

FIELD EXPERIMENTATION AND VIDEO RECORDING
OF THREE FINFISH SEPARATOR DEVICES TO REDUCE
BY-CATCH IN THE SHRIMP FISHERY

I. Introduction

A. Background Information

The problem of juvenile finfish by-catch in the shrimp trawl fishery is receiving increased attention from the sportfishing and environmental communities and the media. It has been widely reported in the press that six pounds of juvenile finfish are discarded for every pound of shrimp caught. Investigators have reported finfish catch rates between 2.8 and 18.0 kg. for each kilogram of shrimp caught (Watson and Taylor, 1986).

Commercial fishermen are also concerned about the bycatch. They do not like to waste a resource and are becoming increasingly concerned about the negative public perception of the by-catch issue. They fear this concern could lead to draconian management measures such as recently occurred in Old Tampa Bay where the Florida Marine Fisheries Commission proposed to the Governor of Florida to close shrimping because it was found that three area skippers produced a 1,000 pound waste catch to produce 92 pounds of shrimp. Among the waste was "more than 100 redfish and at least that many trout." (Tampa Tribune, 4-26-89). The North Carolina Marine Fisheries Commission received a petition signed by 1500 individuals to ban trawling and gill-netting in all territorial waters because of the by-catch problem. At the August 14, 1989 meeting several commissioners voiced concern that the anti-trawl advocates would by-pass the Marine Fisheries Commission and directly seek legislation to ban trawling. At the meeting, Dr. William Hogarth, Director of the Division of Marine Fisheries, called for more work on finfish separator devices as an **alternative** to banning trawling.

In some areas of the Southeast, especially North Carolina, most shrimping occurs in the bays and estuaries, which is also prime habitat for juvenile fishes. The problem is inherent in the design of the standard shrimp trawl which is indiscriminate with regard to catch. The purpose of this proposal is to test and evaluate three finfish separator devices to be installed in a standard two seam flat net using input in the design stage from industry. The National Marine Fisheries Service - Pascagoula Laboratory has conducted work on the problem and developed several separator designs. This project will evaluate and modify NMFS and North Carolina netmaker, Steve Parrish, designs.

The TED development process showed that industry has much expertise to offer in the area of gear development. Five of the six certified TED designs were developed by industry. In order to capture industry expertise and creativity, this Project Will solicit industry opinions during all phases of the project. It is also our belief that industry involvement will not only lead to better gear development ideas, but also will facilitate faster adoption of finfish separator devices.

B. Statement of Problem

The project is an extension of one previously funded, and another pending Saltonstall-Kennedy project. In 1988, the P.I.**B initiated a project to evaluate three turtle excluder device (TED) designs to minimize shrimp loss.* The approach used was to: (1) solicit ideas on design modifications from industry, (2) experimentally test the designs at the David Taylor Research Center's flume tank; and (3) field test the best designs on the University of Georgia's R/V Bulldog. A pending S-K project extends this work and addresses laboratory and field experimentation of three finfish separator devices (FSDs) to-reduce by-catch in the shrimp fishery. The proposal was ranked fourth out of 55 projects submitted to the Southeast region and at this time we anticipate funding. (See attached letter from Dr. Angelovic).

In this project a similar process will be used. We will begin during the Fall of 1989 by surveying leading commercial fishermen regarding their recommendations for modifications of three FSD designs and to solicit ideas for other approaches. Using Sea Grant advisory service agents and industry trade associations (N.C.

Commercial Fishermen's Association, Carteret County **Waterman's Association** and the South Carolina Shrimpers

Association) a minimum of 20 "highliner commercial shrimpers will be identified in the Carolinas and interviewed in person. The interviews will consist , of brainstorming sessions using drawings (see Appendix) of the three FSDs as a point of discussion. The fishermen will be asked to provide their view on the chances for success of the designs, recommend modifications and suggest other approaches to the problem. The interviews will be summarized and upon conclusion Steve Parrish and Jim Bahen will make the final decision about which FSDs and/or modifications should be developed for further testing.

The second phase will be to evaluate and test under laboratory conditions at least three designs using a flume tank at the David Taylor Research Center. The three designs are the escape panel, two funnel separator and separator aft of rigid TED design. They may be modified based on industry suggestions identified in Phase I. The designs are as follows:

I. Escape Panel Design

- A) Description: An escape panel located in the top portion of a standard trawl. The panel is made of 4.5 inch stretch mesh webbing of No. 18 ol, No. 21 twines. The panel if installed 15 to 20 meshes from where the extension or tailbag is attached to the body of the net. The panel is 60 meshes X 30 meshes.
- B) Theory of Operation: We have determined through earlier testing that there is greater flow of water in the upper portion of a trawl then in the belly or bottom. Fish entering the trawl should have a tendency to work toward the top of the net and coupled with the increased flow, find their way out through the escape panel.,

II. Two Funnel Separator

- A) Description: This design is in the form of an extension to the tailbag. The separator consists of a series of hoops made of a 1.75 inch stretch mesh X 100 stretch mesh funnel, attached to the net and followed by another funnel of the same dimensions. Between the, two funnels is the escape area consisting of a large 4.5 mesh sewn on the bars. The escape webbing is located .75 distance around extension.
- B) Theory of Operation: In researching earlier data and testing information, the two funnel' separator design has the most potential. By using the information from NMFS Pascagoula on the accelerator funnel in the NMFS TED, the weaker swimming species such as shrimp are forced toward the tail bag. The escape webbing is located between the two funnels in an area of "quiet" water. It is in this area that finfish will be able to escape.

III. Separator Aft of Rigid TED Design

- A) Description: This design incorporates the design of the finfish separator in the NMFS TED located just behind the rigid deflector panel of the TED. It will be installed with accelerated funnel surrounded by the escape webbing of 4.5 inch mesh on the bar.
- B) Theory of Operation: Installed as an extension to the tailbag. Large objects will exit the trawl through the opening located at the base of the deflector grid. Smaller objects (shrimp, fish, etc.) will be forced toward the tailbag through the funnel or accelerator. With the reduced flow of water through the tail bag, located around the outside of the funnel, this area should provide an area for the stronger finfish to escape.

The third step is to field test the designs to determine by-catch reduction and shrimp retention. A critical element in this phase is video taping for fish behavior analysis and later educational purposes with commercial fishermen. The thrust of this proposal is to request funds from the National Undersea Research Center to help us with this element of the FSD development process. NURC is ideally suited to help us with the field testing and underwater documentation necessary for successful completion of the project. In the companion S-K project we budgeted for four days of vessel time, which reviewers said was not enough. In addition, funds and expertise are not available in the S-K project to beat conduct the underwater component.

Our hypothesis is that by involving commercial fishermen in the design and by experimentally testing, and fine tuning the designs at the flume tank, we can develop an FSD which will reduce by-catch by 50 percent without affecting shrimp production. To achieve this goal we will need to select a design which: (1) is effective as a separator, (2) is placed properly in relation to the flow dynamics of the trawl, and (3) takes advantage of differences in juvenile finfish and shrimp behavior, while maintaining trawl performance. Specifically the objectives of the project are:

1. To field test the three designs under actual commercial shrimping conditions.
2. To videotape and assess fish behavior in relation to various physical relationships between the FSD, trawl and water flow.
3. To develop and distribute a completion report, construction manual and video tape of the results.

Methods

A. Description of Major Tasks

In order to duplicate actual commercial shrimping operations, we propose to charter the R/V Georgia Bulldog, a former commercial shrimping vessel now used by the university for testing and evaluating commercial fishing gear. The Bulldog is equipped with SKAN-MAR, which enables accurate documentation of net width and height. In addition, the investigators have chartered the vessel before for similar TED evaluation work, and are familiar with its capabilities.

We propose to charter the vessel for two, seven day periods in late June and late August. During each period we will tow each of the three FSD designs for two days at five tows/day for a total of 20 tows/FSD over the duration of the project. The seven day charter will allow one day of slack time for maintenance or weather. The purpose for the two periods is to assess FSD performance related to juvenile finfish at times when species composition or in-species sizes may differ. This will allow us to judge how the full range and size of species react to the FSDs. All tows will be made during daylight hours.

Two underwater video cameras are required. We presently have access to a SONY CCD-M8 handy cam, housed in an Aquavision capsule 10 housing. This camera will be installed near the tall bag and fore of. the FSD to provide a close up view of finfish and shrimp behavior relative to the FSD. A second tethered videocamera will be required and installed near the headrope to provide a full view of trawl performance. This camera should have real time viewing as a precaution against losing tow time due to clogging. Additionally divers are requested for filming more distant views of complete trawl spread. This filming will only be necessary once for each of the three FSD designs and has the later purpose of showing commercial fishermen that net spread and performance is maintained under actual shrimping conditions.

B. Sites and Systems Descriptions

1. Dive Site(s)

The dive Bites will be in-shore waterB <12 nautical miles from shore in standard commercial shrimping grounds with zero relief on sandy to silty waters. Maximum water depth will not exceed 15 meters. Brunswick, Georgia

is chosen as the research site because it is the home port of the R/V Bulldog. Also vessel travel time will be reduced, and the captain and crew are familiar with the local fishing grounds.

2. Systems and Equipment

The R/V Bulldog is fully rigged for commercial shrimping. It is one of the few vessels in the U.S. which has SKAN-MAR capabilities. This system electronically measures various parameters associated with trawl performance (depth, height, width, spread, etc.) and will allow us in situ ~ verification of FSD performance versus a control net. Also needed are two 65' two seam flat nets. They will be fished simultaneously with one fitted with an FSD and the other acting as a control net. The UNC Sea Grant program owns two of these which will be made available to the study.

Catches in each net will be measured to determine total by-catch weight, total shrimp weight, species composition, average weight, and shrimp length frequency. Differences between total by-catch and total shrimp weight between the two trawls will be calculated to evaluate the FSD designs. In addition, expertise will be available during all cruises to suggest necessary adjustments. Dr. Roger Rulifson will analyze fish behavior on a per tow basis and suggest necessary changes, if any. If adjustments or fine tuning are required, both Sea Grant agent Jim Bahen and, netmaker Steve Parrish will be available to make, them.

3. Alternative Approach

The only way to practically analyze the designs is to test them under actual shrimping conditions. The key to NURC support is assistance with video taping. This step is necessary for both the analysis of fish behavior and as an educational tool to show the results to commercial fishermen. As a commercial netmaker commented at a gear selectivity workshop in 1986, "I'd like to summarize by saying what I think really needs to be done. When you think about all the presentations so far and what you've seen, the only time I'm really convinced is when somebody shows a videotape of the actual underwater observation?" (Shuman, 1986).

Our experience with TEDs has been similar. A fishermen is much more interested in and convinced by a video of actual performance than by a written report. High quality underwater video will be essential for making a 20 to 30 minute professional video which describes the project and findings. Mike Gray, news editor and television producer for the Agricultural Extension Service at NCSU will provide the equipment and crew to produce and edit the video. He has assisted UNC Sea Grant on four other video projects.

C. Dive Schedule

Dives will not be required on each tow, but rather are required on an as needed basis to install and adjust the two cameras. In addition, at least one dive will be required to videotape from a distance each of the trawls containing FSDs in order to visually document total trawl spread and shape.

D. Constraints and Risks

1. Given or Assumed Constraints

Our approach is reasonably routine and should not be difficult to achieve. The major problems would be adverse weather or visibility. The visibility problem could be handled by adjusting the location of the trawling operation i.e. moving further from inlets or further offshore as the situation dictates.

2. Environmental Impact

None

III. Discussion

A. Justification

Potential benefits of the project could be enormous. Because of environmentalist and sportfishing pressure, many people in the fishing community believe we will see a piecemeal closure of shrimping grounds. Fisheries managers and shrimpers will need effective alternatives in order to continue existing operations. This project will assess the feasibility of several gear alternatives. This project should not be viewed as the final statement on FSD development. Rather, it should be looked at as the beginning. We need to engage the best minds in industry in order to initiate the development process. It is our intention the project will serve as a catalyst to stimulate others in the Southeast region to experiment with other ideas.

A major problem in TED development was the relative lack of industry involvement in the design stage. Industry first became involved in an influential way in 1987 when environmental groups threatened a lawsuit to mandate TEDs. Five of the six certified designs were certified and tested under crisis conditions. This project begins with involving 20 "highliner" fishermen from the Carolinas in the FSD design phase, and it involves commercial netmaker Steve Parrish in all phases. The timing is also ideal, since most fisheries managers believe the issue is impending, but not at the crisis stage. The project is also listed as a high priority objective by the NURC program at UNC-W. As stated in the NOAA Office of Undersea Research Guidance Document for 1989 and Beyond a high priority objective under the biological productivity and living marine resources section is

"To determine the efficiency of traditional biological sampling and fishing methods and the future development of novel and innovative means to harvest fish and shell fish. To assess the level of environmental impact imposed by fishing gear in the form of incidental catch or benthic impact."

B. Future Efforts

In the Southeast, shrimping is a twenty-four hour a day job, and accordingly a significant percentage of shrimping takes place during the night. Watson discovered during finfish separator tests in the Gulf, a drastic difference in separation rates between day and night (50 percent vs. 10 percent) (Watson, 1986). He believed the reaction of the fish was visual. He experimented with some success with a stainless steel wire behind an FSD which acted both as a physical stimulus when the fish hit it and made a humming noise which may have also caused an avoidance reaction. However, it was subject to clogging.

In year two, we propose to observe fish behavior at night by using a nightscope. Avoidance behavior of finfish and shrimp in response to several types physical stimuli will be observed. These stimuli include separator grids, vibrating wires electrical impulses and light.

VI. A. Administration

Jim Murray will serve as principal investigator. He has been Director of Marine Advisory Services in North Carolina for seven years and in this capacity has administered numerous projects, including applied research projects. Jim Bahen has been the principal TED contact in North Carolina for five years. He has made a variety of cruises evaluating commercial fishing gear. Steve Parrish is the owner of S & S Nets which has been a family business for more than 50 years. Until recently, he also worked for Carolina Power & Light where he is a gear designer for the fisheries biological unit. Parrish and Bahen both have experience at the David Taylor Research Center evaluating shrimp trawl designs and TEDs. Mr. Parrish designed one of the six certified TEDs (the Parrish TED). Roger Rulifson is a research scientist at East Carolina University. He is an authority on juvenile finfish and shrimp behavior.

Murray will be responsible for team management, reporting, logistics and coordination. Jim Bahen will be responsible for all decisions related to gear while at sea.

B. See VI B above.

The estimate of amount of time spent an this project include:

Murray - 8 days
Bahen - 60 days (including NMFS work)
Parrish - 40 days (including NMFS work)
Rulifson - 14 days (including NMFS work)
Gray - 0 Days

VII.

- A. The Southeast Regional Office of the National Marine Fisheries Service is providing \$39,137 to support the **FSD development work**. Funds requested from NURC are required for vessel time and video documentation. The funds requested are as follows:

BUDGET

1.	R/V Georgia Bulldog - 10 days @ \$1,500/day	\$15,000
2.	Travel - Four people, two trips to Brunswick, GA. 6400 miles @ \$.23/mile	1,472
	per them 40 days @ \$60/day	2,400
3.	Video Production Costs	3,000
4.	Publication Costs	500

LITERATURE CITED

Shuman, Paul, "Limitations of Practicality-A Netmakers Viewpoint." Conference Proceedings: Gear Selectivity as a Management Tool. Edited by Goudey, C.A. et.al. MIT Sea Grant Program. 1986.

Tampa Tribune, April 26, 1989.

Watson, J.W. and Taylor, W.C., Research on Selective Shrimp Trawl Designs for Panaeid Shrimp the United States, A Review of Selective Shrimp Trawl Research in the United States since 1973. FAO, Rome, 1986.

Watson, J.W., "Observations of Gulf of Mexico Pelagios. Conference Proceedings: Gear Selectivity as a Management Tool. Edited by Goudey, C.A. et. al. MIT Sea Grant Program, 1986.