

Scallop Dredge Comparison Study

**Final Report
For
NMFS, Northeast Fisheries Science Center
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Submitted By

**Ronald Smolowitz and Matthew Weeks
Coonamessett Farm, Inc**

**277 Hatchville Road
East Falmouth, Massachusetts, USA 02536
508-564-5516 FAX 508-564-5073
cfarm@capecod.net**

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Executive Summary

The purpose of this contract was to provide trained scientific data collectors who collected catch information during commercial fishing trips. Since June 2007 under this contract we have sampled sixteen commercial fishing trips that were collecting RSA compensation. The trips compared the turtle excluder dredge designs to the standard New Bedford dredge; both dredge types rigged without turtle chains in areas where turtles were known to be present. These trips entailed 154 days at sea (DAS) and 1675 tow pairs observed for turtles, 841 of which were sampled for catch. During these tows, three turtles were considered takes by the turtle excluder dredge and three turtles were taken by the standard dredge. The hypothesis being tested is that fishing with the Cfarm turtle excluder dredge will result in a lower probability of turtle injuries than fishing with a standard dredge. As of the completion of this contract, insufficient data has been collected to test the hypothesis. More trips are needed to understand the ability of this dredge design on reducing injury and mortality possibly resulting from benthic sea turtle interactions and resulting catch.

1. Project Background and Description

During the last decade, fisheries observers have documented turtle interactions with the Atlantic sea scallop dredge fishery. During 2001 and 2002, NEFSC collected observer data from the Hudson Canyon Access Area and the Virginia Beach Access Area and estimated that there were 169 catches of sea turtles in scallop dredge fishery (in these two areas during 2001 and 2002). Observer coverage extended spatially in 2003 and 2004, and NEFSC estimated the number of turtle catches in the Mid-Atlantic region was 749 in 2003 (Murray 2004) and 180 in 2004 (Murray 2005).

In response to the known and estimated turtle interactions with scallop dredge gear, Coonamessett Farm with support from NMFS began investigating gear modifications that could reduce the probability and severity of sea turtle interactions. Coonamessett Farm and VIMS tested a chain mat excluder that was designed to keep turtles from entering the dredge bag and reduce the risk of injury associated with being in the dredge bag or being brought on board. In 2004, the scallop industry proposed that NMFS issue a rule to require the use of the chain mat excluder for all sea scallop dredge vessels fishing south of Long Island and North of Cape Hatteras from May 1 through October 15 each year. The chain mats have sharply reduce the capture of sea turtles in the dredge itself, as well as any ensuing injuries as a result of being caught in the dredge (*e.g.*, drowning, crushing in the dredge bag, crushing on deck, etc.). Although it is possible that the chain mat could also reduce benthic interactions, NMFS is not assuming the chain mat will reduce the number of injurious benthic interactions, such as turtles passing under the cutting bar. The industry and NMFS continue to research ways to further reduce the number and severity of turtle interactions in the scallop dredge fishery. One goal of this project is to determine whether a difference in takes between the two dredge designs can be attributed to the location where turtles may be interacting with the dredges. Analysis of scallop and fish catches was not covered under this project's contract.

2. Hypothesis/Objectives

The hypothesis being tested is that fishing with the Cfarm turtle excluder scallop dredge will result in a lower probability of turtle injuries than fishing with a traditional dredge. The paired testing would evaluate whether the Cfarm dredge reduces the number of sea turtles that are observed taken in the gear. The presumption is made that any differences in turtle catch between the two dredges is due to bottom interactions and that interaction rates during haulback are similar. If the Cfarm dredge has significantly lower catches of turtles then interactions are occurring on the sea floor and injury mitigation is probably occurring.

3. Methods

The Cfarm dredge is a design that was built and explored in a collaborative effort between Cfarm, VIMS, NERO, NEFSC, and SEFSC. 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. These changes are hypothesized to decrease harmful benthic interactions with sea turtles by allowing the turtles to move up and over the frame rather than forcing them under the cutting bar. Divers videoed this modified dredge coming in contact with turtle carcasses and turtle models during 12 successful trials (Milliken et al, 2007). In a preliminary study (SEFSC, 2005) the carcass came in contact with the modified dredge and was deflected up and over the dredge frame. In another case, the carcass got wedged under the bale bar and was forced under the cutting bar. In order to further increase the probability of turtles going over the dredge frame (rather than being crushed beneath it), this dredge design was further modified by decreasing the number of bale bars. This modified dredge was experimentally fished in 2005 under another research effort to assess its ability to catch scallops, and preliminary results suggest no significant difference in scallop catches was detected. Additional testing in September 2008 in Cape Cod bay using divers and dredge mounted cameras found the latest Cfarm turtle excluder dredge design, referenced in this document as dredge design 5, may be 100% effective in guiding turtles up and over the dredge frame based on nine encounters with turtle carcasses (Smolowitz et al, 2008).

The experimental design under this contract uses two paired dredges, one equipped with a standard dredge and one equipped with the Cfarm turtle excluder dredge. There were five variations of the turtle excluder dredge used during this project. One design change was the testing of various forms of turtle guards; additions added to the cutting bar to possibly aid turtles up and over the cutting bar. For the purpose of this project, we grouped all turtle dredge designs together. This paired design is an accepted standard in gear work and is utilized to minimize unaccountable environmental variation. Our planned statistical analysis is to use a paired t-test, which is an appropriate statistical test to use with the paired experimental design.

The number of hauls needed to detect a statistical difference (if one exists) between the traditional and modified dredges depends on how effective the modification is at reducing the number of observed turtle catches. We used a simple power analysis to estimate the number of hauls needed to detect a significant difference ($\alpha=0.05$). In the analysis we used the catch rate documented in the scallop dredge final report (DuPaul et al 2004, traditional dredge = 8 turtles in 3248 hauls), and we assumed that hauls were

independent. If the catch rate in the DuPaul study is mirrored in this upcoming study and the dredge reduces the observed turtle bycatch by 25%, then 5278 hauls would be needed to detect a significant difference between the dredges. If the dredge reduces the observed turtle bycatch by 75%, then 2030 hauls would be needed to detect a significant difference between the dredges. The number of sea days required to accomplish 5278 hauls can be approximated by dividing by 10 (9.89 observed hauls per day, based on preliminary September through December 2005 sea scallop observer data). Thus, we were planning for about 528 sea days. Higher scallop catch rates in recent years in the access areas means less tows are accomplished per trip further increasing the amount of effort required to gather the needed data.

4. Results

Coonamessett Farm arranged and coordinated sixteen trips on commercial scallop vessels and arranged for NMFS trained scientific data collectors to be onboard. A total of 154 DAS, in which 1675 paired tows (Table 1) were conducted and scallop and turtle catch monitored. Scallop and fish catch data was collected from 841 of the observed tows (Table 2). No statistical analyses were conducted under this contract however catch data has been analyzed (Smolowitz et al, 2007; Smolowitz and Weeks, 2008)

Table 1: Trip Summary for trips covered by observers funded by this contract.

Vessel/Trip #	Date Sailed	Date Landed	DAS	Total # of Tows	Dredge with Turtle	Date of Inc. Take	Tow # with Take
Friendship 2007-4	6/5/2007	6/20/2007	16	116			
Friendship 2007-5	8/22/2007	8/29/2007	8	42			
Celtic 2007-6	11/5/2007	11/13/2007	9	109			
Westport 2007-2	11/20/2007	11/29/2007	10	100			
Kathy Ann 2008-2	8/6/2008	8/12/2008	7	107	Cfarm & Standard	8/9 & 8/10	55 & 74
Tradition 2008-1	8/6/2008	8/13/2008	8	92	Cfarm		
Grand Larson 2008-1	8/19/2008	8/22/2008	4	63			
Elizabeth 2008-1	10/31/2008	11/5/2008	6	60			
Araho 2009-1	6/4/2009	6/11/2009	8	111	Standard	6/4/2009	12
Celtic 2009-1	6/11/2009	6/20/2009	10	106	Cfarm	6/12/2009	11
Generation 2009-1	6/17/2009	6/26/2009	10	38			
Kathy Ann 2009-2	6/22/2009	7/2/2009	12	118			
Generation 2009-2	7/8/2009	7/17/2009	10	41			
Kathy Ann 2009-4	7/17/2009	8/4/2009	19	203			
Westport 2009-1	8/25/2009	9/2/2009	7	130			
Kathy Ann 2009-7	9/19/2009	9/28/2009	10	239			
		Total Tows	154	1675			

Notes: No turtle chains were used on any tows.
Turtle takes recorded for all tows; scallop and fish catch on sampled tows.
Control dredges were all New Bedford (NB) style

Note: A turtle caught in a standard dredge after this contract period (Tradition 2009-2) is counted in the six takes covered by this report.

Table 2: Catch Summaries from trips testing dredge design 5 in the Mid-Atlantic region (Fish catch in numbers).

Trip	Experimental					Control						
	Scallop (bu)	Trash (bu)	L. Skate	Fourspot	Monk	Fluke	Scallop (bu)	Trash (bu)	L. Skate	Fourspot	Monk	Fluke
Kathy Ann 2008-2	185	49	171	17	6		162	47	200	11	7	
Tradition-2008-1	782	178	1982	38	90		832	173	1730	27	76	
ARAHO-2009-1	634		990	63	152		498		722	35	98	
Celtic 2009-1	94	48	127	5	14		93	46	125	7	30	
Kathy Ann 2009-2	417	1064	1812	33	93		436	1037	1366	24	102	
Generation2009-2	812	244	204	3	23		828	260	247	4	21	
Kathy Ann 2009-4	745	2290	1659	51	134		775	2325	1349	55	123	
Westport 2009-1	389	281	1268	44	162		368	287	1279	50	135	
Kathy Ann 2009-7	1271	1877	3252	73	2	60	1145	1847	3021	72	2	70
Diligence-2009-3	487	759	1990	43	40		460	698	1913	50	39	
F/V Tradition 2009-2	838	0	884		1	312	867	0	907		13	353
Celtic-2009-4	1016		483	3	3	58	1171		454	15	2	75
Diligence 2009-4	858	298	1842	17	4	141	811	294	1949	14	2	183
Totals	8527	7087	16664	390	724	571	8442	7013	15262	364	650	681
Percentages	101.00%	101.06%	109.19%	107.14%	111.38%	83.85%						

Blank spaces indicate catch was not recorded.

Dredge Design

Experimental Dredge Frame Design 3, as seen in Figures 1-7, was tested on trips Friendship 2007-4, and Friendship 2007-5. On the remaining trips, the dredge was fished without any turtle guards attached to the cutting bar (Design 5).



Figure 1. Experimental dredge design 3 with turtle guards on the cutting bar and a doubled outer bale.

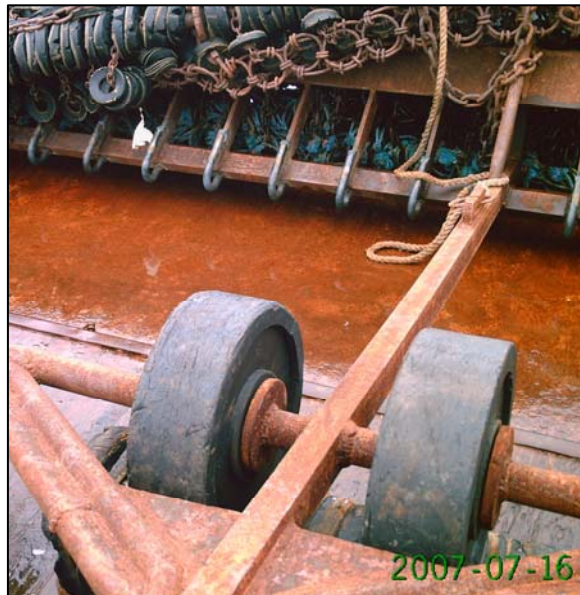


Figure 2. Wheels used on the experimental dredges had two molded 5"x 16" wheels with the axis positions 30" from top of the gooseneck.



Figure 3. Side view of shoe used; the shoe was $\frac{1}{2}$ " x 3" spring steel cut 17 $\frac{1}{2}$ " long and attached to 1 $\frac{1}{2}$ " x 3 $\frac{1}{2}$ " x 15" long bar stock



Figure 4. Space between struts measured 8 $\frac{1}{2}$ "; the spacing between the 8" depressor plate and cutting bar measure 10". The turtle guards were made of 1" hardened steel round stock and placed every 9" along struts



Figure 5. The bale extended forward 9 inches (interior measurement) before tapering to the tow point.



Figure 6. Overall view of dredge

Turtle Take Information:

Vessel/Trip ID: Araho 2009-1 **Date of Take:** 6/4/2009 **Tow #:** 12
Time: 1022 **Gear & Location of Turtle:** Standard dredge; in bag
Condition: Badly injured **Carapace Length:** 77.5 cm **Species:** Loggerhead

Commentary: A loggerhead turtle was observed inside the bag of the port (control) dredge as the captain lifted the bag over the rail of the boat and set the bag of the dredge on deck. The observer and crew removed the turtle from the chain bag. The captain had not set the dredge frame on deck yet; he held the dredge frame up in the air while the crew removed the turtle from the chain bag. The turtle was facing upside down on its carapace in the middle of the chain bag on top of the catch. The turtle was removed from the bag and placed to the side while the gear was dumped. The turtle's carapace was cracked almost its entire length and the front left flipper had quite a bit of fresh blood present. The turtle was alive, moving its head up and down, but appeared to have some pretty bad injuries.

The observer speculated that since the turtle was right on top of the catch with no scallops or bycatch on top of it and the dredge frame had not yet been let down, the turtle might have received the damage to its carapace when the dredge contacted the side of the boat while the dredge was being lifted out of the water or during the tow. The observer did not expect the turtle to survive. He took measurements, noted injuries, took pictures, identified ID characteristics, took a DNA sample, and only placed one inconel tag (#RRH306) since the turtle was likely to be brought ashore dead.

Project Leader Ron Smolowitz was contacted and he informed the vessel to transfer the turtle to the F/V Bay Star VII, which was returning to port, so that the turtle could be sent to rehabilitation. At 1500 hours the F/V Bay Star VII arrived and the turtle was transferred wrapped in a twine top. The turtle was placed carefully over the stern into the water and the other boat pulled the line in and lifted the turtle over the side. The turtle was still alive and trying to swim when pulled aboard the other vessel.

The turtle died at the rehabilitation facility several days later and underwent a necropsy.

Vessel/Trip ID: Tradition 2008-1 **Date of Take:** 08/09/2009 **Tow #:** 32
Time: 0711 **Gear & Location of Turtle:** turtle dredge; not observed
Condition: unknown **Carapace Length:** 100 cm estimated **Species:** Loggerhead

Commentary: Large loggerhead spotted on the port side by crew member during haul back after tow 32. Crewmember was on stern after hooking up when he noticed a splash while the dredge was being dumped on deck. The crewmember who initially spotted the turtle said he saw it 1 ft away from the boat as the dredge was being brought onboard. He said that it had a fresh 1 ft wound in the middle of the carapace toward the back end. He described the wound as white and seemed to be deep. No bleeding was witnessed.

Dredge was completely onboard and the vessel out of gear when turtle was first noticed. The observer and crew never saw the turtle in contact with dredge or vessel.

Turtle observed by observer from wheelhouse immediately after initial spotting. Observer initially spotted from above in wheelhouse about 40 feet away from the turtle. Turtle was in the glare of the sun the entire time, so details were difficult to witness. The observer did briefly see a crack in the carapace described in the same way when initially spotting the turtle. Large barnacles were observed on the vertebral scutes. Photos were obtained. Turtle sighted for a total of 2 minutes. Turtle was swimming away from the vessel on the surface, but seemed to have trouble making way. The observer witnessed two breaths taken by the turtle before diving. Vessel turned around to set back out and the turtle dove and not spotted again. Captain, observer, and initial spotted all saw to looked to be a fresh crack in the carapace about 1 ft long running longitudinally along dorsal scutes.

GPS log was being recorded, temperature loggers was deployed on starboard dredge, depth was 28 fathoms, weather was clear and sunny, tide was slack, wind was 10-15 northwest, boat had turned on starboard dredge, average speed was 4.5 knots. Both dredges caught 10 bushels of scallops. Several other turtles had been sighted during this day. A recreational boat was also going fast 500 yards off the vessel's starboard during the spotting. Six other scallop vessels fishing within 5 miles of sighting. Position was 38.61, -73.84

Vessel/Trip ID: Celtic 2009-1 **Date of Take:** 6/12/2009 **Tow #:** 11
Time: 0550 **Gear & Location of Turtle:** Turtle dredge; in bag
Condition: minor injuries **Carapace Length:** 83.0 cm **Species:** Loggerhead

Commentary: The loggerhead was caught on the starboard side (Turtle dredge) in the chain bag. The turtle was very active crawling around the deck; very good condition with some superficial injuries (1-inch crack in carapace and two shallow holes in plastron). The observer conducted the required sampling and let the turtle go and watched it dive right away. Two flipper tags were applied (RRT035 and RRT 036).

Vessel/Trip ID: Kathy Ann 2008-2 **Date of Take:** 8/9/2008 **Tow #:** 55
Time: 1345 **Gear & Location of Turtle:** Standard dredge; in bag
Condition: minor injuries **Carapace Length:** 80.0 cm **Species:** Loggerhead

Commentary: PSID 01- Loggerhead turtle; Carapace reddish brown in color, 2 pairs of prefrontal scales; overall body was in good condition; animal was conscious and alert and active on deck. The carapace was cracked (appeared to be new) in two locations; one crack was about an inch and a half long on the left side towards the rear; a little bit of white showing but no blood. The other carapace crack was over the right flipper about four inches long with a little blood possibly to the flesh underneath bright red in color. The observer speculated that the cracks probably occurred when dredge was dumped out. There were no other fresh wounds or scars. The turtle was caught in the control dredge.

Vessel/Trip ID: Kathy Ann 2008-2 **Date of Take:** 8/10/2008 **Tow #:** 74
Time: 1218 **Gear & Location of Turtle:** Turtle dredge; in bag **Condition:** unharmed
Carapace Length: 35 cm estimated **Species:** Unknown

Commentary: One of the crew members, Jose Guiao, threw the turtle overboard out of habit before the observer was able to identify species or take a photograph. The turtle was caught in the experimental dredge. The plastron did appear to be white from the wheelhouse along with underside of the flippers. (Tow 74 hauled @ 1218 on 8/10/2008; 38-45.8, 73-59.9). Since there was some confusion regarding this take, further interviews were conducted to ascertain the condition and fate of the turtle.

When the observer was questioned about PSID 02, by Matt Weeks and Ronald Smolowitz, she could not confirm that someone in the crew implied the turtle was dead. In her brief viewing of the turtle from the pilothouse, she thought it was a loggerhead. It should be noted that scallop crews return everything on deck, other than scallops that they keep, to the sea as fast as possible as they work through the pile of catch.

Jose Guirao was questioned, by the vessel captain and vessel fleet manager, upon landing and described the interaction and his involvement as follows: "A haul back occurred. After the dredges were emptied and put back over the side. I saw a small turtle in the pile. I approached the turtle, noticed he was fine, and released him over the side. I just reacted; I did not think. I did what I would do under a normal trip...I just made a mistake with regard to the fact that we had an observer aboard who needed to identify and be the lead with any turtle before release. The boat was not moving yet, it was before we set the gear

out again. The turtle appeared to be the same species as the previous turtle we tagged and released. The turtle was approximately 14" x 10" and weighed approximately 5-7 lbs. When the turtle was released I saw it swim away." Our preliminary conclusion from the crewmembers description was that PSID 02 could be a small loggerhead, approximately 35 cm in length that was uninjured. Due to the unusually small size for a loggerhead and lack of positive identification, it may be best to classify the turtle as "nk".

Vessel/Trip ID: Tradition 2009-2 **Date of Take:** 10/20/2009 **Tow #:** 138
Time: 0308 **Gear & Location of Turtle:** Standard dredge; in bag
Condition: unharmed **Carapace Length:** 107.5 cm **Species:** Loggerhead

Commentary: The captain hauled the dredge back and observed a turtle inside the port (control) dredge. The turtle was sitting upright on top of the catch in the center of the bag. The crew took the turtle out of the dredge bag before the frame was set down on deck. The observer photographed, scanned for PIT tags, obtained a biopsy, and measured the turtle. The observer placed two Inconel tags in the rear flippers (#RRH325 in the left; #RRH307 in the right). The turtle was alive and active trying to bite the observer. There appeared to be no damage or blood showing at all on the turtle. Four of the crew lifted the turtle and placed him back in the water. The turtle swam off appearing to be in good physical condition.

Note: All carapace measurements provided above are curved notch to tip.

Table 3: Summary of all turtle dredge research trips.

Vessel/Trip ID	Date Sailed	Date Returned	Area	Total Tows	Observed Tows	Experimental Frame	Chain Mat?
Celtic 2006-1	5/19/2006	5/21/2006	SNE open	11	11	Dredge Frame 1	No
Celtic 2006-2	5/25/2006	6/11/2006	SE part	218	92	Dredge Frame 1	No
Westport 2006-1	7/31/2006	8/6/2006	CAII	27	9	Dredge Frame 1	No
Celtic 2006-3	10/6/2006	10/18/2006	CAII	114	76	Dredge Frame 2	No
Westport 2006-2	9/14/2006	9/26/2006	CAII	162	75	Dredge Frame 2	No
Resolution 2006-1	11/7/2006		NLSA	25	14	Dredge Frame 4	No
Resolution 2006-2	11/13/2006		CAII	91	30	Dredge Frame 4	No
Resolution 2006-3	12/9/2006		Northern Edge	186	74	Dredge Frame 2	No
Nordic Pride 2007-1	1/6/2007		Northern Edge	252	98	Dredge Frame 2	No
Nordic Pride 2007-2	2/9/2007		Northern Edge	295	76	Dredge Frame 2	No
Westport 2007-1	3/28/2007		ETAA	68	45	Dredge Frame 3	No
Celtic 2007-1	4/10/2007		ETAA	32	16	Dredge Frame 3	No
Freindship 2007-1	5/15/2007	5/29/2007	HCAA	100	53	Dredge Frame 3a	Yes
Freindship 2007-2	6/5/2007	6/20/2007	HCAA	184	89	Dredge Frame 3	Yes
Freindship 2007-3	6/27/2007	7/10/2007	HCAA	161	43	Dredge Frame 3	Yes
Freindship 2007-4	6/5/2007	6/20/2007	HCAA	116	55	Dredge Frame 3	No
Freindship 2007-5	8/22/2007	8/29/2007	ETAA	42	19	Dredge Frame 3	No
Diligence 2007-1	9/20/2007		CAI	88	50	Dredge Frame 3	No
Diligence 2007-2	8/20/2007	8/27/2007	CAI	93	54	Dredge Frame 3	No
Celtic 2007-6	11/5/2007	11/13/2007	ETAA	109	60	Dredge Frame 3	No
Westport 2007-2	11/20/2007	11/29/2007	ETAA	100	60	Dredge Frame 3	No
Kathy Ann 2008-2	8/6/2008	8/12/2008	ETAA	107	12	Dredge Frame 5	No
Tradition 2008-1	8/6/2008	8/13/2008	ETAA	92	57	Dredge Frame 5	No
Grand Larson 2008-1	8/19/2008	8/22/2008	ETAA	63		Dredge Frame 5	No
Elizabeth 2008-1	10/31/2008	11/5/2008	ETAA	60		Dredge Frame 5	No
Araho 2009-1	6/4/2009	6/11/2009	ETAA	111	46	Dredge Frame 5	No
Celtic 2009-1	6/11/2009	6/20/2009	ETAA	106	8	Dredge Frame 5	No
Generation 2009-1	6/17/2009	6/26/2009	ETAA	38	17	Dredge Frame 5	No
Kathy Ann 2009-2	6/22/2009	7/2/2009	ETAA	118	61	Dredge Frame 5	No
Generation 2009-2	7/8/2009	7/17/2009	ETAA	41	23	Dredge Frame 5	No
Kathy Ann 2009-4	7/17/2009	8/4/2009	ETAA	203	106	Dredge Frame 5	No
Westport 2009-1	8/25/2009	9/2/2009	ETAA	130	39	Dredge Frame 5	No
Kathy Ann 2009-7	9/19/2009	9/28/2009	ETAA	239	109	Dredge Frame 5	No
Diligence 2009-3	9/30/2009	10/8/2009	ETAA	127	54	Dredge Frame 5	No
Tradition 2009-2	10/9/2009	10/23/2009	Delmarva	159	82	Dredge Frame 5	No
Celtic 2009-4	10/13/2009	10/26/2009	Delmarva	118	76	Dredge Frame 5	No
Diligence 2009-4	10/13/2009	10/26/2009	Delmarva	152	79	Dredge Frame 5	No
Trip Total: 37			Tow Total	4338	1868		

Table 4: Brief descriptions of turtle dredge modifications used during testing.

Dredge Frame 1	single outer bale, rebar guards, long shoe			
Dredge Frame 2	single outer bale, wheel guards, long shoe			
Dredge Frame 3	doubled outer bale, hardened guards, short shoe			
Dredge Frame 3a	doubled outer bale, wheel guards, short shoe			
Dredge Frame 4	Single Bale			
Dredge Frame 5	doubled outer bale, short shoe			

Notes:

Outer Bale: The bar that runs along the outside of the dredge from the frame to the towing point. Figure 5 shows a double bale bar while figure 6 shows a single bale bar.

Turtle guards: Loops of steel welded to the cutting bar made of rebar initially (dredge design 1) and upgraded to hardened steel in dredge design 3 as shown in the dredge figures. In dredge design 3a the turtle guards were made of rubber wheels.

Dredge shoes: The section of the dredge frame that rides along the sea floor. The short shoe was 40 cm long; the long shoe was 80 cm in length.

Vessel/Trip #	Date Sailed	Date Landed	Area	DAS	Total # of Tows	Dredge with Turtle	Take Date	Tow #	Time	Gear location	Condition	Hypothesis		
Friendship 2007-4	6/5/2007	6/20/2007	HCAA	16	116									
Friendship 2007-5	8/22/2007	8/29/2007	ETAA	8	42									
Celtic 2007-6	11/5/2007	11/13/2007		9	109									
Westport 2007-2	11/20/2007	11/29/2007		10	100									
Kathy Ann 2008-2	8/6/2008	8/12/2008	ETAA	7	107	Cfarm	8/9/2009	55	1345	In bag	minor injuries	possibly injured when dredge was dumped		
Kathy Ann 2008-2	"	"	"			Standard	8/10/2009	74	1218	In bag	unharmd			
Tradition 2008-1	8/6/2008	8/13/2008	ETAA	8	92	Cfarm								
Grand Larson 2008-1	8/19/2008	8/22/2008	ETAA	4	63									
Elizabeth 2008-1	10/31/2008	11/5/2008	ETAA	6	60									
Araho 2009-1	6/4/2009	6/11/2009	ETAA	8	111	Standard	6/4/2009	12	1022	In bag	badly injured	Caught on seafloor		
Celtic 2009-1	6/11/2009	6/20/2009	ETAA	10	106	Cfarm	6/12/2009	11	0550	In bag	minor injuries	Caught on haulback; injured on deck		
Generation 2009-1	6/17/2009	6/26/2009	ETAA	10	38									
Kathy Ann 2009-2	6/22/2009	7/2/2009	ETAA	12	118									
Generation 2009-2	7/8/2009	7/17/2009	ETAA	10	41									
Kathy Ann 2009-4	7/17/2009	8/4/2009	ETAA	19	203									
Westport 2009-1	8/25/2009	9/2/2009	ETAA	7	130									
Kathy Ann 2009-7	9/19/2009	9/28/2009	ETAA	10	239									
Diligence 2009-3	9/30/2009	10/8/2009	ETAA	8	127									
Tradition 2009-2	10/9/2009	10/23/2009	Delmarva	15	159	Standard	10/20/2009	138	0308	In bag	unharmd	Caught on haulback		
Celtic 2009-4	10/13/2009	10/26/2009	Delmarva	14	118									
Diligence 2009-4	10/13/2009	10/26/2009	Delmarva	14	152									
		Total Tows		205	2231									
Notes: No turtle chains were used on any tows.														
Turtle takes recorded for all tows; scallop and fish catch on sampled tows.														
Control dredges were all New Bedford (NB) style														

Table 5: Summary of all trips conducted during the turtle season in turtle areas without turtle chains.

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