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Fishery Resource Grants Program
Final Report

Project Title: Scallop Trawl Improvement Program

Project Investigator: Old Point Packing, Inc.

Project Goals:

1. To design and test modifications to sea scallop trawl nets enabling reduction in bycatch of regulated finfish species.
2. To test the viability of using smaller trawls, with modified sweeps, to catch larger sizes of sea scallops.

Summary of Results:

Over the course of the five trips made for this project several different designs for reducing by-catch from scallop trawls were tested. Simple holes in the top of the net were tested. Hard shooters, similar in design to TEDs (turtle excluder devise) were tested. A trawl design with a dropped back head-rope was tested. Soft shooters were also tested. As a result of this testing we have several conclusions:

- Scallops, once in the net, are prone to stay close to the bottom and sides of the webbing, while openings in the top of the net show little reduction in the catch of scallops.
- Flounder and other species can be directed out of the net after being caught by means of a fish shooter or ramp devise directing their flow towards a hole in the top of the net directly forward of the cod-end, while scallops tend to work their way into the bag.
- After first being bumped over the sweep of the net, flounder tend to find their way quickly back down to contact with the webbing, without swimming high enough to go over the head-rope and escape, even with the head-rope set back several feet.
- A "hard" style fish ramp directing the flow of fish upwards, even at sharp angles, tends to constrict the flow of caught material, distort the normal trawl shape and fill up with trash.
- A fish shooter or ramp made entirely of webbing is most effective at directing fish and trash out of the net, while still allowing the scallops to push through into the cod-end.
- A smaller net, 25 or 40 feet versus the normal 70', with a double 5/8 ", very tightly hung sweep, can catch as many scallops as a normally hung net. The size of scallops caught did not vary between the two designs, but the smaller nets "dug" better and caught less trash, indicating these designs' feasibility in trashier large scallop areas of the bottom.

Project Description

Two 70' scallop trawl nets and two 25' scallop trawl nets were first built to specifications for this project. Investigation into designs of fish and turtle excluders was undertaken. A preliminary design for a scallop trawl fish shooter was decided upon and built out of stiff but flexible vinyl piping material. During the first trip, in March of 2001, on F/V Capt. Tuck, this shooter was installed in one of the two new 70' nets and tested with the other, non-modified net as the control.

All of the testing of fish shooters used this methodology: one net with experimental gear and the other without, dragged side by side along the bottom in a double rig configuration. The comparison of the experimental gear's catch versus the control's catch indicated the effect of the various modifications.

During this first, preliminary data gathering trip, we began by opening up a hole in the top of the net forward of the cod-end to determine the loss of catch. There was little to no reduction in either scallop catch or flounder catch with a hole as big as 5' wide and 18" deep here. We then installed the stiff shooter at a 45 degree angle inside the net directly forward of the cod-end. A reduction in by-catch was seen with very little reduction in scallop catch, but the shooter showed a tendency to clog up with scallops and trash. After changing the angle of attack of the shooter from 2-1 to 3-1, its effectiveness was enhanced whilst not presenting as much of a problem with clogs.

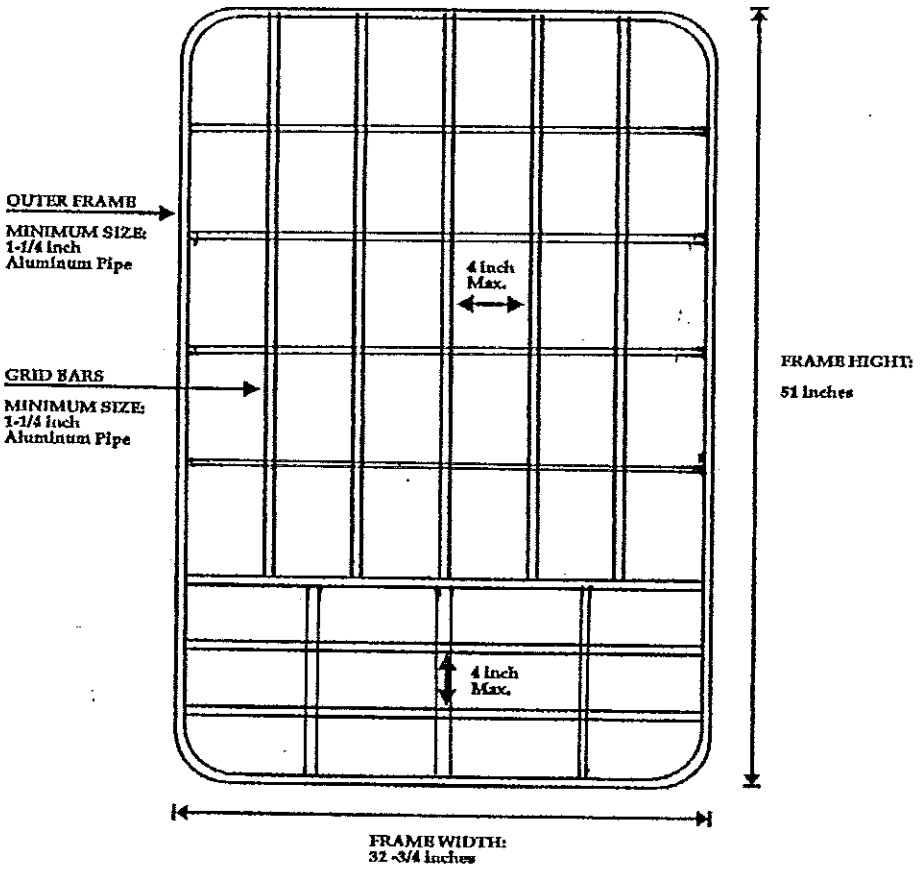
The data from this preliminary design showed a definite reduction in the retention of flounder caught in the net, while the difference in the scallop catch between the two nets was negligible.

The 25' nets were also tried during this trip. Because the doors used to spread the 2 nets were of a size designed to spread much larger nets, a chain was attached between the doors to limit their spread. Although there was time for only a few tows with the 25' nets, they shcaught scallops with very little trash, encouraging us to move forward with this portion of the project on subsequent trips.

It was decided for the next trip to concentrate solely on testing designs for fish shooters. To this end two shooters were built. The first was an aluminum Turtle Excluding Devise (TED), modified as shown below:

Figure 1.

FLOUNDER TED



The modifications were welded aluminum round stock, the same as the TED's construction, with the goal of providing fish an avenue of escape, while being strong enough to withstand the chafing of scallops going through. This shooter was installed as a TED would be, with an escape hole at the top, except without the covering flap and at a slightly greater angle, 35-40% vs 45%.

The soft shooter that we built was made from flexible combination wire rope material, with openings identical to the hard shooter above, but in a rounder shape designed to match the normal shape of that portion of the net forward of the cod-end while towing.

Testing of both these designs was done during the next project trip in November 2001 on board F/V Capt. Tuck. The hole in the top of the net was three feet for the hard shooter, then enlarged to four feet to match the increased width of the combination rope shooter. The same 70' nets were used on both sides for these trials.

Results for both of these designs were negative. The modified TED hard shooter showed promise for excluding fish while retaining scallops, but had constant problems with the aluminum panel clogging with trash. There were a few tows without a clog where by-catch showed a reduction compared to the control net, but most tows were jammed up, causing escape of scallops ahead of the shooter, distortion of the normal trawl shape while towing and excessive chafing around the area of the shooter. It became evident that the creation of smaller holes in the TED in order to force fish out the top hole also created the issue of trash, fish and scallop jams collapsing the shooter.

The "soft" shooter was then installed in the net for its test. It encountered problems immediately, as the combination rope material it was made from was too heavy to keep its shape and to allow the top shooter hole to stay open. Much effort was made to modify the way it was sowed into the net to alleviate this problem, to no avail. It was too heavy for the force of the water running through it to keep it open, and one of two things results would occur. Either it would lay flat and most everything, including the scallops would escaape out the top hole, or its compressed situation would snag caught material in the webbing, forcing bad jam-ups.

The failure of these two shooter designs to work effectively, and the reasons for the failures pointed the way towards an eventual solution to the problem. The hard shooter failed because of rigidity an inability to release larger trash from itself once caught in the openings. The inflexible way it was sowed into the net did not allow for it to lay down when hit with heavy trash, giving the trash nowhere to go as the water pressure continued to push. The combination shooter had

the opposite problem, without the rigidity to keep itself upright, and too much weight to keep the trawls shape, everything would either roll out the hole or it would jam the top of the net to bottom of the net. These problems suggested the solution, which we tested successfully during the fourth trip.

However, another design was suggested by Dave Buetel of the University of Rhode Island, which was tested on the third trip of the project. The idea was to modify the design of the scallop net in order to give flounder an opportunity to swim over the net before ever being caught within it. All scallop nets are designed with the even and identical top and bottom panels. This is a simple, sturdy and easy to repair design. All flounder nets are designed with an overhanging top line, so that when the fish are herded into the sweep area of the net, and they are forced to swim over the sweep, if they attempt to swim up and away they are still caught by the overhanging top panel of the net. The idea was to do just the opposite and drop the headrope back behind the sweep, showing the flounder stirred up by the sweep an avenue of escape overhead. To this end, using his experience designing and testing nets at the research facility at the University of Rhode Island, Mr. Buetel designed modifications to a 70' net. Mr. Buetel traveled to Virginia to build the modifications to his specifications.

In January 2002, Mr. Buetel and Dave Rudders of VIMS went with the F/V Capt. Tuck to the fishing grouds to test this hypothesis. They found an area where both flounder and fish were located and used the same methodology as before for testing: two nets pulled double rig, with one modified and one normal as the control. Over a period of four days of testing the results showed that there was no reduction in catch of either flounder or scallops with the drop back head rope modified net. The only noticeable difference was during a couple tows where an appreciable number of sea bass were caught, there seemed to be a reduction in the catch of these within the modified net. This suggests that this head-rope drop back may have more impact on bycatch reduction of groundfish species such as cod and haddock than it exhibited with flounder. The testing during this trip did confirm the finding of the first trip, namely that flounder tend to stay close to the bottom, unless given some positive push up. (This is also consistent with industry practice of using long cookie ground wires to herd flounder into nets, even though the fish have the capability of swimming over the groundwire and missing the net entirely.)

The findings from our third trip suggested what needed to be done to get a fish shooter to work on our next trip. Both the hard shooters tested showed the ability to herd flounder out a hole in the top of the net while allowing scallops to continue on into the cod-end. We believed the key to this was the stiffness of the shooters allowed the webbing to keep its shape while traveling through the water. The problem to overcome was the clogging and jam-ups occurring because of the rigidity. The solution that we decided upon was one that has been used by southern shrimpers in the past to provide an escape hatch for problem quantities of seaweed and trash fish. A simple panel of webbing placed across the extension of a shrimp net, sometimes angled toward the bottom of the net toward a hole is known as a bottom shooter. The same panel of webbing is sometimes installed angling toward the top of the net, as in our previous designs. The bottom shooter wouldn't work for scallops because, unlike shrimp, scallops are always trying to stay close to the sea-bed, which would only give them an avenue of escape.

We decided on trying the basic shrimp top shooter design. There were two areas of concern in modifying the design for our purposes. The first consideration was to use a twine for the panel that was tough enough to withstand the chafing of scallops running through, but light enough to have little effect on the shape and pull of the net as it ran through the water. The second consideration was to design a hole in the top of the net that would allow fish and trash to escape, while not adversely affecting the water pressure holding the proper shape of the net.

We decided to try 5mm webbing, with core, in both 8" and 10" sizes. We needed to find out which size twine would work best for herding flounder, while still allowing scallops to pass through without clogging. We decided on a longitudinal hole in the top of the net instead of the transverse hole we employed in our previous designs. We felt this disrupt the shape and strength of the webbing the least while providing for a more flexible escape route.

We tested these designs during our four day trip aboard the R/V Blue Fin in April 2003. We started with the 8" twine panel sowed in as follows: Starting in the bottom of the net, one mesh ahead of the cod-end, the panel was sowed in straight across the bottom panel from seam to seam, then cutting and sewing the shooter panel into the top panel of the net with a 4-1 taper up towards the front of the net. This makes for a triangular shape shooter panel, running from all

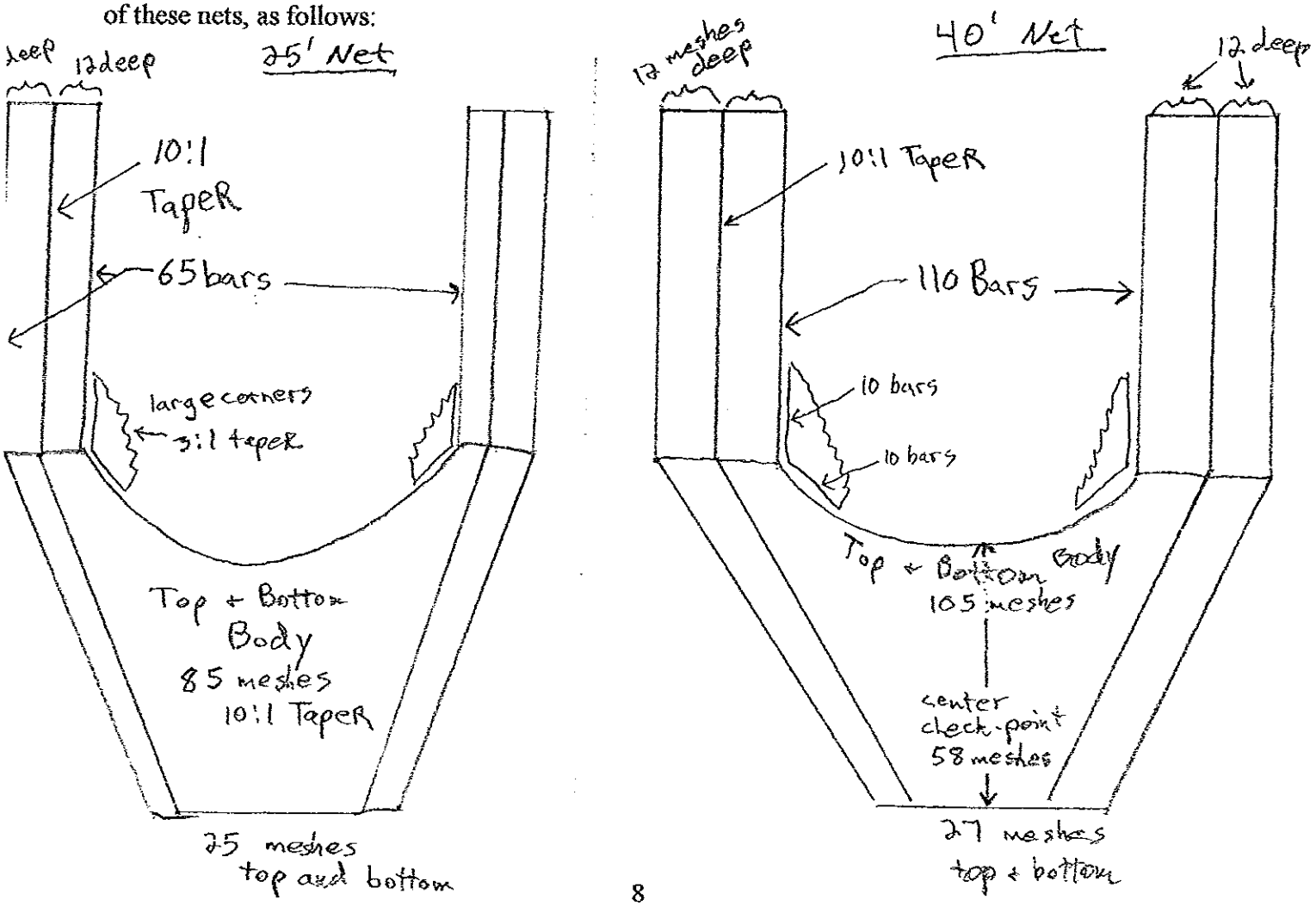
the way across the bottom of the net forward of the cod-end to an escape hatch in the top of the net. We stopped cutting our shooter panel when the two sides of the taper were within 3 meshes of each other in the top panel of the net. We then cut out a hole toward the cod end, only one mesh wide several meshes toward the cod-end. To strengthen and widen this escape hole we pulled back the twine on either side and gored them up.

The results from this configuration showed a significant reduction in flounder catch, but also a great reduction in scallops. No clogs occurred and there was also a significant reduction in trash caught. We then changed the taper to a 3-1 on the top panel, creating a smaller shooter panel, using the same hole design and experienced better retention of scallops, but still less than the control net and some clogging occurred. Finally, on the second day of towing we changed over to the 10" webbing with a 3-1 taper and a hole 10 meshes long, gored open as before. This configuration proved to be the best. The result was a significant reduction in flounder caught, with very little loss of scallops compared to the control net. A very welcome addition to the result was a great difference in the amount of trash and cut shell caught with the soft top shooter in this configuration compared to the regular net. It seems that the trash, along with the fish, found the slope up the shooter panel to be the path of least resistance, while the scallops, running along the bottom edges of the net went through the panel at its widest.

The final trip of this project was undertaken by the R/V Blue-Fin to test the smaller, tighter nets. We built two more nets of 40' to test along with the 25' nets. Normal scallop sweeps are made with twin ½ in chain attached loosely to combination wire rope from whence is hung the net. We built our test nets with double 5/8 chain, shackled tightly together and hung as tight as possible to the hanging combination line. The goal was to design a net that would tend bottom much better, catching more scallops out of the sand. This should help to catch bigger scallops as they tend to be stuck to the sandy bottoms tighter than smaller scallops. Also, in areas of greater trash, where many larger scallops like to live, the much smaller nets should serve to catch less trash, allowing for nets to drag in those locations. Usually net boats avoid these trash areas because the nets fill up too fast for a chance at the scallops.

The results from this trip were very encouraging. The 25' nets performed especially well, catching almost as much as the 70' nets and not nearly as much trash. Unfortunately there was no difference in the size distributions between the 25' nets and the 70' nets. This is possibly due to the area in which we were fishing. There were no big scallops there. We had hoped to be able to try an area known for larger scallops, but time restraints precluded looking any further than a spot where we could compare to the control net.

A problem encountered with the 25' net was that it was hung too tight in the corners and chafed out badly along the seams. After bringing the nets in, we increased the size of the corners and re-hung the nets as tight as they were before. The 40' net didn't seem to have this problem. The Captain of R/V Blue-Fin was so impressed with the 25' and 40" nets' performance that, after he moved on to Captain the F/V Capt. AT, he took both sets of nets with him and used them before he used his 70' nets with good results. He used these nets during a regulsar scallop trip, without any request to do so in reference to this project. This is a strong recommendation of the design of these nets, as follows:



Conclusions: The soft, top fish shooter as developed in this project shows promise as a tool to reduce by-catch and incidental trash in scallop trawls. The hard shooters and combination shooter tried present serious problems and do not warrant further testing, but did provide valuable information leading to our final design. The reduction of flounder by-catch using our last design, while keeping the ability to retain scallops, fulfills one of the goals of this project. The ability of the soft shooter to expel trash suggests this design may also have uses in allowing net-scallopers to fish in underutilized areas that currently present too much of a trash by-catch problem to be feasible. Other features that recommend this design are that it is inexpensive, can easily be used on net drums and is fairly quick and easy to install and remove. After removal, the escape hole on top can easily be seamed back up again, leaving the net without need of additional repair.

The second goal of the project, to demonstrate the feasibility of smaller nets to catch larger scallops than being caught with current designs has not been proved, but there are indications that this may very well be possible. We have seen that the 25' and 40' nets as hung and tested, did catch a comparable quantity of scallops to the larger standard nets. We have seen a reduction in the amount of incidental catch with the smaller nets due to the shorter sweeps. These two observations show the basic workability and economics of the smaller nets, but further testing in appropriate fishing areas is necessary to show whether they can be used economically to target larger scallops.

Recommendations: We recommend that the soft shooter design be incorporated in one of the nets of a commercial scallop vessel during the next season this fall when many fish and scallops are found together in our southern region. The expense of this should be minimal as use of this design is fairly unobtrusive, overall reduction in catch should be minimal and only one observer and one twine man should be necessary to complete the work. This shooter design should also be tested, with observer coverage, in the areas off New England where dredge scallopers are allowed but not net scallopers. The net scallopers are not permitted for fear of excessive by-catch of ground-fish. This design should be tested up there to confirm its ability to release the various species of fish found there. Lastly, the smaller nets should be tested further, with and without the soft shooter installed to determine the economic feasibility of using them, while reducing by-catch and potentially targeting larger scallops.