, heading west. 1207: **Turtle 2** sighted from masthead passing astern of vessel (38-38.9, 74-03.7, 51.5 m, 27.0°C).

1322: **Turtle 3** spotted from masthead submerged 10 m off port side (38-37.3, 74-05.9, 53.4 m, 27.2°C). Turtle 3 was pursued unsuccessfully with small boat. 1402: **Turtle 4** sighted on surface 50 m off port bow and submerged rapidly (38-36.7, 74-04.6, 57.4 m, 27.0°C). 1506: **Turtle 5** sighted (38-36.2, 74-02.2, 54.7 m, 26.9°C); launched small boat but lost contact with turtle.

Monday, August 24, 2009

0750: Drizzle, overcast, wind light and variable; began search transect (38-39.6, 74-13.5, 44.6 m, 26.5°C); heading 040°, speed 5.5 kn. 0806: **Turtle 6** spotted from main deck when head came up for breath (38-40.8, 74-12.3, 44.4 m, 26.7°C. 1040: **Turtle 7** and **Turtle 8** observed on surface together flipper flopping (38-49.4, 74-00.0, 46.3 m, 26.7°C); small boat launched but turtles dove out of sight. 1149: **Turtle 9**, a leatherback, sighted from masthead submerged 20 m off port side (38-51.2, 73-55.5, 43.4 m, 26.8°C).

1540: **Turtle 10** sighted alongside starboard side submerged (38-57.3, 73-37.4, 51 m, 26.9°C). 1550: **Turtle 11**, a small fast moving submerged turtle voided bow (38-58.0, 73-36.0). 1640: **Turtle 12** sighted; small boat launched, manual capture successful (**Take 1**; 38-58.7, 73-35.2, 50.1 m, 27.0°C). 1650: Turtle 12 on deck for tagging. 1810: Turtle 12 tagged and released. 1902: **Turtle 13** sighted while submerged, small boat on scene and Turtle 13 captured using manual technique (**Take 2**; 38-59.8, 73-32.1, 53.7 m, 26.8°C). 1915: Turtle 13 on deck for tagging. 2030: Turtle 13 tagged and released.

Tuesday, August 25, 2009

0700: Wind light and variable, swell 2-3 meters (38-40.4, 74-02.0, 52.2 m, 26.6°C); heading 000°, 4.0 kn. 0918: **Turtle 14** sighted from masthead submerged passing down port side (38-52.8, 74-01.1, 40.6 m, 26.8°C). 0935: **Turtle 15** sighted from masthead passing down port side 50 m off taking breaths (38-53.2, 74-00.8, 39.4 m, 26.8°C). 1020: **Turtle 16** sighted from masthead submerged (38-56.1, 73-57.5, 40.4 m, 27.0°C); lost

Appendix C: Narrative: F/V Kathy Ann 2009-6 ROV Trip

The F/V Kathy Ann departed Barnegat Light, New Jersey at 1600 on Friday, September 11, 2009 and proceeded to the northern boundary of the ETAA

Saturday, September 12, 2009

0700: Cloudy, seas 2-3 meters, wind SW at 15 kn (38-34.5, 73-53.6, 30.3 m, 22.6°C); begin transect heading 300°, speed 5 kn. 0900: **ROV Dive 1**; jelly fish survey (38-28.9, 74-00.1, 55 m, 22.7°C). 0940: ROV on deck; had to use short tether- no jellies observed. 1100: **Turtle 1** sighted from masthead 50 m to starboard (38-21.0, 74-06.1, 58.5 m, 23.1°C); launched **ROV Dive 2** but lost visual on turtle 1; ROV dove to sea floor- no jellies, hermit crabs and sea scallops present. 1130: ROV on deck; resumed transect.

1147: **Turtle 2** sighted off starboard bow on surface (38-20.7, 74-06.8, 59.7 m, 23.2°C); **ROV Dive 3** in water; Turtle 2 acquired (**Take 1**). 1220: Lost contact with Turtle 2 due to short tether; it was a small loggerhead.

1233: **Turtle 3** sighted just off starboard side (38-20.5, 74-06.8, 58.0 m, 23.1°C); **ROV Dive 4** launched; no contact, searching. 1246: Turtle 3 acquired (**Take 2**). 1250: **Turtle 4** sighted off starboard beam 50 m out while tracking Turtle 3 (38-20.6, 74-06.7). 1332: **Turtle 5** sighted 100 m from Turtle 4 (38-20.7, 74-06.2, 59.9 m, 23.2°C); partly cloudy, seas 1-2 m. Turtle 3 dove to bottom and ate a number of scallops. 1410: Turtle 3 and ROV on way up from sea floor. 1440: Turtle 3 dives but is lost by the ROV near sea floor but soon spotted on surface; Turtle 5 is still in view from vessel. 1526: ROV reacquires Turtle 3 soon after a social interaction with Turtle 5. 1630: ROV follows Turtle 3 to sea floor again but losses contact due to low visibility. 1655: Turtle 3 sighted again on surface from vessel while ROV is on the way up from the sea floor (38-20.7, 74-05.2, 70.0 m, 23.4°C). 1707: ROV on deck.

Sunday, September 13, 2009

0700: Laying to in the DelMarVa access area (37-54.1, 74-39.4, 44.5 m, 20.3°C); very overcast and dark, wind north at 10-15 kn, seas 1.5 meters. 0734: **ROV Dive 5;** jelly fish survey to sea floor ((37-53.5, -74-39.3). 0810: ROV on deck; commenced transect heading 060°, 5 kn. 1200: (38-01.9, 74-32.6); wind N 15-20 kn, seas 2-3 m, overcast. 1500: Sky is clearing; sea dropping (38-12.2, 74-17.5, 19.8°C). 1515: **Turtle 6** sighted on surface off port side (38-13.5, 74-15.9, 47.9 m, 19.8°C); turtle dives. 1525: Resumed track.

1541: **Turtle 7** sighted from masthead 100 m off starboard side (38-14.3, 74-14.7, 50 m, 19.7°C); dives quickly. 1554: **Turtle 8** sighted from masthead 100 m off starboard bow (38-14.4, 74-13.8, 55.2 m, 20.0°C); lost contact. 1600: **Turtle 9** sighted just submerged off port bow (38-14.5, 74-13.6); small loggerhead; launched **ROV Dive 6**; no contact. 1610: ROV on deck.

(38-17.9, 74-09.3, 62.1 m, 22.9°C); dives. 1726: **Turtle 13** sighted just submerged from masthead 50 m off starboard bow (38-17.9, 74-09.0, 61.5 m, 22.9°C). 1728: Launched **ROV Dive 7**; no contact. 1735: ROV on deck. 1756: **Turtle 14** sighted from masthead 200 m ahead (38-19.5, 74-08.4, 54.6 m, 22.9°C); lost contact.

1821: **ROV Dive 8**; jelly fish survey (38-21.2, 74-07.6, 56.6 m, 22.9°C). 1837 **Turtle 15** sighted 200 m to starboard. 1840: ROV on deck. 2100 ROV Dive 9; jelly fish dive (38-19.5, 74-06.3, 65.1 m, 22.7°C).

Monday, September 14, 2009

0730: Commenced transect (38-47.7, 73-43.6, 51.0 m, 22.6°C); wind NW 15-20 kn, seas 2 m, clear sky, heading 000°, sped 3 kn. 0815 Sargassum weed line (38-49.1, 73-43.6, 52.2 m, 22.2°C); launched **ROV Dive 10**; malfunctions and is brought back on deck. 0902: Turtle 16 sighted from pilot house on surface (38-47.6, 73-43.7, 50.5 m, 22.7°C); dives. **ROV Dive 11** launched; no contact; ROV dives to sea floor. **Turtle 16** is sighted again off bow; ROV on way to surface. 0947: **Turtle 17** sighted on surface (38-45.2, 73-44.7, 50.0 m, 22.5°C); dives. 1002: **Turtle 18** sighted on surface 100 m off starboard bow (38-44.7, 73-45.6, 50.2 m, 22.6°C); **ROV Dive 12** launched; glimpsed Turtle 18 but no contact. 1015: ROV on deck.

1022: **Turtle 19** sighted from pilot house 30 m off starboard bow(38-44.3, 73-46.3, 49.3 m, 22.7°C); dives. 1044: **Turtle 20** sighted 100 m off starboard bow (38-43.3, 73-47.7, 51.2 m, 22.8°C); **ROV Dive 13** launched. 1054: No contact; ROV on deck. 1125: **Turtle 21** sighted 500 m ahead (38-43.1, 73-44.7, 56.5 m, 22.9°C). 1152: **Turtle 22** sighted near Sargassum mat (38-43.7, 73-43.9, 55.7 m, 22.8°C); dives.

1234: **Turtle 23** sighted on surface off the port beam 100 m (38-43.4, 73-40.5, 58.2 m, 23.1°C); **ROV Dive 14** launched; Turtle 23 acquired (**Take 3**); dives to bottom then comes up and contact lost. 1257: ROV on deck. 1300: On last reported position of tagged turtle (38-43.7, 73-40.3, 59.5 m, 23.2°C). 1301: **Turtle 24** sighted 300 m ahead; dives. 1316: **Turtle 25** and **Turtle 26** sighted from pilot house on surface 100 m off port bow flipper flopping; **ROV Dive 15** launched; Turtle 25 acquired (**Take 4**). 1537: ROV still tracking Turtle 25 (38-46.4, 73-38.5, 58.0 m, 23.6°C). **Turtle 27** sighted ahead. 1602: **Turtle 28** sighted 200 m out (38-46.9, 73-38.3, 58.1 m, 23.5°C). ROV loses contact with Turtle 25 due to short tether (38-47.4, 73-38.1, 57.5 m, 22.8°C).

1800: **ROV Dive 16**; jelly fish survey (38-54.5, 73-42.5, 46.0 m, 20.0°C). 1820: ROV on deck. 2123 **ROV Dive 17**; jelly fish survey (39-07.8, 73-42.9, 42.8 m, 18.2°C). 2200: ROV on deck.

Tuesday, September 15, 2009

0730: **ROV Dive 18**; jellyfish survey (39-19.5, 73-42.8, 29.2 m, 20.1°C); wind West at 10 kn, seas 1 m, partly cloudy. 0808: ROV on deck; begin transect, heading 000°, 6 kn. 0855: 39-22.3, 73-44.1, 32.5 m, 20.3°C. 0930: Wind and sea building; NW 15-20, seas 1-2 m. 0959: **Turtle 29** sighted just coming to surface from pilot house just ahead of vessel (39-27.5, 73-44.0, 31.0 m, 20.2°C); **ROV Dive 19** launched and Turtle 29 briefly acquired (**Take 5**) but soon lost. 1014: ROV on deck.

1029: **Turtle 30** sighted from pilot house on surface (39-27.8, 73-44.6, 32.2 m, 20.3°C); dives. 1035: Turtle 30 re-sighted; **ROV Dive 20** launched; water very murky and sonar not working; no contact. 1053: ROV on deck; resumed track. 1055: Turtle 30 re-sighted; **ROV Dive 21** launched; Turtle 30 re-acquired but then ROV losses contact. 1130: ROV searching for Turtle 30 which is visible from vessel: **Turtle 31** is sighted next to Turtle 30; ROV can not acquire either (39-27.2, 73-44.8, 30.4 m, 20.4°C). 1135: ROV on deck; resumed track. 1230: End operations; heading back to Barnegat (39-31.1, 73-49.8).

Take Summary for Project:

Kathy Ann 2009-3	18 ROV takes
Kathy Ann 2009-5	2 Tagging takes
Kathy Ann 2009-6	5 ROV takes

Date: ______________ *Observer:* ______________ *Pilot:* ______________ *Transect:* ______________ *Page* ______ *of* ______

Track Alt.: __________ *Speed (kts):* ______________ *Wind Dir.:* __________ *Time Transect Start:* ____:____ *Time Transect End:* ____:____

(enter a record for each transect begin/end)

GPS	Time		Lat N		Long W			Cloud		Sea	Glare		Species			Comments
ID	h	m	deg	min	deg	min	Spotter	cov%	Viz	State	L	R	Ship	Total #	Depth	(used other side for additional comments)

BONGO NET FIELD DATA SHEET

TE: 07/09/09 TIME: 1544 LATITUDE: 38 55.8 N

LONGITUDE: 73 34.8 W

ANSECT: Line G STATION NO: 19

LD CHIEF: R. Curry CREW: C. Ryther, C. Wright, S.Curry F/V: Diligence

Weather Data

nd Speed:	Wind Direction:	Sea State: (give wave ht if possible)	Sky Conditions:
0-1 Knots		Calm	Clear (X)
2-10 (X)		Small (X)	Partly Cloudy
11-20		Moderate	Cloudy
21-30		Mod-rough	Overcast
31-40		Rough	Drizzle
		Very Rough	Rain

Net Data

:	1	2	Time: 1544	Depth (ft): 156
ter Start:	452672	168640	Towing speed: 2 kts	Amnt wire out (ft): 100
ter Stop:	469797	185586	towing: start- 1544	Wire angle: 45 degrees
al Revs.:	17,125	16,946	stop- 1600	

neral Observations: Net clean, few small comb jellies 1/4-1/2 inch (Pleurobrachia)

Mesoglea (jelly of jellyfish) Data

soglea Volume: (use displacement of water)	Net 1	Net 2
Total #milliliters	8 ml	9 ml

Composition: (visual estimate cover classes 0-5%, 5-25%, 25-50%, 50-75%, 75-95%, or 95-100%)

Ctenophores	(Comb jellies) TOTAL	100 % 19 total count	100 % 15 total count
	(Beroe)	_____	_____
	(Mnemiopsis)	_____	_____
Scyphozoa	(Typical jellyfish) TOTAL	None	None
	(Chrysaora) sea nettle	_____	_____
	(Aurelia) moon jelly	_____	_____
	(_____)	_____	_____

Zooplankton

served with 5% formalin (~50 ml in liter glass jars)

al number of jars Net 1 (1) Net 2` (1)

BONGO NET FIELD DATA SHEET

DATE: 07/11/09 **TIME: 0746** **LATITUDE: 38 23. 5 N**

LONGITUDE: 73 45.3 W

TRANSECT: Line B **STATION NO: 49**
FIELD CHIEF: R. Curry **CREW: C. Ryther, C. Wright, S.Curry** **F/V: Diligence**

Weather Data

Wind Speed:	Wind Direction:	Sea State: (give wave ht if possible)	Sky Conditions:
0-1 Knots		Calm (X)	Clear (X)
2-10 (X)		Small	Partly Cloudy
11-20		Moderate	Cloudy
21-30		Mod-rough	Overcast
31-40		Rough	Drizzle
		Very Rough	Rain

Net Data

Net:	1	2	Time: 0746	Depth (ft): 85
Meter Start:	469861	185521	Towing speed: 1.5 kts	Amnt wire out (ft): 100
Meter Stop:	488512	204456	towing: start- 0746	Wire angle: 45 degrees
Total Revs.:	18,651	18,935	stop- 0801	

General Observations: Many comb jellies 1/4-1/2 inch (Pleurobrachia)

Mesoglea (jelly of jellyfish) Data

Mesoglea Volume: (use displacement of water)		Net 1	Net 2
Total #milliliters		158 ml	168 ml

% Composition: (visual estimate cover classes 0-5%, 5-25%, 25-50%, 50-75%, 75-95%, or 95-100%)

Ctenophores	(Comb jellies) TOTAL	100 %	100 %
	(Beroe)	_____	_____
	(Mnemiopsis)	_____	_____
Scyphozoa	(Typical jellyfish) TOTAL	None	None
	(Chrysaora) sea nettle	_____	_____
	(Aurelia) moon jelly	_____	_____
	(_____)	_____	_____

Zooplankton

Preserved with 5% formalin (~50 ml in liter glass jars)

Total number of jars **Net 1 (1)** **Net 2` (1)**

BONGO NET FIELD DATA SHEET

DATE: 07/11/09 **TIME: 1442** **LATITUDE: 38 02. 9 N**

LONGITUDE: 74 24.0 W

TRANSECT: Line B **STATION NO: 54**
FIELD CHIEF: R. Curry **CREW: C. Ryther, C. Wright, S.Curry** **F/V: Diligence**

Weather Data

Wind Speed:	Wind Direction:	Sea State: (give wave ht if possible)	Sky Conditions:
0-2 Knots		Calm	Clear (X)
2-10 (X)		Small (X)	Partly Cloudy
11-20		Moderate	Cloudy
21-30		Mod-rough	Overcast
31-40		Rough	Drizzle
		Very Rough	Rain

Net Data

Net:	1	2	Time: 1442	Depth (ft): 174
Meter Start:	204467	488532	Towing speed: 1.5 kts	Amnt wire out (ft): 150
Meter Stop:	222921	507072	towing: start- 1442	Wire angle: 45 degrees
Total Revs.:	18,454	18,540	stop- 1457	

General Observations: Moderate amount comb jellies 1/4-1/2 inch (Pleurobrachia)

Mesoglea (jelly of jellyfish) Data

Mesoglea Volume: (use displacement of water)	Net 1	Net 2
Total #milliliters	**60 ml**	64 ml

% Composition: (visual estimate cover classes 0-5%, 5-25%, 25-50%, 50-75%, 75-95%, or 95-100%)

Ctenophores	**(Comb jellies) TOTAL**	**100 %**	**100 %**
	(Beroe)	_____	_____
	(Mnemiopsis)	_____	_____
Scyphozoa	**(Typical jellyfish) TOTAL**	**None**	**None**
	(Chrysaora) sea nettle	_____	_____
	(Aurelia) moon jelly	_____	_____
	(_____)	_____	_____

Zooplankton

Preserved with 5% formalin (~50 ml in liter glass jars)

Total number of jars **Net 1 (1)** **Net 2` (1)**

BONGO NET FIELD DATA SHEET

DATE: 07/11/09 **TIME: 1752** **LATITUDE: 37 53. 8 N**
LONGITUDE: 74 14.8 W

TRANSECT: Line B **STATION NO: 56**
FIELD CHIEF: R. Curry **CREW: C. Ryther, C. Wright, S.Curry** **F/V: Diligence**

Weather Data

Wind Speed:	Wind Direction:	Sea State: (give wave ht if possible)	Sky Conditions:
0-3 Knots		Calm	Clear (X)
2-10 (X)		Small (X)	Partly Cloudy
11-20		Moderate	Cloudy
21-30		Mod-rough	Overcast
31-40		Rough	Drizzle
		Very Rough	Rain

Net Data

Net:	1	2	Time: 1752	Depth (ft): 246
Meter Start:	222638	507084	Towing speed: 1.5 kts	Amnt wire out (ft): 250
Meter Stop:	24411	528300	towing: start- 1752	Wire angle: 45 degrees
Total Revs.:	21,773	21,216	stop- 1807	

General Observations: very few comb jellies 1/4-1/2 inch (Pleurobrachia)

Mesoglea (jelly of jellyfish) Data

Mesoglea Volume: (use displacement of water) **Net 1** **Net 2**

Total #milliliters **1 ml (2) total count** 2 ml (5) total count

% Composition: (visual estimate cover classes 0-5%, 5-25%, 25-50%, 50-75%, 75-95%, or 95-100%)

Ctenophores	**(Comb jellies) TOTAL**	**100 %**	**100 %**
	(Beroe)	_____	_____
	(Mnemiopsis)	_____	_____
Scyphozoa	**(Typical jellyfish) TOTAL**	**None**	**None**
	(Chrysaora) sea nettle	_____	_____
	(Aurelia) moon jelly	_____	_____
	(_____)	_____	_____

Zooplankton

Preserved with 5% formalin (~50 ml in liter glass jars)

Total number of jars **Net 1 (1)** **Net 2 (1)**

BONGO NET FIELD DATA SHEET

DATE: 09/23/09 **TIME: 1357** **LATITUDE: 38 07.128 N**

LONGITUDE: 74 10.216 W

TRANSECT: Line C **STATION NO: 47**
FIELD CHIEF: R. Curry **CREW: C. Ryther, E. Perrone** **F/V: Diligence**

Weather Data

Wind Speed:	Wind Direction:	Sea State: (give wave ht if possible)	Sky Conditions:
0-4 Knots		Calm	Clear
2-10 (X)		Small (X)	Partly Cloudy (X)
11-20		Moderate	Cloudy
21-30		Mod-rough	Overcast
31-40		Rough	Drizzle
		Very Rough	Rain

Net Data

Net:	1	2	Time: 1357	Depth (ft): 212
Meter Start:	269641	551663	Towing speed: 1.5 kts	Amnt wire out (ft): 200
Meter Stop:	297179	578199	towing:	Wire angle: 45 degrees
			start- 1357	
Total Revs.:	27,538	26,536	stop- 1412	Max depth (ft) 125

General Observations: No ctenophores or jellyfish, phytoplankton abundant

Mesoglea (jelly of jellyfish) Data

Mesoglea Volume: (use displacement of water)		Net 1	Net 2
Total #milliliters		0 ml	0 ml

% Composition: (visual estimate cover classes 0-5%, 5-25%, 25-50%, 50-75%, 75-95%, or 95-100%)

Ctenophores	(Comb jellies) TOTAL	0	0
	(Beroe)	_____	_____
	(Mnemiopsis)	_____	_____
Scyphozoa	(Typical jellyfish) TOTAL	0	0
	(Chrysaora) sea nettle	_____	_____
	(Aurelia) moon jelly	_____	_____
		_____	_____

Zooplankton

Preserved with 5% formalin (~50 ml in liter glass jars)

Total number of jars **Net 1 (1)** **Net 2 (1)**

BONGO NET FIELD DATA SHEET

DATE: 09/23/09 **TIME: 1357** **LATITUDE: 38 07.128 N**

LONGITUDE: 74 10.216 W

TRANSECT: Line C **STATION NO: 47**
FIELD CHIEF: R. Curry **CREW: C. Ryther, E. Perrone** **F/V: Diligence**

Weather Data

Wind Speed:	Wind Direction:	Sea State: (give wave ht if possible)	Sky Conditions:
0-5 Knots		Calm	Clear
2-10 (X)		Small (X)	Partly Cloudy (X)
11-20		Moderate	Cloudy
21-30		Mod-rough	Overcast
31-40		Rough	Drizzle
		Very Rough	Rain

Net Data

Net:	1	2	Time: 1357	Depth (ft): 212
Meter Start:	269641	551663	Towing speed: 1.5 kts	Amnt wire out (ft): 200
Meter Stop:	297179	578199	towing:	Wire angle: 45 degrees
			start- 1357	
Total Revs.:	27,538	26,536	stop- 1412	Max depth (ft) 125

General Observations: No ctenophores or jellyfish, phytoplankton abundant

Mesoglea (jelly of jellyfish) Data

Mesoglea Volume: (use displacement of water)	Net 1	Net 2
Total #milliliters	0 ml	0 ml

% Composition: (visual estimate cover classes 0-5%, 5-25%, 25-50%, 50-75%, 75-95%, or 95-100%)

Ctenophores	(Comb jellies) TOTAL	0	0
	(Beroe)	_____	_____
	(Mnemiopsis)	_____	_____
Scyphozoa	(Typical jellyfish) TOTAL	0	0
	(Chrysaora) sea nettle	_____	_____
	(Aurelia) moon jelly	_____	_____
		_____	_____

Zooplankton

Preserved with 5% formalin (~50 ml in liter glass jars)
Total number of jars **Net 1 (1)** **Net 2 (1)**

BONGO NET FIELD DATA SHEET

DATE: 09/23/09 **TIME: 1608** **LATITUDE: 38.02.142 N**

LONGITUDE: 74 04.843 W

TRANSECT: Line C **STATION NO: 49**
FIELD CHIEF: R. Curry **CREW: C. Ryther, E. Perrone** **F/V: Diligence**

Weather Data

Wind Speed:	Wind Direction:	Sea State: (give wave ht if possible)	Sky Conditions:
0-6 Knots		Calm	Clear (X)
2-10 (X)		Small (X)	Partly Cloudy
11-20		Moderate	Cloudy
21-30		Mod-rough	Overcast
31-40		Rough	Drizzle
		Very Rough	Rain

Net Data

Net:	1	2	Time: 1608	Depth (ft): 335
Meter Start:	297180	578202	Towing speed: 1.5 kts	Amnt wire out (ft): 120
Meter Stop:	324429	605657	towing:	Wire angle: 45 degrees
			start- 1608	
Total Revs.:	27,249	27,455	stop- 1623	Max depth (ft) 58

General Observations: No ctenophores, 1 water jelly

Mesoglea (jelly of jellyfish) Data

Mesoglea Volume: (use displacement of water)		Net 1	Net 2
Total #milliliters		30 ml	0 ml

% Composition: (visual estimate cover classes 0-5%, 5-25%, 25-50%, 50-75%, 75-95%, or 95-100%)

Ctenophores	(Comb jellies) TOTAL	0	0
	(Beroe)	_____	_____
	(Mnemiopsis)	_____	_____
Scyphozoa	(Typical jellyfish) TOTAL	100 %	0
	(Chrysaora) sea nettle	_____	_____
	(Aurelia) moon jelly	_____	_____
	Water Jelly	1_____	_____

Zooplankton

Preserved with 5% formalin (~50 ml in liter glass jars)

Total number of jars **Net 1 (1)** **Net 2 (1)**

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
2	7/9/09								
3	DISC 1								
4	DIVE 1								BOTTOM SURVEY
5	32:50	18.33							SOME JELLIES IN H20 COL
6	34:10	19:20:76							53 M SHELL DEBRIS PULLED OFF STATION
7									
8	DISC 2								
9	DIVE 2								LARGE PATCH OF WEEDS
10	3:57	3:36:00			N			1M	
11	11:46	11:22:00			N			2M	
12	14:52	14:16:00							DIVE TO BOTTOM
13									SAND / SHELL DEBRIS/SPONGE
14									SEA STARS SOME JELLIES
15									
16	DISC 2								
17	DIVE 3								
18	TURTLE								
19	41:38		41:38						
20	41:36					B			BREATHE THEN LOST IN TURBULENCE
21									
22	DISC 2								
23	DIVE 7								
24	TRTLE 5								
25	47:08	11:60	47:08		N/VARIES			1M	
26	48:00							2M	
27	48:50			51:40				5M	
28									
29	DISC 2								
30	DIVE 4								
31									
32	1:03:29								POD OF DOLPHIN
33									
34	DISC 3								
35	DIVE 5								
36	TURTLE 15								
37	1:19:11	24:00	1:19:11						
38	1:20:03								FACING ROV
39	1:21:16				S		NO	5M	
40	1:22:00				W		NO	2M	
41	1:24:09				N		NO	5M	
42	1:24:28				W		NO	9M	
43	1:24:52				W			6M	
44	1:25:51				W			3M	
45	1:25:44				W			3M	
46	1:26:35							1M	APPROACH ROV
47	1:29:16				SW			1M	
48	1:29:47				N			2M	
49	1:30:48					B			
50	1:32:16					B			
51	1:32:34								APPROACH ROV
52	1:32:48							1M	
53	1:33:00				W			3M	
54	1:33:50				W			1M	
55	1:34:49							3M	
56				1:34:58					
57									
58	7/10/09								
59	DISC 4								
60	DIVE 6								
61	TURTLE 16								
62	55:36	11:33	55:36						TURTLE MOVING AWAY / JELLIES
63				56:00					
64									
65	DIVE 7								
66	TURTLE 17								
67	39:53	39:25	39:53	40:01					DOVE
68									
69	DISC 5								
70	DIVE 8								
71	30:57							57M	BOTTOM SURVEY
72	32:26							57M	SHELL DEBRIS/MOUNDS
73	33:00							57M	HOLE WITH SCALLOP
74	33:43							57M	SPONGE/MOUNDS
75	34:50							57M	HERMIT CRABS
76	35:09							57M	SCALLOPS SWIMMING
77	35:27							57M	SCALLOPS SWIMMING
78	38:30								ASCENT
79									
80	DISC 5								
81	DIVE 9				W				NIGHT DIVE BOTTOM SURVEY
82	1:37	1:11							DESCENT
83	5:19	4:49:00						45M	SHELL DEBRIS/ SAND/SAND DOLLARS
84	7:50								CRAB
85	8:42								LING
86	12:10								SCALLOP
87	13:42								SCALLOP
88	16:06								HERMIT
89	19:19								RAZOR CLAM/SCALLOP/SAND DOLLAR
90	20:01								EEL
91	20:31								EEL
92	21:09								EEL
93	21:22								EEL
94	21:56								SWIMMING SCALLOP

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
95	23:33								ANENOME
96	28:40	26:13:00			E			45M	
97	29:23								WINTER SKATE
98									SAND DOLLARS/SHELL DEBRIS/SAND
99	34:32								MOON SNAIL
100	35:36								SCALLOP/LING
101	38:34				N			45M	SAND/SAND DOLLARS/CRAB
102	51:50								ASCENT
103									
104									
105	DISC 6								
106	DIVE 10								
107	TURTLE 30								
108	33:43		33:43						
109	35:21	50:04	35:21						NO JELLIES
110	35:49				N				
111	36:25				N			2M	
112	36:39				E			1M	
113	37:04				S			2M	
114	37:14				SW			1M	
115	38:15				N			2M	
116	38:25				N			3M	
117	38:59				NW			3M	
118	40:24				NE			2M	
119	41:07				NE			3M	
120	42:32				NE			3M	
121	43:50				NE			3M	
122	44:18				W			-1	
123	44:47				W	B			
124	44:58				W	B			
125	45:03				W	B		2M	
126	45:19				W	B			
127	45:55				W				FACE ROV
128	46:51				W				APPROACH ROV
129	47:11				W				
130	47:26				W			3M	DIVE
131	47:55				W				APP ROV
132	48:10				W				
133	49:31				W				
134	51:04				W				
135	51:12				SW			5M	DIVE
136	51:49				NW			4M	
137	52:03				NW			1M	
138	52:30				N			1M	
139	52:56				W			1M	
140	53:41				N			1M	FACR ROV
141	54:30				N			1M	
142	55:34				W			1M	
143	56:09				N			1M	
144	56:26								APP ROV
145	56:39							3M	DIVE
146	57:05				N			2M	
147	58:28				N				
148	1:00:21				N				
149	1:02:52					B			
150	1:03:06				N				
151	1:04:40					B			
152	1:05:30				N				
153	1:05:33				NE				
154	1:06:01					B			
155	1:06:23							3M	DIVE
156	1:06:31					B			
157	1:06:41				NE				FACE ROV
158	1:06:54							4M	DIVE
159	1:09:12								
160	1:09:27								
161	1:09:49							2M	DIVE
162	1:09:59								APP ROV
163	1:10:12								BUMP ROV
164	1:10:43				NE			1M	
165	1:11:11								
166	1:13:04								
167	1:13:22								APP ROV
168				1:14:00					
169	1:16:20	1:46:00	1:16:20						
170									
171	1:16:20								
172	1:16:57				E			2M	
173	1:20:50				E			1M	
174	1:23:11					B			
175	1:23:54					B			
176	1:25:24					B			
177	1:26:34				W			1M	
178	1:27:15				N			1M	
179	1:27:40								APP ROV
180	1:27:49								DIVE
181	1:28:00				N			1M	
182	1:30:21					B			
183	1:30:37				N			1M	
184	1:31:03					B			
185	1:31:12							2M	DIVE
186	1:31:56					B			
187	1:32:33					B			

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
189	1:33:33				N			1M	
189	1:35:15					B			
190	1:36:06					B			
191	1:36:11							3M	
192	1:38:50							B	
193	1:39:02							B	
194	1:39:12							B	
195	1:39:22							B	
196	1:39:32							B	
197	1:39:45							B	
198	1:39:57							B	
199	1:40:05							B	
200	1:40:21							B	
201	1:40:29								DIVE
202	1:41:08							9M	
203	1:41:15							10M	
204	1:41:25							9M	APP ROV
205	1:41:38							8M	BUMP ROV
206	1:41:56							7M	BUMP ROV
207	1:42:16							5M	
208	1:42:38								DIVE
209	1:43:08							5M	
210	1:43:15							7M	
211	1:43:19							8M	
212	1-4356							6M	
213	1:44:07							4M	
214	1:44:20							2M	
215	1:44:25					B			
216	1:44:42					B			
217	1:44:56					B			
218	1:44:10					B			
219	1:44:21					B			
220	1:45:32								AT SURFACE
221	1:45: 44								DIVE
222				148:00					
223	DISC 7								
224	TURTLE 32								
225	DIVE 11								
226	2:17:32	4:41:00	2:17:32						
227	2:18:02				W			3M	
228	2:18:32				S			4M	
229	2:20:01				S			5M	
230	2:20:16				E			6M	
231	2:21:00				N			7M	
232	2:22:09				N			6M	
233	2:23:04				S			5M	
234	2:23:21				S			4M	
235	2:2717				SE			3M	
236	2:28:34				E			1M	
237	2:33:00					B			
238	2:34:16					B			
239	2:34:23							3M	
240	2:34:36							6M	
241	2:35:18				S			7M	
242	2:35:45							6M	TUCKED TAIL
243	2:36:50							6M	
244	2:37:45							5M	
245	2:38:32							4M	
246	2:39:25					B			
247	2:39:30							2M	
248	2:41:38					B			
249	2:42:08				SE			5M	
250	2:42:16				SE			6M	
251	2:43:58					B			
252	2:44:01								DIVE
253	2:44:28				E			3M	
254	2:46:07					B			
255	2:46:12								DIVE
256	2:46:29				S			4M	
257	2:50:00				E			2M	
258	2:51:18					B			
259	2:51:21								DIVE
260	2:51:55				E			4M	
261	2:52:38							2M	
262	2:53:00							1M	
263	2:53:13					B			
264	2:53:26					B			
265	2:53:30								DIVE
266	2:54:00				SE			4M	
267	2:55:02				SE			2M	
268	2:55:47					B			
269	2:55:53								DIVE
270	2:56:55				S			1M	
271	2:57:13					B			
272	2:58:08				S			3M	
273	2:59:29				SE			1M	
274	3:02:01					B			
275	3:02:05								DIVE
276	3:06:03								REGAIN CONTACT
277	3:06:52				SE			3M	
278	3:08:27				E			1M	
279	3:09:19					B			
280	3:09:21								DIVE

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
467	1:12:17				E				
468	1:12:51				E				
469	1:13:50				NE				
470	1:14:10				NE				
471	1:14:30					B			
472	1:14:35								DIVE
473	1:14:58				NE			8M	
474	1:15:12							10M	
475	1:15:32				NE			11M	
476	1:16:15							10M	
477	1:16:30							9M	
478	1:16:50							8M	
479	1:17:00							7M	
480	1:17:19							6M	
481	1:19:29							5M	
482	1:17:39				NE			4M	
483	1:17:51				NE			3M	
484	1:17:58							2M	
485	1:18:16				NE			3M	
486	1:18:45					B			
487	1:19:11							1M	
488	1:19:30							2M	
489	1:20:46					B			
490	1:20:51								DIVE
491	1:21:27				NE			7M	
492	1:21:49							9M	
493	1:22:00							10M	
494	1:22:17							12M	
495	1:22:40								SWIM TO ROV
496	1:23:19								BUMPS
497	1:23:30								BUMPS
498	1:25:46				NE			9M	
499	1:26:07							6M	
500	1:27:15							5M	
501	1:28:24							4M	
502	1:28:30				SE			3M	
503	1:28:45							2M	
504	1:29:12					B			
505	1:29:15								DIVE
506	1:30:35				N			4M	
507	1:31:22				NE			2M	
508	1:31:35								DIVE
509	1:32:04							11M	
510	1:32:27							6M	
511	1:32:39							4M	
512	1:32:45				NE			2M	
513	1:33:46				SE			1M	
514	1:33:54					B			
515	1:34:12				E			4M	
516	1:35:00							1M	
517	1:35:14					B			
518	1:35:20								DIVE
519	1:35:33							4M	
520	1:36:06							5M	
521	1:36:36							4M	
522	1:37:36					B			
523	1:37:40								DIVE
524	1:37:55							5M	
525	1:38:18							7M	
526	1:38:28							8M	
527									
528	1:38:37							9M	
529	1:38:53							10M	
530	1:39:11							11M	
531	1:39:27							12M	
532	1:39:47				NE			10M	
533	1:40:23							7M	
534	1:41:00							5M	
535									
536	1:41:31							3M	
537	1:41:40							2M	
538	1:41:56					B			
539	1:42:25							5M	
540	1:42:43							7M	
541	1:44:06							3M	
542	1:44:14							2M	
543	1:44:22							1M	
544	1:44:33					B			
545	1:44:59					B			
546	1:45:23							3M	
547	1:46:28							2M	
548	1:47:00							1M	
549	1:47:20					B			
550	1:47:33					B			
551	1:47:55				NE			2M	
552	1:48:00							3M	
553	1:49:43							1M	
554	1:49:50					B			
555	1:50:03							1M	
556	1:51:10					B			
557	1:51:29					B			
558	1:51:41					B			

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
374	4:34:13				N			9M	
375	4:35:28				E			8M	
376	4:35:59				SE				
377	4:37:00				SE			9M	
378	4:37:40				N			8M	
379	4:38:18				NW			4M	
380	4:39:05				SE			3M	
381	4:39:38				N			4M	
382	4:40:35					B			
383	4:41:32				NE			4M	
384	4:42:00				N			5M	
385	4:42:37				N			4M	
386	4:43:55				NW			4M	
387	4:44:12				NE			4M	
388	4:44:46				SW			4M	
389	4:45:08				N			3M	
390	4:45:39				E			2M	
391	4:46:00				N			1M	
392	4:46:36				SE			3M	
393	4:50:47				N			3M	
394	4:51:24					B			
395	4:51:30								DIVE
396	4:51:50				SE			7M	
397									
398	4:52:32				E			10M	
399	4:52:57				E			12M	
400	4:54:16				SE			10M	
401	4:57:00				SE			11M	
402	4:37:30								
403	5:02:25		5:02:25						
404		12:47							
405	5:02:40							7M	
406	5:04:17							12M	
407	5:04:36							16M	
408	5:05:00				N			14M	
409	5:05:44							7M	
410	5:05:06								
411	5:06:22								UNTANGLED SELF
412	5:06:45				SE			4M	
413	5:07:22							6M	
414	5:08:31							2M	
415	5:08:46					B			
416	5:08:50								DIVE
417				5:09:37					
418	5:11:19								BOTTOM SEARCH
419	5:16:25								ASCENT
420									
421									
422	**DIVE 13**								
423	**TURTLE 37**								
424									
425		1:11:53							
426	5:27:11		5:27:11						
427	5:27:53				NE			1M	
428	5:35:45				NE			1M	
429	5:36:37					B			
430	5:37:04				NE			2M	
431	5:40:13					B			
432	5:41:49				NE			1M	
433	5:44:00				NE			1M	
434	5:49:30				NE				
435	5:50:12					B			
436	5:50:19				NE			3M	
437	5:51:00				NE			2M	
438	5:51:20				NE			1M	
439	5:51:47					B			
440	5:51:56				N			2M	
441	5:55:08								
442	5:55:29				N			3M	
443	5:56:19					B			
444	5:56:36					B			
445	5:56:56				NE			2M	
446	5:57:51					B			
447	5:58:12				NE			2M	
448	5:58:43					B			
449	5:59:00				NE			2M	
450	5:59:30					B			
451	5:59:37					B			
452	6:00:35				NE				
453	6:01:41				E			1M	
454									LOST AT 26M
455									
456	**DIVE 16**								
457	**TURTLE 43**								
458	1:08:22	58:00	1:08:22						
459	1:09:04								FACE ROV
460	1:09:50								SWIM FACING ROV
461	1;10:04				N			2M	
462	1:10:18								FACE ROV
463	1;10:33				N				
464	1:11:00				SE				
465	1:11:19				NE				
466	1:11:56				N				

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
560	1:54:21					B			
561	1:54:59					B			
562	1:55:15				NE			2M	
563	1:56:22					B			
564	1:57:09					B			
565	1:57:45					B			
566	1:58:31					B			
567	1:59:34					B			
568	2:00:04					B			
569	2:01:25								
570	2:01:28								DIVE
571	2:02:40							12M	
572	2:02:50							14M	
573	2:03:12							9M	
574	2:03:46							4M	
575	2:04:00				NE			2M	
576	2:04:32					B			
577	2:04:40								DIVE
578	2:05:18							9M	
579	2:05:39							6M	
580	2:06:03							3M	
581	2:07:12					B			
582	2:07:28					B			
583	2:07:39					B			
584	2:07:41								DIVE
585	2:11:12							53M	LOST
586	2:11:36							57M	BOTTOM
587									
588									
589	DIVE 17								
590	TURTLE 43								
591	2:37:19	2:57:00	2:37:19						
592	2:38:25				NE			3M	
593	2:38:56							1M	
594	2:41:58								DIVE
595	2:42:15							3M	
596	2:44:09					B			
597	2:45:03					B			
598	2:47:16					B			
599	2:47:26				NE			2M	
600	2:48:39							1M	
601	2:49:59					B			
602	2:50:39					B			
603	2:50:45				NE			1M	
604	2:51:07					B			
605	2:52:20					B			
606	2:54:58							1M	
607	2:56:19					B			
608	2:59:38					B			
609	3:02:13					B			
610	3:02:55					B			
611	3:03:56					B			
612	3:04:58					B			
613	3:05:20				NW			2M	
614	3:05:55				NE			1M	
615	3:06:10					B			
616	3:06:50					B			
617	3:07:33					B			
618	3:08:15					B			
619	3:08:36					B			
620	3:10:05					B			
621	3:11:00					B			
622	3:11:55				NW			1M	
623	3:12:23								
624	3:13:23					B			
625	3:13:51				E			1M	
626	3:14:13					B			
627	3:14:18								
628	3:14:58					B			
629	3:16:00				W			1M	
630	3:16:58					B			
631	3:17:10								
632	3:18:21					B			
633	3:19:18					B			
634	3:20:43					B			
635	3:21:37					B			
636	3:21:45							1M	
637									
638	3:23:24					B			
639	3:23:36					B			
640	3:24:49				NE			3M	
641	3:25:12							5M	
642	3:25:20							6M	
643	3:25:47						J	9M	
644	3:26:00							8M	
645	3:26:26						J	3M	
646	3:27:12				NE			2M	
647	3:27:19							1M	
648	3:27:56								SURFACE
649	3:28:55					B			
650	3:29:23					B	J		
651	3:30:03					B	J		
652	3:30:16					B			

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
653	3:30:24					B			
654	3:31:49								DIVE
655	3:32:18								LOST
656	3:34:12							57M	BOTTOM
657	3:34:33								
658	3:35:52								FOUND TURTLE ON SONAR
659	3:36:09								EATING SOMETHING
660									(MONKEY DUNG)
661	3:36:46								PASS OVER CRAB
662	3:37:25								EATING SOMETHING
663	3:38:26								EATING
664	3:38:44								
665	3:40:56								SWIMMING ALONG BOTTOM
666	3:42:01								EATING
667	3:42:46								EATING
668	3:43:06								PASSED LING
669	3:44:00								SWIMMING ALONG
670	3:44:27								EATING
671	3:44:50								SWIMMING
672	3:45:35								EATS ROCK CRAB
673	3:46:00								EATING CRAB
674	3:48:00								CONTINUES FORAGING
675	3:48:26								EATS SOEMTHING
676	4:49:40								CONTINUES SWIMMING
677	3:50:25								EATS MONKEY DUNG?
678	3:50:47								
679	3:51:05								SWIM ALONG
680	3:50:20								
681	3:52:13								
682									ASCENDS AND IS LOST
683	TURTLE 43								
684	DIVE 18								
685	4:25:50	11:18:08	4:25:50		NW			3M	
686	4:26:36							3M	
687	4:26:59							1M	
688	4:28:00				NW				
689	4:28:48					B			
690	4:29:00							1M	
691	4:30:26							6M	
692	4:30:57							1M	
693	4:31:39				NE			1M	
694	4:33:59					B			
695	4:34:35							4M	
696	4:34:50							5M	
697	4:35:47							3M	
698	4:36:26				NE			2M	
699	4:37:00							1M	
700	4:37:19					B			
701	4:38:31					B			
702	4:39:50				NE			1M	
703	4:41:09					B			
704	4:41:32					B			
705	4:42:16				E			2M	
706	4:43:06				NE			1M	
707	4:43:49					B			
708	4:44:17								DIVE
709	4:44:32							7M	
710	4:44:55							2M	
711	4:45:38					B			
712	4:46:46							6M	DIVE
713	4:47:14				SE			7M	
714	4:49:31								EATING JELLIES
715	4:47:40							6M	
716	4:50:44							4M	
717	4:51:30							3M	
718	4:51:48							2M	
719	4:52:08					B			
720	4:52:55							3M	
721	4:53:47							4M	
722	4:55:23							2M	
723	4:55:38							1M	
724	4:55:52					B			
725	4:56:21								SURFACE
726	4:56:46					B			
727									
728	4:57:10							2M	
729	4:58:26					B			
730	4:58:59								
731	4:59:22					B			
732	5:00:24					B			
733	5:01:07								
734	5:03:42					B			
735	5:04:15					B			
736	5:04:59					B			
737	5:09:12					B			
738	5:10:00					B			
739	5:11:18					B			
740	5:15:20					B			
741	5:16:43					B			
742	5:17:47					B			
743	5:18:17					B			
744	5:18:47					B			
745	5:22:19					B			

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
746	5:22:38					B			
747	5:22:48					B			
748	5:22:58					B			
749	5:24:45					B			
750	5:25:13					B			
751	5:25:41					B			
752	5:26:06					B			
753	5:28:13								DIVE
754	5:29:04							6M	EAT JELLY
755	5:29:27							6M	APPROACH ROV
756	5:30:34							10M	
757	5:31:36							1M	
758	5:31:46					B			
759	5:32:48							7M	
760	5:35:25					B			
761	5:36:17					B			
762	5:37:02					B			
763	5:37:39					B			
764	5:38:09					B			
765	5:38:55					B			
766	5:39:42					B			
767	5:41:08					B			
768	5:43:15					B			
769	5:44:20					B			
770	5:45:17					B			
771	5:46:12					B			
772	5:51:07					B			
773	5:57:20					B			
774	5:58:49					B			
775	5:59:11					B			
776	6:00:33							3M	EATING JELLY
777	6:02:20					B			
778	6:04:10					B			
779	6:06:52					B			
780	6:09:40					B			
781	6:11:33					B			
782	6:13:00					B			
783	6:14:18					B			
784	6:16:09					B			
785	6:16:53					B			
786	6:19:17					B			
787	6:20:20					B			
788	6:20:31					B			
789	6:21:00								DIVE
790	6:21:24							7M	
791	6:22:46							1M	
792	6:24:46					B			
793	6:25:38					B			
794	6:27:59					B			
795	6:28:00								DIVE- 8M
796	6:29:30							2M	
797	6:30:05					B			
798	6:30:35					B			
799	6:31:14					B			
800	6:32:05					B			
801	6:31:14					B			
802	6:32:05								OCEANIC TRIGGER FISH
803	6:32:48								CLEANING TURTLE
804	6:34:25								
805	6:35:22								
806	6:36:05								
807	6:41:38					B			
808	6:42:40					B			
809				6:44:00					
810	6:45:26		6:45:26						
811	6:47:11					B			
812	6:47:45								BUMP ROV
813	6:48:49					B			
814	6:50:54					B			
815	6:53:58								DIVE
816	6:54:21							4M	
817	6:54:39							2M	EATS PARTICLE (ALGEA?)
818	6:55:40					B			
819	6:57:39					B			
820	7:03:26					B			
821	7:03:55					B			
822	7:04:25					B			
823	7:07:16					B			
824	7:09:05					B			
825	7:12:23					B			
826	7:12:44					B			
827	7:16:41								DIVE 7M
828	7:17:00								APP ROV
829	7:17:58							1M	
830	7:18:38							3M	
831	7:20:00							7M	
832	7:21:00							3M	
833	7:27:40					B			
834	7:28:00				N			1M	
835	7:29:24					B			
836	7:29:45					B			
837	7:30:53					B			
838	7:33:38								EATS JELLY (?)

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
839	7:34:37					B			
840	7:36:13					B			
841				7:37					LOST
842	7/13								
843	TURTLE 46								
844	DIVE 20								
845	1:22:00	1:35:61	1:22:00						
846	1:24:05							1M	FACE ROV
847	1:25:29					B			
848	1:26:11					B			
849	1:26:44					B			
850	1:27:37				S				
851	1:28:00				SE			3M	
852	1:29:32							1M	
853	1:34:46							2M	
854	1:36:16					B			
855	1:36:19								DIVE
856	1:36:40							2M	
857	1:37:05					B			
858	1:37:15					B			
859	1:37:30							2M	LOST VIDEO
860	1:39:53					B			
861	1:40:01					B			
862	1:40:22					B			
863	1:40:38					B			
864	1:41:05								DIVE
865	1:42:05								
866	1:43:47							10M	
867	1:44:53							4M	
868	1:45:00							2M	
869	1:45:13					B			
870	1:45:49							2M	
871	1:47:02					B			
872	1:47:25							1M	
873	1:47:46							2M	
874	1:48:43					B			
875	1:49:23					B			
876	1:49:29								DIVE
877	1:50:00			1:50:00					LOST ON DESCENT
878									
879	TURTLE 48								
880	DIVE 21								
881	2:44:16	3:45:00	2:44:16						
882	2:44:55				E			1M	
883	2:45:13							5M	DIVE
884	2:45:36				W			6M	
885	2:47:16							3M	
886	2:50:34				N			2M	
887	2:55:12								DIVE
888	2:55:50				S			9M	
889	2:58:06				SE			5M	
890	2:58:48				SE			3M	
891	3:00:48				SE			3M	
892	3:06:28					B			
893	3:06:30								DIVE-LOST
894	3:08:44							50M	DESCEND/SEARCH
895	3:14:27								ASCEND
896									
897	TURTLE 50								
898	DIVE 23								
899	4:17:50	10:30:00						9M	
900	4:18:22				S			9M	
901	4:18:50							6M	
902	4:19:35				S			10M	
903	4:20:00							11M	
904	4:21:28							9M	
905	4:21:50							11M	
906	4:22:07							14M	
907	4:22:26							16M	
908	4:23:10								ASCENDING
909				4:23:20					LOST
910									
911									
912	TURTLE 51								
913	DIVE 24								
914									
915	4:40:22	53:96:00	4:40:22						
916	4:41:03							2M	SWAM IN CIRCLES
917	4:43:31							3M	
918	4:44:45							3M	
919	4:48:30			4:48:30					LOST
920									
921	TURTLE 58								
922	DIVE 26								
923	17:34	2:00:03	17:34						
924	18:04							8M	
925	18:29							11M	
926	19:12							7M	
927	21:04							5M	
928	22:22				N			6M	
929	22:47				SW			4M	
930	23:57				SE			5M	
931	24:47				SE			2M	

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
932	25:45				S			1M	
933	26:47				SW			3M	
934	28:35				E			1M	
935	29:52					B			
936	30:04								DIVE
937	30:24				S			8M	
938	30:30				S			9M	
939	31:02				SE			8M	
940	31:57							6M	
941	32:05							5M	
942	32:44							4M	
943	33:17							3M	
944	33:39					B			
945	33:57					B			
946	34:13					B			
947	34:33					B			
948	35:00				SE			3M	
949	35:27				SE			4M	
950	39:00				SE			3M	
951	40:39				S			1M	
952	40:52				S			2M	
953	41:40				SE			3M	
954	44:58					B			
955									
956									
957	TURTLE # (?)								
958	DIVE 27								
959	1:18:19	3:43:00							
960	1:21:06							12M	
961	1:21:30				NE			6M	
962	1:22:30				NE			1M	
963	1:23:36								AT SURFACE
964	1:24:32							1M	
965	1:24:44				S			1M	
966	1:25:06					B			
967	1:25:09								DIVE
968	1:26:35				SW			5M	
969	1:27:02				W			6M	
970	1:27:22							6M	
971	1:29:05				S			8M	
972	1:29:22							9M	
973	1:30:15							8M	
974	1:31:20							3M	
975	1:32:20			1:32:20					LOST
976									
977	TURTLE 59								
978									
979	20:03	12:05:29							
980	2:02:33					B			
981	2:03:04				S			1M	
982	2:04:01				SE			2M	
983	2:07:54				SE			2M	
984	2:08:58				NE			2M	
985	2:10:19							1M	
986	2:10:36					B			
987	2:10:56					B			
988	2:11:00								DIVE-5M
989	2:15:16				NE			1M	
990	2:16:50					B			
991	2:17:04					B			
992	2:17:16					B			
993	2:18:11				E			3M	
994	2:19:24							3M	
995	2:21;12								AT SURFACE
996	2:22:38					B			
997	2:22:50					B			
998	2:23:07					B			
999	2:23:30					B			
1000	2:23:38					B			
1001	2:24:03					B			
1002	2:24:07					B			
1003	2:24:20					B			
1004	2:24:28					B			
1005	2:24:46					B			
1006	2:24:48								DIVE
1007	2:25:28				E			13M	
1008	2:25:49							18M	
1009	2:26:35								LOST
1010	2:26:49							45M	
1011								51M	AQUIRED BY SONAR
1012	2:30:50							51M	EATING SOMETHING IN SAND
1013	2:31:18							51M	EATING SOMETHING IN SAND
1014	2:31:37							51M	EATING SOMETHING IN SAND
1015	2:32:28							51M	EATING SOMETHING IN SAND
1016	2:32:41							51M	EATING SOMETHING IN SAND
1017	2:32:54							51M	EATING SOMETHING IN SAND
1018	2:33:28							51M	EATING SMALL CRAB
1019	2:34:11							51M	EATING SOMETHING IN SAND
1020	2:34:52							51M	EATING SOMETHING IN SAND
1021	2:35:15							51M	EATING SOMETHING IN SAND
1022	2:35:52							51M	EATING SOMETHING IN SAND
1023	2:36:15							51M	EATING SOMETHING IN SAND
1024	2:36:24							51M	EATING SOMETHING IN SAND

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
1025	2:37:04							51M	EATING SOMETHING IN SAND
1026	2:37:47							51M	EATING SOMETHING IN SAND
1027	2:38:16							51M	EATING SOMETHING IN SAND
1028	2:40:59							51M	EATING SOMETHING IN SAND
1029	2:41:37							51M	EATING SOMETHING IN SAND
1030	2:42:47							51M	EATING SOMETHING IN SAND
1031	2:43:15							51M	EATS HERMIT CRAB
1032	2:44:01							51M	EATING SOMETHING IN SAND
1033	2:44:31							51M	EATING SMALL SAND DOLLAR (?)
1034	2:45:06							51M	EATING SOMETHING IN SAND
1035	2:45:56							51M	EATING SOMETHING IN SAND
1036	2:46:38							51M	EATS CRAB
1037	2:47:08							51M	EATING
1038	2:47:35							51M	EATING
1039	2:49:32								ASCENT
1040	2:49:50								LOST
1041	2:57:09	4:35	2:57:09						AQUIRED AT SURFACE
1042	2:58:47				SE			2M	
1043	3:02:52				NE			1M	
1044	3:07:08				NE			1M	
1045	3:13:22					B			
1046	3:14:22					B			
1047	3:19:50				NE			1M	
1048	3:24:40					B			
1049	3:24:51					B			
1050	3:25:02					B			
1051	3:25:15					B			
1052	3:25:31								
1053	3:25:44					B			
1054	3:25:57					B			
1055	3:25:08					B			
1056									
1057	3:29:36				NE			3M	
1058	3:33:07				NE			3M	
1059	3:38:50				NE			3M	
1060	3:41:06				NE			2M	
1061	3:46:26								AT SURFACE
1062	3:46:46					B			
1063	3:47:10					B			
1064	3:47:30					B			
1065	3:47:50					B			
1066	3:48:15					B			
1067	3:48:36					B			
1068	3:48:51					B			
1069	3:49:11					B			
1070	3:49:30					B			
1071	3:50:14					B			
1072	3:50:34					B			
1073	3:50:51					B			
1074	3:51:10					B			
1075	3:52:40					B			
1076	3:51:57					B			
1077	3:52:17					B			
1078	3:52:22								DIVE
1079	3:53:12							17M	
1080	3:53:49							26M	
1081	3:54:38							46M	
1082	3:54:50							51M	BOTTOM
1083	3:55:25							51M	EATING
1084	3:56:18							51M	EATING
1085	3:57:46							51M	EATING
1086	3:58:32							51M	EATING
1087	3:58:57							51M	EATING HERMIT CRAB
1088	4:00:34							51M	EATING
1089	4:01:22							51M	EATING
1090	4:01:31							51M	EATING
1091	4:02:16							51M	EATING HERMIT CRAB
1092	4:02:46							51M	EATING
1093	4:03:25							51M	EATING
1094	4:03:45							51M	EATING
1095	4:05:48							51M	EATING
1096	4:06:22							51M	EATING
1097	4:09:14							51M	EATING
1098	4;11:21							51M	EATING
1099	4;13:20							51M	EATING
1100	4;14:46							51M	SWIMMING ALONG BOTTOM
1101	4;15:20							51M	SWIMMING ALONG BOTTOM
1102	4;15:37							51M	EATING
1103	4;16:14							51M	EATING CRAB
1104	4:21:09							51M	EATING
1105	4:21:39							51M	EATING
1106	4:21:53							51M	EATING
1107	4:23:46							51M	EATING
1108	4:24:10							51M	EATING
1109	4:24:28							51M	EATING
1110	4:25:13							51M	EATING
1111	4:26:06							51M	EATING
1112				4:32					LOST
1113			4:37:48		NE			2M	
1114	4:39:26							3M	
1115	4:42:38							1M	
1116	4:44:26					B			
1117	4:45:00				NE			2M	

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
1118	4:46:40				NE			3M	
1119	4:50:56				NE			3M	
1120	4:55:55				NE			3M	
1121	5:00:33							3M	
1122	5:03:21					B			
1123	5:03:38								DIVE
1124	5:03:57				NE			2M	
1125	5:08:40				NE			2M	
1126	5:13:04				NE			2M	
1127	5:17:41							2M	
1128	5:20:22								ASCENT
1129	5:20:29					B			
1130	5:20:43					B			
1131	5:20:49					B			
1132	5:21:02					B			
1133	5,21:09					B			
1134	5:21:22					B			
1135	5,21:33					B			
1136	5:21:45					B			
1137	5:21:54					B			
1138	5:22:09					B			
1139	5:22:12								DIVE
1140	5:22:33							3M	LEVEL OFF 3M
1141	5:24:10							2M	
1142	5:29:26							2M	
1143	5:35:16							2M	
1144	5:36:15							1M	
1145	5,37:13					B			
1146	5:37:31					B			
1147	5:37:40					B			
1148	5:37:55					B			
1149	5:38:10					B			
1150	5,38:26					B			
1151	5:38:39					B			
1152	5:38:44					B			
1153	5:38:51					B			
1154	5:39:10					B			
1155	5:39:25					B			
1156	5:39:41					B			
1157	5:40:00					B			
1158	5:40:15					B			
1159	5:40:37					B			
1160	5:40:43								DIVE
1161	5:41:38							48M	
1162	5:41:58							20M	
1163	5:44:12							49M	LOCATED BY SONAR
1164	5:44:28							52M	EATING
1165	5:45:11							52M	EATING
1166	5:46:27							52M	EATING
1167	5:48:11							52M	EATING
1168	5:48:28							52M	EATING
1169	5:50:06							52M	EATING
1170	5:50:25							52M	EATING
1171	5:51:42							52M	EATING
1172	5:52:04							52M	EATING
1173	5:52:38							52M	EATING
1174	5:52:59							52M	EATING
1175	5:53:39							52M	EATING
1176	5:54:12							52M	EATING
1177	5:54:38							52M	EATING
1178	5:57:01							52M	EATING HERMIT CRAB
1179	5:57:14							52M	SCALLOP SWIMS BY
1180	5:59:07							52M	EATING
1181	5:59:21							52M	EATING
1182	5:59:59							52M	EATING HERMIT
1183	6:01:37							52M	EATING
1184	6:02:16							52M	EATING
1185	6:02:40							52M	EATING HERMIT
1186	6:03:48							52M	EATING
1187	6:04:17							52M	EATING
1188	6:06:35							52M	EATING
1189	6:08:07							52M	EATING
1190	6:09:01							52M	EATING
1191	6:11:04							52M	SCALLOP SWIMMING AWAY
1192	6:11:22							52M	EATING
1193	6:13:14							52M	EATING HERMIT
1194	6:14:13								ASCENT
1195	6:15:29							20M	
1196	6:16:35							10M	
1197	6:16:45								GLIDDING
1198	6:17:33					B			
1199	6:18:12								AT SURFACE
1200	6:18:25					B			
1201	6:19:04					B			
1202	6:19:29					B			
1203	6:19:56					B			
1204	6:20:19					B			
1205	6:20:46					B			
1206	6:21:06					B			
1207	6:21:27					B			
1208	6:22:01					B			
1209	6:22:08				NE			2M	DESCEND TO 2M
1210	6:25:40				NE			1M	

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
1211	6:30:54					B			
1212	6:31:22					B			
1213	6:31:31					B			
1214	6:32:14					B			
1215	6:33:16					B			
1216	6:35:00				NE			2M	
1217	6:38:00				NE			2M	
1218	6:41:53				NE			2M	
1219	6:45:45				NE			2M	
1220	6:47:43					B			
1221	6:47:55					B			
1222	6:48:15					B			
1223	6:48:30					B			
1224	6:48:58					B			
1225	6:49:11					B			
1226	6:49:25					B			
1227	6:49:30					B			
1228	6:49:54					B			
1229	6:50:09					B			
1230	6:50:31					B			
1231	6:51:02					B			
1232	6:51:21					B			
1233	6:51:44					B			
1234	6:52:07					B			
1235	6:52:37					B			
1236	6:53:00					B			
1237	6:53:25					B			
1238	6:53:30								DIVE
1239	6:55:38							35M	
1240	6:55:57							50M	SWIMMING
1241	6:57:01								
1242	6:57:20								GRABS SOMETHING
1243	7:02:23								EATING
1244	7:03:14								SCALLOP SWIMMING
1245	7:03:35								EATING
1246	7:04:03								EATING HERMIT CRAB
1247	7:04:39								EATING
1248	7:05:23								EATING
1249	7:07:55								EATING
1250	7:08:20								EATING
1251	7:10:13								EATING
1252	7:11:59								EATING
1253	7:12:57								EATING
1254	7:13:43								EATING
1255	7:14:36								EATING
1256	7:15:33								EATING
1257	7:15:42								EATING
1258	7:16:14								EATING HERMIT CRAB
1259	7:18:05								EATING CRAB
1260	7:19:40								EATING
1261	7:20:50								EATING
1262	7:21:29								EATING
1263	7:23:00								EATING
1264	7:24:16								EATING
1265	7:24:50								EATING
1266	7:25:54								EATING
1267	7:26:38								EATING
1268	7:27:04								EATING
1269	7:28:05								EATING
1270	7:29:00								EATING
1271	7:30:14								EATING
1272	7:31:03								EATING
1273	7:32:32								EATING
1274	7:33:50								ACSENT
1275	7:37:51								
1276	7:38:01					B			
1277	7:38:15					B			
1278	7:38:25					B			
1279	7:39:30				SE			1M	
1280	7:42:40								LOST
1281	7:43:00				NE			1M	
1282	7:50:17				NE			1M	
1283	7:50:50					B		1M	
1284	7:51:21							2M	
1285	7:52:30				NE			1M	
1286	7:54:45					B			
1287	7:56:00							1M	
1288	7:58:14							4M	
1289	8:00:47				NE			1M	
1290	8:07:40				NE			1M	
1291	8:08:42					B			
1292	8:09:38								SWAM BY JELLY
1293	8:10:30								
1294	8:20:36					B			
1295	8:20:57					B			
1296	8:21:10					B			
1297	8:21:30					B			
1298	8:21:38					B			
1299	8:21:54					B			
1300	8:22:04								DESCENT
1301	8:22:35				NE			2M	
1302	8:35:43				NE			2M	
1303	8:37:15					B			

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
1304	8:37:27					B			
1305	8:37:41					B			
1306	8:37:51					B			
1307	8:38:05					B			
1308	8:38:23					B			
1309	8:38:34					B			
1310	8:38:49					B			
1311	8:39:00				NE				DESCEND TO 2M
1312	8:44:30								FACE ROV
1313	8:45:40					B			
1314	8:46:24				NE			1M	
1315	8:49:25					B			
1316	8:49:51					B			
1317	8:50:11					B			
1318	8:50:26					B			
1319	8:50:30				NE				DESCEND TO 2M
1320	9:01:14				NE			1M	
1321	9:01:55					B			
1322	9:02:15					B			
1323	9:02:20					B			
1324	9:02:29					B			
1325	9:02:43					B			
1326	9:03:01					B			
1327	9:03:31					B			
1328	9:03:38				NE				DESCEND TO 2M
1329	9:07:40					B			
1330	9:08:13					B			
1331	9:09:01				NE			1M	
1332	9:17:40					B			
1333	9:18:27					B			
1334	9:19:51					B			
1335	9:20:09					B			
1336	9:20:43					B			
1337	9:21:01					B			
1338	9:21:17					B			
1339	9:21:35					B			
1340	9:21:50					B			
1341	9:22:08					B			
1342	9:22:13								DIVE
1343	9:24:38							52M	
1344	9:25:51							52M	EATING
1345	9:26:09							52M	EATING
1346	9:26:34							52M	EATING
1347	9:28:06							52M	EATING
1348	9:28:17							52M	EATING
1349	9:29:06							52M	EATING
1350	9:29:13							52M	EATING
1351	9:30:11							52M	EATING
1352	9:32:38							52M	EATING
1353	9:34:34							52M	EATING
1354	9:35:05							52M	EATING
1355	9:35:59							52M	EATING
1356	9:36:28							52M	EATING
1357	9:36:49							52M	EATING
1358	9:37:10							52M	EATING
1359	9:37:53							52M	EATING
1360	9:38:47							52M	EATING
1361	9:40:25							52M	EATING
1362	9:41:20								
1363									
1364									
1365	**July 15**							53M	BOTTON SURVEY WITH CLUMP WT
1366	**BOTTOM SURVEY**								
1367	**DIVE 28**								
1368									
1369	5:10							53M	SHRIMP/HERMIT CRAB
1370	5:33							53M	BURROWING ANEMONES
1371	5:47							51M	HERMIT CRAB
1372	6:01							51M	SAND DOLLARS
1373	6:18							51M	HERMIT CRAB
1374	6:46							51M	GEALTINOUS MASS
1375	7:01							51M	BURROWING ANEMONE
1376	7:21							51M	HERMIT CRAB/MONKEY DUNG
1377	7:37							51M	CLOSE UP - HERMIT CRAB
1378	8:56							51M	HERMIT CRAB
1379	9:57							51M	HERMIT / SAND DOLLARS
1380	10:17							51M	HERMIT
1381	11:00							51M	CHANGE CAMERA ANGLE
1382	11:55							51M	HERMIT
1383	12:58							51M	HERMIT
1384	15:40							51M	SEA STAR
1385	16:10							51M	SEA SLUG
1386	16:58							51M	SEA SLUG
1387	18:49							51M	
1388	19:50							51M	BEGIN CIRCULAR PATTERN
1389	22:10							51M	CLUMP WT
1390									
1391									
1392	27:57								TOWARD CHUM FIELD
1393	28:18								WORMS ON SCALLOP
1394	29:32								TUBE WORM
1395	33:33								SCALLOP
1396	24:49								THRUSTER ON SCALLOP

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
1397	35:29								LITTLE MOVEMENT FROM SCALLOP
1398	35:55								SCALLOP SWIMS SHORT DISTANCE
1399	36:21								HERMIT
1400	39:08								ASCENT
1401									
1402	**TURTLE 60**								
1403	52:37				NW			4M	
1404	53:18							9M	
1405	53:30				S			13M	
1406	54:37							14M	
1407	55:11							11M	
1408	55:34				NW			8M	
1409	57:13				E			6M	
1410	58:13				E			3M	
1411	59:59				E			2M	
1412	1:03:06							1M	
1413	1;04:50								NEAR SURFACE
1414	1:04:58					B			
1415	1:05:01							1M	DIVE TO 1M
1416	1:07:13				SE			2M	
1417	1;08:45					B			
1418	1:08:51							3M	DIVE TO 3M
1419	1:10:23				SE			4M	
1420	1:16:20				SE			2M	
1421	1:17:07					B			
1422	1:17:13								DIVE
1423	1:17:43							11M	LEVEL OFF
1424	1;18:08				NE			12M	
1425	1;18:53				NE			9M	
1426	1:19:55				NE			10M	
1427	1:26:55				SE			8M	
1428	1:28:08							6M	
1429	1:28:24				SE			4M	
1430	1:28:34							3M	
1431	1:28:48					B			
1432	1:28:51							5M	DIVE TO 5M
1433	1:29:24				SE			6M	LEVEL OFF AT 6M
1434	1:29:59				SE			4M	
1435	1:34:04				SE			5M	EATING (SALP)
1436	1:35:51							4M	
1437	1:37:51				SE			2M	
1438	1:38:52					B			
1439	1:39:00							4M	LEVEL 4M
1440	1:40:51							2M	
1441	1:44:02					B			
1442	1:44:30							5M	LEVEL OFF 5M
1443	1:46:25							5M	
1444	1:50:53							4M	EATING
1445	1:52:10							2M	
1446	1:52:29					B			
1447	1:52:41							2M	LEVEL OFF 2M
1448	1:52:51				SE			3M	
1449	1:56:37					B			
1450	1:58:40					B			
1451	1:57:00							6M	DIVE
1452	1:59:34							8M	
1453	2:00:24							4M	
1454	2:01:57							1M	
1455	2:02:01					B			
1456	2:02:14							1M	
1457	2:02:29					B			
1458	2:02:38					B			
1459	2:03:04				SE			6M	
1460	2:03:13							7M	
1461	2:06:24				SE			6M	
1462	2:08:49								EATING
1463	2;08:05							7M	
1464	2:10:23							4M	
1465	2:10:55							1M	
1466	2:11:15							2M	
1467	2:11:36							5M	
1468	2:11:56							7M	
1469	2:12:50							4M	
1470	2:13:27							1M	
1471	2:13:50				SE			4M	
1472	2:14;06				SE			6M	
1473	2:14;40				SE			4M	
1474	2:15:38					B			
1475	2:16:07					B			
1476	2:16:18					B			
1477	2:17:05				SE			6M	
1478	2:17:35							5M	EATING
1479	2:24:30							2M	
1480	2:25:03							5M	
1481	2:22:14							3M	
1482	2:28:01					B			
1483	2:28:23							4M	
1484	2:28:53				SE			6M	
1485	2;34:06				SE			5M	
1486	2:34:24							3M	
1487	2:35:28							2M	
1488	2;36:17							4M	
1489	2:38:06							2M	

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
1490	2:38:28					B			
1491	2:38:49					B			
1492	2:39:00							4M	DIVE
1493	2:39:41							2M	
1494	2:39:51					B			
1495	2:40:30							6M	DIVE
1496	2:41:47								EATING
1497	2:44:48				SE			4M	
1498	2:45:54							2M	
1499	2:46:10					B			
1500	2:46:17					B			
1501	2:46:28					B			
1502	2:46:37					B			
1503	2:46:47					B			
1504	2:46:59					B			
1505	2:47:10					B			
1506	2:47:44							8M	
1507	2:47:55							9M	
1508	2:50:49				SE			3M	
1509	2:51:24							7M	
1510	2:52:49							10M	
1511	2:54:05							6M	
1512	2:54:40							5M	
1513	2:54:53							4M	
1514	2:55:08							3M	
1515	2:55:17							1M	
1516	2:55:56							5M	
1517	2:58:00							7M	
1518	3:00:54							5M	
1519	3:03:09							9M	EATING
1520	3:04:02				SE			3M	
1521	3:04:34							2M	
1522	3:04:40					B			
1523	3:04:43					B			
1524	3:04:55					B			
1525	3:05:07					B			
1526	3:05:29					B			
1527	3:06:00							2M	
1528	3:06:10					B			
1529	3:06:19					B			
1530	3:06:44							4M	
1531	3:07:04							6M	
1532	3:08:00							5M	
1533	3:09:36				SE			7M	
1534	3:10:05							5M	
1535	3:10:42							4M	
1536	3:11:51							7M	
1537	3:11:59								EATING
1538	3:12:08								EATING
1539	3:12:30							5M	
1540	3:13:00								DEFECATES
1541	3:13:09								DEFECATES
1542	3:13:23							3M	
1543	3:13:32								DEFECATES
1544	3:13:55							2M	
1545	3:15:14					B			
1546	3:15:27				SE			1M	
1547	3:15:39					B			
1548	3:16:04					B			
1549	3:16:39							7M	
1550	3:17:06							6M	
1551	3:17:57							8M	
1552	3:18:49							6M	
1553	3:24:00							1M	
1554	3:24:59					B			
1555	3:25:30				SE			3M	
1556	3:26:16					B			
1557	3:26:30							2M	
1558	3:26:55							1M	
1559	3:27:04					B			
1560	3:27:20							2M	
1561	3:27:49					B			
1562	3:28:00							3M	
1563	3:28:44					B			
1564	3:28:56					B			
1565	3:29:30							4M	
1566	3:34:44							3M	
1567	3:35:52					B			
1568	3:36:02					B			
1569	3:36:15					B			
1570	3:36:30				SE			1M	
1571	3:36:40					B			
1572	3:36:48					B			
1573	3:36:59					B			
1574	3:37:09					B			
1575	3:37:19					B			
1576	3:37:33					B			
1577	3:37:47								APPROACH ROV
1578	3:38:26				SE				6M
1579	3:39:56							9M	
1580	3:40:09							10M	
1581	3:40:15							11M	
1582	3:41:02							7M	

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
1583	3:43:29							6M	
1584	3:44:30							4M	
1585	3:45:39							2M	
1586	3:45:56					B			
1587	3:46:04					B			
1588	3:46:14					B			
1589	3:46:26					B			
1590	3:47:19					B			
1591	3:48:52					B			
1592	3:49:33							1M	
1593	3:52:23				SE			1M	
1594	3:53:20					B			
1595	3:53:31					B			
1596	3:53:39				SE			1M	
1597	3:55:26					B			
1598	3:56:20					B			
1599	3:56:40				SE			1M	
1600	3:59:58					B			
1601	4:00:08				SE			1M	
1602	4:01:30					B			
1603	4:01:40				SE			1M	
1604	4:05:08					B			
1605	4:05:18				SE			1M	
1606	4:05:41					B			
1607	4:05:50				SE			1M	
1608	4:06:56					B			
1609	4:07:17					B			
1610	4:07:28							1M	
1611	4:10:44					B		3M	
1612	4:10:50							1M	
1613	4:11:33							3M	
1614	4:12:15							1M	
1615	4:13:28				SE			8M	
1616	4:14:48							3M	
1617	4:16:45							16M	
1618	4:18:35							52M	
1619	4:19:29								BOTTOM
1620	4:20:55								EATING
1621	4:21:35								EATING HERMIT
1622	4:22:00								EATING HERMIT
1623	4:23:05								EATING
1624	4:24:00			4:24:00					LOST
1625									
1626	4:27:00								OBSERVED ON SURFACE
1627	TURTLE # (?)								
1628	5:01:32								2 TURTLES
1629	5:02:03								STAYING WITH ONE OF TWO AT 5M
1630	5:02:40								FACING ROV
1631	5:03:10								DIVING
1632	5:03:25							7M	
1633	5:03:40							10M	
1634				5:03:50					LOST
1635	5:04:20							8M	AQUIRED
1636	5:04:38				NW			8M	
1637	5:04:53				SW			10M	
1638	5:05:16				NE			12M	
1639	5:06:39				NE			9M	
1640	5:07:00				NW			10M	
1641	5:07:26				NW			8M	
1642	5:08:08							10M	
1643	5:08:18								DEFECATES
1644	5:08:55							7M	
1645	5:09:11				NE			4M	
1646	5:09:30				SE			2M	
1647	5:10:25								CAUGHT ON TETHER/RELEASE
1648	5:10:37				NW				3M
1649	5:12:04				S				4M
1650	5:13:09				S				1M
1651	5:13:23								DIVE
1652	5:13:38								4M
1653	5:14:30								3M
1654	5:14:38								2M
1655	5:14:50								DIVE
1656	5:15:12				S				5M
1657	5:15:37				SW				1M
1658	5:16:01								DIVE/ TOOK ONE LONG BREATH
1659				5:16:40					
1660	5:18:00		5:18:00						AQUIRED ON SONAR
1661	5:18:47							19M	
1662	5:19:35							20M	
1663	5:19:44							21M	
1664	5:19:57							25M	
1665	5:20:09							26M	
1666				5:20:17					LOST
1667	TURTLE # (?)								
1668	5:24:34								ASCEND
1669	5:30:12	3:19:62	5:30:12						
1670	5:30:41							20M	
1671	5:30:48							25M	
1672	5:31:33								AQUIRED ON BOTTOM
1673	5:31:55								WALKING ON BOTTOM
1674	5:32:29								ASCENT
1675				5:32:48					LOST ON ACSENT

	A	B	C	D	E	F	G	H	I
1	TIME CODE VIDEO	BV START	AQUIRED	LOST	DIRECTION	BREATHS	JELLIES	DEPTH	COMMENTS
1676	5:38:40	11:49	5:38:40						AQUIRED
1677	5:38:57								DIVING
1678	5:39:06							~2M	
1679	5:39:19							~6M	
1680	5:39:31							~9M	LEVELS OFF ~9M
1681	5:39:45							~8M	ASCENDING
1682	5:39:58				NW			~7M	
1683	5:40:29				SE			~6M	
1684	5:40:53				NE			~5M	
1685	5:41:54				W			~6M	GLIDE
1686	5:42:20				W			21M	
1687	5:42:46				NW			23M	
1688	5:43:09							27M	
1689	5:43:24								GLIDING ON DESCENT
1690	5:43:59								ON BOTTOM
1691	5:44:20								WALKING ALONG BOTTOM
1692	5:44:56								
1693	5:45:48								
1694	5:46:07								LOST ON ASCENT