

# **Testing of a Low Profile Excluder Dredge For Flatfish Bycatch Reduction**

## **A Proposal Prepared for the 2011 Sea Scallop Research Set-Aside**

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By

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## Project Summary

A new low profile concept for a scallop dredge frame has been designed and constructed based on experiences with the Cfarm turtle excluder dredge. The low profile dredge will be taken to sea on a three day research trip and the operation extensively video taped using gear mounted cameras in an area with concentrations of winter flounder. The low profile dredge frame will then be comparison fished against Cfarm turtle excluder dredge frames (which are starting to become the dredge of choice in the scallop fishery) and standard dredge frames. The testing will take place on Georges Bank, in areas of high yellowtail and winter flounder bycatch. Four commercial vessels will each make one trip of seven DAS; possibly in pairs. Other modifications to be tested will include a forward sweep chain in front of the cutting bar and wider depressor plates. All catch will be measured and then returned to the sea.

## Project Goals and Objectives

To ascertain the effectiveness of a low profile turtle excluder dredge in reducing fish bycatch rates. To investigate how forward sweeps and wider depressor plates can reduce fish bycatch rates.

## Project Management

Ronald Smolowitz, Matt Weeks	Project management, data analysis, reporting
Bill Dupaul, Dave Rudders	Field testing and biological analyses
Ronnie Enoksen, Peter Anthony	Dredge construction

All the participants will work closely with each other on all aspects of the project; the purpose of the above list is to indicate the key roles of the participants.

**Project Duration**     March 1, 2011 through February 28, 2012

## Background

The scallop resource is in good condition but time and time again the optimized scallop harvest is reduced due to fish and turtle bycatch issues resulting in the loss of millions of dollars in revenues. The introduction of yellowtail ACLs and AMs may create a very complex regulatory environment if time and area restrictions are the only tool available. AMs may even require reduction in scallop yields. Gear solutions hold out the promise of a much simpler regime.

A new concept for construction of a New Bedford style sea scallop (*Placopecten magellanicus*) dredge frame was designed and tested with the goal of keeping loggerhead sea turtles (*Carretta carreta*) from snagging on top of the dredge frame and becoming trapped under the dredge bale while the gear is towed. The dredge frame was designed to smoothly guide turtles over the top of the dredge primarily by moving the cutting bar forward and eliminating most of the bale bars (Smolowitz et al. 2010; Smolowitz et al. 2008).

From May 2006 until November 2009 a total of thirty-three trips were made on thirteen different commercial scallop vessels to test dredge modifications for impacts on scallop catch, fish bycatch, and frame durability. Five general design modifications were tested by conducting paired tows using the modified dredge design along side a standard New Bedford dredge as a control. Both the modified dredge and control dredges were fished using identical tow parameters. A total of 4,059 paired tows were conducted in which tow data and scallop catch were recorded; total catch was quantified from 40% of these tows. In addition, flume tank testing was utilized for flow characterization to determine if there were any significant differences in cutting bar and frame hydrodynamics between the various design options.

The final dredge frame design tested in the study held up to the rigors of commercial fishing on most scallop grounds, maintained commercially acceptable levels of scallop catch, had significantly lower bycatch of several species, while applying features that could reduce injury to sea turtles. In addition, this dredge design was found to be readily acceptable and applied by fishers with no increase in costs or labor.

Overall the experimental dredge design concept (cutting bar forward of depressor plate, 45° cutting bar and strut angle, doubled outer bale, and reduced number of bale bars) increased the catch of scallops while decreasing the retention of important bycatch species. Of the 1,632 observed tows analyzed (student's t test for paired means  $\alpha=0.05$ ) relative to the standard New Bedford dredge, the experimental dredges increased scallop catch by 3% ( $P = 0.0000$ ) while having significant decreases in summer flounder (-11%,  $P= 0.003$ ), yellowtail flounder (-46%,  $=0.0000$ ), winter flounder (-69%,  $P=0.0000$ ), barndoor skate (-18%,  $P= 0.0000$ ), winter skate (-20%,  $= 0.005$ ), sand dab (-47%,  $P=0.0000$ ), and fourspot flounder (-20%,  $P=0.0000$ ). Interestingly there were no significant difference in the catch of little skate (-0.3%,  $= 0.404$ ) and monkfish (1%,  $P= 0.309$ ).

## **Gear Description**

The hypothesis on why the dredge reduces flatfish bycatch is that the forward cutting bar design encourages the fish to swim upwards and over the dredge. In a standard dredge, if a flatfish encounters the cutting bar and swims up it comes into contact with the depressor plate and can only head into the dredge bag. In the forward cutting bar design the depressor plate does not block this escape route.

The new idea we are proposing to test under this proposal is to lower the profile of the dredge to make it easier for fish to swim over the oncoming frame. This will be accomplished by changing the frame angle, on a 15-foot wide dredge, from 45° to 22.5° and lowering the dredge frame height by four inches. The resulting low profile dredge frame will have a shoe 22 inches long compared to the existing standard dredge shoe of 15 inches. We will maintain the turtle excluder dredge strut spacing of 9 inches, the reduced number of bale bars, the doubled outer bale, and the 45° cutting bar angle. We may try a wider depressor plate as this should reduce the opening above the cutting bar further blocking fish entering the dredge. We have also had some success with forward sweeps on the forward cutting bar design and may conduct additional testing of this concept.

Additionally, the scallop bag will have to be redesigned to accompany the reduced height of the frame. We will decrease the number of rows in the side pieces to compensate for the height

change. Interestingly, the lower height of the frame and bag might aid in the escapement of fish that enter the dredge. To prevent a loss of scallops we may have to have the apron rings overhang the sweep which is still a common practice in the fleet.

We have received a challenge grant (\$29,000) from the Commercial Fisheries Research Foundation to start work on the low profile dredge for the purpose of reducing winter flounder bycatch in SNE. This funding covered the construction of one prototype low profile dredge, a new camera system, and a short testing trip. To date we placed the prototype dredge on a commercial trip made by the F/V Celtic and the crew found the dredge to fish as well on scallops as the Cfarm turtle excluder dredge. There was no fish bycatch to compare.

## **Statement of Work**

### **Part 1:**

The proposed low profile dredge will be designed by the project participants and constructed at Dockside Repair, Inc in New Bedford. A complete set of CAD drawings, using Solidworks software, will be made by Tor and Hans Bendiksen of Reidar's Manufacturing, New Bedford. The completed set of engineered drawings will allow the use of computer models to conduct stress and flow analyses in the future.

Under this proposed project, we would take the dredge out to sea on a three day trip to an area where the fleet is reporting the highest catches of winter flounder. We will use four dredge-mounted video cameras to document the interactions between the new dredge and encountered species. Two camcorders (Panasonic SDR-H18 and Sony DCR-SR62) will be placed into underwater housings and mounted on the bale, one on each side of the center bale bar. These cameras will be aimed aft to view the cutting bar and frame. A third camera, an underwater Deep Sea Power & Light, Inc (DSPL) model 2060 Multi-SeaCam mounted on the port end of the dredge depressor plate, will be aimed across the dredge to gain a full view of the entire bale. This camera will be connected by cable to an underwater housing containing a video recorder and power pack. The fourth camera, a similar DSPL model with underwater recorder housing, will be mounted just below the top of the dredge frame at the center and aimed ahead to view most of the dredge bale. The cameras will be re-arranged to also view into and above the dredge bag to observe fish escapement. We have used this four camera strategy before with great success.

Coonamessett Farm has been working with the NEFSC and WHOI to develop a new camera system for gear mounted observations and we expect to have this camera system available for these tests. We need to find out which species can swim forward during 4.5 knot tows and whether turbidity (caused by turtle chains) blocks their view of escape opportunities.

The video will be reviewed and documented by the scientific collaborators and results included in the project's final report and the video edited onto a DVD. Video review and editing of four cameras is a very time consuming task; any funding shortfalls will be covered by Coonamessett Farm Foundation, Inc.

**Vessel:** F/V Tradition Captain Ronnie Shrader

## **Part 2:**

There will be two types of trips during this part of the project; directed research with no retained catch and compensation trips. On all trips the dredges will conform to all existing regulations. On the directed research trips we will compare a standard New Bedford control dredge to the experimental low profile excluder dredge. The dedicated research trips will fish in the scallop special access areas within groundfish CAI and/or CAII. These areas have the highest ratios of bycatch to scallop catch for yellowtail (CAII), skates (CAI & CAII), winter flounder (CAI) and summer flounder (CAI). They also contain a range of habitat types from flat sand to occasional boulder. It is not known in what location compensation trips will be fished until the project compensation is negotiated with NMFS. Catch on compensation trips is closely monitored by the project PI's to ensure that the set-aside is not exceeded. All trips will occur between July 1 2011 and January 31, 2012.

Two dredges will be towed simultaneously during all four trips. Towing speeds will be maintained at 4.5 knots and wire scope will be three to one. Portions of some or all of these trips will have two of the participating vessels paired so that multiple comparisons can be made. When a promising design is identified we will test in a manner that would provide statistically valid results. Modifications will be tested independently and in conjunction with the dredge comparisons.

On all directed research trip tows the entire scallop catch will be counted in bushel baskets and a one basket sub-sample measured in 5 mm increments. A one bushel sample has been found to accurately represent the size of the scallops in a commercial catch (4-inch ring dredge bag) based on our previous research. The fish catch will be counted and measured, in one cm increments, by species. All scallops and fish will be returned to the sea. We will accomplish a minimum of 80 fully documented tow pairs per vessel per trip. For each area a standard tow time will be chosen based on catch rates. Particular attention will be paid to minimize variability between tows on any given trip. We may consider testing 30 minute versus 60 minute tow times (alternating tow times) to document the impact of tow time on bycatch rates. We will also try to standardize haul direction relative to tide. Our recent trip has shown this is significant in "open" gear and we hope to use our cameras to identify why this is the case.

Data from this project will be analyzed to determine differences in catch rates between dredges of target and non-target species and any differences in size selectivity of the target and non-target catch. A paired t-test at the  $\alpha=0.05$  level will be used to test for significance in catches between the standard control and experimental dredge. Multivariate problems will inevitably exist due to weather and geographic variability but the experimental design of this project limits the variance between gears by pairing tows and using newly constructed gear. We also plan to switch gear between sides at least once per trip. In addition to the paired t-test, other non-parametric statistical tests could be performed to avoid assumptions such as homogeneous distribution of the resource.

A final report will be submitted upon completion of the project. Ronald Smolowitz is the Technical Advisor to the Fisheries Survival Fund (FSF), the primary industry organization for the vast majority of the limited access sea scallop fleet. The results of this project will be disseminated to all members of the FSF. This has been shown to be an effective approach with the Cfarm turtle excluder dredge as over 100 have been placed into use without a regulatory requirement. Ronnie Enoksen is the leading dredge builder in New Bedford and we expect that improvements in dredge design will be utilized by his shop and others will follow. Tor and

Hans Bendiksen are leading dredge bag builders in the New Bedford area and will similarly apply successful results. An article will be prepared for Commercial Fisheries News and a publication will be prepared for the peer reviewed literature as results warrant. A DVD of the underwater video will be prepared for presentation to the NEFMC.

After consideration of the scope of work for the proposed project, we believe that a waiver of special access area restrictions is required. We believe an LOA is all that would be needed as catch will not be retained during the directed research trips. We have submitted an LOA/EFP request to the NERO last year which will need to be renewed. We do not plan to test undersize mesh so an exemption will not be needed. All we believe we need is an LOA authorizing us to conduct the work in CAI and CAII.

### Sea Turtle Handling

Since we plan to work on Georges Bank and we may encounter sea turtles. Ronald Smolowitz and Matt Weeks are Investigators (PI's) on the Coonamessett Farm Foundation ESA Sea Turtle Permit and have been trained in sea turtle handling/sampling. Any sea turtles brought aboard that are comatose or inactive turtles shall be handled in accordance with Sea Turtle Resuscitation Regulations at 50 CFR 223.206(d)(1). Sea turtles that are actively moving shall be released by the crew of the vessel over the stern of the boat when gear is not deployed and engine gears are in neutral position, in areas where they are unlikely to be recaptured or injured by vessels. When possible live injured turtles will be transferred to a cooperating U.S. Coast Guard Vessel and delivered to an authorized rehabilitation facility. Loggerhead turtles injured within 36 hours of anticipated return will be brought in to the dock, unless arrangements can be made for a U.S. Coast Guard vessel to pick up the animal. All sea turtle interactions will be reported.

### **Vessels**

Each vessel will make one compensation trip and one research trip under charter.

F/V Celtic	Captain Charles Quinn
F/V Westport	Captain Edward Welch
F/V Diligence	Captain Scott Larsen
F/V Tradition	Captain Ronnie Shrader

### **Specific Exemptions Requested:**

Exemption to scallop special access area closures: Four research trips into the scallop special access areas within CAI and/or CAII (no catch retained; 28 DAS fishing). This exemption is requested in that these two special access areas (CAI & CAII) are the only locations where there currently is a significant bycatch of yellowtail flounder and sea scallops. High levels of catch are needed to obtain the statistically needed sample sizes in the time allotted.

An LOA may also be required to exempt the vessel from DAS. The vessel will be under the control of Coonamessett Farm Foundation, Inc, a Massachusetts non-profit research and education entity classified by the IRS as a 501c (3) corporation. No catch will be retained for sale.

## References Cited:

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