Project Report

Assessing the Efficacy of the Coonamessett Farm (Cfarm) Turtle Excluder Sea Scallop Dredge in Reducing Injury to Loggerhead Sea Turtle Carcasses

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Abstract

The purpose of this project was to quantitatively evaluate the effectiveness of the Cfarm Turtle Excluder Sea Scallop Dredge allowing turtle carcasses to pass over the dredge frame while the dredge was fishing on the seafloor. This was accomplished by having divers place a series of weighted loggerhead sea turtle carcasses on the sea floor in the path of a towed scallop dredge, and then conducting 6 tows (11 passes) with the Cfarm turtle excluder dredge (equipped with video cameras to record the turtle interactions and fate of the carcasses) through the test area. Nine encounters with the turtle carcasses were documented by the video cameras. All nine carcasses hit the dredge cutting bar and/or frame and then passed over the dredge frame. Little damage was observed on the recovered carcasses.

Introduction

Sea scallop dredge gear fished in the Mid-Atlantic Region incidentally capture sea turtles (Murray 2004a, 2004b, 2005, 2007). Coonamessett Farm (Cfarm) has been working collaboratively with the scallop industry, Northeast Fisheries Science Center (NEFSC), Virginia Institute of Marine Science (VIMS), and the Southeast Fisheries Science Center (SEFSC) to mitigate the bycatch of sea turtles in the sea scallop dredge fishery. A study with twenty-two experimental cruises and 3,248 paired hauls assessed the effectiveness of "turtle chains", designed by Coonamessett Farm, affixed to sea scallop dredge gear in reducing sea turtle bycatch (DuPaul et. al., 2004). On August 25, 2006, NMFS issued a final rule to require sea scallop dredge vessels fishing south of 41° 9.0′ N. latitude between May 1 through November 30 each year to have dredges equipped with turtle chains (71 FR 50361,''chain mat rule").

Despite the implementation of the chain mat rule, there is a concern that some turtles may sustain injuries if they encounter the dredge on the seafloor and go under the dredge. Questions have also been raised about injuries turtles might sustain if, after they interacted with the dredge, they go over the dredge rather than under the cutting bar.

In response to these concerns, the sea scallop industry, working with the NEFSC, funded the development of a modified dredge designed to act as a wedge and guide turtles over the top of the dredge. The dredge design concept and prototype, developed by Coonamessett Farm, was evaluated in 2005 and 2006 in Panama City, Florida using fiberglass turtles and turtle carcasses. This work achieved success at increasing the probability of turtle carcasses going over the dredge as opposed to under the cutting bar, and resulted in several ideas for additional modifications. These dredge modifications were tested in the commercial fishery using scallop Research Set Aside (RSA) funds and have resulted in a dredge design that seems to catch more scallops and less fish bycatch. The dredge still required further testing to determine its effectiveness at causing turtle carcasses to go over the dredge while fishing on the seafloor.

The hypothesis tested in this project was that fishing with the turtle excluder scallop dredge lowered the probability of turtle injuries compared to fishing with a traditional dredge. The CFarm turtle excluder dredge is a design that was built and explored in a collaborative effort between CFarm, NERO, NEFSC, SEFSC and VIMS. The modification reduced the number of

support bars on the bale and changed the geometry of the dredge frame by moving the cutting bar forward (Fig. 1). These changes were hypothesized to decrease harmful benthic interactions with sea turtles by allowing the turtles to move up and over the frame rather than being forced under the cutting bar. The NMFS Pascagoula dive team videoed previous versions of the CFarm turtle excluder dredge encountering turtle carcasses and turtle models (Milliken et al., 2007). This CFarm turtle excluder dredge was experimentally fished in 2005 thru 2007 to assess its ability to catch scallops, and results indicate either equal or higher scallop catches (Smolowitz and Weeks, 2008). The purpose of this project was to determine if the Cfarm dredge was effective at passing sea turtle carcasses over the dredge during active fishing operations of the dredge on the seafloor.

Methods

The experiment was designed to simulate "the worst case scenario" of a dredge overtaking and hitting a motionless turtle lying on the sea floor. This scenario was achieved by having divers place turtle carcass in a marked location on the sea floor. The turtle carcasses were placed several feet apart, in a line perpendicular to the tow path. Each end of the line was marked by a surface buoy. The commercial scallop vessel, fishing the Cfarm dredge, then attempted to tow through the carcasses, with the interactions recorded on the dredge-mounted video cameras.

The vessel used in the project was the *F/V Challenge*, a 60-foot long by 20-foot beam commercial scalloper owned by Quinn Fisheries of New Bedford. The experimental dredge was an 11-foot wide version of the CFarm turtle excluder dredge, outfitted with two bale wheels and a standard set of turtle chains. The dredge was towed at 3 knots using 3:1 scope (90 feet of wire in 30 feet of water depth).

A three member dive team operated from a separate vessel. The dive team vessel anchored off one end of a line delineated at both ends by surface floats, which were anchored to the sea floor by a cement and steel filled bucket. The surface buoys, set with minimal scope, were positioned about 40 feet apart. The divers placed the turtle carcasses (initially five, but seven carcasses were used in most of the dredge evaluations) in a line between the two buoy anchors. The carcasses were spaced about 5 feet apart, starting at the windward buoy. After each dredge tow, the divers checked and realigned the carcasses. Visibility on the bottom was about ten feet at the beginning of the experiment, but decreased to only a few feet by the end, making the diver held cameras unusable.

The four dredge-mounted video cameras documented the encounters with the carcasses on the sea floor. Two camcorders were placed into underwater housings and mounted on the bale, one on each side of the center bale bar. These cameras were aimed aft to view the cutting bar and frame. A third camera, an underwater DeepSea Power & Light, Inc (DSPL) model 2060 Multi-SeaCam mounted on the port end of the dredge depressor plate, was aimed across the dredge to gain a full view of the entire bale. This camera was connected by cable to an underwater housing containing a video recorder and power pack. The fourth camera, a similar DSPL model mounted just below the top of the dredge frame at the center, was aimed ahead to view most of the dredge bale. This camera, connected by cable to a monitor and recorder on the towing vessel, provided real-time images.

The 6 tows, in which 11 passes were made, were conducted using a standard protocol. Before any of the tows were performed, the seven turtle carcasses were inspected and any pre-existing

damage recorded. The divers then placed the turtles on the seafloor (as previously described) and, after returning to the surface, would signal all was ready. The *F/V Challenge* would then set the dredge and tow between the two surface buoys favoring the windward side. The real-time camera was monitored during each tow to determine if any carcass interactions occurred. During the first three tows, only one pass was made and the dredge was hauled and cameras checked while the divers checked on the turtles. During tows 4 and 5, several dredge passes were made with the divers checking on the carcasses between each pass. During the last tow two passes were made without a diver check between the passes. After this last tow, the seven turtle carcasses were retrieved and checked for any new damage.

Results

The experimental tows reviewed in this paper were conducted in Cape Cod Bay, Massachusetts on September 9, 2008. Nine encounters with the turtle carcasses were documented on the video recordings. All nine carcasses interacted with the dredge cutting bar and/or frame and were then passed over the dredge frame. Two carcasses went over the dredge bale, while seven went underneath the bale.

Two of the carcasses appeared to have hit the hard rubber bale wheels, and were hung up for a few seconds before passing the bale (one over and one under) and over the dredge frame. This was the only evidence of potential dragging of the turtle carcasses in the experiment.

Two lobsters were observed to have come into contact with the cutting bar. Both lobsters went up and over the cutting bar; one between the cutting bar and depressor plate, and the other completely over the frame.

Very little damage was observed on the five recovered carcasses (see "Turtle Condition Sheets" Pages 13-29); two carcasses were lost during the experiment and were not evaluated.

Discussion

The experimental field results suggest that the Cfarm turtle excluder dredge was 100% effective in preventing turtle carcasses from being passed under the cutting bar. Damage to the carcasses from the dredge encounters appeared to be minimal. Live turtles may be even less likely to have an adverse encounter with this dredge as they probably exhibit a greater level of avoidance behavior than dead turtles (Palika, 1998).

Literature Cited:

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Turtle Carcass
Run-Over Log Sheet

F/V Challenge
Trip # 2008-1

Date: 9/5/08 Tow: # **1**

Tow Speed: 3.0 knots Wire Out (ft): 90 Heading: 102 Depth (ft): 32

Start Time (Dredge on bottom): 1059
Turtle Location: Lat: 41-44.623 Long: 70-21.023

End Time (Dredge on deck): 1103

Dredge Mounted Camera Operations:

#1: Starboard view aft	Model: Sony	Result: Failed
#2: Port view aft	Model: Panasonic	Result: Good
#3: Frame cross dredge	Model: 1050 DSPL	Result: Good
#4: Live view forward	Model: 2050 DSPL	Result: Good

Turtle Tag #'s: 0042, 0041, 0043, 0032, 0034

Narrative (All times are video record times; min & sec):

#2: 17:21- Dredge on bottom; good view/visibility
20:50- Dredge snags marker buoy anchor bucket
21:51- Haulback

#3: 08:25- Dredge on bottom; good view/visibility
11:48- Dredge snags marker buoy anchor bucket
13:03- Haulback

#4 02:15- Dredge on bottom
05:27- Dredge bale hits anchor bucket on portside

Turtle Carcass
Run-Over Log Sheet

F/V Challenge
Trip # 2008-1

Date: 9/5/08 Tow: # **2**

Tow Speed: 3.0 knots Wire Out (ft): 90 Heading: 098 Depth (ft): 32

Start Time (Dredge on bottom): 1128
Turtle Location: Lat: 41-44.623 Long: 70-21.023

End Time (Dredge on deck): 1134

Dredge Mounted Camera Operations:

#1: Starboard view aft	Model: Sony	Result: Shut off on bottom
#2: Port view aft	Model: Panasonic	Result: Out of focus
#3: Frame cross dredge	Model: 1050 DSPL	Result: Failed at start
#4: Live view forward	Model: 2050 DSPL	Result: Good

Turtle Tag #'s: 0042, 0041, 0043, 0032, 0034

Narrative (All times are video record times; min & sec):

#1: 05:16- Dredge on bottom; camera trips off on impact

#4: 07:26- Dredge on bottom
11:19- Haulback

Turtle Carcass
Run-Over Log Sheet

F/V Challenge
Trip # 2008-1

Date: 9/5/08 Tow: #**3**

Tow Speed: 3.0 knots Wire Out (ft): 90 Heading: 104 Depth (ft): 32

Start Time (Dredge on bottom): 1157
Turtle Location: Lat: 41-44.623 Long: 70-21.023

End Time (Dredge on deck): 1203

Dredge Mounted Camera Operations:

#1: Starboard view aft	Model: Sony	Result: Shut off on deck
#2: Port view aft	Model: Panasonic	Result: Good
#3: Frame cross dredge	Model: 1050 DSPL	Result: Good
#4: Live view forward	Model: 2050 DSPL	Result: Good

Turtle Tag #'s: 0042, 0041, 0043, 0032, 0034

Narrative (All times are video record times; min & sec):

#2: 12:23- Dredge on bottom; good view/visibility
16:12 Haulback

#3: 15:01- Dredge on bottom; good view/visibility
17:46- Turtle (**Encounter 1**) goes under starboard bale, flips over, and goes over the dredge frame barely hitting the frame.
18:04- Turtle (**Encounter 2**) goes under the end of the starboard bale, hits the cutting bar, and goes up and over the dredge frame.
18:50- Haulback

#4: 16:31- Dredge on bottom; good view/visibility
19:39- Upside down turtle (**Encounter 1**) passes under starboard bale.
20:11- Haulback

Turtle Carcass
Run-Over Log Sheet

F/V Challenge

Trip # 2008-1 Date: 9/5/08 Tow: #**4**

Tow Speed: 3.0 knots Wire Out (ft): 90 Heading: 090 Depth (ft): 32

Start Time (Dredge on bottom): 1305
Turtle Location: Lat: 41-44.623 Long: 70-21.023
End Time (Dredge on deck): 1328

Dredge Mounted Camera Operations: Three passes

#1: Starboard view aft	Model: Panasonic	Result: Poor; zoomed in
#2: Port view aft	Model: Panasonic	Result: Poor, zoomed in
#3: Frame cross dredge	Model: 1050 DSPL	Result: Good
#4: Live view forward	Model: 2050 DSPL	Result: Good

Turtle Tag #'s: 0042, 0041, 0043, 0032, 0034

Narrative (All times are video record times; min & sec):

#1: 15:32- Dredge on bottom; poor view/visibility 27:00- Haulback
32:54- Dredge back on bottom 36:02- Haulback

#2: 12:19- Dredge on bottom; poor image, zoomed in
15:14- Turtle (**Encounter 3**) hits frame and goes over 23:12- Haulback
30:00- Dredge back on bottom
31:59- Turtle (**Encounter 4**) going over frame 32:56- Haulback

#3 17:17- Dredge on bottom; good view/visibility
20:06- Turtle (**Encounter 3**) goes under the port bale, hits the cutting bar, and flips right over the dredge frame. The encounter lasts less than 2 seconds.
21:06- A lobster goes under the bale and over cutting bar into the dredge frame.
28:04- Haulback 34:51- Dredge back on bottom
36:49- Turtle (**Encounter 4**) caught in front of port bale wheel. 36:51- Turtle free from bale wheel, passes over bale and over frame.
36:52- Turtle (**Encounter 5**) going over starboard bale, hits frame and goes right over dredge in less than 1 second.

#4: 26:39- Dredge on bottom
29:30- Turtle (**Encounter 3**) passes under port bale. 36:55- Haulback
02:57- Dredge back on bottom
05:03- Turtle (**Encounter 4**) caught in front of port bale wheel.
05:05- Turtle goes over dredge frame 05:53- Haulback

Turtle Carcass
Run-Over Log Sheet

F/V Challenge

Trip # 2008-1 Date: 9/5/08 Tow # **5**

Tow Speed: 3.0 knots Wire Out (ft): 90 Heading: 090 Depth (ft): 32

Start Time (Dredge on bottom): 1433
Turtle Location: Lat: 41-44.623 Long: 70-21.023
End Time (Dredge on deck): 1503

Dredge Mounted Camera Operations: Three passes

#1: Starboard view aft	Model: Sony	Result: Camera stopped
#2: Port view aft	Model: Panasonic	Result: Good
#3: Frame cross dredge	Model: 1050 DSPL	Result: Failed
#4: Live view forward	Model: 2050 DSPL	Result: Good

Turtle Tag #'s: 0042, 0041, 0043, 0032, 0034, 0037, 0038

Narrative (All times are video record times; min & sec):

#2: 24:42- Dredge on bottom; variable visibility
28:12- Turtle (**Encounter 6**) hits cutting bar carapace first (turtle upside down) and goes right over dredge frame- good visibility.
48:19- Turtle (**Encounter 7**) hits frame and goes right over- poor visibility
51:40 Haulback

#4: 16:29- Dredge on bottom; poor visibility/glare on video
20:00- Turtle (**Encounter 6**) barely visible
30:21- Turtle (**Encounter 8**) on starboard bale wheel
30:28- Turtle (**Encounter 8**) hung up on live cam. 30:44 Clear view of the turtle
30:59 Turtle (**Encounter 8**) out of view; went over dredge frame
43:40- Haulback

Turtle Carcass
Run-Over Log Sheet

F/V Challenge

Trip # 2008-1 Date: 9/5/08 Tow: # **6**

Tow Speed: 3.0 knots Wire Out (ft): 90 Heading: 090 Depth (ft): 32

Start Time (Dredge on bottom): 1541
Turtle Location: Lat: 41-44.623 Long: 70-21.023
End Time (Dredge on deck): 1547

Dredge Mounted Camera Operations: Two passes

#1: Starboard view aft	Model: Handycam	Result: Poor; zoomed in
#2: Port view aft	Model: Panasonic	Result: Good
#3: Frame cross dredge	Model: 1050 DSPL	Result: Good
#4: Live view forward	Model: 2050 DSPL	Result: Good

Turtle Tag #'s: 0042, 0041, 0043, 0032, 0034, 0037, 0038

Narrative (All times are video record times; min & sec):

#1: 12:30 Dredge on bottom; poor view/visibility 31:22- haulback

#2: 07:24- Dredge on bottom; poor visibility
22:34- Turtle (**Encounter 9**) hits and goes right over. 26:00- Haulback

#3: 30:49- Dredge on bottom; poor visibility
37:58- Lobster hits cutting bar and goes over dredge frame
46:10- Turtle (**Encounter 9**) goes under port bale; carapace hits cutting bar and flips over frame in under one second. 49:30- haulback

#4: 02:30- Dredge on bottom; poor visibility/glare on video
15:46- Turtle (**Encounter 9**) goes under port bale
21:01- Haulback

Figure 1: Cfarm turtle excluder dredge

Figure 2: Turtle carcass encountering cutting bar (Encounter #3).

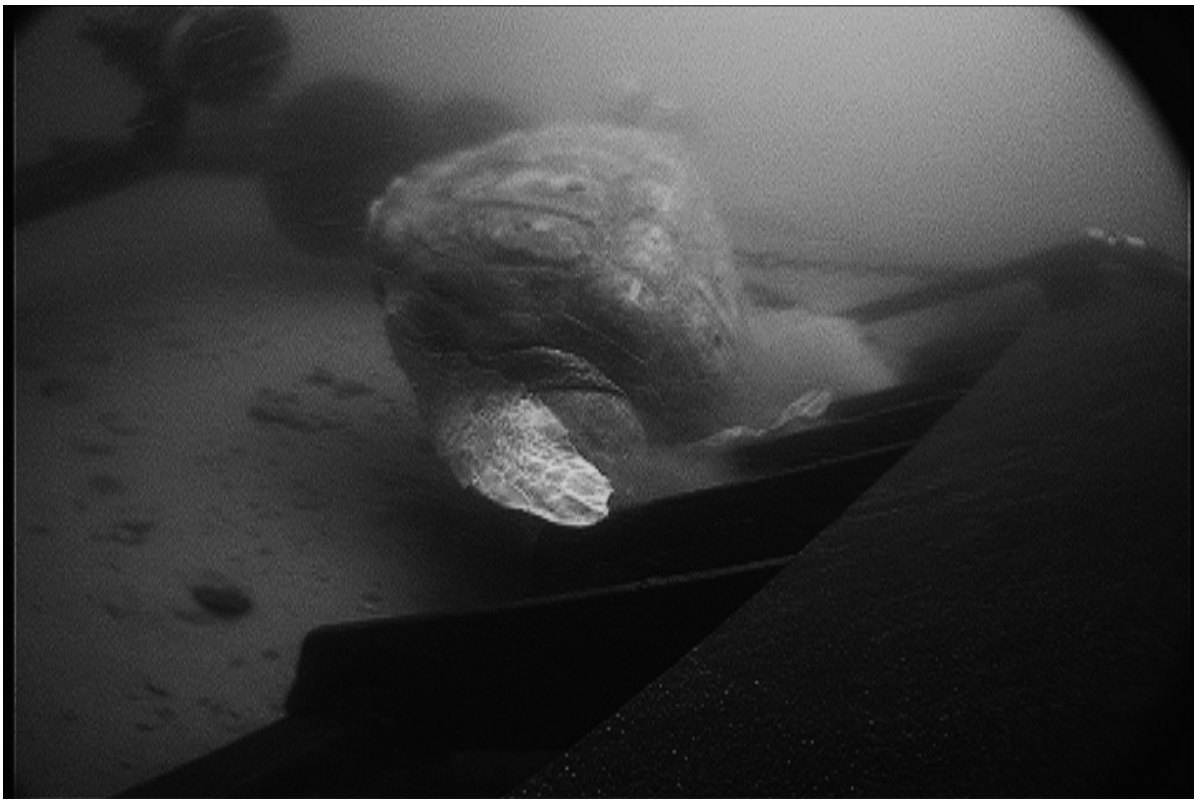


Figure 3: Same turtle carcass going up over dredge frame after cutting bar encounter.

TURTLE RUN-OVER PROJECT
TURTLE CONDITION SHEET

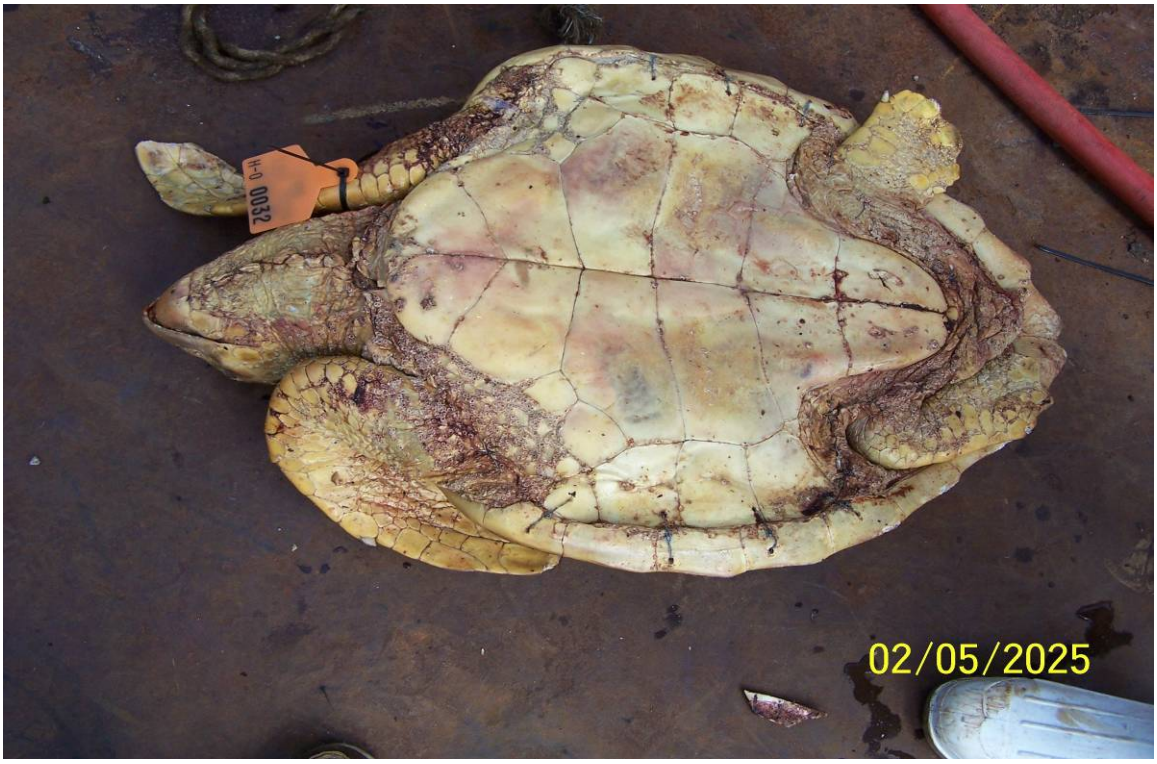
Nine turtles were available in the hold of the F/V Challenge.
Seven turtles were used. (put on the seafloor)
Five turtles were recovered. (the two missing turtle tag ID #'s are 0034 and 0043)

Tag ID # 0032

No apparent damage caused by dredge.
0032Pre

0032Post

0032Pre



0032Post

Tag ID # 0037

Posttest exam shows small chip in surface layer of carapace.

0037Pre

0037Post

0037Pre

0037Post

Tag ID # 0038

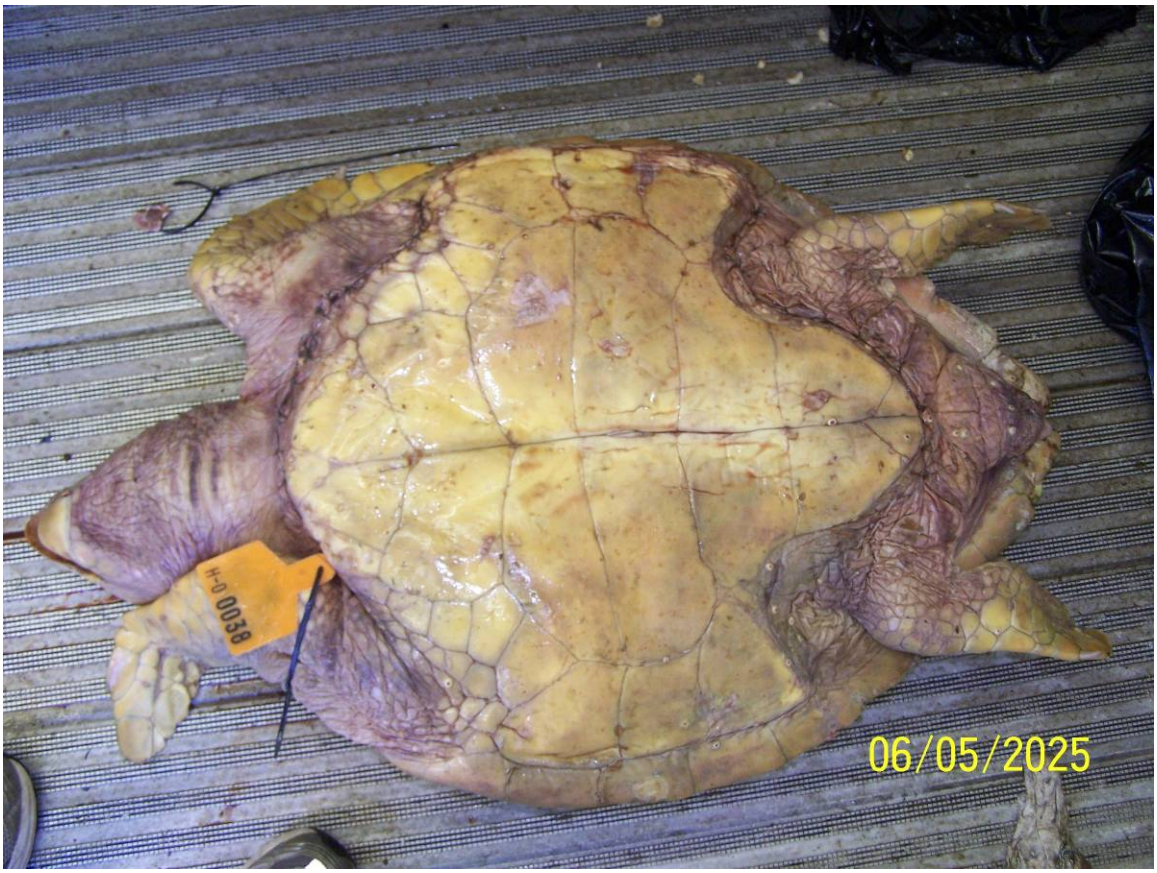
Wire sutures failed on left plastron

0038Pre

0038Post

0038Pre

0038Post



Tag ID # 0041

Wire sutures failed on left plastron. Tag was lost, but ID is clear from characteristics in the photos.

0041Pre

041Post

0041Pre

0041Post

Tag ID # 0042

No apparent damage caused by the dredge. No Pre-test dorsal photos were taken.

0042Pre

0042Post

0042Post