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INTERIM REPORT

**Industry Trials of a Modified Sea Scallop Dredge
to Minimize the Catch of Sea Turtles**

Scientific Data Collectors

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Submitted to:

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Interim Report

Industry Trials of a Modified Sea Scallop Dredge to Minimize the Catch of Sea Turtles

Introduction

Until 2000, there was very little concern that there was an interaction between scallop dredge gear and sea turtles. During the summer of 2000 scallop captains started to report to their technical advisors that they were seeing sea turtles where they had rarely, if ever, seen them before and that some were coming up in the scallop dredges. Inquiries to NMFS from industry discovered two key facts; loggerhead turtle populations may be on the increase and that there were few documented takes in scallop dredges (Table 1).

During 2001, the NMFS observers recorded 11 encounters between sea scallop vessels and sea turtles in the Mid-Atlantic (5286 observed hauls). The observed take, when expanded to overall fleet effort, provided an estimate of 95 turtles taken. In comparison, high observer coverage in recent years on Georges Bank has not record any turtle interactions. In 2002, over 20 turtle takes were reported for 72 observed trips into the Hudson Canyon Closed Area. In 2003 similar take rates were observed in other areas of the Mid-Atlantic as well.

Clearly, turtles and scallop dredges were starting to have interactions. The uncertainty was how and why. Sea sampling reports that had been made public indicated that the turtles had been found wedged into forward parts of the dredge frame or in the bag where they may have been damaged by the dredge frame when the catch was dumped on deck. In addition, the turtle takes were being observed in a very limited geographical area when compared to the range of the sea scallop fishery. There were many theories of whether the interactions were occurring in the water column, on the bottom when the dredge was fishing or when the dredges were flared on the side of the vessel prior to setting.

A meeting was held at Coonamessett Farm on June 11, 2002 between NMFS, NEFMC, VIMS, and scallop industry technical advisors. After much discussion, there was general consensus on the following actions:

- (1) To produce a wheel house card to advise fishermen how to avoid interactions and how to respond to a take. Subsequently, the scallop industry and VIMS, with advice from NMFS, produced the card and distributed it to the fleet (Appendix 1).
- (2) To begin experimental testing of turtle excluder gear.
- (3) To use video camera gear to examine the behavior of turtles in association with scallop dredges.
- (4) To enhance training of NMFS observers to gain better quality data.

The development of concepts to minimize turtle interactions with sea scallop dredges had begun as soon as the scallop industry's technical advisors heard of the potential problem in 2001. The industry recognized that if a gear solution was not found to reduce the take rate; the Mid-Atlantic might have to be closed from May through October, redirecting a large amount of scalloping onto Georges Bank and Gulf of Maine. This shift in effort would have impacts on groundfish rebuilding and thus risked further limiting of scallop fishing.

Methods to Deal with Interactions:

There are three general methodologies for reducing bycatch related mortality. They are (a) separate fishing activity in time and space from the species of concern, (b) exclude the species from the gear, and (c) if caught, release the species alive by proper handling. One or more of these approaches have been applied to reducing bycatch mortalities of fish, birds, marine mammals, and turtles.

In regards to the first approach, separation, there is very little data on the actual geographic location of the turtles in real-time and little understanding of their bottom foraging capabilities on sea scallop grounds (temperature and turtle species behavior are key). Some turtles continue to migrate through our area as the season progresses; others seem to remain in one area for the season. These factors indicate that to maintain scallop fleet/turtle separation would require a fast action notification system with full participation of the scallop fleet/observers. This is costly as a regulatory system and would be a least preferred approach.

The second method, exclusion, may be the easiest to achieve. Exclusion can be achieved by gear design and operating practice; the latter near impossible to regulate but can be very effective if implemented by industry.

Gear design modifications to the scallop dredge may be the best approach. Recent efforts to exclude flatfish and skates have shown significant results and possibly some of the modifications may work for turtles as well. The addition of excluder ring panels would prevent turtles from getting caught up in the dredge frame. Reports had indicated that some turtles were hauled up on top of the gear. Many were seen to swim away when the gear reaches the vessel. This may imply that the turtles are getting snagged on the gear, either the frame or the twine top, and being prevented from escaping either by being wedged, entangled, or held by the flow of water. Stopping the dredge/vessel before hauling back is a simple operational change that may eliminate some of the potential takes. Placing bars or rings between the depressor plate and bale may prevent any wedging of turtles in the frame.

A particular gear modification that the industry thought would work was to increase the number of up and down chains between the sweep, ticklers, and dredge frame. This has the effect of preventing the bag from draping below the frame during hauling and setting; an opportune time to catch anything big in the water column.

The third methodology, handling the turtles which are taken onboard to avoid injury, can also be easily achieved on a scallop vessel. During the season and area when turtles are present, after the dredge gets to the block and in the air, the crewmen would be instructed to observe if

there is a turtle before dumping the dredge on deck. If there is a turtle the captain and crew use the other side's tackle to bring the bale over to the other side of the boat and use that side's tackle on the club stick to gently dump the contents of the bag without ever dropping the dredge or bag on deck. This or a similar protocol would prevent the crushing of turtles when the catch is dumped on deck. The wheelhouse card was used as an educational tool to accomplish this task.

Chain Design:

Industry and VIMS decided to work together on the development of turtle chains to keep turtles from entering the dredge bag as a first step in dredge modification. We developed the following initial design criteria:

- prevent turtles of >24" from entering dredge bag (6 ticklers by 11 or 13 up and downs)
- decrease the size and weight of the chains to keep impacts low
- increase chain hardness (grade) to minimize wear and stretching
- place tickler chains on top of up and down chains (allows gear to slide rather than dig)
- rubber cookies at each shackle to prevent wear
- minimize bottom impacts by keeping gear light

We calculated that an arrangement of six ticklers and eleven up and downs on a fifteen foot wide dredge would require 200 feet of chain. Even with this quantity of chain there would be as much as a 32 inch diagonal between connection points if the chains were hung in the typical rock chain fashion; draped from the sweep. The solution was to run the ticklers straight across attaching the ends to the main sweep chain. The function of the ticklers in this application is to maintain the spacing of the up and downs. The initial design was that the ticklers would be on top and thus would minimize the tendency to dig.

The following was the suggested chain grade and size:

Up and downs:	Grade: 70	Size: 5/16"	Load limit: 4700 lbs.
Ticklers:	Grade: 70	Size: 3/8"	Load limit: 6600 lbs.

Note: Grade 30 5/8" chain, common for ticklers, has a load limit of 6900 lbs.

2002 Field Trials:

In 2002, the NMFS provided limited funding to construct and test the turtle chains as a precursor to a scientific study. Five sea scallop vessels volunteered to participate in taking the turtle chains to sea for preliminary evaluation. Each vessel fished one side with and one side without the turtle chains. The higher powered vessels had higher catches with the chains; the lower powered vessels felt they had a reduced scallop catch using the chains. During the trials there were two turtle interactions. In one case the turtle was captured in the bag of the dredge without the chains. In the other case, the turtle was seen "hanging onto the chain mat when the dredge surfaced...then it swam away." The captain felt certain that the turtle would have been

captured by the dredge if not for the chain mat.

The preliminary trials were very promising and the decision was made to submit an application for scallop TAC set aside to conduct a full scale scientific experiment. This report contains the preliminary results of this project.

2003 Field Trials:

The gear trials for the turtle excluder chain dredge modifications were made possible through funding from two grants. The first was a grant made available through the NMFS Sea Scallop Research TAC Set-Aside program. This grant allowed participating vessels to recover some of the costs associated with using the turtle chains by receiving extra TAC while fishing in the Hudson Canyon Closed Area. It was also provided funds to cover the cost of the research conducted by the Virginia Institute of Marine Science (VIMS). In addition, one trip was designated as a Research Camera Cruise where underwater video was made of the modified dredge during normal fishing operations.

The Research TAC Set-Aside was augmented with a contract from NMFS, NEFSC to provide trained observers for the participating fishing vessels. The objective of this contract was to ensure that trained scientific data collectors documented both the bycatch of turtles as well as the catch of scallops and other finfish species in order to adequately determine the effectiveness of the gear modification. VIMS undertook the training of the observers by providing a full day of sea turtle biology, identification and necropsy. In addition, all observers received extensive fishing vessel safety training in accordance with the curriculum set forth by the Alaskan Marine Safety Education Association.

The experimental design for this study was straightforward. Only one of the vessel's two dredges were modified with the addition of turtle chains. The turtle chains are basically a modified rock chain arrangement constructed of lighter, but stronger chain. The vessels used 3/8" hardened steel chain in an arrangement to cover the opening of the dredge. For 14' and 15' dredges, 11 up and downs and six ticklers were used; for smaller dredges, 9 up and downs were used. Please see attached materials for a full description of the turtle chain and a photograph.

Gear trials began on July 17, 2003 and were completed on November 12, 2003. In total, a series of 15 experimental fishing trips were carried out with a total of 195 days and 2,430 observed tows. Table 2 provides a complete summary of the trips. During the study, a total of 7 turtle interactions were observed, all of them with the unmodified scallop dredge. The location and disposition of the sea turtles captured is listed in Table 3 and Figure 1. All of the captured turtles were loggerhead turtles. Of the seven, two escaped uninjured and three were released with injuries sustained during capture or during the emptying of the dredge or when the dredge was brought onboard. One of the animals was killed when the dredge frame fell on the turtle. In cases where the turtles were landed on the vessel, photographs were taken. Turtle measurements and vital statistics were recorded on a "turtle stranding form."

Scallop catches were highly variable from vessel to vessel and trip to trip (Table 4). On average, scallop losses averaged 6.8% less and the loss was statistically significant ($p < 0.001$). It

is assumed that as vessel captains become more familiar with rigging the turtle chains, catch rates will become less variable and more consistent with the dredges without the modification.

2004 Field Studies:

During the summer of 2004, we will continue the field studies and conduct 4-5 trips with one of the vessel dredges modified with the turtle chains.

Summary

In response to increasing numbers of sea turtle interactions observed by the sea scallop industry and subsequently corroborated by NMFS observers, a series of 15 experimental cruises were carried out during the summer and early fall of 2003 on the continental shelf waters of the mid-Atlantic Bight. The objective of the cruises was to examine the efficacy of a modified commercial sea scallop dredge designed to reduce the bycatch of sea turtles in the sea scallop fishery. The modification consisted of a chain mat spanning the opening of the dredge mouth. The performance of the experimental gear was assessed by comparing a modified dredge fished simultaneously with an unmodified dredge. Although additional cruises are scheduled for the summer of 2004, preliminary results indicate that the modification was successful in eliminating the bycatch of turtles with relatively small reductions in the catch of the target species. A total of 2,430 tows in 195 days at sea were observed during the trials with seven sea turtles captured in the unmodified dredge and none captured in the modified dredge. Of the tows that were sampled by the observers, the modified dredge captured significantly ($p < 0.001$) less scallops relative to the unmodified dredge. On a percentage basis, the modified dredge captured 6.8% less scallops than the unmodified dredge. It is anticipated, however, that the difference in sea scallop catches will decrease over time as industry becomes more familiar with the use of the chain configuration. These cruises demonstrated that a simple modification to the standard sea scallop dredge can be effective in eliminating the incidence of sea turtle bycatch without substantial concomitant reductions in the capture of the target species.

Ancillary Activities

The Fisheries Survival Fund and the VIMS Sea Grant Program produced two placards designed to instruct captains and crew about sea turtle interactions. Both of the placards are included as additional information to this interim report. As of May 20, 2004, over 300 of the placards designed to show the construction of the turtle chains have been distributed to vessel captains and owners. Industry has taken the proactive action of installing turtle chain dredge modification on vessels fishing in the mid-Atlantic.

Figure 1.

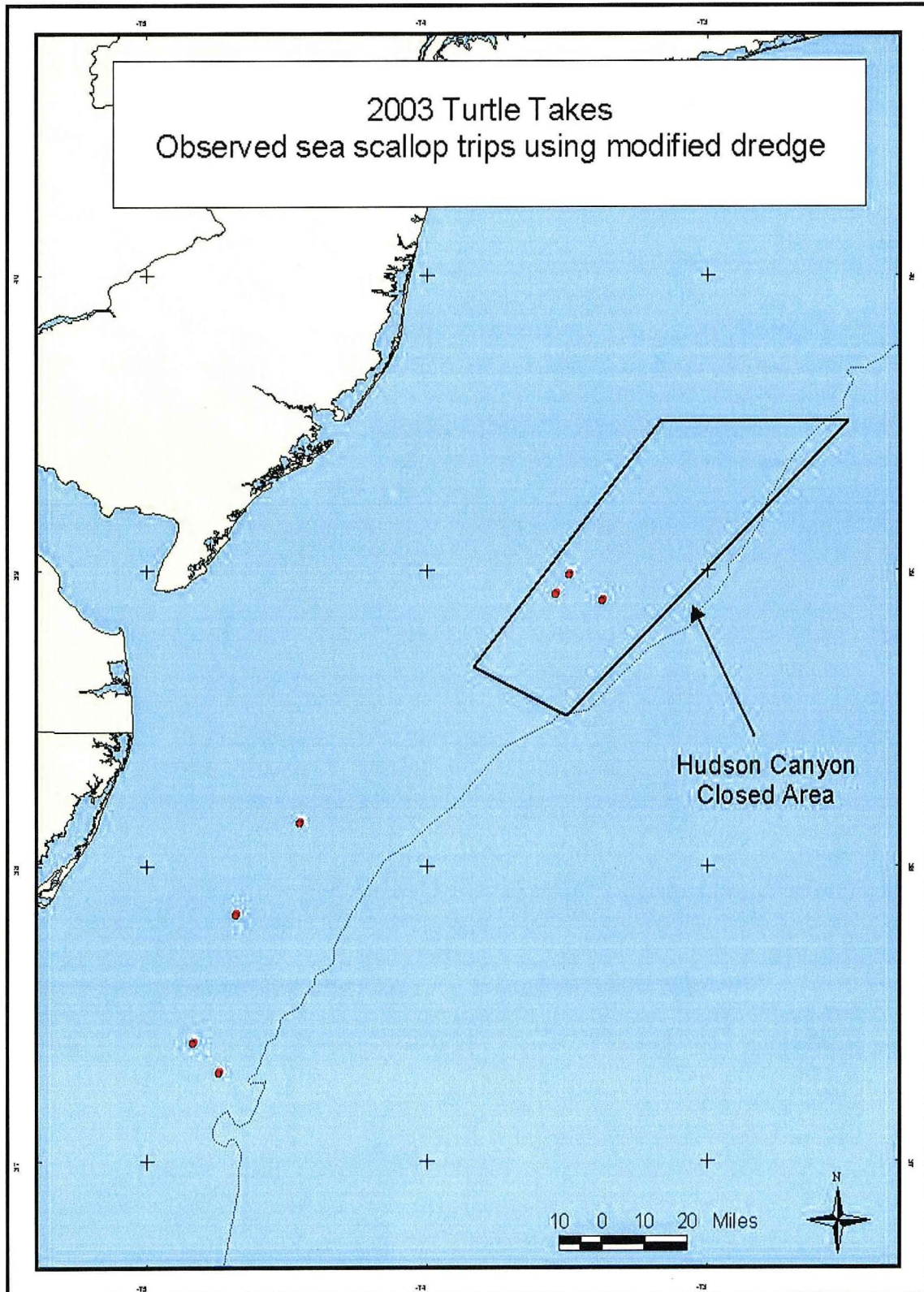


Table 1. Reports of Sea Turtle/Scallop Gear Interactions 1996-1999.

Date	Home Port	Trip	Haul	Location	Depth in fathoms	Bottom Type	Species	Characterization of Take
07/11/1996	Newport News, VA	A41022	213	36° 54 N 74°52 W	24-68	rocky	loggerhead	Live loggerhead caught on bar of starboard dredge. Washed off as dredge broke surface. Animal did not appear to be injured. Estimated length of 60 cm
09/07/1997	Barnegate Light, NJ	A24038	71	39°57 N 73°33 W	18-20	sand	green	Live green caught in forward portion of dredge and released with crowbar. Turtle sustained a crack in the carapace across the upper right lateral scutes. Animal released alive injured. Estimated length 70 cm.
09/09/1999	Cape May, NJ	B38017	30	40°06 N 73°47 W	15-18	sand	unknown	Turtle brought on board alive with a cracked carapace, possibly from rocks in the dredge. Released alive injured. Curved carapace length 106 cm.
09/15/1999	Cape May, NJ	B38017	69	40°13 N 73°46 W	16-18	sand	unknown	Severely decomposed small turtle entangled in old gillnet brought up in dredge. No measurements. Clearly not associated with dredge activity.

Table 2. Comparison of sea turtle bycatch between one dredge equipped with turtle excluder chains and one without the chain configuration on observed trips during 2003.

Trip	Vessel	Company	Date Departed	Date Returned	Trip Length	# of Tows	Turtle Interactions	
							Unmodified dredge	Modified dredge
1	Capt. Billy Haver	Captain Juan Inc.	07/11/2003	07/21/2003	11	125	1	0
2	Wilma & Irene	Peabody	07/17/2003	07/31/2003	15	220	0	0
3	Bay Star III	Ches. Bay Packing	07/28/2003	08/10/2003	14	125	0	0
4	Capt. Billy Haver	Captain Juan Inc.	07/31/2003	08/12/2003	13	154	0	0
5	Janice Lynell	Peabody	08/05/2003	08/16/2003	12	169	2	0
6	Bay Star III	Ches. Bay Packing	08/15/2003	08/28/2003	14	101	0	0
7	Capt. Billy Haver	Captain Juan Inc.	08/24/2003	09/05/2003	13	168	0	0
8	Janice Lynell	Peabody	08/26/2003	09/08/2003	14	210	1	0
9	Westport	Eastern Fisheries	08/27/2003	09/04/2003	9	93	2	0
10	Celtic	Quinn Fisheries	09/06/2003	09/18/2003	13	181	0	0
11	Kayla Rose	A J Scalloping, Inc.	09/20/2003	10/01/2003	12	151	0	0
12	O'Neal's Pride	Denny O'Neal	09/26/2003	10/16/2003	21	230	0	0
13	Kayla Rose	A J Scalloping, Inc.	10/09/2003	10/22/2003	14	173	0	0
14	Pursuit	Eastern Fisheries	09/28/2003	10/06/2003	9	107	1	0
15	Capt. Billy Haver	Captain Juan Inc.	10/24/2003	11/12/03	20	223	0	0
Total					195	2430	7	0

Table 3. Detailed information concerning sea turtle interactions during the experimental cruises comparing an unmodified dredge to one equipped with turtle excluder chains. Coordinates are in decimal degrees and depth is in fathoms.

Vessel	Date	Latitude	Longitude	Closed Area	Depth	Species	Disposition
Capt. Billy Haver	07/15/2003	37.836	74.676	no	24	Loggerhead	Dead
Janice Lynell	08/06/2003	37.302	74.741	no	28	Loggerhead	Alive Released Injured
Janice Lynell	08/13/2003	37.402	74.829	no	27	Loggerhead	Alive Released Injured
Westport	09/01/2003	38.922	73.535	yes	27	Loggerhead	Alive Released Injured
Westport	09/01/2003	38.986	73.488	yes	27	Loggerhead	Alive Escaped Uninjured
Janice Lynell	09/03/2003	38.148	74.449	no	23	Loggerhead	Dead
Pursuit	10/01/2003	38.900	73.370	yes	34	Loggerhead	Alive Escaped Uninjured

Table 4. Comparison of sea scallop catch (in bushels) between one dredge equipped with turtle excluder chains and one without the chain configuration. Scallop catch is from sampled tows on observed trips. Percent difference represents the difference in catch between the two dredges relative to the catch of the unmodified dredge.

Trip	Vessel	Company	Date Departed	Date Returned	Trip Length	# of Tows on Trip	# of Tows Sampled	Scallop Catch		% Diff
								Unmodified dredge	Modified dredge	
1	Capt. Billy Haver	Captain Juan Inc.	07/11/2003	07/21/2003	11	125	45	469.25	444.00	-5.38
2	Wilma & Irene	Peabody	07/17/2003	07/31/2003	15	220	46	334.00	259.25	-22.38
3	Bay Star III	Ches. Bay Packing	07/28/2003	08/10/2003	14	125	49	719.00	604.00	-15.99
4	Capt. Billy Haver	Captain Juan Inc.	07/31/2003	08/12/2003	13	154	58	589.80	550.50	-6.66
5	Janice Lynell	Peabody	08/05/2003	08/16/2003	12	169	51	407.66	414.50	1.68
6	Bay Star III	Ches. Bay Packing	08/15/2003	08/28/2003	14	101	77	2387.00	2360.00	-1.13
7	Capt. Billy Haver	Captain Juan Inc.	08/24/2003	09/05/2003	13	168	53	474.00	424.48	-10.45
8	Janice Lynell	Peabody	08/26/2003	09/08/2003	14	210	65	523.50	511.25	-2.34
9	Westport	Eastern Fisheries	08/27/2003	09/04/2003	9	93	15	168.00	171.25	1.93
10	Celtic	Quinn Fisheries	09/06/2003	09/18/2003	13	181	96	868.95	880.75	1.36
11	Kayla Rose	A J Scalloping, Inc.	09/20/2003	10/01/2003	12	151	67	875.00	920.00	5.14
12	O'Neal's Pride	Denny O'Neal	09/26/2003	10/16/2003	21	230	80	759.75	525.90	-30.78
13	Kayla Rose	A J Scalloping, Inc.	10/09/2003	10/22/2003	14	173	75	355.50	306.50	-13.78
14	Pursuit	Eastern Fisheries	09/28/2003	10/06/2003	9	107	23	873.00	898.00	2.86
15	Capt. Billy Haver	Captain Juan Inc.	10/24/2003	11/12/2003	20	223	68	879.75	687.75	-21.82
Total					195	2430	868	10684.16	9958.13	-6.80

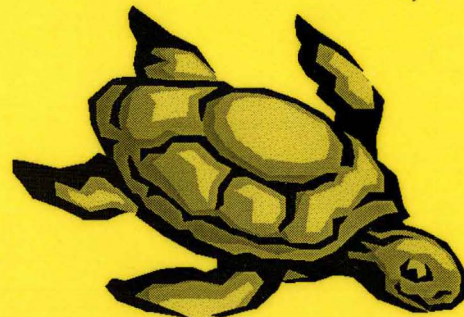
APPENDIX

Laminated Placards:

1. Wheelhouse Card: Turtle Interactions
“Sea Turtles & You: Avoiding Interactions”
2. Wheelhouse Card: Turtle Chains
“Rigging of Turtle Chains”

Sea Turtles & You:

Avoiding Interactions



It is the responsibility of each and every fishing vessel captain to avoid the capture and injury of sea turtles, which are protected under the Endangered Species Act. You can take practical measures to reduce sea turtle interactions and reduce mortality of those accidentally caught in scallop dredge gear. By working together to avoid taking turtles, we can prevent restrictive government regulations.

Sea Turtle Protection Guidelines:

- ◆ Follow these procedures when turtles are present in your operating area:
 - Do not set dredges if you see turtles in your wake; relocate to another area.
 - Alert other scallop vessels to the presence of turtles.
 - Do not steam or jog with the dredge frame in the water.
 - Stop the dredge on the way up for 30 seconds at the 10-fathom mark.
 - Observe the dredge when it comes alongside and carefully check for turtles.
 - If a turtle is in or on the dredge, handle gear carefully to avoid injury while dumping.

If You Catch a Turtle:

- ◆ Sea turtles that are actively moving or dead must be released with engines *out of gear*.
- ◆ Turtles taken must not be consumed, sold, landed, or kept below deck.
- ◆ A turtle is only considered to be dead if its muscles are stiff (rigor mortis) or the flesh is rotting. All other inactive turtles are considered to be comatose.
- ◆ Sea turtles that are comatose or inactive must be resuscitated before release:
 - Place turtle on its bottom shell right side up, and elevate hindquarters at least 6 in.
 - Periodically rock the turtle gently by lifting each side of the shell, in turn, at least 3 in.
 - Gently touch the eye and pinch the tail periodically to see if there is a response.
 - Sea turtles being resuscitated must be shaded and kept wet using damp cloths.
 - Continue resuscitation attempts for at least 4 hours and preferably, 24 hours.
- ◆ If an observer is onboard, make sure accurate and detailed information is recorded.

**Remember, comatose turtles returned to the sea will drown!
Resuscitation is a must!**

Share other ideas on ways to avoid turtle interactions.



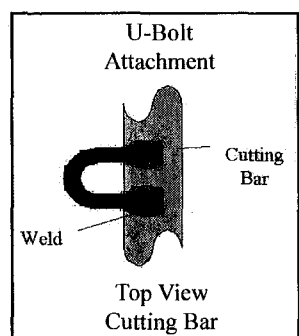
New Bedford-style scallop dredge rigged with turtle chain.

RIGGING OF TURTLE CHAINS

In 2003, as part of a cooperative research program 12 fishing trips were conducted by the scallop industry in which one dredge was modified with turtle chains. In 2,500 observed tows, seven turtles were caught, but none on the side with turtle chains.

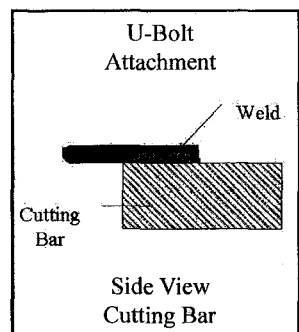
The scallop industry needs to take proactive measures to avoid sea turtle takes in order to minimize restrictions on the fishery. The preliminary success of the turtle chains strongly suggests that scallop vessels fishing between May and October south of Long Island rig turtle chains on their dredges.

The photograph on the reverse side pictures a turtle chain. As shown, it is simply a modified rock chain arrangement constructed of a lighter, but stronger, chain.



Chains: Use 3/8-inch Grade 70 or Trawlex chain, long or short link. This hardened steel chain reduces wear and stretching. It is significantly lighter but has the same breaking strength of a standard 5/8-inch sweep chain.

Hanging: Up and downs are hung from the back of the cutting bar. (See drawings.) Starting at the center and working toward each shoe, "U" bolts are welded 14 inches apart. We recommend for 14-foot to 15-foot dredges, using 11 up and downs, and on 11-foot to 13-foot dredges, using 9 up and downs.



Generally, 6 ticklers are hung running along the sweep, with the first starting at the rear of the shoes. Spaced on a normal sweep arrangement, this should give about a 12 to 13-inch square pattern.

Crossing points between the up and downs can be linked or shackled.

CAUTION: Do not hang the up and downs and ticklers tight onto the sweep; if they are too loose, however, the up and downs will get under the sweep.

We do not have a recommended action that the ticklers be placed outside or inside the up and downs. Some vessels had better luck maintaining scallop catches with the ticklers on the outside.

For additional information, call Ron Smolowitz with the Fisheries Survival Fund at (508) 564-5516, or Bill DuPaul at the Virginia Institute of Marine Science at (804) 684-7163.