# FOLLOW-UP WORKSHOP ON BYCATCH REDUCTION IN THE SHRIMP FISHERY OF THE GULF OF MEXICO AND SOUTH ATLANTIC

February 7 – 8, 2001
Ramada Airport Inn
Tampa, Florida

# FINAL REPORT

Sponsored by

Gulf & South Atlantic Fisheries Foundation, Inc.

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Tampa, Florida 33609

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Edited by Dr. Tomas Vergel C. Jamir
Program Director and Workshop Coordinator

# FOLLOW-UP WORKSHOP ON BYCATCH REDUCTION IN THE SHRIMP FISHERY OF THE GULF OF MEXICO AND SOUTH ATLANTIC

## EXECUTIVE SUMMARY

A follow-up workshop to the October 1999 ***Industry Workshop on Bycatch Reduction in the Shrimp Fishery*** was conducted by the Gulf and South Atlantic Fisheries Foundation under the auspices of NOAA/National Marine Fisheries Service (Purchase Order No. 40 GANF000073). The major objective of this follow-up workshop was to review the progress made by NMFS and other fishery management agencies in addressing the key issues and recommendations identified by commercial fishing industry representatives during the previous workshop.

Individual evaluation forms were used to rate the degree of progress made in addressing the issues identified during the 1999 workshop. Group or consensus evaluation was also made following a thorough discussion of each issue or recommendation. Most of the issues require long-term programs and ample periods of time before real progress could be measured. Hence, in terms of absolute progress, lower evaluation scores were expected to be the norm given the limitations of what fishery agencies could possibly accomplish within one year. To highlight the "relative annual progress" made on each issue, average raw evaluation scores were "standardized" in proportion to the item that got the highest overall score - in this case, the improvements made on the BRD Certification Testing Protocol. In 1999, this was identified as the major obstacle hindering industry involvement in the government's bycatch reduction effort. Now, industry representatives regard this issue resolved and adequately addressed by the agency.

In general, NMFS received high marks (standardized rating or SR = 90% indicating "Good to "Major Progress") for their on-going effort to simplify the BRD Certification Testing Protocol and to reduce high shrimp loss emanating from BRD use. NMFS also got high marks ("Good" to "Major Progress") for involving commercial shrimp fishermen in the revision of the protocol (SR = 88%); simplification of the whole BRD technology development process (SR = 73%); and for involving the industry in planning, implementation and evaluation of fisheries research and management programs (SR = 66%). Industry representatives gave State and Federal fishery management agencies only "Fair" to "Moderate Progress" ratings on the following: (a) balancing multiple stakeholder demands and industry representation in the councils, (b) recognition of regional differences in bycatch reduction needs, and (c) enhancement of "customer service"/streamlining of fishery agency operations.

The participants also recognize the complex biological, technological, socioeconomic and perceptual nature of the bycatch problem. In fisheries management perception often equates to reality. It was the consensus of the group that relatively little is being done to address the perceptual side of this issue. Hence, it was highly recommend that the industry, state and federal fishery agencies pool their resources together to support the development and implementation of appropriate education and communication programs as a first step towards correcting these deficiencies. These programs should be aimed at improving the public's knowledge and perception of bycatch issues, and highlight efforts made by different stakeholders to solve them.

Gulf & South Atlantic Fisheries Foundation, Inc.

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## A G E N D A

### February 7, 2001 (Wednesday)

| | | |
|---|---|---|
| 12:45-1:00 | Registration | |
| 1:00-1:15 | Welcome Address & Workshop Overview | Mr. Philip Horn/Dr. Tomas Jamir<br>Co-Facilitators |
| 1:15-1:45 | Review of BRD Protocol and Permit Process | Dr. Steve Branstetter, NMFS SERO |
| 1:45-2:15 | BRD Certification – Statistical Procedure | Dr. Arvind Shah, U. South Alabama |
| 2:15-3:15 | Industry Experience and Concerns | Mr. Dave Harrington - U. Georgia<br>Mr. Gary Graham-Texas A&M U. |
| 3:15-3:30 | Nourishment Break | |
| 3:30-4:00 | Developments in Fish Behavior Research | Mr. John Watson, NMFS Pascagoula<br>Mr. Dan Foster, NMFS Pascagoula |
| 4:00-4:30 | Economic Incentives as Alternative to BRDs | Dr. Walter Keithly, Louisiana State U. |
| 4:30-5:00 | Wrap-Up and Overview of Evening Activities | Dr. Tomas Jamir, Gulf & South Atlantic Fisheries Foundation, Inc. |
| 5:00-7:00 | Dinner | |
| 7:00-8:30 | Review of Past Year's Accomplishments | Dr. Bill Hogarth, NOAA/NMFS |
| 8:30-8:45 | Distribute Evaluation Form (Individual) | All Workshop Participants |
| 8:45 | Adjourn for next day | |

### February 8, 2001 (Thursday)

| | | |
|---|---|---|
| 8:30-11:30 | Start Group Evaluation Session | All Workshop Participants |
| 11:30-12:00 | Workshop Wrap-Up and Other Business<br>Video Presentation (Bill Hickman) | |
| 12:00 | Adjourn | |

**Ms. Judy Jamison**
Executive Director
Gulf & South Atlantic Fisheries Foundation, Inc.
Lincoln Center, Suite 997
5401 West Kennedy Blvd.
Tampa, FL 33609

**Dr. Walter Keithly**
Associate Professor
Louisiana State University
CFI/CFWR
Baton Rouge, LA 70803

**Mr. James Leland**
Commercial Shrimper
P.O. Box 357
McClellanville, SC 39458

**Mr. Wayne Magwood**
South Carolina Shrimpers Association
220 Lucas Street
Mt. Pleasant, SC 29465

**Mr. John Mitchell**
Harvesting Systems & Engineering Division
National Marine Fisheries Service
P.O. Drawer 1207
Pascagoula, MS 39567-1207

**Dr. James Nance**
Southeast Fisheries Science Center
Galveston Laboratory
National Marine Fisheries Service
4700 Avenue U
Galveston, TX 77550

**Mr. Russell O'Brien**
Fishery Observer Coordinator
P.O. Box 1747
Crystal Beach, TX 77650

**Capt. Gary Petrae**
Acting Deputy Regional Administrator
Southeast Regional Office
National Marine Fisheries Service
9721 Executive Center Drive, North
St. Petersburg, FL 33702

**Dr. Joseph Powers**
Acting Regional Administrator
Southeast Regional Office
National Marine Fisheries Service
9721 Executive Center Drive, North
St. Petersburg, FL 33702

**Mr. Ross Pritchard**
Dixie Bag & Burlap
915 Weinacker Avenue
Mobile, AL 36605

**Mr. Wayne Redden**
D&R Trawl Board Company
6112 Grand Caillou Road
Houma, LA 70363

**Ms. Elizabeth Scott-Denton**
Southeast Fisheries Science Center
Galveston Laboratory
National Marine Fisheries Service
4700 Avenue U
Galveston, TX 77550

**Dr. Arvind Shah**
Department of Mathematics & Statistics
University of South Alabama
c/o National Marine Fisheries Service
P.O. Drawer 1207
Pascagoula, MS 39567-1207

**Ms. Susan Shipman**
South Atlantic Fishery Management Council
c/o Georgia Department of Natural Resources
One Conservation Way
Brunswick, GA 31420

## EVALUATION PROCEDURE

### a. Selection of Workshop Participants

A short list of attendees for this follow-up workshop was drawn from the recommendations of the previous workshop participants. Most of the industry names included on the list represent their respective state's commercial fishery and were also present in the original workshop. Alternate delegates were also identified in case the primary person listed could not attend or is not the current representative or spokesperson of a given state's commercial fishery association. As in the original workshop, if both the primary and alternate delegates are not available, the Foundation staff asked the Foundation's trustees of the given state as well as the respective State Sea Grant or Marine Extension Agent for recommendations.

In order to maintain balance and a wide variety of views during the discussions, representatives from various offices or laboratories of the National Marine Fisheries Service, the Gulf of Mexico and the South Atlantic Fishery Management Councils, academic researchers, fishery observers, and State Sea Grant or Marine Extension Agents were also invited to participate.

### b. Evaluation Tools and Method of Analysis

Prior to this workshop, the delegates were provided with an executive summary of the previous workshop for their perusal. This document contained a list of key issues or problems and recommended solutions identified by the industry. On the first day of the workshop, the participants were provided with short presentations on new ideas, breakthrough research findings or updates of progress on bycatch reduction by various experts in the field. Group discussion and evaluation of last year's progress in addressing the bycatch issue were conducted on the second day of the workshop.

An evaluation form was drafted to facilitate the review process (see Appendix A). This form lists the key issues/problems and recommended solutions identified by the previous workshop. A rating scale that ranged from 0% (No Progress) through 100% (Major Progress) accompanied each item on the list, i.e.,

| 0% | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% | 100% |
|---|---|---|---|---|---|---|---|---|---|---|
| **No Progress** | | **Poor** | | **Fair** | | **Moderate** | | **Good** | | **Major Progress** |

Workshop participants were asked to circle the appropriate score corresponding to their assessment of the degree of progress made on a particular issue or recommendation. Individual written comments were also encouraged. The evaluation forms were distributed to each participant on the first day of the workshop and were collected before the start of the next day's group evaluation session.

Afterwards, the staff tabulated the individual responses of industry and fishery management representatives. Since most of the key issues and recommended solutions require long-term programs before progress could be adequately assessed, low scores were expected to be the norm on this year's evaluation. To highlight the "relative progress" made on each of the review criteria, average raw

# PART 1. PRESENTATION TOPICS

The following are *verbatim* transcription of the individual speaker's presentations based on video and sound recordings of the proceedings. Some sections were edited to achieve clarity and continuity of thought. Long-winded discussions on similar issues were summarized into more concise paragraphs. All supplementary information provided by the speakers can be found in the Appendix or enclosed separately (e.g., VHS videotape of fish behavior studies).

## *Review of BRD Protocol and Permit Process*

**Dr. Steve Branstetter**
**National Marine Fisheries Service - SERO**

A number of issues were raised by the industry upon the publication and implementation of the original BRD Certification Testing Protocol. Fishermen found the protocol requirements so rigid that certification tests proved difficult to complete in practice. The Gulf and South Atlantic Fishery Management Councils were made aware of these problems even before the Industry Workshop on Bycatch Reduction in the Shrimp Fishery was conducted. During the 1999 workshop, industry representatives singled out these issues as the main stumbling block preventing active industry participation in the government's bycatch reduction program and requested NMFS to consider their input in the formulation of a more workable protocol. NMFS took this issue to heart and developed a revised protocol that allows for more flexibility within certain limits, i.e., that it should statistically achieve a 40% age-0 and age-1 red snapper mortality reduction for the Gulf of Mexico or a gear reduction of 40% weakfish in the South Atlantic. Taking industry recommendations seriously, the following are the major changes made by NMFS to the original BRD Certification Testing Protocol.

- The need to restart a new test following major gear change has been removed in the new protocol. After any major gear change, the new protocol requires that tuning tows be conducted to make sure that the experimental and control nets work evenly (although possibly with different efficiency). Any good tows collected thereafter are counted towards the minimum of 30 cumulative good tows needed to conduct the statistical tests. Hopefully this procedure will also increase the statistical robustness of the test given that you do not have to conduct the test in one single fishing trip but you can spread them out over several trips, even different fishing boats and various fishing grounds and operating conditions.

- The restriction on tow times to within 10% of a chosen period is relaxed in the new protocol. A standard tow time is still needed since catch rates changes with varying tow time, however, now the applicant can choose their own tow duration as long as they vary only within 10% of the chosen value. The chosen tow time needs to be specified and included in the BRD Certification Test Plan as part of the request for a letter of authorization from the Regional Administrator. In the plan, the applicant defines the tow time that would be used including what will be done in case it gets revised (i.e., either increased or decreased) during the test. Since catch rates are done on a catch per hour basis, this allows the applicants to make some necessary adjustments in tow times as long as the changes can be justified. Note: Statisticians

## *BRD Certification – Statistical Procedure*

**Dr. Arvind Shah**
**University of South Alabama**

Once the data are gathered, what happens next? The next step in the BRD Certification process is to conduct the statistical analysis. In order to understand the statistics behind the BRD certification tests, it is necessary to get a good grasp of the concept of "burden of proof" and associated risks.

There are two types of risks involved in this process, i.e., consumer's risk and producer's risk. The first type of risk is the consumer's risk and involves the probability of rejecting an acceptable or good BRD, or alternatively, the probability of accepting an unacceptable BRD. The second type of risk is the producer's risk and involves the probability of accepting an unacceptable BRD or the probability of not accepting a good BRD.

The relationship between risk and burden of proof is as follows. If the burden of proof is placed on the industry, then the chance of getting good or acceptable BRDs certified is very difficult (= high consumer risk). The opposite is true, i.e., if the burden of proof is switched or placed on NMFS, then the probability of turning down an unacceptable BRD is very low because the government lacks evidence to prove otherwise (= high producer risk).

Both of these risks are not acceptable. So a compromise approach is called for, i.e., look for a middle ground. We can still put the burden of proof on the government on the condition that candidate BRDs will not even be statistically tested for certification unless the sample reduction rate comes within 5% or 10%, 20%, or X%, etc. of what is required (call it delta).

In summary, placing the burden of proof on the industry makes it harder for acceptable BRDs to get accepted – a serious problem for industry especially in view of the current state of technology (i.e., 40% to maybe 60% reduction). Placing the burden of proof on the government makes it too easy for unacceptable BRDs to get accepted – a serious problem for NMFS. Compromise approach – place burden of proof on government but conduct statistical testing only if the sample reduction rate is no less than delta from the required reduction rate, Ro. Delta could be set at any reasonable amount (like 5%, 3%, etc.).

The impact of this compromise approach is to bring the two extreme conditions into the middle, which gives reasonable chance for acceptable BRDs to be accepted. Also, under the compromise approach, the better performing the BRD, the higher is its chance of getting approved. At the same time, the compromise approach cuts down on the chances of under-performing or unacceptable BRDs from getting accepted or certified.

What are some of the implications of this shift in burden of proof? If the burden of proof was on industry during a given BRD's initial certification tests and the BRD fall marginally short of the acceptable level, then it is highly possible that the same BRD could pass the certification tests once the burden of proof is shifted to the government.

## *Industry Experience and Concerns with BRD Certification Testing*

**Mr. Gary Graham - Texas A&M University**
**Mr. Dave Harrington – University of Georgia**

In 1992, a *Research Plan Addressing Finfish Bycatch in the Gulf and South Atlantic Shrimp Fishery* was published by the Gulf and South Atlantic Fisheries Foundation, Inc. This plan was a consensus document developed by the industry and state/federal fishery management agency representatives. An integral part of that program is the "development of an integrated plan to provide the gear development, testing, and data collection necessary to provide viable solutions to current bycatch problems."

For the Gulf of Mexico, juvenile red snapper are the key species of concern while weakfish and Spanish mackerel were the target species for bycatch reduction in the South Atlantic. Over the last ten years, different BRDs were tested, including fish eyes placed at different locations in the bag. Some soft TEDs were also tested and received good results, e.g., the 5" Andrews TED. When testing soft TEDs, it should be realized that it should first and foremost be able to eliminate sea turtles from the nets.

Last year, industry designed BRDs were tested under sub-contracts from the Gulf and South Atlantic Fisheries Foundation, Inc. Industry participation was key to this BRD project that involved various fisheries observers and industry cooperators working together. As with any shipboard-type of research, a major part of the Foundation's operating cost is used to provide Protection and Indemnity (P&I) insurance for cooperating or contractual vessels that allow fishery observers to work and live on-board. This is a very important consideration as will be made clear later.

Presented below is a summary of the preliminary results of industry BRDs approved by the Gear Review Panel (GRP) and tested under the auspices of the Gulf and South Atlantic Fisheries Foundation, Inc. and the Department of Commerce/NOAA National Marine Fisheries Service (Contract No. NA87FD0099):

(1) Double-funnel Extended Mesh – out of Palacios with David Aparicio. Aparicio encountered a real problem with a former Johnson Controls contracted fishery observer that boarded his vessel while participating in a NMFS project. The resulting lawsuit resulted in Aparicio's lawyer advising him to terminate his BRD certification tests with the Foundation.

(2) Modified Fish Eye (Aparicio) – terminated.

(3) Modified, Double-opposed Fish Eye (Adam's BRD from Alabama) – project completed, 13 good tows/115 tows (11%), total finfish reduction of 24%, total shrimp loss of 0%, red snapper reduction of 60%. Promising red snapper reduction. Additional tows made but not yet included in this report.

(4) Modified Super-shooter TED as BRD (Burnell) – project pending; underwater hydrodynamic tests conducted at Panama City by NMFS identified design problems that need modifications.

(15) Modified Fish Eye (Charles King from Alabama) – completed, 17 good tows/77 tows (13%), 32.5% total finfish reduction, 12.7% shrimp loss, 25% red snapper reduction, red snapper <100 mm has 45% reduction, red snapper >100 mm had 17% reduction.

The following are some of the obstacles to BRD certification:

- Definition of what constitutes a "good tow" limits the number of available tows that could be used in the statistical analysis. High number of discarded tows also reinforces fishermen's perception that NMFS is making it too hard for them to get BRDs certified. As a result, many lose interest in cooperating with the project.
- Strict adherence to the10% variance in tow time rule. While it is recognized that fishing efficiency may be affected by the tow duration, the 10% variance limit may be too restrictive.
- Inconsistent red snapper and weakfish production. Trawlers are required to pull BRDs whenever they are fishing but red snapper or weakfish are abundant only during certain times of the year. Furthermore, trawl captains prefer to drag their nets in areas with low fish or red snapper density to achieve higher fishing efficiency. In the Gulf, some cooperating fishermen have to fish out of their normal shrimp fishing ground just to catch the minimum number of juvenile red snapper required by the protocol.
- The BRD certification process is very expensive. It costs at least $15,000 to $20,000 per BRD just to have observers and cooperating vessels gather data for a minimum of 30 good tows.

The following were the positive changes made to the protocols:

- Eased off on schedule for switching sides
- Done away with the mackerel requirement
- Allowed use of try net on twin-rigged boat
- Don't have to restart test after gear change

Regional Differences – The conditions in the South Atlantic are different from those encountered in the Gulf of Mexico. In the South Atlantic, most of the shrimp comes close to shore, around sand bars, inside channels, etc. For a variety of reasons, shrimp escapement through the BRDs may also be different in the South Atlantic compared to the Gulf of Mexico. In general, however, the smaller the escape hole of the BRD, the less shrimp loss is incurred, e.g., in diamond-shaped fish eye that is allowed in the State waters of Georgia. South Atlantic fishermen also place their BRDs as far forward into the bag as possible to prevent excessive shrimp loss. Other factors influencing excessive shrimp loss in fisheye BRDs are as follows:

- Low/restricted tow speeds (i.e., <2.3 knots)
- Slow winch retrieval
- Small bags 80-100 meshes
- Strong tides
- Debris, crab traps, jelly
- Rough weather

A related concern is that the public does not actually get a true picture of the shrimp loss problem because the protocol only requires good tows for analysis. So what gets published is just a

## *Developments in Fish Behavior Research*

**Mr. John Watson and Mr. Dan Foster**
**NMFS - Pascagoula**

Both speakers expressed their appreciation for the opportunity to meet with representatives of the fishery as they learned a lot from the industry's input during 1999 BRD workshop held by the Gulf and South Atlantic Fisheries Foundation. This presentation updates everyone on current NMFS research activities and relevant findings. The speakers also solicited industry comments, insights and ideas on how to develop new bycatch reduction devices or improve upon current BRD designs.

BRD Evaluation Techniques:

Review of the results of the research carried out by NMFS Harvesting and Engineering Branch at Pascagoula, Mississippi over the past 2-3 years was presented so that Workshop attendees would understand how the recent developments evolved. Initially, NMFS engaged in studying different aggregation methods for juvenile (Age 0 and Age 1 year class) red snapper. Juvenile red snapper habitat preference and designs were learned as a result of this research. For example, 2 $m^2$ trawlable net reefs with floats were designed to provide vertical relief; it was found that this design attracts Age 1 red snapper and removal of the float flattens the vertical relief and the net attracts purely Age 0 red snapper.

The NMFS-Pascagoula Laboratory has acquired a new (refurbished) vessel from the U.S. Navy. Christened R/V Nino, this 40 ft vessel was refitted for trawling operations over reefs to study fish behavioral information. Red snappers going through trawls were video-recorded using a small camera system wired to the vessel. This system provides an efficient and cost-effective way to evaluate experimental BRDs.

Fish behavior inside the trawl was discussed, e.g., at a towing speed of 2.5 knots, 60 ft depth with the Jones-Davis BRD it was noted that the red snapper do not leave the trawl – a very common and well described fish behavior, indicating two fish behavioral responses were working here, i.e., optimotor and rheotactic response.

Optimotor response – If a juvenile red snapper goes into an area of the trawl where it can swim for long periods of time along with the trawl, it becomes visually fixed to the pattern of the trawl around it and the fish start schooling within the trawl and exhibit no reason to leave.

Rheotactic response – Red snapper tend to swim towards the direction of the water flow. As the water flow changes, the snapper will change its swimming direction in order to keep its spatial orientation to the visual pattern of the webbing.

For several years now, researchers have known that the optimotor response needs to be broken in order to force the red snapper to get out of the trawl. A box-type BRD with tickler was designed to break this optimotor pattern by creating a reverse water flow and forcing the snapper to get into an area of the trawl where it will not hold up or get visually fixated into a pattern. While red snapper did face the back of the trawl as the flow reversed, they did not face into the incline (or upward) of the water flow indicating that this behavior is not a true rheotactic response.

NMFS researchers hope to take all the things that work and incorporate them in the development of a good BRD design. The researchers also looked at the Jones-Davis BRD to see how shrimps crawl on the webbing and out of the BRD. In test tank experiments, they found that all shrimp species try to crawl out of the webbing. Shrimp always face the direction of the water flow no matter what direction they were placed on the experiment tube. NMFS is now working with Mississippi State University to study shrimp swimming and crawling behavior out of the nets.

NMFS found that bottom-positioned TED escape holes are more suitable for red snapper reduction but they tend to incur higher shrimp loss from crawling. Side-positioned TED escape holes may be better. Weakfish response to the top shooting BRDs has not been tested. Also, all behavioral observations were done during daytime because the strobe lights were found to affect fish behavior at night. This year, NMFS will conduct tests to determine the difference in reduction rates between day and night time trawling runs.

Given the capabilities of NMFS (i.e., 28 trawlable reefs with red snapper, dedicated research vessel) and the things that researchers have learned so far, the agency hopes to share this information and tools to the industry. In the long run, it is hoped that development and testing of effective BRDs with a quick turn-around and cheaper costs can be achieved.

Copies of the video shown during this presentation are available from Dr. Tomas Vergel Jamir at the Gulf and South Atlantic Fisheries Foundation, Inc. They can also be requested from the Harvesting Systems and Engineering Branch, National Marine Fisheries Service, P.O. Drawer 1207, Pascagoula, MS 39567-1207

The second question is, "Can the program be cost effective?" Again, industry feels that BRDs result in the reduction of profits. Can we use some type of economic incentive package that results in lower reduction in profits? Will monitoring and enforcement costs be reasonable? Does the policy tend to give the industry incentives to go beyond that which is mandated or required? With certain types of point source pollution, economic incentives tend to achieve a goal at sometimes half or less than half the cost of technological devices.

For example, if a fisherman knows the location of hot spots for red snappers but gets taxed for fishing there, would that change the fisherman's behavior? Definitely. What if the government subsidizes fishermen for not fishing there, would that change their behavior? Again, the answer is yes. The goal of economic incentives is to change behavior voluntarily.

Examples of more traditional incentives used in the past include subsidies (often used by the USDA), taxes (used sparingly) and tradable permits (used more frequently now especially by manufacturing companies). Flexible economic incentives, which is where non-point agricultural pollutions is moving, has a whole suite of different economic options for managing emissions in agriculture. Among them are taxes and charges, subsidies, performance bonds, compliance awards (i.e., if one complies with certain provisions, then they are qualified to apply for other beneficial programs). It may not even be necessary for the government to raise money to implement these strategies. For example, some fishers could be taxed if they wish to fish in red snapper hot spots. The revenues generated by this taxation could be used to subsidize fishers who voluntarily refrain from fishing in the red snapper hot spots. Another example of a compliance award is the use of "eco-labels." Assuming consumers prefer safer products and are willing to pay dearly for it, then anyone who can show that they are providing a safe product (through a recognized eco-label) could get higher prices for their produce. No single incentive program fits everybody.

The fishery industry could work with NMFS to develop a host of economic incentive schemes that could work for them. Let us say the fleet's profit margin is reduced by 10% with the use of BRDs (keeping in mind that the loss in shrimp catch does not translate directly into loss in profits). If the fleet is compensated for the equivalent amount of loss, then they will have no reason to complain since there is no loss in profits.

The similarity between the shrimp fishery and agriculture (with respect to the problem of non-point source pollution) is remarkable. It should be recognized that minimal progress in the reduction of non-point pollution is achieved in agriculture due to the complexity of the problem. This is no different from the complexity encountered in the shrimp fishery industry. Because of these problems, it is hard to implement any flexible incentive program in the shrimp fishery. It is not to say that it cannot be done, however, it requires a lot of cooperation among fishermen.

What are the potential limitations of the flexible economic incentive program in the shrimp fishery? The sheer number of heterogeneous vessels that are geographically dispersed makes the task daunting. There is also relatively little organization in the shrimp fishery, which implies that large transaction cost may be needed to bring people together to create and agree on any given flexible economic incentive program. There is also a problem with enforcement and monitoring (same as with non-point solution). But perhaps one of the fishery industry's biggest problems involves the issue of property rights, i.e., nobody owns the fish or shrimp while it is still in the water.

## *NMFS in the 21st Century: Management and Science Challenges Facing NOAA Fisheries*

**Dr. William Hogarth, Acting Assistant Administrator for Fisheries**
**National Oceanic and Atmospheric Administration**

Improving Constituent Relations – NOAA/NMFS needs to talk to fishermen. A series of regional meetings have been scheduled over the next few weeks to solicit input from the industry and to get an idea on how NMFS needs to proceed in the future.

NMFS Modernization – More work needs to be done in cooperation with industry. To effectively do this, NMFS also need to modernize, especially its stock assessment capabilities. The agency also needs to change the way it conducts business. NMFS needs to reach out to its constituents in a number of areas, for example:

- *Improving scientific communications* – NMFS needs to conduct more outreach programs in order to effectively communicate scientific findings to constituents. This includes working with industry research foundations and various state fishery agencies to make sure that everyone gets the opportunity to provide their input into the scientific process.

- *Improving management efficiency* – NMFS need to change the way it conducts business by involving constituents in the process. The industry has a lot to contribute and more efficient ways of conducting research or outreach efforts could be achieved by getting their input.

- *Utilizing new technology* – NMFS has purchased new ocean and fishery data collection platform (new research vessel) to improve its research capabilities. The agency has also developed real time management capabilities through the employment of electronic logbooks. In the area of enforcement, NMFS has developed Vessel Monitoring Systems (VMS). If these tools are adopted as a management measure, the current philosophy of NMFS is to request Congress to fund these programs under NMFS instead of putting the financial burden on the shoulders of the industry.

- *Improving and expanding stock assessment capabilities* – NMFS needs to spend more effort in getting more fish stocks out of the "unknown status" category. To do this, it needs to expand its capabilities in stock assessment.

- *Improving social science capabilities* – NMFS admits that they have not looked well at the economic impact of fishery regulations. They will try to concentrate their efforts in this area, although it is tough to get money to do these things.

- *Building public familiarity and trust through web-based public information services* – NMFS has established "Fish News" as one of the means to achieve this end. They have also created a recreational fishery database that is accessible through the web.

- *Using industry and environmental collaboration to improve scientific acceptance and more effective participation in the management process* – NMFS realized the need to be closer to clients and to establish close collaboration with the industry to get things done.

- $0.750 M for bottlenose dolphin research.
- $16.0 M for habitat restoration including $1.5 M for Tampa Bay.
- Other moneys are available for stock assessment and NEPA related EIS work.

Rebuild the Nation's Overfished Stocks and Sustain Healthy Stocks – Every year, NMFS is required to present a report to congress regarding the status of the Nation's fish stocks. Compared to 1999, the year 2000 has seen an increase in the number of "Overfished" stocks not because of further exploitation but due to a reclassification of unknown species by the different Fishery Management Councils. This year, there is also an increase in the category of "Not Overfished" stocks and a decrease in the category of "Harvest Too High." Overall, the fishery is in good shape as the harvest rate is in line with what the stocks can sustain.

Improving Stock Assessments – At present NMFS has conducted stock assessment on 21 species in the southeast region, including red snapper. However, NMFS needs to hire more people to be able to reduce the number of species that needs stock assessment work. To alleviate the shortage of highly skilled scientific workforce, the agency has started a program with some universities where graduate students are guaranteed jobs upon completion of their studies.

Matching Harvesting Capacity with Stock Productivity – NMFS need to define what the harvesting capacity of each species within a given habitat is and develop a national plan of action that would maintain sustainable levels for the fishery.

Sustaining the Economic Health of our Nation's Fishing Communities – This takes the form of disaster relief, which in the past is usually allocated only to climatic or weather-related conditions. Now it also includes economic displacement of fishing communities arising from management policies. Congress has allocated $5 million supplemental budget for FY 2000 for disaster relief, the largest so far. There are two ways to avail of disaster relief support, i.e., through the congressional route (senators or representatives declaring disaster through the supplemental process) or through the state route (governor writing that a fishery is in a state of disaster). NMFS (through grant processes) can also channels disaster grants to the state government who does the actual allocation. NMFS will work with some senators to simplify the process for availing of disaster relief funds from the Magnuson-Stevens Fishery Conservation and Management reauthorization act.

Minimizing Conflicts between Commercial Fishing Operations and Marine Animals – This includes prevention of habitat losses through: consultations (ESA Section 7), declaration of EFH sites, habitat replacement to offset loss, maintain/enhance fish passage, South Florida Ecosystem Restoration Project, CWPPRA (58,000 acres for habitat restoration in the southeast), DARP (Rhode Island lobster, New Bedford Harbor, Commencement Bay, East Timbalier), community-based projects (over 100 projects), Kentucky PRIDE.

Restoring and Conserving Essential Fish Habitat to Ensure Healthy Fisheries – All EFH Fishery Management Plan amendments are already in place, including integrated EFH consultation built into existing processes. NMFS also completed agreements with the U.S. Corps of Engineers with the overall objective of clamping down on lawsuits based on EFH compliance.

***Open Discussion:***

Participant: Could you give us an update on NOAA /NMFS and EFH regulations?

Hogarth: There are lots of empty positions at NOAA-NMFS at the moment, e.g., Baker's position is still open. Updates on the results of fishing gear impacts on EFH are not yet out but we will present the results to the Councils and industry once they are out.

Participant: It is understandable to require BRDs in the Gulf of Mexico to protect red snappers due to their interaction with the commercial and recreational fishery. However, such is not the case in Georgia and South Carolina where there is no recreational or targeted fishery for weakfish. Yet, we are required to pull BRDs. If we want to protect the weakfish, it makes more sense to close the directed fishery of North Carolina and get the bycatch problem solved.

Hogarth: The Georgia and South Carolina weakfish belong to the same stock as those found in North Carolina. They also form a species complex with other finfishes and we need to reduce total bycatch everywhere.

Participant: Most of the problems we're having with BRDs started when we set very high bycatch reduction expectations right at the start when we really do not know the capabilities nor proper usage of the existing technology. What we need is a gradual, step-by-step process for increasing the bycatch reduction hurdle.

Hogarth: What we need to do is to reduce the total bycatch reduction in all fisheries.

Participant: In Georgia it will be easier for us to reduce total bycatch rather than just weakfish. Simply regulating North Carolina's take would solve most of the weakfish problems. Also, if we shift towards an overall bycatch reduction criteria, soft TEDs are by-and-large the best gear to use.

Hogarth: What we really need to focus on is bycatch reduction in all fisheries. The shrimp fishery is not being singled out with the BRDs and TEDs requirements.

Participant: Up to the 1980s, red snapper bycatch in the shrimp fishery was considered only as a minor, incidental catch. Then the situation was switched and shrimp fishery became tied with red snapper reduction. The Council then thought that the solution to the red snapper stock recovery could be achieved by simply regulating the shrimp industry. I wonder whether we have reached the end of the rope with respect to the capabilities of the existing BRD technology. We have to open our options and look at the directed fishery and see their impact on the health of the stocks. I think we need to look at a bigger picture.

Hogarth: I hope the industry and academic researchers could use the $750,000 MARFIN money to study the impact of the directed fishery and different management options on the stocks.

in the southeast region, especially the Pascagoula Lab for BRD research...we just need to talk with one another. On the sea turtle issue, we have a number of turtle workshops going on, including a national workshop and ASMFC meeting this coming April. We'll see where we can go from there. We need the states and the industry to participate in a cooperative research program to address the problem comprehensively.

Participant: Is NMFS involved in artificial reef and habitat enhancement programs?

Hogarth: We are doing some artificial reef studies in cooperation with the states but NMFS does not do much of it. Artificial reefs are the state's main program.

Participant: A "reef ball" artificial reef project in South Carolina plans to stack overlapping reefs along the length of the shelf. If this is implemented, this poses problems to shrimp trawlers. I see it erupting as a major problem as it basically limits the available trawlable areas to at least one mile away from these obstructions.

Hogarth: Yes, that would be a problem. Thank you for inviting me to this workshop. I am looking forward to working with the region's fishery industry in the following weeks.

On more practical matters, the group also recommends that NMFS reconsider allowing net flaps to be reattached on the cod end to prevent shrimp loss due to backwash. In order to prevent "unacceptable tows" from being considered as "good tows," the participants also recommend that captains of cooperating vessels should also be consulted by the fishery observers when deciding what constitutes "good tows" and the reasons for accepting or rejecting specific tows during BRD certification testing.

A-3. BRD Certification Protocol-related issues were identified by the original workshop participants as major obstacles for getting industry support for government bycatch reduction programs. In a tribute to NMFS and Dr. William Hogarth's effort, the group unanimously regarded this issue resolved and adequately addressed by the fishery agency. The group recommends that NMFS look for ways to expedite the process of getting the revised BRD Certification Testing Protocol approved.

A-4. Regarding the lack of fishermen's input in the BRD rule-making process, the group cited the progress made since the last workshop as proof that this issue has already been adequately addressed and that NMFS is right on track. It was also noted that feedback from the industry and Advisory Panels were heeded well by the respective Fishery Management Councils with respect to this issue.

A-5. Efforts have been made by state fishery agencies to maintain consistency between state and federal BRD regulations through the Atlantic States Marine Fisheries Commission. It was noted that the Gulf States Marine Fisheries Commission has not made much progress in acknowledging the contributions of the commercial fishery industry compared to their south Atlantic counterpart. As an initial step, the group suggested that Mr. Gary Graham attend the Commission's meeting in Texas and present some of the positive things that the commercial shrimp fishery industry has done and is currently doing to address the bycatch reduction issue.

A-6. The workshop participants rated the current industry-government trust level as improving based on the progress made during this and last year's meeting. It was noted that both sides are listening to what the other has to say. The new (presidential) administration in Washington, D.C. also chose a promising mix of potential appointees to critical government posts, including the NOAA/NMFS. The participants also think that we are moving ahead especially with respect to fostering state-federal-industry cooperation. The group recommends the need for more communication and consideration of the economic and social impacts of fishery regulations.

Individual Comments:

[*While it appears there is some movement of BRD protocol, I am still concerned about the applicant having to define their testing procedure.*]

[*There seems to be some improvement from what I've heard at this meeting. NMFS needs to realize that different regions need different BRDs.*]

[*Positive changes in protocol, as a result of last meeting.*]

[*Until protocol change is implemented, state-federal inconsistency will prevail.*]

[*Fishermen have little authority in BRD rule-making process; however, they do have opportunities for input. NMFS is the only entity with authority in BRD approval process.*]

Following the presentation of Dr. Walter Keithly, the group suggested that the industry frame the solution not as "compensation for gear and BRD related shrimp loss" but as "recouping loss or tax break." A tax deduction formula was suggested in the following format:

BRD Loss per Pound (at 20% of annual shrimp catch) x Average Shrimp Price per Pound = Tax Deduction from Adjusted Gross Income

Dr. Keithly suggested that the industry be proactive and look at the projected long term bycatch reduction rate that may be imposed by the government five to ten years down the line. In this regard, he recommends that both the government and industry initiate pre-implementation planning negotiations to determine what type of compensation or economic incentives may be possible and have this worked out ahead of time to prevent future conflicts.

Summary of Individual Responses to the Evaluation Questionnaire:

The 1999 workshop participants identified the difficulty of getting BRDs certified due to stringent BRD Certification Testing Protocol as the most troublesome obstacle towards industry participation in the government's bycatch reduction program. In response, Dr. Bill Hogarth (then Southeast Regional Administrator of the NOAA/National Marine Fisheries Service), promised to tackle the problem to the best of his ability.

Within a period of one year, the commercial shrimp fishery industry recognized NMFS' remarkable progress in addressing this problem as shown by the highest standardized rating score of 99% (raw score of 65%) or "Major Progress" accorded by the workshop participants to this issue (Table 1). As a consequence, a recognizable air of optimism generally pervades among the participants throughout the follow-up workshop. Overall, industry representatives rated progress towards addressing the key issues or problems identified during the 1999 BRD workshop as "Moderate" to "Good."

Regarding the progress made by NMFS or other government fishery management agencies in adopting industry recommended solutions to the BRD problems, a lower overall rating of "Fair" (42%) was achieved. In sorting through the responses, the low ratings were attributed to the recognition by the industry that some of the recommended solutions (e.g., BRD moratorium and compensation for gear and BRD related shrimp loss) are either beyond the authority of NMFS to unilaterally act upon or are essentially non-feasible solutions to the given problems. The industry also recognized that the effectiveness of these series of BRD workshops were clear manifestations that NMFS actually provides the commercial shrimp fishery industry with direct means to provide input into the development of a workable BRD Certification Testing Protocol and rated progress on these measures as "Moderate" to "Good."

Improvements made by State and Federal agencies to achieve consistency in BRD regulations received a rating of " Fair" to "Moderate" from the industry representatives. Most agree that efforts along these lines take time but groundwork is already in progress. Industry representatives look forward to Dr. Hogarth's promise to provide greater support for industry BRD certification testing programs (e.g., through the Gulf and South Atlantic Fisheries Foundation) as a means to effectively address issue A-8 which received a low 36% or "Poor" to "Fair" progress rating.

**Group B: Alternative (Non-gear) Solutions to the Bycatch Problem**

Key Issues, Problems or Concerns: (Gulf of Mexico)

B-1. Need to address the effectiveness of present measures (i.e., bycatch reduction from both BRDs and TEDs) vs. the contributions of non-trawlable but otherwise high-value habitat to the maintenance of juvenile red snapper and other species.

B-2. Determine the actual bycatch:population ratio and reevaluate the methodology for estimating shrimp trawl bycatch for age 0 and age1 juvenile red snapper and other species of relevant value.

B-3. Lack of NMFS and Council endorsement of the shrimp industry, especially in public relations, law enforcement and public education programs.

B-4. Need to correct errors and reexamine the ecological realism of biomass projections of the current model vs. the habitat's carrying capacity and recent biological findings.

B-5. Consider economic stability as a factor when establishing optimum yield (OY).

B-6. Not enough credit given to the industry for its many contributions towards gear and non-gear related bycatch reduction.

**S-3. Overall progress in addressing issues included in this section**

Group Evaluation:

B-1. The group recognized significant progress already being made on researching this issue, (e.g., Foundation supported field research work by Dr. Steve Szedlmayer of Auburn University), and recommends encouragement and support of similar efforts. While the industry recognize and support the role of artificial reefs in decreasing red snapper mortality (by moving juveniles out of shrimp trawling areas) and/or improve their chance of survival, they recommend that efforts should also be made to protect these "conservation reefs" from exploitation by other groups (e.g., commercial red snapper and recreational fishery). The group also suggested mapping and measuring no shrimp trawling zones and assess their contributions to the overall red snapper stock recovery. This should be done in view of giving the industry "mitigation" credits for setting aside certain trawling areas out of circulation.

B-2. The group recognized that this issue is beyond the general level of understanding of the average fisher and should be relegated to qualified scientific experts.

B-3. This issue is already addressed in item A-1. The group identified the Dauphin Island Sea Lab's "Discovery Hall" display and educational program as a possible example of a good pilot program aimed at addressing this issue.

Key Issues/Problems or Concerns: (South Atlantic)

B-7. Need to remove species-specific rates of (bycatch) reduction and reassessment of required rates.
B-8. Overly complicated stock assessment models and use of inaccurate data or suspect information.
B-9. Duplication of fishery management by different government agencies (i.e., state agencies and ASMFC) and the resulting inconsistency among state and federal laws.
B-10. Lack of NMFS and Council endorsement of the shrimp industry, especially in public relations, law enforcement and public education programs.

**S-4. Overall progress in adopting solutions included in this section**

Group Evaluation:

B-7. It was pointed out that the North Carolina fishery primarily drives the required weakfish reduction in the bycatch of South Atlantic trawlers. In view of this, the group recommended the following research priority areas: (1) look at the migration pattern of weakfish and assess the differential impact of the different state's fishing fleet on the health of this stock, (2) implement genetic classification studies to determine if the south Atlantic weakfish belongs to one unit stock or not, and (3) conduct species characterization studies in support of the above research. Depending on the result of these studies, the group recommended that states determine the possibility of defining appropriate BRD requirements for each state or specific regions or season within states.

B-8. Already addressed in item B-4.

B-9. Already addressed in item A-5. The goal of both state and federal fishery agencies is to develop "seamless management" and significant effort is already being made to achieve consistency of regulations.

B-10. Already addressed in item A-1.

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Individual Comments:

[*Need more publicity about the positive things industry and council has done and is currently doing.*]

[*Councils are moving toward recreational fishery but stock assessment are at least being reviewed.*]

[*Bycatch reduction requirement should be "reduce finfish as much as possible without economic injury to the industry."*]

B-13. Already addressed in items A-5 and A-10 above. The Magnuson-Stevens Fishery Conservation and Management Act, whose goal is: "local conditions to dictate data collection needs and BRD design/criteria," address the regional autonomy issues. It was also noted that the Gulf of Mexico FMC already started looking at the regional approach when they designed Amendment 10 for South Florida where area closures are considered more feasible than BRDs.

B-14. Already addressed in items B-4 and B-7 above.

B-15. Already addressed in item B-4 above. The group recommended that NMFS and the industry explore different funding mechanisms for these educational programs, e.g., MARFIN grant, industry contributions, NMFS sub-contracted projects, etc.

Summary of Individual Responses to the Evaluation Questionnaire:

Industry representatives gave this section an overall progress rating bordering on "Fair" to "Moderate" indicating that work is slow but things are moving in the right direction (Table 2). On the Gulf of Mexico, research being conducted by Dr. Steve Szedlmayer through the Gulf and South Atlantic Fisheries Foundation are recognized and highly supported by the industry. Differences in the life history pattern of critical species prevent similar strategies to be implemented in the South Atlantic, however, dropping Spanish mackerel as a target species in the revised BRD Certification Testing Protocol was much appreciated by the industry.

The industry representatives are also hopeful that species-specific stock assessment models would be replaced by something better (e.g., ecosystem-based approach) with the re-authorization of the Magnuson-Stevens Fishery Conservation and Management Act. In both regions, industry representatives felt a serious need to present a positive public image of the industry through proper education and PR campaigns. In various press releases, the industry representatives felt that NMFS and State fishery agencies are increasingly recognizing industry contributions towards bycatch reduction.

Individual Comments:

[*The public still perceives shrimpers as ocean "ropers."*]

[*Big need to educate the public.*]

[*We need funding to do a much better job of this.*]

It was noted that, in general, the credibility of regulating agencies is still poor mainly due to (1) lack of effective communication/institutional public relations strategies, (2) credibility gap with respect to producing good science, and (3) the impact of agency decisions made based on political considerations or pressure rather than good science.

C-2. Same as the comments on item C-1 above. The group also recognized the need to encourage positive dialogue between the industry and regulators such as this workshop where issues are identified and addressed in a rational and cooperative manner.

C-3. Same as items A-5 and A-10 above.

C-4. Same as item A-5 above.

C-5. The group felt that efforts are being made by NMFS to correct the imbalance of stakeholder representation in the Councils.

Individual Comments:

[*There seems to be a lot of talk going on but not a lot of progress, although the talks seem to be going in the right direction.*]

[*Dr. Bill Hogarth has improved state/federal fishery agency dialogue.*]

[*On need for area-specific regulations: I think the proposed flexibility in the BRD testing protocol better accommodates this.*]

[*On consistency of state-federal agency requirements: Again, we are moving in that direction but have to get the revised BRD protocols implemented as soon as possible!*]

Key Solutions:

C-6. Update database and computer models.
C-7. Assign an objective regional ombudsman.
C-8. No blanket regulations.
C-9. More interaction and dialogue between Federal and State (Fishery Agencies).
C-10. Increase stakeholder nominations to NMFS (Councils?).

**S-7. Overall progress in adopting solutions included in this section**

**Table 3. Individual Evaluation Rating Summary for Group C – Harnessing Industry Involvement: Key Issues and Recommendations.**

| | | WORKSHOP EVALUATION QUESTIONS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RATING | | C1 | C2 | C3 | C4 | C5 | S6 | C6 | C7 | C8 | C9 | C10 | S7 |
| No Progress | 0% | 2 | 1 | 1 | 2 | 7 | 1 | 1 | 2 | 4 | 1 | 6 | 1 |
| | 10% | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 3 | 2 | 1 |
| Poor | 20% | 5 | 4 | 2 | 1 | 0 | 3 | 2 | 2 | 2 | 0 | 0 | 3 |
| | 30% | 1 | 1 | 2 | 3 | 0 | 1 | 2 | 1 | 0 | 2 | 1 | 2 |
| Fair | 40% | 0 | 3 | 2 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 0 |
| | 50% | 3 | 1 | 1 | 1 | 0 | 0 | 1 | 3 | 2 | 1 | 1 | 1 |
| Moderate | 60% | 0 | 0 | 1 | 2 | 0 | 1 | 2 | 0 | 1 | 1 | 0 | 4 |
| | 70% | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 2 | 0 | 2 | 1 | 0 |
| Good | 80% | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | 90% | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Major Progress | 100% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| n = | | 13 | 13 | 13 | 13 | 11 | 11 | 12 | 12 | 12 | 11 | 12 | 12 |
| Average Raw Scores = | | 23% | 30% | 30% | 27% | 13% | 30% | 38% | 39% | 25% | 38% | 18% | 35% |
| Standardized Scores = | | 36% | 46% | 46% | 41% | 20% | 46% | 59% | 60% | 38% | 59% | 27% | 54% |

**Problems, Issues, Barriers or Constraints:**

D-1. Complicated, impractical and rigid protocol and/or test permit application process.
D-2. High shrimp loss and cost of compliance.
D-3. Non-recognition of regional differences in the need for bycatch reduction devices.
D-4. Practical and theoretical problems with the use of species specific vs. overall bycatch reduction rates.
D-5. Extensive bureaucracy and lack of ("customer") service among fishery agencies.
D-6. Lack of consistency in state-federal regulations and inadequately trained law enforcement personnel.
D-7. Difficulty in balancing multiple stakeholder demands.
D-8. Lack of two-way communication, trust and appropriate technology transfer program.

**S-8. Overall progress in addressing issues included in this section**

(Note: At this point it was time to adjourn the workshop. Hence, only individual survey questionnaire responses were available for analysis.)

Individual Comments:

[*Need for more local input from council and NMFS; interact with area fishermen.*]

[*Good progress is being made in several areas but all need more improvement.*]

[*This workshop was very beneficial to all participants – particularly industry representatives, although limited progress was made. Fishery managers, scientists and researchers will leave this workshop with a better perspective of the role NMFS and all participants will play in addressing and solving problems in shrimp trawl bycatch reductions. It is my hope that we may possibly be nearer the end of reaching further bycatch reduction with present day gear technology. It is time to consider the possibility that shrimp trawl bycatch is not the most serious impediment to restoring red snapper stocks in the Gulf of Mexico.*]

[*I heard from talks during this workshop that there has been more industry involvement and improvements made in fisheries management. But personally, I have not seen any improvements since the last workshop.*]

**Table 4. Individual Evaluation Rating Summary for the Sections on General Problems, Issues, Barriers or Concerns; and Suggestions for Improvement.**

| | | WORKSHOP EVALUATION QUESTIONS | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RATING | | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | S8 | D9 | D10 | D11 | D12 | S9 |
| No Progress | 0% | 0 | 4 | 3 | 4 | 2 | 5 | 2 | 2 | 1 | 0 | 0 | 2 | 2 | 0 |
| | 10% | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 0 | 2 | 1 | 1 | 1 |
| Poor | 20% | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 0 | 0 | 3 | 1 |
| | 30% | 2 | 1 | 0 | 3 | 2 | 2 | 1 | 1 | 1 | 0 | 4 | 2 | 1 | 1 |
| Fair | 40% | 0 | 2 | 1 | 0 | 4 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 |
| | 50% | 0 | 3 | 2 | 1 | 2 | 0 | 0 | 2 | 1 | 2 | 1 | 2 | 0 | 2 |
| Moderate | 60% | 3 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| | 70% | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 2 | 2 | 1 | 1 |
| Good | 80% | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 1 | 1 | 3 |
| | 90% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| Major Progress | 100% | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| n = | | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 11 | 13 | 13 | 13 | 12 | 11 |
| Average Raw Scores = | | 58% | 58% | 24% | 30% | 24% | 28% | 15% | 35% | 33% | 57% | 48% | 43% | 33% | 50% |
| Standardized Scores = | | 90% | 90% | 37% | 46% | 37% | 44% | 24% | 53% | 50% | 88% | 73% | 66% | 50% | 77% |

## Workshop Evaluation

Overall, the workshop participants overwhelmingly rated the ***Follow-up Workshop on Bycatch Reduction in the Shrimp Fishery*** as "Effective" to "Highly Effective" in achieving its primary goal. Participants also rated this workshop as a "Very Productive" undertaking. Individual comments for improvement include:

*[More State DNR involvement, i.e., South Carolina DNR, Texas DNR]*

differences in bycatch reduction needs, and (c) enhancement of "customer service"/streamlining of fishery agency operations.

The participants also recognize the complex biological, technological, socioeconomic and perceptual nature of the bycatch problem. In fisheries management, perception often equates to reality. It was the consensus of the group that relatively little is being done to address the perceptual side of this issue. Hence, it was highly recommended that the industry, state and federal fishery agencies pool their resources together to support the development and implementation of appropriate education and communication programs as a first step towards correcting these deficiencies. These programs should be aimed at improving the public's knowledge and perception of bycatch issues, and highlight efforts made by different stakeholders to solve them.

## ACKNOWLEDGEMENT

This workshop owes its success to the active participation of various industry, state/federal fishery management agencies, academic research and Sea Grant/Marine Extension representatives. The participation of Dr. Bill Hogarth and the financial support from NOAA/National Marine Fisheries Service for this workshop is also gratefully acknowledged. Mr. Jerald Horst of the Louisiana Sea Grant Program was very helpful in identifying and convincing industry representatives from Louisiana to join and share their concerns in this forum. The staff of the Gulf and South Atlantic Fisheries Foundation was instrumental in organizing this workshop. Thanks are also due to various speakers who found time in their hectic schedules to attend and present their ideas to the workshop participants. Congratulation also goes to Mr. Philip Horn for facilitating another well-run meeting.

# APPENDIX A

## FOLLOW-UP WORKSHOP ON BYCATCH REDUCTION IN THE SHRIMP FISHERY OF THE GULF OF MEXICO AND SOUTH ATLANTIC

## INDIVIDUAL PROGRESS EVALUATION FORM

## FOLLOW-UP WORKSHOP ON BYCATCH REDUCTION IN THE SHRIMP FISHERY

## BYCATCH REDUCTION WORKSHOP ISSUES AND RECOMMENDATIONS PROGRESS EVALUATION FORM

### Group A. Possible Areas of Innovation in BRD Designs

| Key Issues, Problems or Concerns: | Degree of Progress Made in Addressing Key Issues or Problems: |
|---|---|
| ▪ Trawl bycatch is a perceived problem and not a biological problem. | 0 10 20 30 40 50 60 70 80 90 100% (No Progress – Major Progress) |
| ▪ Too much shrimp loss with BRDs on certain vessels. | 0 10 20 30 40 50 60 70 80 90 100% (No Progress – Major Progress) |
| ▪ Too difficult to approve BRDs using existing BRD Certification Testing Protocols. | 0 10 20 30 40 50 60 70 80 90 100% (No Progress – Major Progress) |
| ▪ Fishermen have little authority on BRD rule-making process. | 0 10 20 30 40 50 60 70 80 90 100% (No Progress – Major Progress) |
| ▪ Inconsistency between state and federal BRD regulations. | 0 10 20 30 40 50 60 70 80 90 100% (No Progress – Major Progress) |
| ▪ Lack of trust between industry and government. | 0 10 20 30 40 50 60 70 80 90 100% (No Progress – Major Progress) |

**Overall progress in addressing issues included in this section:** 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
No Progress Poor Fair Moderate Good Major Progress

COMMENTS:

**Group B: Alternative (Non-gear) Solutions to the Bycatch Problem**

| Key Issues, Problems or Concerns: (Gulf of Mexico) | Degree of Progress Made in Addressing Key Issues or Problems: |
|---|---|
| ▪ Need to address the effectiveness of present measures (i.e., bycatch reduction from both BRDs and TEDs) vs. the contributions of non-trawlable but otherwise high-value habitat to the maintenance of juvenile red snapper and other species. | 0 10 20 30 40 50 60 70 80 90 100%<br>No Progress — Major Progress |
| ▪ Determine the actual bycatch:population ratio and reevaluate the methodology for estimating shrimp trawl bycatch for age 0 and age1 juvenile red snapper and other species of relevant value. | 0 10 20 30 40 50 60 70 80 90 100%<br>No Progress — Major Progress |
| ▪ Lack of NMFS and Council endorsement of the shrimp industry, especially in public relations, law enforcement and public education programs. | 0 10 20 30 40 50 60 70 80 90 100%<br>No Progress — Major Progress |
| ▪ Need to correct errors and reexamine the ecological realism of biomass projections of the current model vs. the habitat's carrying capacity and recent biological findings. | 0 10 20 30 40 50 60 70 80 90 100%<br>No Progress — Major Progress |
| ▪ Consider economic stability as a factor when establishing optimum yield (OY). | 0 10 20 30 40 50 60 70 80 90 100%<br>No Progress — Major Progress |
| ▪ Not enough credit given to the industry for its many contributions towards gear and non-gear related bycatch reduction. | 0 10 20 30 40 50 60 70 80 90 100%<br>No Progress — Major Progress |

**Overall progress in addressing issues included in this section:** 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
No Progress — Poor — Fair — Moderate — Good — Major Progress

COMMENTS:

Key Solutions:

Degree of Progress in Adopting Recommended Solutions:

- Attract fish to areas of minimal trawling (activities).
  0 10 20 30 40 50 60 70 80 90 100%
  Not Adopted Major Progress
- Evaluate areas that are presently closed.
  0 10 20 30 40 50 60 70 80 90 100%
  Not Adopted Major Progress
- Distinguish regional needs.
  0 10 20 30 40 50 60 70 80 90 100%
  Not Adopted Major Progress
- Evaluate biological realism of the model(s).
  0 10 20 30 40 50 60 70 80 90 100%
  Not Adopted Major Progress
- Educate the public -- get the message out.
  0 10 20 30 40 50 60 70 80 90 100%
  Not Adopted Major Progress

**Overall progress in addressing issues included in this section:** 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

No Progress Poor Fair Moderate Good Major Progress

COMMENTS:

Key Solutions:

Degree of Progress in Adopting Recommended Solutions:

- Update database and computer models. 0 10 20 30 40 50 60 70 80 90 100% (Not Adopted – Major Progress)
- Assign an objective regional ombudsman. 0 10 20 30 40 50 60 70 80 90 100% (Not Adopted – Major Progress)
- No blanket regulations. 0 10 20 30 40 50 60 70 80 90 100% (Not Adopted – Major Progress)
- More interaction and dialogue between Federal and State (Fishery Agencies). 0 10 20 30 40 50 60 70 80 90 100% (Not Adopted – Major Progress)
- Increase stakeholder nominations to NMFS (Councils?). 0 10 20 30 40 50 60 70 80 90 100% (Not Adopted – Major Progress)

**Overall progress in adopting solutions included in this section:** 0% (No Progress) 10% 20% (Poor) 30% 40% (Fair) 50% 60% (Moderate) 70% 80% (Good) 90% 100% (Major Progress)

COMMENTS:

**Suggestions for Improvement:**

Degree of Progress in Adopting Suggestions for Improvement:

- Revise the current protocol incorporating practical input from, and significant involvement of fishermen.
  0 10 20 30 40 50 60 70 80 90 100%
  Not Adopted — Major Progress
- Simplify and streamline the whole BRD technology development process.
  0 10 20 30 40 50 60 70 80 90 100%
  Not Adopted — Major Progress
- Involve the industry in the planning, implementation and evaluation of fisheries research and management programs.
  0 10 20 30 40 50 60 70 80 90 100%
  Not Adopted — Major Progress
- Improve the operation of fishery management agencies.
  0 10 20 30 40 50 60 70 80 90 100%
  Not Adopted — Major Progress

**Overall progress in adopting suggestions included in this section:** 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

No Progress — Poor — Fair — Moderate — Good — Major Progress

COMMENTS:

# APPENDIX B

## FOLLOW-UP WORKSHOP ON BYCATCH REDUCTION IN THE SHRIMP FISHERY OF THE GULF OF MEXICO AND SOUTH ATLANTIC

## WORKSHOP EVALUATION QUESTIONNAIRE

Gulf & South Atlantic Fisheries Foundation, Inc.

## Follow-Up Workshop on Bycatch Reduction in the Shrimp Fishery
## Workshop Evaluation Questionnaire

Name: _____ Survey Code: _____

☐ Gulf Shrimp Industry ☐ So. Atlantic Shrimp Industry ☐Others (Please specify): _____

This workshop was organized in response to the recommendations made by the participants in the October 13-14, 1999 "Industry Workshop on Bycatch Reduction in the Shrimp Fishery." The main objective of this workshop is to provide industry and government representatives with a forum to evaluate the progress in addressing critical issues and/or adopting the recommendations made by previous workshop participants.

1. Was this workshop effective in achieving its primary goal (as stated above)?

   ☐ Highly effective
   ☐ Effective
   ☐ Moderately effective
   ☐ Ineffective

2. Rate the utility, relevance and presentation of the following workshop topics/speakers:

   a) Review of BRD Protocol and Permit Process (Dr. Steve Branstetter, NMFS-SERO)

| Utility of Presentation | Relevance of Presentation | Delivery of Presentation |
|---|---|---|
| ☐ Very useful | ☐ Highly relevant | ☐ Excellent presentation |
| ☐ Useful | ☐ Relevant | ☐ Good presentation |
| ☐ Moderately useful | ☐ Somewhat relevant | ☐ Fair presentation |
| ☐ Barely useful | ☐ Not relevant | ☐ Poor presentation |

   b) BRD Certification – Statistical Procedures (Dr. Arvind Shah, Univ. South Alabama)

| Utility of Presentation | Relevance of Presentation | Delivery of Presentation |
|---|---|---|
| ☐ Very useful | ☐ Highly relevant | ☐ Excellent presentation |
| ☐ Useful | ☐ Relevant | ☐ Good presentation |
| ☐ Moderately useful | ☐ Somewhat relevant | ☐ Fair presentation |
| ☐ Barely useful | ☐ Not relevant | ☐ Poor presentation |

   c) Industry Experience and Concern (Dave Harrington, Univ. Georgia/Gary Graham, Texas A&M U.)

| Utility of Presentation | Relevance of Presentation | Delivery of Presentation |
|---|---|---|
| ☐ Very useful | ☐ Highly relevant | ☐ Excellent presentation |
| ☐ Useful | ☐ Relevant | ☐ Good presentation |
| ☐ Moderately useful | ☐ Somewhat relevant | ☐ Fair presentation |
| ☐ Barely useful | ☐ Not relevant | ☐ Poor presentation |

# APPENDIX C

# FOLLOW-UP WORKSHOP ON BYCATCH REDUCTION IN THE SHRIMP FISHERY OF THE GULF OF MEXICO AND SOUTH ATLANTIC

## ISSUES CONCERNING BRD CERTIFICATION

**Dr. Arvind K. Shah**

Concept Of Burden Of Proof (BOP)

CASE A: BOP on the device (industry)

**Ho: The candidate BRD is unacceptable**
**i.e., the candidate BRD has a lower reduction rate than the required rate for certification.**

$$H_0 : R \le R_0 \Rightarrow 1 - \left( \mu_B / \mu_S \right) \le R_0 \Rightarrow (1 - R_0)\mu_S - \mu_B \le 0$$

$$H_a : R \succ R_0 \Rightarrow 1 - \left( \mu_B / \mu_S \right) \succ R_0 \Rightarrow (1 - R_0)\mu_S - \mu_B \succ 0$$

**$\alpha$ - to be specified by NMFS**

**$\alpha$ = Probability of rejecting true Ho**
**= Probability of accepting an unacceptable BRD**
**= Consumer's Risk**

**$\beta$ = Probability of accepting false Ho**
**= Prob. of not accepting an acceptable BRD**
**= Producer's Risk**

---

**In hypothesis testing, $\alpha$ is controlled but not $\beta$.**
**This case yields high producer's risk ($\beta$ values).**

CASE B: <u>BOP on the government (NMFS)</u>

**This can reduce the producer's risk.**
**However, at what cost? Is it advisable?**

**Ho: The candidate BRD is acceptable**
**i.e., the candidate BRD meets the reduction rate required for certification.**

$$H_0 : R \geq R_0 \Rightarrow 1 - \left( \mu_B / \mu_S \right) \geq R_0 \Rightarrow (1 - R_0)\mu_S - \mu_B \geq 0$$

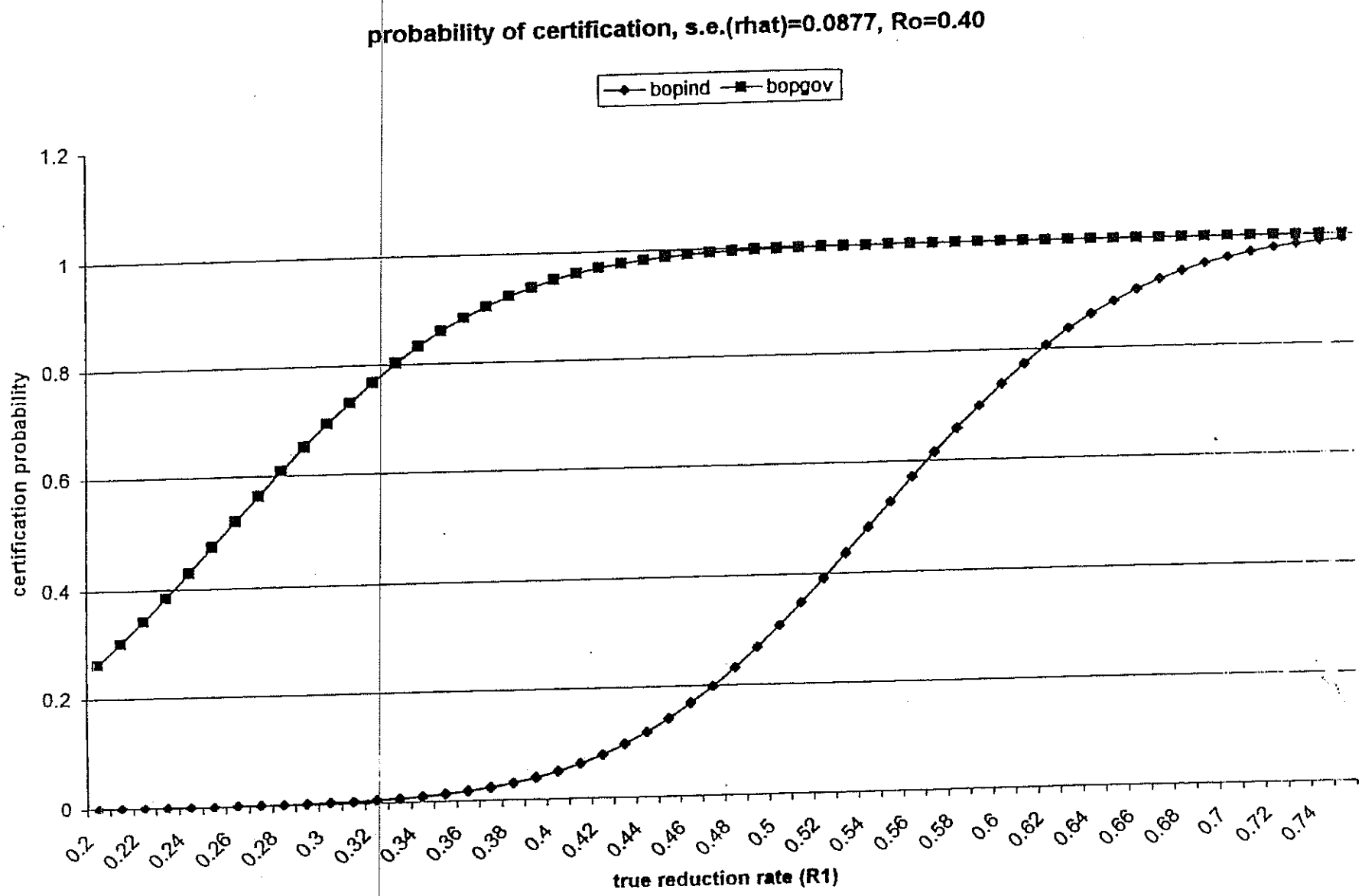
$$H_a : R \prec R_0 \Rightarrow 1 - \left( \mu_B / \mu_S \right) \prec R_0 \Rightarrow (1 - R_0)\mu_S - \mu_B \prec 0$$

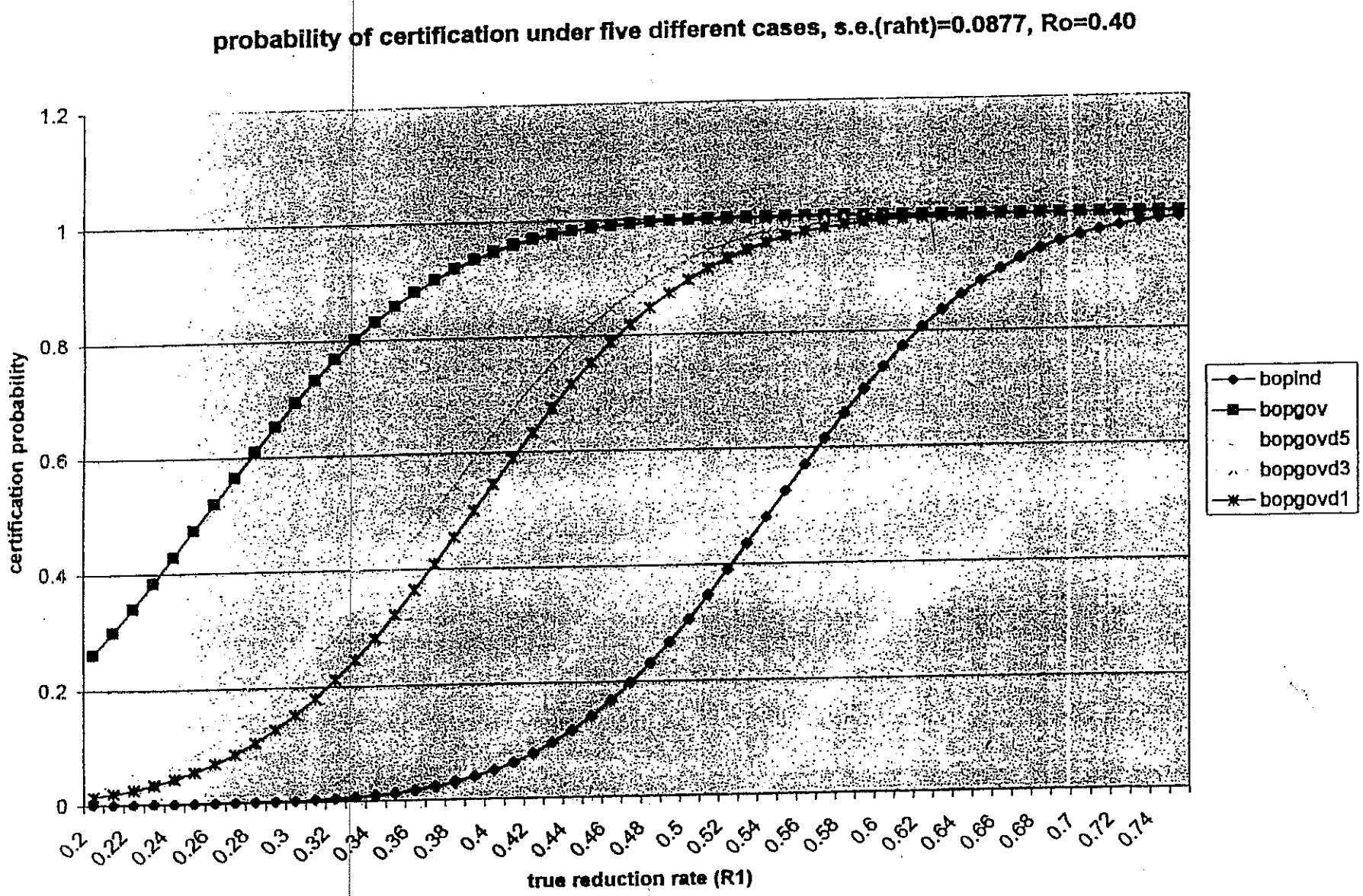
---

**$\alpha$ = Probability of rejecting true Ho**
**= Prob. of not accepting an acceptable BRD**
**= Producer's Risk**

**$\beta$ = Probability of accepting false Ho**
**= Probability of accepting an unacceptable BRD**
**= Consumer's Risk**

**In hypothesis testing, generally $\alpha$ is controlled but not $\beta$.**
**This case yields high consumer's risk ($\beta$ values).**


probability of certification, s.e.(rhat)=0.0877, Ro=0.40
bopind
bopgov
certification probability
1.2
1
0.8
0.6
0.4
0.2
0
0.2
0.22
0.24
0.26
0.28
0.3
0.32
0.34
0.36
0.38
0.4
0.42
0.44
0.46
0.48
0.5
0.52
0.54
0.56
0.58
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74
true reduction rate (R1)


probability of certification under five different cases, s.e.(raht)=0.0877, Ro=0.40
certification probability
1.2
1
0.8
0.6
0.4
0.2
0
0.2
0.22
0.24
0.26
0.28
0.3
0.32
0.34
0.36
0.38
0.4
0.42
0.44
0.46
0.48
0.5
0.52
0.54
0.56
0.58
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74
true reduction rate (R1)
bopind
bopgov
bopgovd5
bopgovd3
bopgovd1

Hypothesis testing approaches:

1. "Modified" Paired t test

$$t = \frac{(1-R_0)\overline{X} - \overline{Y}}{\sqrt{s^2_{do,i}/n}},$$

where, $d_{0,i} = (1-R_0)X_i - Y_i, i = 1,2,\ldots,n(\#tows)$
t statistic ~ t distribution with (n-1) d.f. under Ho.

2. Ratio test

$$t = \left(\hat{R} - R_0\right) \Big/ \sqrt{s^2_{\hat{R}}} \quad ,$$

where, $\hat{R} = 1 - \left(\overline{Y}/\overline{X}\right)$ = sample reduction rate,

$s^2_{\hat{R}}$ = estimated variance of $\hat{R}$

$$= \frac{1}{n\overline{X}^2}\left[\frac{\sum\left\{Y_i - \left(1-\hat{R}\right)X_i\right\}^2}{n-1}\right].$$

Statistic t ~ t distribution with (n-1) d.f.

A (1-α)100% confidence interval on R is given by

$$\hat{R} \pm t_{\frac{\alpha}{2}}.s_{\hat{R}}.$$

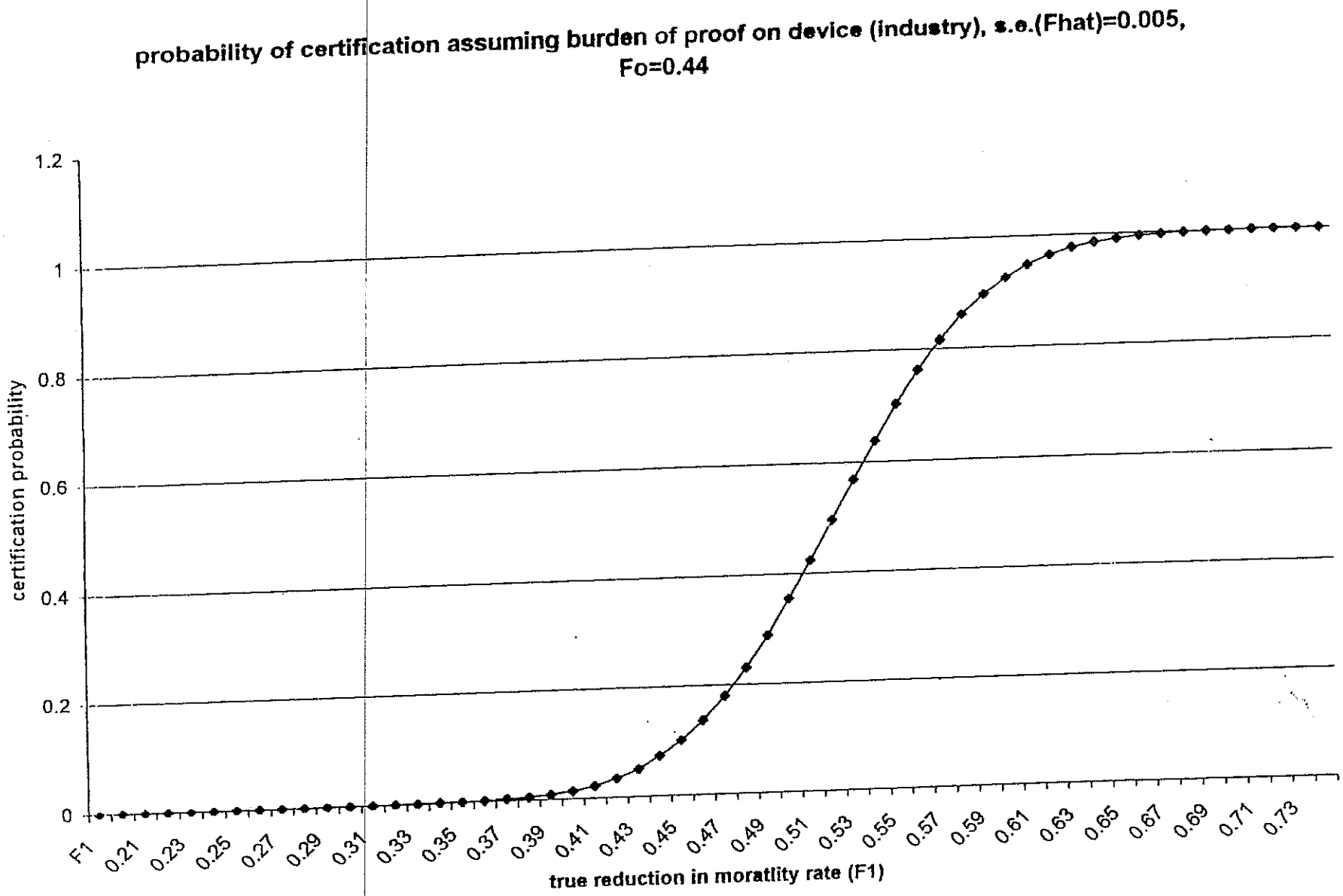
## Estimation of Reduction in Fishing Mortality (F):

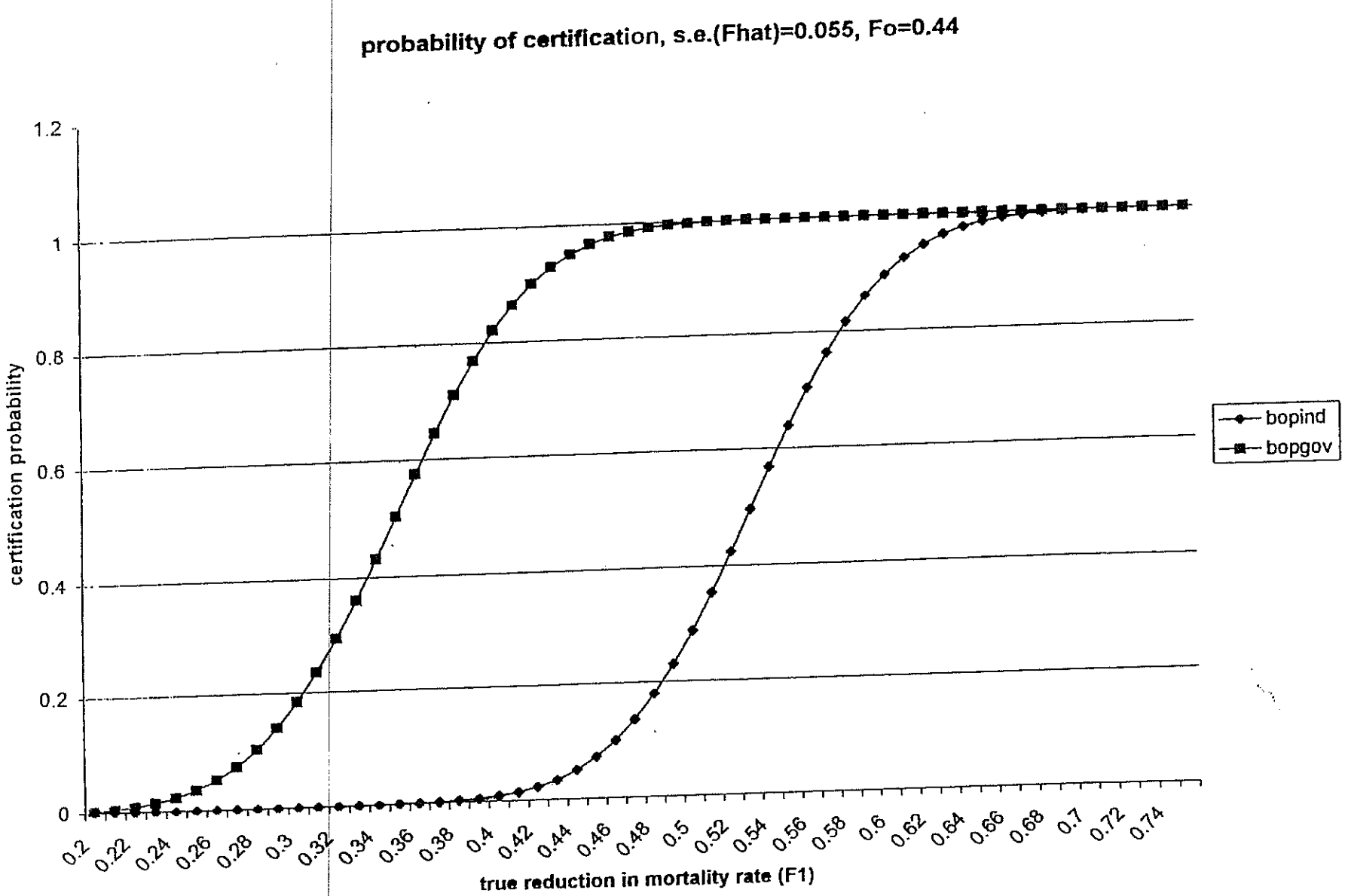
In an attempt to simplify the process of estimating (approximating) F reduction and to facilitate the construction of confidence interval on it, Nichols (1999) has proposed using a linear combination of $\hat{R}o$ and $\hat{R}_1$, the estimated numerical reduction rates in two size intervals, respectively, (of red snapper) as an approximation of F. Thus,

$$\hat{F} \approx c_0\hat{R}_0 + c_1\hat{R}_1$$

where $c_0$ and $c_1$ are determined appropriately for any size division from the distribution of F by size inherent in Goodyear's procedure. Nichols has suggested using $c_0 = 0.30$ and $c_1 = 0.70$ for red snapper less than 130mm and greater than or equal to 130mm fork length, respectively.

It is now possible to construct a confidence interval on F assuming $c_0$ and $c_1$ constants. The construction of confidence interval requires working with infinite power series and truncation of terms. The confidence interval derived based upon one term truncation is given below. Higher order approximations are complex, and are being studied currently.


probability of certification assuming burden of proof on device (industry), s.e.(Fhat)=0.005, Fo=0.44
certification probability
1.2
1
0.8
0.6
0.4
0.2
0
F1
0.21
0.23
0.25
0.27
0.29
0.31
0.33
0.35
0.37
0.39
0.41
0.43
0.45
0.47
0.49
0.51
0.53
0.55
0.57
0.59
0.61
0.63
0.65
0.67
0.69
0.71
0.73
true reduction in moratlity rate (F1)


probability of certification, s.e.(Fhat)=0.055, Fo=0.44
certification probability
1.2
1
0.8
0.6
0.4
0.2
0
0.2
0.22
0.24
0.26
0.28
0.3
0.32
0.34
0.36
0.38
0.4
0.42
0.44
0.46
0.48
0.5
0.52
0.54
0.56
0.58
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74
true reduction in mortality rate (F1)
bopind
bopgov

# SAS PROGRAMS

**PROGRAM 1. SIMPLIFIED SAS PROGRAM FOR COMPUTING REDUCTION RATES AND CONFIDENCE INTERVAL ALONG WITH HYPOTHESIS TESTING.**

---

**Sample Dataset**

```
1 3 138 203 6 4 14.00 10.25
2 3 32 30 21 14 13.00 21.00
3 3 62 32 24 15 13.00 12.00
4 3 30 14 2 3 20.50 15.50
5 3 48 21 47 5 20.00 10.50
6 3 107 86 27 15 16.00 16.50
7 3 102 70 55 9 25.50 15.50
8 3 167 76 101 12 19.00 15.00
9 3 108 57 36 8 23.25 18.50
10 3 99 26 102 12 5.39 5.17
11 3 12 4 23 10 9.90 8.14
12 3 78 44 29 7 30.80 27.50
13 3 90 20 31 20 31.90 26.40
14 3 24 4 29 8 42.90 37.40
15 3 11 8 11 19 23.10 16.50
16 3 26 6 62 14 72.60 41.80
17 3 66 18 49 25 48.40 30.80
18 3 23 12 11 21 50.60 39.60
19 3 23 17 8 11 39.60 30.80
20 3 65 40 65 7 33.00 26.40
21 3 24 32 23 17 18.70 28.60
22 3 4 4 17 10 33.00 22.00
23 3 2 9 59 8 88.00 77.00
24 3 25 11 16 17 57.20 39.60
25 3 48 18 21 22 41.80 33.00
26 3 58 37 8 4 41.80 37.40
27 3 10 10 18 12 38.50 30.80
28 3 6 3 4 6 22.00 22.00
29 3 27 23 8 2 24.20 22.00
30 3 15 6 30 20 44.00 37.40
31 3 18 12 29 6 55.00 39.60
32 3 7 7 10 0 41.80 39.60
33 3 76 25 25 8 48.40 33.00
```

---

```
N=NZ;
DROP _TYPE_ _FREQ_;
REDM=1-RATIOM;
SERED=ZS/CPUESM;
TESTSTAT=REDM/SERED;
ABST=ABS(TESTSTAT);
PVALUE=2*(1-PROBT(ABST,N-1));
T=TINV(0.95,N-1);
BOUND=T*SERED;
LLRED90=REDM-BOUND;
ULRED90=REDM+BOUND;
PSERED=SERED*100;
PREDM=REDM*100;
PLLRED90=LLRED90*100;
PULRED90=ULRED90*100;
TSTAT40=(REDM-0.40)/SERED;
PVALUE40=PROBT(TSTAT40,N-1);
BRDTYPE='NCFEYE';
SPECIES="WEAC";
BOP="GOVT";
PROC PRINT DATA=FINAL2;
VAR BRDTYPE SPECIES N PREDM PVALUE
PLLRED90 PULRED90 PSERED TSTAT40 PVALUE40 BOP;
RUN;
```

---

The above program was created from the following program by
changing YYYY to WEAC globally in the program.

```
***KEEP SPECIES NAME FOUR LETTER LONG AND ATTACH B (FOR BRD);
***OR S (FOR STANDARD) AT THE END;
***IN THE FOLLOWING PROGRAM CHANGE YYYY TO THE SPECIES NAME (FOUR;
***LETTER LONG) TO BE ANALYZED GLOBALLY;

DATA SHAH;
INFILE 'C:\BYCATCH\SHIPMAN\NCFEYE.DAT';
INPUT TOW HRSTOW WEACS WEACB SPACS SPACB SHRWS SHRWB;
DATA SHAH1;
SET SHAH;
XXXXB=YYYYB;
XXXXS=YYYYS;
KEEP TOW HRSTOW XXXXB XXXXS;
DATA SHAH12;
SET SHAH1;
CPUESTD=XXXXS/HRSTOW;
CPUEBRD=XXXXB/HRSTOW;
```

```
PVALUE40=PROBT(TSTAT40,N-1);
BRDTYPE='NCFEYE';
SPECIES="YYYY";
BOP="GOVT";
PROC PRINT DATA=FINAL2;
VAR BRDTYPE SPECIES N PREDM PVALUE
PLLRED90 PULRED90 PSERED TSTAT40 PVALUE40 BOP;
RUN;
-----------------------------------------
```

**PROGRAM 2. ESTIMATION OF FISHING MORTALITY (F) REDUCTION BY LINEAR COMBINATION OF THE GEAR REDUCTION RATES OF TWO DIFFERENT SIZE CLASSES**

```
*****THIS PROGRAM ESTIMATES REDUCTION IN F BY A LINEAR COMBINATION OF;
*****REDUCTIONS IN TWO SIZE INTERVALS. IT REQUIRES INPUTING THE COEFF;
*****FOR LINEAR COMBINATIONS, TWO REDUCTION RATES, AND THEIR VAR IN THE;
*****PROGRAM. SNXC,SNYC,SNZC ARE 0,1,& OVER1 YEAR BREAKDOWN OF SNAC;
*****SN1C AND SN2C ARE LT130MM AND GE130MM LENGTH BREAKDOWN OF SNAC;
*****CHANGE YYYY TO SN1C AND KKKK TO SN2C GLOBALLY IN THIS PROGRAM
FOR;
*****SNAC ANALYSIS;
DATA ONE;
INFILE 'C:\BYCATCH\BYCAT.99H\BYCAT1.TXT';
INPUT TRIP 1-7 TOW $ 8-13 NETPOS $ 14 NETGR $ 15-18 TED $ 15
BRDTYPE $ 16-17 STIM $ 18 HRSTOW 19-22
TOTWE 23-28 TOTWS 29-34 TFIWE 35-40 TFIWS 41-46
SHRWE 47-52 SHRWS 53-58 DATE 59-66 YEAR 59-62 MONTH 63-64 DAY 65-66
GORA $ 67 VESSEL $ 68-70;
DATA TWO;
INFILE 'C:\BYCATCH\BYCAT.99H\BYCAT2.TXT';
INPUT TRIP 1-7 TOW $ 8-13 NETPOS $ 14
SNACE 15-19 SNAWE 20-26 SNACS 27-31 SNAWS 32-38
SNXCE 39-43 SNXCS 44-48 SNYCE 49-53 SNYCS 54-58 SNZCE 59-63 SNZCS 64-68
SN1CE 69-73 SN1CS 74-78 SN2CE 79-83 SN2CS 84-88;
DATA SHAH;
MERGE ONE TWO;
*GORA="QQQQ";
RUN;
DATA SHAH1;
SET SHAH;
*IF BRDTYPE="BB";
*IF NETPOS NE "PPP";
*IF VESSEL="VVV";
```

```
VHATRZ=SHATRZ**2;
CX=0.3;
CZ=0.7;
COV=((CX*CZ)/(MSX*MSZ*(N-1)))*(MTXTZ-((1-RHATZ)*MTXSZ)-((1-RHATX)*MSXTZ)
+((1-RHATX)*(1-RHATZ)*MSXSZ));
FHAT=(CX*RHATX)+(CZ*RHATZ);
TCRIT90=TINV(0.95,N-1);
VFHAT=((CX**2)*(VHATRX))+((CZ**2)*(VHATRZ))+(2*COV);
SEFHAT=VFHAT**0.5;
TSTAT40=(FHAT-0.40)/SEFHAT;
PVALUE40=PROBT(TSTAT40,N-1);
BOUND90=TCRIT90*SEFHAT;
LLTF90=FHAT-BOUND90;
ULTF90=FHAT+BOUND90;
*BRDTYPE="&BB";
*SPX="YYYY";
*SPZ="KKKK";
*GORA="QQQQ";
*NETPOS="PPP";
*VESSEL="VVV";
PROC PRINT DATA=LAST;
*TITLE "BOP ON GOVT, Fo=0.4, GORA=QQQQ BRDTYPE=BB NETPOS=PPP VESSEL=VVV
SPX=YYYY SPZ=KKKK";
RUN;
-----------------------------------------------------
```

# Proposed Revisions to the Bycatch Reduction Device Testing Protocols for the South Atlantic and Gulf of Mexico

Steve Branstetter, Ph.D.
NMFS SERO

The Gulf of Mexico and South Atlantic Fishery Management Councils (Councils) approved management actions to require, with limited exceptions, the use of certified bycatch reduction devices (BRDs) in shrimp trawls towed in the exclusive economic zone (EEZ) of their respective regions. Regulations implementing the Councils' amendments to their shrimp fishery management plans (Amendment 2 for the South Atlantic and Amendment 9 for the Gulf of Mexico) also specified that a testing protocol would be developed whereby new BRD candidates could be evaluated for their bycatch reduction performance. BRDs tested under such a protocol and determined to meet the bycatch reduction criterion of the respective Councils would be certified for use in the shrimp fisheries operating in the EEZ. These protocols were implemented by the National Marine Fisheries Service (NMFS) in 1999.

Several experimental BRDs have been tested under the established protocol procedures, but none have been certified. Applicants, who were approved by the Regional Administrator (RA) to evaluate various BRD candidates, have been unable to meet the stringent data collection procedures described in the protocol, or the experimental BRDs failed to meet the bycatch reduction criterion using the current statistical procedures. A 1999 shrimp fishery stakeholder's workshop, sponsored by the Gulf and South Atlantic Fisheries Foundation, Inc., identified several key issues, problems and concerns with the current BRD protocol. Based on the conclusions of this workshop, input from the Councils' respective BRD Advisory Panels, and other input from the public, the Councils concluded that the BRD protocol should be revised to address and alleviate these impediments. During 2000, the Councils reviewed and approved draft revisions to the BRD testing protocols for each region.

The proposed revisions to the South Atlantic and Gulf of Mexico protocols would modify the data collection procedures and statistical tests used to certify BRDs for use in the shrimp fishery of the two regions. Under the proposed revisions, the two protocols would have nearly identical requirements. The proposed revisions are intended to incorporate flexibility in the field sampling procedures used to evaluate the effectiveness of experimental BRDs, and to establish an alternative statistical hypothesis to determine if the experimental BRD meets the established bycatch reduction criterion. In summary, these changes include:

**Gear Change Requirements:**
The revisions would allow an applicant to compile the results from several series of short tests that cumulatively meet the 30 tow requirement for a specific BRD design. With the proposed change, the tests could be continued after making a gear change due to damaged gear (also see **gear tuning** below). Just as importantly, tests could be conducted over a longer period, aboard different vessels, using different fishing gear configurations (with the same BRD design), or fishing in different areas. This modification should facilitate gathering more robust information

**Use of a Trynet During BRD Tests:**
The proposed revisions would modify the protocol procedures to allow the use of a trynet during BRD tests aboard double-rigged vessels, as long as the fishing time for the trynet remains a consistent percentage of the tow time between and among the various tows of the test. Maintaining this consistent trynet tow time will minimize and compensate for any biases that the trynet may have on the catch of the main net being towed behind it. Allowing the use of a trynet reinforces the need to rotate the BRD between the port and starboard nets, so that both the control and experimental nets are exposed to similar effects introduced by the trynet.

**Data Collection**:
The current protocol requires the collection of information on a variety of species taken as catch and bycatch in shrimp trawls. Under the proposed revisions, certification would limited to the ability of the BRD to reduce the catch of juvenile red snapper (Gulf of Mexico) or weakfish (South Atlantic) to meet the bycatch reduction criterion established by each Council, and the catch of commercial shrimp. Data collection for the remainder of the catch would be recommended, but voluntary.

**Statistical Hypothesis:**
The statistical hypothesis tested under the current protocol assumes that the BRD candidate does not meet the bycatch reduction criterion. Based on evaluations of the existing BRD database, NMFS has determined that, under the current hypothesis, a point estimate of the reduction rate must be greater than 50 percent to have a reasonable probability of the BRD candidate meeting the bycatch reduction criteria established by the Councils. NMFS has determined that this is an unreasonably high target.

To encourage industry innovations in gear development, while still maintaining some control over the risk of certifying unacceptable devices, the BRD certification statistical procedure would be modified. Under the modification, the null hypothesis would assume the BRD candidate meets the bycatch reduction criterion. The RA would determine the effectiveness of the BRD candidate using ratio estimates. This approach would allow the construction of confidence intervals and hypothesis testing on the sample reduction rate (R) to ensure that the bycatch reduction criterion is met. To maintain reasonable control over the risk of certifying unacceptable devices (a Type II statistical error), statistical testing for certification will only be conducted for experimental BRDs where the sample reduction rate is within 5 percent of the target criterion.

---

If implemented, these changes would facilitate the involvement of industry and other gear researchers in the development of new and innovative BRD designs. Development of a wide variety of BRDs for use in the fishery will provide shrimp fishers a greater flexibility in choosing BRDs that are optimal for particular fishing conditions and operations. This should provide for greater economic returns to the fishery while providing ecological benefits to the environment.