

# Annual Report to Congress on the Bycatch Reduction Engineering Program



NOAA

Issued Pursuant to Section 316(d) of the  
Magnuson-Stevens Fishery  
Conservation and Management Act  
(as Reauthorized and Amended in 2006)

U.S. Department of Commerce  
National Oceanic and Atmospheric  
Administration  
National Marine Fisheries Service  
2011



## Table of Contents

---

<b>Executive Summary</b> .....	3
<b>Introduction</b> .....	4
<b>Funding Provided to Implement the BREP in 2010</b> .....	5
<b>Project Summaries</b>	
Characterization of Target Catch CPUE as a Function of Bait Soak Time in the Gulf of Mexico Bottom Longline Reef Fish Fishery .....	7
Gear Modification Research to Reduce the Bycatch of Butterfish in the Offshore Loligo Pealeii Fishery .....	9
World Wildlife Fund’s Smart Gear Initiative .....	11
Turtle Excluder Device (TED) Technology: Evaluations and Fisher Outreach .....	15
Assessment of the Impacts of Gear Modifications in the Monkfish Fishery on Bycatch of Atlantic Sturgeon and Harbor Porpoise .....	18
Fishing Technology and Conservation Engineering to Reduce Trawl Bycatch in Alaskan Fisheries .....	20
Continued Support for a Contract Employee to Assist with Gear Research Studies and Purchase of Two Underwater Camera Systems to Aid in Behavioral Studies .....	24
Evaluating the Post-Release Survival of Large Pacific Blue Marlin Captured in the Pacific Longline Fisheries: I. PSAT Studies .....	26
NMFS National Seabird Program .....	28
Shrimp Trawl Bycatch Reduction Device Technology .....	31
Evaluating the Effects of Trailing Gear in the California Recreational Thresher Shark Fishery .....	33
Developing, Testing, and Demonstrating Bycatch Reduction Devices in West Coast Trawl Fisheries .....	36
Commercial Longline Sea Turtle Mitigation .....	40
Gear Technician and Bycatch Reduction Research .....	41
The Double-Shot TED: Incorporating a TED and BRD into a Single Device to Improve Debris Exclusion and Shrimp Retention .....	43
Reducing Bycatch in the U.S. Gulf of Mexico Shrimp Fishery Utilizing TEDs with Reduced Bar Spacing .....	45
Determination of Alternate Fishing Practices to Reduce Mortality of Prohibited Dusky Shark in Commercial Longline Fisheries .....	48
Evaluating the Physiological Status of Large Pacific Blue Marlin Captured in the Pacific Longline Fisheries: II. Biochemical Correlates of Morbidity and Mortality .....	52
Gulf of Mexico Pelagic Longline Bluefin Tuna Bycatch Mitigation .....	54
Estimation of Seabird Bycatch in Northeast Commercial Fisheries .....	57
Evaluating Gear Modifications to Prevent Marine Mammal Depredation in the California Halibut Trawl Fishery in Southern California .....	59
Providing Direct Observation Video Camera Systems to Fishermen for Use in Evaluating Industry-Designed Approaches to Reducing Bycatch and Impacts to Benthic Habitats .....	63
Alaska Fisheries Science Center Coordinated Seabird Studies .....	65

Developing a California Sea Lion Bycatch Reduction Strategy Based on Visual Cues .....	67
Temporal Variation in Seabird Distribution and Density in the Eastern Tropical Pacific .....	68
Free Streamer Line Program.....	70
Seabirds in the Western North Atlantic and Interactions with Fisheries .....	72
Seabird Bycatch Avoidance for West Coast Groundfish Fisheries .....	73
Coastal Observation and Seabird Survey Team.....	75
Fisheries-Independent Marine Bird Surveys at the Northwest Fisheries Science Center .....	77
Contribution to World Seabird Conference .....	79
<b>Proposals to Address Bycatch or Seabird Interaction Problems .....</b>	<b>80</b>
<b>Economic Importance of Reducing Bycatch .....</b>	<b>84</b>
Appendix 1: NMFS Bycatch Reduction Engineering Program Policy Directive.....	86
Appendix 2: Section 316 of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 .....	94

## Executive Summary

Section 316(a) of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSA) required the development of a bycatch reduction engineering program (BREP). The MSA language is described in more detail in the Introduction to this report (page 4). NOAA allocated \$1,996,828 to implement the BREP in 2010. This amount included a \$182,000 grant to the World Wildlife Fund (WWF) to support its Smart Gear Initiative. BREP funds were distributed in the following manner to the WWF and NMFS Regions and Headquarters Offices (including for the National Seabird Program, which is funded by the BREP):

- Northeast—\$419,111
- Southeast—\$654,850
- Northwest—\$139,985
- Southwest—\$106,350
- Alaska—\$272,986
- Pacific Islands—\$145,000
- Office of Protected Resources—\$76,546
- WWF—\$182,000

In terms of bycatch problems addressed, BREP funding in 2010 fell into the following categories:

- Fish—\$923,582
- Sea turtles—\$605,624
- Seabirds—\$290,272
- Marine mammals—\$177,350

The BREP has made significant progress in 2010 to develop technological devices and other conservation engineering designed to minimize bycatch, seabird interactions, bycatch mortality, and post-release mortality in federally managed fisheries. 2010 BREP projects to reduce bycatch in Gulf of Mexico shrimp and longline fisheries, Atlantic gillnet and trawl fisheries, Alaska and Northwest trawl fisheries, California recreational fisheries, and Hawaii-based fisheries longline fisheries, as well as to enhance documentation and monitoring of seabird bycatch around the country, will help NMFS meet its obligations under the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, Marine Mammal Protection Act, and the U.S. National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries. In addition, 2010 BREP investments in underwater video camera systems that will be loaned to the fishing industry will help strengthen cooperation and collaboration between NMFS and the fishing industry.

# 2010 REPORT ON THE BYCATCH REDUCTION ENGINEERING PROGRAM RELEVANT TO SECTION 316(d) OF THE MAGNUSON-STEVEN'S FISHERY CONSERVATION AND MANAGEMENT REAUTHORIZATION ACT OF 2006

## **Introduction**

Section 316(a) of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSA) states, "Not later than 1 year after the date of enactment of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, the Secretary, in cooperation with the Councils and other affected interests, and based upon the best scientific information available, shall establish a bycatch reduction program, including grants, to develop technological devices and other conservation engineering changes designed to minimize bycatch, seabird interactions, bycatch mortality, and post-release mortality in federally managed fisheries." The National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) established its Bycatch Reduction Engineering Program (BREP) through a NMFS Policy Directive signed January 11, 2008, by the NOAA Acting Assistant Administrator for Fisheries. This Policy Directive (see Appendix 1) contains terms of reference for the BREP, as well as the following BREP mission:

"The mission of the BREP is to develop technological solutions and investigate changes in fishing practices designed to minimize bycatch of fish (including sponges and deep sea and shallow, tropical corals) and protected species (including marine mammals, seabirds, and sea turtles) as well as minimize bycatch injury and mortality (including post-release injury and mortality)."

Section 316(d) of the MSA requires the Secretary of Commerce to transmit an annual report to the Senate Committee on Commerce, Science, and Transportation and the House of Representatives Committee on Resources that:

1. Describes funding provided to implement this section;
2. Describes developments in gear technology achieved under this section; and
3. Describes improvements and reduction in bycatch and seabird interactions associated with implementing this section, as well as proposals to address remaining bycatch or seabird interaction problems.

This report responds to the requirements of Section 316(d) of the MSA. (Section 316 of the MSA appears in its entirety in Appendix 2.)

## Funding Provided to Implement the BREP in 2010

Funding to implement the BREP totaled \$1,996,828 in 2010. Table 1 lists the projects funded to implement the BREP in 2010. Individual projects, developments in gear technology related to these projects, and improvements and reduction in bycatch and seabird interactions associated with these projects are described on pages 7—79. It is important to note that several of these projects leveraged funds from sources outside NMFS and involved partners from other federal agencies, state governments, nongovernmental organizations, universities, and the fishing industry.

**Table 1. Projects funded to implement the BREP in 2010**

<i>Project Title</i>	<i>Funding Provided</i>	<i>Recipient</i>
Characterization of Target Catch per Unit Effort as a Function of Bait Soak Time in the Gulf of Mexico Bottom Longline Reef Fish Fishery	\$210,700	NMFS Southeast Fisheries Science Center
Gear Modification Research to Reduce the Bycatch of Butterfish in the Offshore Loligo Pealeii Fishery	\$185,200	NMFS Northeast Fisheries Science Center
World Wildlife Fund's Smart Gear Initiative	\$182,000	World Wildlife Fund
Turtle Excluder Device (TED) Technology: Evaluations and Fisher Outreach	\$142,622	NMFS Southeast Fisheries Science Center
Assessment of the Impacts of Gear Modifications in the Monkfish Fishery on Bycatch of Atlantic Sturgeon and Harbor Porpoise	\$129,000	NMFS Northeast Fisheries Science Center
Fishing Technology and Conservation Engineering to Reduce Trawl Bycatch in Alaskan Fisheries	\$121,000	NMFS Alaska Fisheries Science Center
Continued Support for a Contract Employee to Assist with Gear Research Studies and Purchase of Two Underwater Camera Systems to Aid in Behavioral Studies	\$104,911	NMFS Northeast Fisheries Science Center
Evaluating the Post-Release Survival of Large Pacific Blue Marlin Captured in the Pacific Longline Fisheries: I. PSAT Studies	\$95,000	NMFS Pacific Islands Fisheries Science Center
NMFS National Seabird Program	\$93,879	NMFS Alaska Regional Office; NMFS Office of Protected Resources
Shrimp Trawl Bycatch Reduction Device Technology	\$81,976	NMFS Southeast Fisheries Science Center
Evaluating the Effects of Trailing Gear in the California Recreational Thresher Shark Fishery	\$74,000	NMFS Southwest Regional Office
Developing, Testing, and Demonstrating Bycatch Reduction Devices in West Coast Trawl Fisheries	\$63,275	NMFS Northwest Fisheries Science Center
Commercial Longline Sea Turtle Mitigation	\$62,691	NMFS Southeast Fisheries Science Center
Gear Technician and Bycatch Reduction Gear Research	\$48,146	NMFS Northwest Fisheries Science Center
The Double-Shot TED: Incorporating a TED and BRD into a Single Device to Improve Debris Exclusion and Shrimp Retention	\$42,600	NMFS Southeast Fisheries Science Center

Reducing Bycatch in the U.S. Gulf of Mexico Shrimp Fishery Utilizing TEDs with Reduced Bar Spacing	\$42,100	NMFS Southeast Fisheries Science Center
Determination of Alternate Fishing Practices to Reduce Mortality of Prohibited Dusky Shark in Commercial Longline Fisheries	\$39,357	NMFS Southeast Fisheries Science Center
Evaluating the Physiological Status of Large Pacific Blue Marlin Captured in the Pacific Longline Fisheries: II. Biochemical Correlates of Morbidity and Mortality	\$34,000	NMFS Pacific Islands Fisheries Science Center
Gulf of Mexico Pelagic Longline Bluefin Tuna Bycatch Mitigation	\$32,966	NMFS Southeast Fisheries Science Center
Estimation of Seabird Bycatch in Northeast Commercial Fisheries	\$32,500	NMFS Northeast Fisheries Science Center
Evaluating Gear Modifications to Prevent Marine Mammal Depredation in the California Halibut Trawl Fishery in Southern California	\$32,350	NMFS Southwest Regional Office
Providing Direct Observation Video Camera Systems to Fishermen for Use in Evaluating Industry-Designed Approaches to Reducing Bycatch and Impacts to Benthic Habitats	\$28,564	NMFS Northwest Fisheries Science Center
Alaska Fisheries Science Center Coordinated Seabird Studies	\$26,500	NMFS Alaska Fisheries Science Center
Developing a California Sea Lion Bycatch Reduction Strategy Based on Visual Cues	\$16,000	NMFS Pacific Islands Fisheries Science Center
Temporal Variation in Seabird Distribution and Density in the Eastern Tropical Pacific	\$16,000	NMFS Southwest Fisheries Science Center
Free Streamer Line Program	\$15,000	Pacific States Marine Fisheries Commission
Seabirds in the Western North Atlantic and Interactions with Fisheries	\$15,000	NMFS Southeast Fisheries Science Center
Seabird Bycatch Avoidance for West Coast Groundfish Fisheries	\$12,000	University of Washington (WA), WA Sea Grant, Oregon State University and NMFS Northwest Fisheries Science Center
Coastal Observation and Seabird Survey Team	\$7,491	University of Washington
Fisheries-Independent Marine Bird Surveys at the Northwest Fisheries Science Center	\$5,000	NMFS Northwest Fisheries Science Center
Contribution to World Seabird Conference	\$5,000	NMFS Southwest Fisheries Science Center
<b>Total</b>	<b>\$1,996,828</b>	

## Project Summaries

### *Project Title*

### **Characterization of Target Catch CPUE as a Function of Bait Soak Time in the Gulf of Mexico Bottom Longline Reef Fish Fishery: A Pilot Study to Examine Sea Turtle Mitigation Measures**

### *BREP Funding Provided*

\$210,700

### *Location of Research*

NMFS Southeast Fisheries Science Center

### *Resource Challenge*

A recent NMFS review of sea turtle interactions in the Gulf of Mexico reef fish fishery indicated that the number of loggerhead sea turtle takes authorized in the 2005 Biological Opinion by the bottom longline component of the reef fish fishery in the Gulf of Mexico had been exceeded. In response to this finding, NMFS published a final rule in April 2010 to implement Amendment 31 to the Fishery Management Plan for Reef Fish Resources in the Gulf of Mexico. The rule restricted reef fish bottom longline fishing in the Eastern Gulf of Mexico to outside the 35-fathom depth contour from June through August; reduced the number of longline vessels operating in the fishery through a longline endorsement; and restricted the number of hooks that may be possessed onboard each reef fish bottom longline vessel. The expected economic impacts of these regulatory measures indicate that harvests, revenues, and expenditures will be negatively affected. The fishery represents the single largest source of commercially caught and marketed grouper in the United States and contributes significantly to many local and State economies, particularly along the west coast of Florida. Modification of fishing practices could help reduce the recent adverse economic impacts to this fishery.



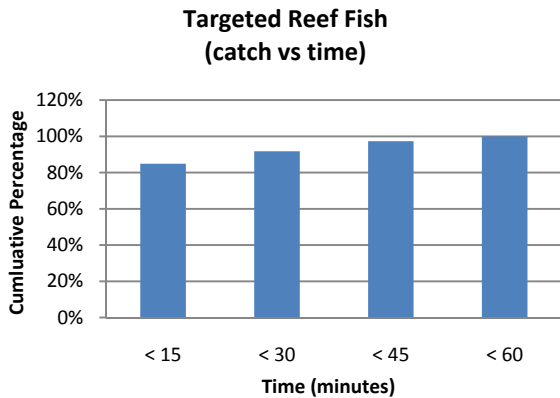
**Figure 1.** West Florida commercial reef fish bottom longliner.

### *Project Summary*

Sea turtle mortality is known to have a significant relationship with respect to time of forced submergence resulting from fisheries interactions. That is, the longer sea turtles are held underwater due to gear interactions, the more likely they are to die. The Southeast Fisheries Science Center (SEFSC) Harvesting Systems Unit is conducting a pilot study to investigate the potential of reduced gear soak times as method of reducing sea turtle interactions and mortality. As a first step, research is being conducted to characterize the catch rate of target species as a function of bait soak time. Three



commercial vessels are participating in the experiment for an expected 120 fishing days. (Figure 1 shows a typical vessel.) Participating vessels carry NMFS observers trained in the data collection requirements for the reef fish or shark bottom longline observer programs. Minor modifications to the standard observer data collection protocol have been made to accommodate the experiment. Hook timers (Lindgren Pitman HT 600) are attached on every fifth gangion in a given set to record the relative time of an interaction by a fish. Due to recent effort restrictions in the fishery, vessels are limited to no more than 750 hooks per set, which results in 150 hook timers being deployed each set.



**Figure 2.** Preliminary results for 73 reef fish caught on hook timers during trip 1.

less than 15 minutes after the hooks reached the bottom, with 100% of the bites occurring less than one hour after deployment (Figure 2).

*Developments in Gear Technology Achieved*

To date, more than 70 of the 120 proposed fishing days have been completed by the three commercial vessels involved in the research. Data entry and quality control measures have been completed for one trip. cursory analysis of the first trip completed shows that majority of reef fish interactions with the gear occurred soon after the hooks were deployed. Of the 73 reef fish caught during the first trip, more than 80% were hooked

*Improvements and Reduction in Bycatch Associated with This Project*

We anticipate the completion of the 120 fishing days by mid-December, with the data analysis completed in the spring of 2011. Although this project may not provide a definitive measure for reducing sea turtle interactions in the reef fish bottom longline fishery, this research may provide promising clues as to next steps. The results of this research will be disseminated to the fishing industry in 2011 with the intent to work in collaboration with fishers to modify fishing methods to optimize the harvest of target catch while reducing interactions and mortality of non-target species such as sea turtles.

*Project Title*

**Gear Modification Research to Reduce the Bycatch of Butterfish in the Offshore *Loligo Pealeii* Fishery**

*BREP Funding Provided*

\$185,200

*Location of Research*

NMFS Northeast Fisheries Science Center

*Resource Challenge*

The Atlantic mackerel (*Scomber scombrus*), squid (*Loligo pealei* and *Illex illecebrosus*), and butterfish (*Peprilus triacanthus*) fishery is a multi-species fishery that is managed by coast-wide annual quotas and operates throughout the year from ports ranging from North Carolina to Maine. The primary gear used in this fishery is a mid-water otter trawl. Butterfish is predominately a bycatch species of the squid fishery, but it also occurs as bycatch in other fisheries. NMFS determined that butterfish were overfished in 2002 and that butterfish discards were estimated to equal twice the directed landings of butterfish. Analyses have shown that the primary source of butterfish discards is the *Loligo* fishery because it uses small-mesh codends and because butterfish and *Loligo* co-occur year round.

*Project Summary*

Because butterfish and squid are both small-bodied and often occur together, separation by mechanical means (e.g., grid or grate) is unlikely. Because mechanical separation is unlikely, this project will rely on behavioral differences to attain species separation. We know that behavioral responses differ due to a number of environmental factors (e.g., light and temperature) and other factors (e.g., reproductive state and size of school), so we need to test any bycatch reduction device in several areas and times to ascertain its effectiveness.

The NMFS Northeast Regional Office, through the NMFS Northeast Cooperative Research Program, has been implementing an approach to resolving bycatch problems involving a network of research institutions. Cornell University had received some funding through NMFS to investigate reducing butterfish bycatch in the squid fishery, but the Cornell project lacked funding to test multiple bycatch reduction devices (BRDs) over diverse areas and times. NMFS used this BREP funding to partner with Cornell researchers to improve the scope of their work. Additionally, staff from the NMFS Northeast Fisheries Science Center (NEFSC) has assisted with the development of the methodology for the project.

*Developments in Gear Technology Achieved*

BREP funds were used to develop and test three separate BRD designs. These prototype BRDs were evaluated at a flume tank at Memorial University in St. John's, Newfoundland. Additionally, the NEFMC is assisting with the attainment of underwater video footage of the full-scale gear to evaluate the performance of the gear and

understand behavior of fish species around the gear to further assess the potential of the different BRD designs.

*Improvements and Reduction in Bycatch Associated with This Project*

This project has just started to investigate the effectiveness of several BRDs designs. We anticipate results from the testing to be analyzed early in 2011. We will use the results to complete a report by spring 2011 on the different BRDs and their effectiveness at reducing butterfish and other bycatch in the directed longfin squid fishery.

*Project Title*

**World Wildlife Fund's Smart Gear Initiative**

*BREP Funding Provided*

\$182,000

*Location of Research*

WWF, Palo Alto, California

*Resource Challenge*

Bycatch is considered to be one of the greatest threats to the sustainability of the marine environment, and bycatch affects practically every species in the ocean. As part of an effort to help address this problem, the World Wildlife Fund (WWF) initiated the International Smart Gear Competition in 2004, with the goal of identifying innovative and practical modifications or improvements to currently used gear with potential for significantly reducing bycatch. The competition, which offers cash prizes totaling \$57,500, has been held four times and attracted more than 260 entries from 40 countries worldwide. The competition also has served as a positive way for conservation interests to cooperate with the fishing industry and as a cornerstone for cross-sector collaboration among non-governmental organizations, the fishing industry, and governments.

*Project Summary*

The competition now has evolved into the WWF Smart Gear Initiative and is comprised of two main elements. The first is the International Smart Gear Competition, and the second is the advancement of the winning ideas to a stage where they can readily be adopted and used by industry. The implementation or advancement strategies for the winning ideas can vary considerably depending on such variables as the stage of development of the idea, the opportunities for change within the fisheries, the cultural and economic status of the fisheries, the responsiveness of respective governments to gear innovations, and the ability to attract funding to assist with advancement of winning bycatch reduction ideas.

In the past, these two elements primarily have been implemented in consecutive years, with the Competition being held one year and the advancement of winning ideas being undertaken in the following year. The Initiative has now reached the stage where the number of winning ideas and opportunities for advancement can now be conducted on a continuous cycle. The primary constraint in this process is the availability of financial resources.

*Developments in Gear Technology Achieved and Improvements and Reduction in Bycatch Associated with This Project*

1. Shark Bycatch Reduction Using Electropositive Metals

The grand prize winning idea for the 2006 International Smart Gear Competition was a concept that used small rare-earth magnets and their associated magnetic fields to repel sharks. The winning investigators demonstrated this idea under laboratory conditions, but

they had yet to carry out extensive trials with the idea under field conditions. Other researchers using a variety of different electro-positive metals have since investigated the concept of using a magnetic field to repel sharks with some initial field trials. One set of trials conducted in waters off Hawaii indicated the ability of an electro-positive alloy to repel at least one species of shark while not demonstrating any effect on a number of other species.

WWF provided funding in 2010 to a group of researchers to undertake field trials in an artisanal pelagic longline fishery based out of Manta, Ecuador. The trials involved testing the effectiveness of an electro-positive metal called Neodymium/Praseodymium in deterring shark interactions with fishing gear.

The open-ocean experiments showed that in the eight sets that were made (i.e., 2,400 hooks in the water), 62.96% of the species were captured on hooks using magnets, and 37.03% were captured on the control hooks without magnets. These results demonstrate that the magnets have no demonstrable deterrent effect on the two main shark species caught, the thresher shark (*Alopias pelagicus*) and the blue shark (*Prionace glauca*). Electromagnets may work better for certain species of sharks whose Lorenzini ampullae are more sensitive to magnetic fields, but at present there appears to be little evidence to demonstrate the potential to utilize electropositive metals on a commercial scale for bycatch reduction of sharks.

## 2. Nested Cylinder Bycatch Reduction Device

The Nested Cylinder, a runner-up prize winner in the 2007 competition, was designed to reduce juvenile red snapper bycatch in the Gulf of Mexico shrimp fishery. Initial testing of prototype versions of the Nested Cylinder indicated the device also had the potential to be very effective at reducing total overall bycatch while maintaining a high catch rate of target species. The Nested Cylinder's performance appeared to be superior to any of the bycatch reduction devices presently available in this fleet.

Further development and testing of the Nested Cylinder was funded by the WWF in 2010, although the experiment was delayed by the oil spill that resulted in closure of much of the Gulf's fishing grounds. Testing of a number of modified Nested Cylinder designs resulted in bycatch reductions averaging around 45%, which is well above the required minimum of 30% for certification. The Nested Cylinder continues to be tested to find ways to improve the shrimp retention rate so that it can be maintained above 90%. Conditions in the Gulf of Mexico have delayed this work, but additional testing will be undertaken by early 2011. Additional modifications involving alternate construction materials such as fiberglass for weight reduction and cost efficiencies also will be tested. A letter of authorization from NMFS for pre-certification testing was obtained prior to the commencement of trials.

## 3. The Selector

During the 2009 International Smart Gear Competition, the WWF offered a regional prize for East Africa, an area of global significance in marine biodiversity and developing fisheries with associated bycatch problems. The judges awarded the prize to a device

called the Selector, which utilizes understanding of fish behavior to reduce the bycatch of goldfish in the Lake Victoria pellegrin fishery. Goldfish are the main source of food for the Nile perch, one of the lake's biggest and most abundant fish. Due to bycatch in the pellegrin fishery, goldfish have dwindled to dangerously low levels, imperiling the most important fishery in the lake.

The WWF in 2010 provided funding for a project to introduce the Selector to Lake Victoria fishermen and provide further testing of its capabilities. Fishermen involved in the project were able to provide feedback on the initial design of the device, and adjustments were made to improve its aerodynamics and subsequent positioning in the water for better efficiency and overall results.

During the experiment a group of 30 fishermen using six boats were contracted to implement the testing protocol. Testing was carried out over seven days, with the results showing a 48.9% reduction in bycatch of goldfish when using the Selector. It appears that this device could prove to be a primary tool in the conservation of goldfish and Nile perch in Lake Victoria.

#### 4. The Batwing Otter Board

The Batwing Otter Board (Figure 3) was a prize-winner in the 2009 International Smart Gear Competition for its innovation and ability to reduce trawl bottom contact by up to 90%. With the reduced bottom impact, there is a large reduction in the amount of benthic material that accumulates in the net, resulting in cleaner catch, lower processing costs and improved product quality. The Batwing Otter Board can also offer fuel savings of 20%, making it an attractive option for commercial fishermen.

WWF contributed funding in 2010 for the production of a larger set of Batwing Otter Boards to be manufactured and tested in a commercial arena in U.S. waters. The boards have been produced and shipped to the United States and were scheduled for field trials in North Carolina in late November 2010. The designer of the Batwing Otter Boards presented a paper on their design and properties at the Energy Use in Fisheries Symposium held in Seattle in mid-November 2010 (for more information on this Symposim, visit <http://www.energyfish.nmfs.noaa.gov/>).

#### 5. The Underwater Baited Hook

This Underwater Baited Hook, designed to address the globally significant problem of seabird bycatch associated with longline fisheries, won the grand prize in the 2009 Competition. This stern-mounted, hydraulically driven device delivers baited hooks underwater, below vessel turbulence and out of sight and reach of seabirds.



**Figure 3.** The Batwing Otter Board.

WWF contributed funding in 2010 for proof-of-concept testing of this device in waters off the coast of Uruguay. Uruguay has the highest seabird mortality rates associated with pelagic longlining of any country in the world. The device was shipped to Uruguay in late July 2010, and testing was carried out in September and October 2010. The researchers were able to spend 30 days at sea. Periodically over the 30 days the researchers and the Underwater Baited Hook device were exposed to a large abundance of seabirds, which gave the researchers the opportunity to test the machine against scavenging seabirds of several different species. Preliminary results were extremely positive, and a detailed report of the results is forthcoming.

The WWF is very pleased with the range and quality of ideas that the International Smart Gear Competition continues to attract. The outcomes and results of these funded projects will be posted on the Smart Gear website ([www.smartgear.org](http://www.smartgear.org)) as well as be shared in workshops and other appropriate venues.

*Project Title*

**Turtle Excluder Device Technology: Evaluations and Fisher Outreach**

*BREP Funding Provided*

\$142,622

*Location of Research*

NMFS Southeast Fisheries Science Center

*Resource Challenge*

Sea turtle excluder devices (TEDs) are federally required equipment in most shrimp trawls fished in the Southeast Atlantic and Gulf of Mexico. NMFS is considering an expansion of the TED requirement to skimmer gear and the mid-Atlantic croaker fishery, which has prompted the development and testing of new TED designs for these fisheries. The NMFS Southeast Fisheries Science Center Harvesting Systems Unit conducts ongoing research to improve TED efficiency for sea turtle exclusion and target catch retention. Industry concepts directed at improving TED performance are evaluated through an annual TED testing project during which NOAA divers and TED specialists perform certification testing of new devices using captive-reared, juvenile sea turtles. Fishery-dependent testing of prototype TEDs to assess usability and target catch retention is also supported by the Harvesting Systems Unit.

*Project Summary*

The project consists of the following performance measures:

TED Research and Development

- Development of improved TED designs through collaborative efforts with the fishing industry
- Candidate TED evaluation and certification testing offered on an annual basis to assess industry-based TED concepts
- New fishery TED development and usability assessments

Performance Monitoring and Reporting

- Analyses and reporting of TED certification data
- Monitoring and evaluation of TED operational performance
- Technical recommendations and assistance in drafting language for rulemaking

Industry Outreach

- Technical training for net shops and fishers in TED construction and installation
- Development of instructional media to assist fishers

Enforcement Training

- Technical training and assistance for NMFS, U.S. Coast Guard, and State law enforcement agencies

*Developments in Gear Technology Achieved*

A usability assessment of the flexible flatbar flynet TED (FFF-TED) (Figure 4) was conducted during 17 days aboard flynet vessels participating in the North Carolina croaker fishery. The FFF-TED was tested over 14 days on six separate trips, while a new



Cable TED prototype was tested over eight days on three separate trips. Fourteen additional days of testing are scheduled for the 2010-2011 fishing season. Underwater video collected during this work revealed sharks, skates, rays, and sturgeon readily escaping from the trawl through the TED opening without a significant amount of target catch loss observed. Catches of up to 40,000 lbs (18,144 kg) were documented. The FFF-TED also performed well functionally, easily wrapping around the net reel with no significant signs of structural damage.



**Figure 4.** FFF-TED deployment aboard a North Carolina flynet vessel.

Testing and certification of candidate TEDs for sea turtle exclusion were conducted using the NMFS small turtle TED testing protocol and NMFS SCUBA divers in June 2010. Among the TED designs tested were the FFF-TED, the “double-shot” TED for the Southeast shrimp fishery, and a TED design for the flynet fishery constructed from flexible cable. Additionally, divers conducted evaluations of a prototype shrimp trawl designed by the Instituto Nacional de Pesca Mexico and a prototype TED from Queensland, Australia.

#### *Improvements and Reduction in Bycatch Associated with This Project*

Outreach activities are essential in insuring that fishers are using regulated gear correctly and within the requirements of the law. Additionally, fisher outreach activities afford NMFS TED specialists an opportunity to provide the latest technical innovations for TEDs, which can improve TED performance for sea turtle exclusion and shrimp retention. During 2010, fisher outreach activities were limited due to a reduction of fishing effort caused by the Gulf oil spill. Dockside visits and net shop training were conducted in Texas, Louisiana, Mississippi, and Florida.

At-sea inspections of gear by NMFS gear specialists and marine law enforcement personnel continue to be the most effective means of sustaining compliance with TED regulations. This effort also has shown to be the most effective method of reaching the fishing industry with information on regulated gear requirements and best-use methods. During 2010, the Harvesting Systems Unit Gear Monitoring Team assisted the NOAA Office of Law Enforcement agents as well as State marine law enforcement agencies in

Texas and Florida in conducting at-sea compliance inspections of commercial vessels operating in the Gulf of Mexico and South Atlantic (Figure 5).



**Figure 5.** NMFS gear specialist providing TED compliance instruction to State marine law enforcement officers.

*Project Title*

**Assessment of the Impacts of Gear Modifications in the Monkfish Fishery on Bycatch of Atlantic Sturgeon and Harbor Porpoise**

*BREP Funding Provided*

\$129,000

*Location of Research*

NMFS Northeast Fisheries Science Center

*Resource Challenge*

At the request of the Atlantic States Marine Fisheries Commission, NMFS's Northeast Fisheries Science Center (NEFSC) estimated the total bycatch of Atlantic sturgeon in sink gillnet and otter trawl gear based on observer data collected on a portion of commercial fishing trips from Cape Hatteras, North Carolina through Maine for 2001-2006. For sink gillnet gear, Atlantic sturgeon bycatch ranged between 2,752 and 7,904 sturgeon annually, averaging about 5,000 sturgeon per year. Atlantic sturgeon bycatch in otter trawl gear similarly ranged between 2,167 and 7,210 sturgeon with an average of about 3,800 sturgeon per year. However, bycatch mortality was markedly different between the two gear types. For sink gillnet fisheries, the estimated annual mortality ranged from 352 to 1,286 sturgeon, with an average mortality of 649 sturgeon per year, or approximately 13% mortality of Atlantic sturgeon caught in sink gillnet gear. The majority of sturgeon bycatch mortality was attributed to the monkfish sink gillnet fishery. The total number of sturgeon killed in otter trawl gear could not be estimated because only three sturgeon mortalities were reported in the observer database, suggesting a low fishing mortality rate.

Based on the observer data, the use of tie-downs, which reduce the height of gillnets in the water column, appears to: (1) increase the overall size range of retained Atlantic sturgeon by increasing the susceptibility of smaller individuals to be retained, and (2) increase the likelihood of mortality for incidentally caught Atlantic sturgeon. However, it was not possible to determine from the observer dataset whether mortality was strictly affected by the use of tie-downs or whether soak time was the controlling or contributing factor with respect to mortality. Virginia Sea Grant and the Virginia Institute of Marine Science (VIMS) conducted a sink gillnet interaction experiment on captive sturgeon under controlled conditions (eight fish placed in a 14-by-21-foot oval tank) to examine the effect of tie-downs on sturgeon retention. The results suggested that removing tie-downs allowed more sturgeon to escape the gear. However, soak times were limited to 30 minutes, and the gear configuration used was not the same as used in the monkfish fishery.

*Project Summary*

The goal of this study, which began in late 2010, is to compare bycatch rates for Atlantic sturgeon and harbor porpoises in a comparative experiment using gillnet gear with and without tie-downs in mid-Atlantic waters as follows:

1. Compare the bycatch rates of Atlantic sturgeon for each net configuration (12 meshes tall with tie-downs, 12 meshes tall without tie-downs);
2. Interrogate NEFSC observer data to examine the effect of tie-downs on harbor porpoise bycatch;
3. Compare the catch rates of the target species (monkfish) for each net configuration; and,
4. Record and compare the bycatch of other species regulated or protected species by NMFS (e.g., skates and sea turtles).

The gillnet strings consisted of 10 net panels per string of the same treatment (12 meshes tall with tie-downs, 12 meshes tall without tie-downs). Testing consisted of setting both treatments in a similar location and keeping all aspects of the operation (e.g., soak time, set direction, haulback speed) standardized between the paired sets. Each treatment of 10 panels was set 60 times for a total of 120 hauls. This number of sets should provide a high level of probability of finding a 20% difference in sturgeon bycatch between treatments.

Fishing trips were conducted by commercial monkfish fishermen on monkfish fishing grounds along the mid-Atlantic coast of the United States. The project was conducted in an area that had high catches of Atlantic sturgeon historically, and was conducted during November to December 2010, which is outside of the Harbor Porpoise Take Reduction Plan-regulated segment of the monkfish fishing season. Soak duration replicated the average soak duration for the study area, and the investigators tried to limit the soak to 96 hours or less.

Onboard the vessels, total catch, including estimated total weight, were recorded. Lengths were recorded for all target species, or a representative subsample, and all protected species were recorded. Sampling occurred in accordance with NEFSC protocols.

#### *Developments in Gear Technology Achieved*

This project began in November 2010. The NEFSC developed and awarded contracts for both the data collection and the construction of the modified fishing gear. The data collection is occurring with the help of two fishermen who are very knowledgeable and involved in the gillnet fishery, and we hope that this partnership will afford us the ability to obtain more ideas and better outreach as we tackle the issue of reducing sturgeon bycatch in bottom set gillnets.

#### *Improvements and Reduction in Bycatch Associated with This Project*

As of late 2010, the data collection has just begun and no results have been obtained. The NEFSC anticipates that its partnerships with the fishing industry will assist in the process of obtaining a viable solution to the issue of sturgeon and porpoise interactions with gillnets.

*Project Title*

**Fishing Technology and Conservation Engineering to Reduce Trawl Bycatch in Alaskan Fisheries**

*BREP Funding Provided*

\$121,000 (includes \$15K to build underwater camera housings for other BREP projects)

*Location of Research*

NMFS Alaska Fisheries Science Center

*Resource Challenges*

Research funded by the BREP at the NMFS Alaska Fisheries Science Center (AFSC) addressed two main resource challenges:

- 1) Bycatch of salmon in the Alaska pollock fishery has been a critical challenge for what is consistently among the largest and most valuable fisheries in the United States. Salmon bycatch is a concern to NMFS because of potential negative impacts on salmon stocks in general, and on western Alaska salmon stocks in particular.
- 2) Overall crab mortality due to trawling in the Bering Sea, including both mortality of captured and discarded crabs and mortality of crabs after escape from trawls on the seafloor, is also an important challenge.

*Project Summary*

1. Salmon Excluders

AFSC Conservation Engineering (CE) scientists participated in a workshop that included tests and refinement of salmon excluder designs at the flume tank facility at Memorial University in St. John's, Newfoundland (Figure 6). This workshop included trawl vessel captains, net manufacturers, fishing industry representatives, and representatives from the Nature Conservancy. The workshop provided an opportunity to improve both the design of the excluder and to communicate with constituents about its application.



**Figure 6.** Participants in salmon excluder testing at the Memorial University flume tank with an example of the salmon excluder in the background. (Photo courtesy of Memorial University Staff)

Full-scale salmon excluders were tested in February and March 2010 on both catcher vessel and catcher–processor trawlers. CE scientists provided and operated underwater video and sonar equipment to directly observe gear, assuring effective tuning of devices. Because of advances made during flume tank development and field monitoring, the escape portals of tested excluders were shown for the first time to be fully available throughout the tows, without interrupting fish flow or damaging the net. Chinook salmon escape rates were between 25 – 35%. The North Pacific Fisheries Research Foundation placed a technician aboard vessels through the summer to demonstrate correct tuning and operation of the new excluder design to promote effective use of these excluders by the fleet. The AFSC provided the camera systems used by this technician from our CE “loaner pool.”

## 2. Mortality rates for crab bycatch in trawls

From August 11 – 27, 2010, CE scientists collected data to estimate the proportions of snow and Tanner crabs captured by trawls with conventional bottom trawl footropes aboard the chartered vessel *F/V Pacific Explorer*. This provided one way to estimate how many crabs are subject to the unobserved mortality rates that we estimated for these species in prior years, and allowed us to collect additional observations to improve 2010 estimates. We also observed mortality rates for crabs that encountered footropes of pelagic trawls that are fished on the seafloor, as occurs frequently in the pollock fishery.

Additionally, CE scientists evaluated crabs caught by commercial trawl vessels in both the Bering Sea and the Gulf of Alaska to estimate snow and Tanner crab bycatch mortality rates. The improved estimates of crab bycatch mortality rates in the respective commercial fisheries will be used in conjunction with the footrope selectivity and escape mortality data collected during the *F/V Pacific Explorer* trip to evaluate trade-offs between target catch retention and bycatch mortality reduction in developing alternative

footropes to reduce overall crab mortality due to trawling.

### 3. Development of and evaluation of trawl groundgears that produce less damage to crabs in soft bottom areas

Development of trawl footropes that reduce overall crab mortality must trade off the potential loss of flatfish catch with reductions in either bycatch mortality or mortality of escaping crabs. In addition to measuring crab bycatch rates and mortality rates for conventional gear, catch and escape rates for target flatfish were also evaluated during the *F/V Pacific Explorer* cruise. This information, for two conventional footropes and one experimental design (Figure 7), provides a basis for direct comparisons of these footropes, evaluating their performance on each aspect that affects overall crab mortality. These results were to be presented and discussed with trawl fishermen in late 2010 to develop alternative designs for testing in 2011.

### 4. Camera Housings

Because new remote camera systems were included in three of the funded 2010 BREP proposals, and because the AFSC CE Program has a widely used and successful design for battery/recorder housings, funds from each of the three BREP projects involving cameras were directed to this project to build the necessary five housings. This direction of funds achieved both cost savings and interchangeability between system components. AFSC CE Program personnel built and delivered these tubes in July 2010. Two tubes went to the NMFS Northeast Fisheries Science Center, two tubes went to the NMFS Northwest Fisheries Science Center, and one tube went to the NMFS Southwest Regional Office.



**Figure 7.** Experimental bottom trawl footrope to reduce impacts to benthic habitat and incidental crab mortality, tested on the *F/V Pacific Explorer* in August 2010. (Photo by Carwyn Hammond)

*Developments in Gear Technology Achieved and Improvements and Reduction in Bycatch Associated with This Project*

As part of outreach and follow-up research on the modified sweeps, we are helping to prepare the Bering Sea flatfish fleet for implementation of new regulations resulting from the North Pacific Fishery Management Council decision at its October 2009 meeting to require Bering Sea flatfish trawlers to use modified sweeps beginning in 2011. AFSC CE scientists participated in a workshop for fisherman to help them better understand the new modified sweep regulation, discuss the sweep configuration options, and answer their questions in October 2010.

This project helped establish a salmon excluder that allows for 25-35% escapement of chinook salmon in the Alaska pollock fishery. Excluder use in the fishery is extensive and increasing, and outreach is being conducted to assure effective application. This project also resulted in an evaluation of bottom trawl footropes, two conventional and one experimental, to determine proportion of flatfish that pass over versus under the various footropes and to estimate overall crab bycatch mortality rates in flatfish fisheries.



*Project Title*

**Continued Support for a Contract Employee to Assist with Gear Research Studies and Purchase of Two Underwater Camera Systems to Aid in Behavioral Studies**

*BREP Funding Provided*

\$104,911

*Location of Research*

NMFS Northeast Fisheries Science Center

*Resource Challenge (Gear Researcher)*

The NMFS Northeast Fisheries Science Center (NEFSC) requires support to effectively administer a myriad of protected species research efforts being undertaken in the Northeast to mitigate the bycatch of sea turtles, sturgeon, cetaceans, and some finfish species in commercial fisheries.

*Project Summary (Gear Researcher)*

The NEFSC has hired a contractor to assist with ongoing gear research projects being conducted in the region. This contractor has been a great asset in assisting with gear research efforts. The first part of this project funded an additional year of the contract.

Funds obtained by the NEFSC are supporting projects to reduce the incidental take of cetaceans, sea turtles, sturgeon and other finfish in commercial fishing gear. Additionally, a workshop held in 2007 to obtain input on research in the trawl fishery to reduce the incidental take of sea turtles identified several ideas that may be viable alternatives or modifications to turtle excluder devices (TEDs) in fisheries where implementation of currently approved TEDs is likely to result in large catch losses. Presently the NEFSC Protected Species Branch has four ongoing gear research projects, and we anticipate that further work will be requested to investigate issues related to the development of trawl regulations for sea turtle conservation.

In the past year, the BREP-funded contractor has assisted the NEFSC with gear-related projects. The contractor's contributions have included:

1. Assisting with a scallop dredge comparison study accompanied by video research aboard scallop dredge vessels comparing modified turtle dredges to a standard New Bedford style scallop dredge;
2. Planning and implementing many aspects of a sturgeon gillnet bycatch study, including oversight of the construction of the experimental and standard gillnet gear utilized in the study;
3. Participating in two legs of a cooperative research trawl sweep comparison study;
4. Providing oversight and trip preparation services for a sea turtle project that captured and satellite-tagged 14 loggerhead sea turtles with the goal of obtaining a better understanding of their behaviors and using this information to mitigate sea turtle bycatch and better understand sea turtle populations; and
5. Leading the testing of tow time data loggers on commercial vessels by contacting fishermen and working with fishermen to secure the logger to their fishing gear.

In addition, the contractor has assisted the NEFSC by researching gillnet gear characteristics, compiling available data, and creating geographic information system maps to understand sturgeon, monkfish and harbor porpoise catch statistics and fishing effort in high bycatch strata. Finally, the contractor has attained or maintained training in (1) Alaska Marine Safety Education Association Survival Trainer and Drills Conductor Certificates, (2) turtle hoop net capture training, (3) CPR and first aid, (4) digital video editing, (5) sea turtle tagging, and (6) Scuba Diving International SCUBA certification.

*Developments in Gear Technology Achieved (Gear Researcher)*

Due to the assistance of this contractor, the NEFSC has been able to accomplish more research and maintain better oversight of the various projects that have been undertaken in 2010.

*Improvements and Reduction in Bycatch Associated with This Project (Gear Researcher)*

The contractor has been involved in some aspect of all of the NEFSC projects (listed at: [http://www.nefsc.noaa.gov/read/protsp/PR\\_gear\\_research/](http://www.nefsc.noaa.gov/read/protsp/PR_gear_research/)) that have addressed regional bycatch concerns.

*Resource Challenge and Project Summary (Camera System)*

This part of the overall project focused on the challenge of developing a robust underwater recording system that can be used on several gear types, is easily deployed, and is easy with regard to offloading video footage. Additionally, footage recorded by this system must be of high enough quality to freeze and grab clear images.

*Developments in Gear Technology Achieved (Camera System)*

The NEFSC worked with the Woods Hole Oceanographic Institution (Woods Hole, Massachusetts) and Coonamesset Farm (Falmouth, Massachusetts) to develop a system. The NEFSC tested many components and selected cameras and digital video recorders that were best able to freeze and grab clear images. The NESFC awarded two separate contracts for the procurement of the video system's components. Five camera systems eventually will be available for behavior and gear analysis.

*Improvements and Reduction in Bycatch Associated with This Project (Camera System)*

A NEFSC researcher completed a cruise using the underwater camera to ascertain the effectiveness of bycatch reduction devices in a BREP-funded project titled "Gear Modification Research to Reduce the Bycatch of Butterfish in the Offshore Loligo Pealeii Fishery" (see page 9). This cruise was the third test of this equipment, and the camera has provided several hours of valuable footage.

*Project Title*

**Evaluating the Post-Release Survival of Large Pacific Blue Marlin Captured in the Pacific Longline Fisheries: I. PSAT Studies**

*BREP Funding Provided*

\$95,000

*Location of Research*

NMFS Pacific Islands Fisheries Science Center

This project is integrated with the BREP-funded project entitled “Evaluating the Physiological Status of Large Pacific Blue Marlin Captured in the Pacific Longline Fisheries: II. Biochemical Correlates of Morbidity and Mortality” (see page 52).

*Resource Challenge*

Management strategies for mitigating effects on the bycatch of large-scale commercial fisheries require accurate estimates of post-release survival in captured teleosts, elasmobranchs, and sea turtles. High mortality from industrial fishing has the potential to reduce parental biomass and ultimately the ability of the stock to rebound. The uncertainty about post-release survival in many pelagic species is challenging for management, but this information is absolutely critical to improve stock assessments and to develop conservation measures. For catch-and-release to be a viable bycatch mitigation strategy, there must be a high likelihood of post-release survival. Marlin and other pelagic bycatch species are released from fishing gear, but it is largely unknown whether animals survive long-term and what population-level effects might result from this practice.

*Project Summary*

The objectives of this project were to (1) determine through pop-up satellite archival tags (PSATs) the post-release survival of large Pacific blue marlin (*Makaira nigricans*) released from pelagic longline gear and (2) develop biochemical techniques that are portable and applicable to rapid analyses of post-release survivorship in many pelagic species. For the analysis of post-release survival, project personnel produced a sampling manual to describe the proper acquisition and storage of biochemical samples from the field. Laboratory equipment to collect and store biochemical samples in the field was procured and assembled into field kits. To carry out the bulk of the field sampling on the project, two fisheries observers were trained and equipped to acquire marlin samples from the Hawaii-based commercial longline fishery and deploy PSATs. As of October 2010, the observers had already provided samples to the project. The project has purchased 15 PSATs, and the NMFS Pacific Islands Fisheries Science Center will provide, in-kind, additional PSATs to supplement the project in 2011. To supplement observer sampling and PSAT deployments, a commercial longline vessel was contracted to complete a total of approximately 30 longline sets. It is expected that sampling and deployment of PSATs on blue marlin will continue in 2011. Pending additional funding, the project may expand to include striped marlin, *Kajikia audax*.

### *Developments in Gear Technology Achieved*

Though this project is not directly involved in gear development, it will provide the necessary tools and methodology to estimate post-release mortality of istiophorid billfish (or many pelagic species) released from commercial longline fishing gear. As such, it may be feasible to design gear configurations and methods that minimize mortality of released animals.

### *Improvements and Reduction in Bycatch Associated with This Project*

This project will provide estimates of post-release mortality of istiophorid billfish released from commercial longline fishing gear in the Hawaii-based commercial longline fishery. Although PSATs can provide unequivocal results on the fate of released animals, cost precludes their widespread application in survival studies. A biochemical approach reduces experimental bias and increases sample size (i.e., more animals can be sampled, regardless of condition) and would therefore optimize experimental design (increase statistical power) and cost:benefit. For example, once the method is operational, about 40 samples can be assayed for the cost of one PSAT (approximately \$4,000). Further, assuming an approximately 5% post-release mortality rate and a Type II ( $\beta$ ) error set at 20%, a sample size of  $\sim n = 300$  would be needed to achieve 80% power in estimating post-release survivorship. To achieve sufficient sample sizes, it is imperative to conduct the PSAT deployments in parallel with the biochemical study.

*Project Title*

**NMFS National Seabird Program**

*BREP Funding Provided*

\$93,879

*Location of Research*

Alaska Regional Office, Headquarters Office of Protected Resources

*Resource Challenge*

The NMFS National Seabird Program (NSP) was formed in 2001 when the United States finalized its National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries (NPOA-Seabirds). The NSP is led by a National Coordinator and implemented regionally through seabird contacts at each NMFS Regional Office, Science Center, and Headquarters Office.

Although seabirds may be impacted by both direct (e.g., incidental catch, gear entanglement, bycatch) and indirect (e.g., prey availability, ecosystem interactions) effects, the primary focus of the NPOA-Seabirds and thus of the NSP to date has been to address the direct impacts of fisheries on seabirds. The NPOA-Seabirds addresses both domestic and international fishery issues. The NPOA-Seabirds calls for assessments of longline fisheries to determine whether seabird bycatch is a problem. If a problem exists, then it is addressed through a variety of efforts including gear research, requirements for mitigation measures, outreach, and continued monitoring and estimation of bycatch.

Seabirds are considered to be important indicators of ecosystem health and are an area of interest to and study by NMFS scientists and managers. NMFS continues to be concerned about the long-term ecosystem effects of seabird bycatch in NMFS-managed fisheries and in fisheries conducted in many areas of the world's oceans. Additionally, seabird abundance and distribution can inform scientists about oceanic prey abundance, climate change, and contaminants.

Seabird connections to NMFS range from survey scientists observing them at-sea on research and stock assessment survey cruises that are a regular part of NMFS practice to fishery observers recording them as incidental catch in the samples they observe onboard fishing vessels. Whereas the primary trust responsibilities for seabirds rests with the U.S. Department of Interior and its U.S. Fish & Wildlife Service (USFWS), NMFS plays a significant role and has responsibilities through various statutory authorities and agency policies. NMFS' role in seabird monitoring and reduction of seabird bycatch is guided by the following:

- Magnuson-Stevens Fishery Conservation and Management Act (MSA) (e.g., Bycatch Reduction Engineering Program (BREP) and seabird language at Section 316)
- Endangered Species Act (ESA)

- National Environmental Policy Act (e.g., assessing impacts/effects of fishery actions on the seabird component of the marine environment)
- NPOA-Seabirds
- United Nations' Food & Agriculture Organization's Best Practice Technical Guidelines for IPOA/NPOA-Seabirds (March 2009)
- NMFS Strategic Plan—FY2005 to FY2010
- NMFS Strategic Plan for Fisheries Research (2010)
- NMFS National Bycatch Strategy and National Bycatch Report
- Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds"
- USFWS List of Birds of Conservation Concern

### *Project Summary*

The NSP budget funds approximately half of the NSP National Coordinator's salary and funds National Coordinator and invitational travel (domestic and international). Project funds allocated through the NSP are described in later sections of this report. The NSP continues to support both the domestic and international implementation of the NPOA-Seabirds and works directly with the BREP to collaboratively implement new seabird language in Section 116 of MSA. All NMFS Regions have worked with the NSP to address NPOA-Seabirds implementation and seabird bycatch reduction. Numerous activities have been undertaken, including seabird avoidance regulations, fishery management plan development addressing seabird mitigation, cooperative mitigation research with the longline industry, fisheries observer training, education and outreach materials for fishermen and the public, and international efforts at regional fishery management organizations, bilateral fisheries meetings, fisheries observer conferences, albatross and seabird conferences, and the Agreement for Conservation of Albatrosses and Petrels (ACAP). Collaborative contributions by multiple partners, including Sea Grant, universities, fishing industry associations, and environmental groups, have been essential to addressing seabird—fishery issues.

In FY10, the National Seabird Coordinator carried out the functions of the NSP by:

- Managing the NSP annual budget and acting as the contracting technical representative on all projects funded by NSP/BREP funds;
- Leading a NMFS Steering Committee on the development of a NMFS Strategic Plan on Seabirds;
- Working with NMFS Regional Offices, Science Centers, and Headquarters Offices to continue to support both the domestic and international implementation of NPOA-Seabirds;
- Working directly with the BREP to implement Section 116 of the MSA and make a presentation at the second annual BREP meeting at the NMFS Alaska Fisheries Science Center in September 2010;
- Participating on an inter-agency team to support a U.S. position for possible accession to ACAP;
- Co-convening the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR) annual Scientific Committee working group on Incidental Mortality Associated with Longline Fisheries in Hobart, Australia, in October 2009;

- Participating on a steering committee for the NMFS National Bycatch Report and coordinating with USFWS experts and other seabird experts for input on seabird bycatch species for the Report;
- Monitoring status of a petition to USFWS to list the black-footed albatross under the ESA;
- Participating at a meeting of the Atlantic Marine Bird Cooperative in Falmouth, Massachusetts in January 2010;
- Coordinating with U.S. delegations to prepare briefings, presentations, and documents for meetings of working groups of regional fishery management organizations including the Western and Central Pacific Fisheries Commission annual meeting in December 2009; and
- Organizing a NOAA team to participate and provide outreach at the First World Seabird Conference in Victoria, British Columbia in September 2010.

NSP travel supported by FY10 BREP funds included attendance at CCAMLR meetings to co-convene a seabird bycatch working group, participation at the annual Pacific Seabird Group meeting and an associated meeting of the North Pacific Albatross Working Group, participation and presentation at the Atlantic Marine Bird Cooperative meeting, participation at the World Seabird Conference, and participation at the second annual BREP meeting.

*Developments in Gear Technology Achieved*

Developments from individual NSP projects are described on pages 57–58, 65–66, and 68–79.

*Improvements and Reduction in Bycatch Associated with This Project*

Improvements and reductions from individual NSP projects are described on pages 57–58, 65–66, and 68–79.

*Project Title*

**Shrimp Trawl Bycatch Reduction Technology**

*BREP Funding Provided*

\$81,976

*Location of Research*

NMFS Southeast Fisheries Science Center

*Resource Challenge*

Federal regulations require the use of an approved bycatch reduction device (BRD) in all shrimp trawls fished in Gulf of Mexico federal waters and the Southeastern Atlantic Ocean. The new BRD certification criterion (February 2008) matched the existing criterion for the eastern Gulf of Mexico and the U.S. South Atlantic, that is, a 30% reduction in finfish. This 2008 action resulted in the certification and provisional certification of three additional BRD designs for use in the Gulf of Mexico: the Extended Funnel, Modified Jones Davis, and the Composite Panel. Additional rule-making in May 2009 changed the allowable configuration of the Fisheye BRD in the Gulf of Mexico in order to meet the new criterion. Additionally, there is a critical need to continue to develop improved bycatch reduction technologies to ensure red snapper management objectives are met. In order to address this ongoing problem, the NMFS Southeast Fisheries Science Center Harvesting Systems Unit conducts research to develop and evaluate shrimp trawl bycatch reduction technology.

*Project Summary*

The project consists of the following performance measures:

BRD Research and Development

- Fish behavioral modification studies
- Development of improved BRD designs through collaborative efforts with the fishing industry
- Assistance in conducting new BRD certification testing

Performance Monitoring and Reporting

- Analyses and reporting of BRD certification data
- Monitoring and evaluation of BRD operational performance
- Technical recommendations and assistance in drafting language for rulemaking

Industry Outreach

- Technical training for net shops and fishers in BRD construction and installation
- Development of instructional media to assist fishers

Enforcement Training

- Technical training and assistance for NMFS, U.S. Coast Guard, and State law enforcement agencies

*Developments in Gear Technology Achieved*

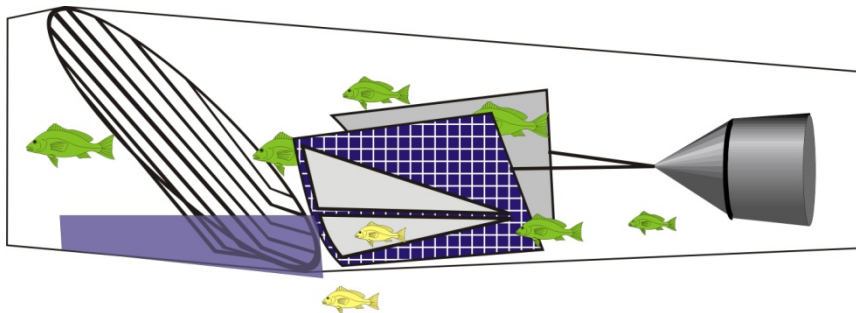
Through fishery independent and dependent research, BRD designs such as the composite panel BRDs with fish stimulator cones have been evaluated for efficacy of



finfish bycatch reduction in the shrimp fishery. After completion of additional testing, we plan to submit the optimal configuration of these BRDs for certification as an allowable shrimp trawl bycatch reduction mitigation measure for use in the southeast U.S. shrimp fisheries.

*Improvements and Reduction in Bycatch Associated with This Project*

The Composite Panel BRD, a design provisionally certified for use in the Gulf of Mexico and the U.S. South Atlantic shrimp trawl fisheries, has shown an overall finfish bycatch reduction rate of 25.3% in the Gulf of Mexico shrimp fishery. Testing in 2009 of the Composite Panel BRD in combination with a Square Mesh Panel BRD demonstrated a finfish reduction rate of 36% by weight, with a shrimp reduction rate of 4%. In an attempt to increase the finfish reduction rate associated with the Composite Panel BRD, a fisheries-dependent certification test was conducted with a combination of the Composite Panel BRD and a Finfish Stimulator Cone in 2010 (Figure 8). A total of 50 tows have been completed. Preliminary results show the observed finfish reduction rate with this BRD combination is 51% by weight, with a shrimp reduction rate of 8.3%. Statistical analysis of Composite Panel BRD with the Square Mesh Panel BRD and the Composite Panel BRD with the Finfish Stimulator Cone will be completed by spring of 2011. It is anticipated that both BRD combinations will be submitted for certification in 2011.



**Figure 8:** Schematic diagram of Composite Panel BRD with the Finfish Stimulator Cone.

*Project Title*

**Evaluating the Effects of Trailing Gear in the California Recreational Thresher Shark Fishery**

*BREP Funding Provided*

\$74,000

*Location of Research*

NMFS Southwest Fisheries Science Center and Southwest Regional Office

*Resource Challenge*

The common thresher shark (*Alopias vulpinus*) is the target of a popular and expanding recreational fishery in Southern California. The large size of the sharks landed in the fishery, their high food-value, and the close proximity of this rebuilding resource to local ports have collectively led to the recent expansion of the fishery. The primary techniques employed in the recreational thresher shark fishery entail trolling heavy baited lures with large J-type hooks. Thresher sharks utilize their elongate upper caudal fin to stun live prey before it is consumed, thus the majority of sharks are hooked by the caudal fin. The tremendous power of large tail-hooked threshers is often sufficient to part the line, making trailing gear an issue of concern in this fishery. Trailing gear refers to the heavy (0.5 kg) terminal tackle that is left embedded in the caudal fin of a free-swimming shark (Figure 9). This BREP-funded research tested the hypothesis that tail-hooked common thresher sharks survive the acute effects of trailing fishing gear.

Specific objectives of this research were to:

1. Estimate the mortality rate associated with trailing gear in the recreational fishery for common thresher sharks.
2. Improve hooking mortality estimates to be used by HMS scientists in stock assessment models and for estimating annual removals as a prerequisite for addressing management objectives embodied in Magnuson-Stevens Act National Standard 1 Guidelines.
3. Develop and test alternative tackle and rigging techniques that use degradable links to reduce the long-term impacts of trailing gear.
4. Expand ongoing outreach activities and public education to raise angler awareness of the need for sustainable fishery practices.
5. Prepare a scientific manuscript on project findings.



**Figure 9.** A 0.5 kg baited lure embedded in the caudal fin of a thresher shark.

### *Project Summary*

This project was designed to quantify mortality rates associated with tail hooking and trailing gear in the Southern California recreational thresher shark fishery. Survivorship was determined using pop-off satellite archival tags (PSATs) deployed on sub-adult and adult common thresher sharks released with trailing gear. Concurrent investigations on the effectiveness of degradable links and alternative fishing techniques also were performed to reduce overall post-release mortality in the recreational fishery.

PSATs were deployed on five common thresher sharks (132 to 175 cm FL) captured using fishery standard techniques and released with trailing tackle. As of late 2010, three tags have reported, revealing a 100% mortality rate with all mortalities occurring within 31 hours of release. All three tags were recovered after the deployment period using a radio direction finder. One of the PSATs still at liberty never reported data, while the final tag is still within the scheduled 30 day recording window. Additional deployments to complete the study during Fall 2010 were designed to complement 2009 BREP-

supported research and provide an overall mortality estimate for tail-hooked thresher sharks in the recreational fishery.

#### *Developments in Gear Technology Achieved*

Experimental gear trials were conducted in 2010 to test the effectiveness of degradable links that may be used to reduce the long-term impacts of trailing gear in this fishery. By incorporating a linkage that corrodes within a pre-determined time period, it may be possible to minimize the impacts on sharks that are lost during the fight. However, results to date suggest that all thresher sharks with trailing gear from which we received data incurred mortality within 31 hours of release, therefore making a degradable link improbable as a sole solution to post-release mortality in the caudal fin-based fishery. Although additional testing and results may provide improved innovations, initial interviews with fishers also suggest that angler acceptance is questionable when it comes to incorporating a weak link into their terminal tackle.

#### *Improvements and Reduction in Bycatch Associated with This Project*

The primary objectives of this project were to assess the incidental hooking mortality rate of thresher sharks with trailing gear, investigate alternative fishing techniques that may increase survivorship, and further develop outreach efforts. Results from this work will provide scientists and managers with an additional estimate of incidental fishing mortality that can be incorporated into total annual take estimates for the recreational fishery.

We have continued a strong public outreach component geared toward the development of alternative fishing methods that reduce post-release mortality. Three seminars offered in 2010 provided over 500 recreational fishers with a thorough review of thresher shark life history, reproductive biology, history of the fishery, fishing tactics, current fisheries management, and possible ways to improve current practices. Seminars also focused specifically on the development of techniques that reduce trailing gear in sharks that are hooked in the tail but not landed. The project team participated in numerous fishing radio shows and submitted informative articles to popular recreational fishing publications. Increased accessibility to thresher shark specimens was made possible through concurrent National Science Foundation (NSF) funded research at the Pflieger Institute of Environmental Research (NSF grant # IOS -0617384) and the strong relationships this team has forged with the angling community.

*Project Title*

**Developing, Testing, and Demonstrating Bycatch Reduction Devices in West Coast Trawl Fisheries**

*BREP Funding Provided*

\$63,275

*Location of Research*

NMFS Northwest Fisheries Science Center

*Resource Challenge*

Bycatch limits for Chinook salmon and several rockfish species (e.g., darkblotched, canary, and widow) have been established in the Pacific hake fishery. These limits have reduced the overall harvest of Pacific hake and have the potential to stop the fishery if bycatch exceeds hard caps on some species. In August 2010, NMFS adopted a catch share program for Pacific coast groundfish trawl fisheries. The new program, which began in January 2011, establishes individual fishing quotas for shore-based trawl fleets as well as fishing cooperatives for the at-sea mothership and catcher/processor sectors. It has been projected that these complex fishery management measures will create further demand for bycatch solutions within the Pacific hake fishery as well as across other sectors of the fishing industry.

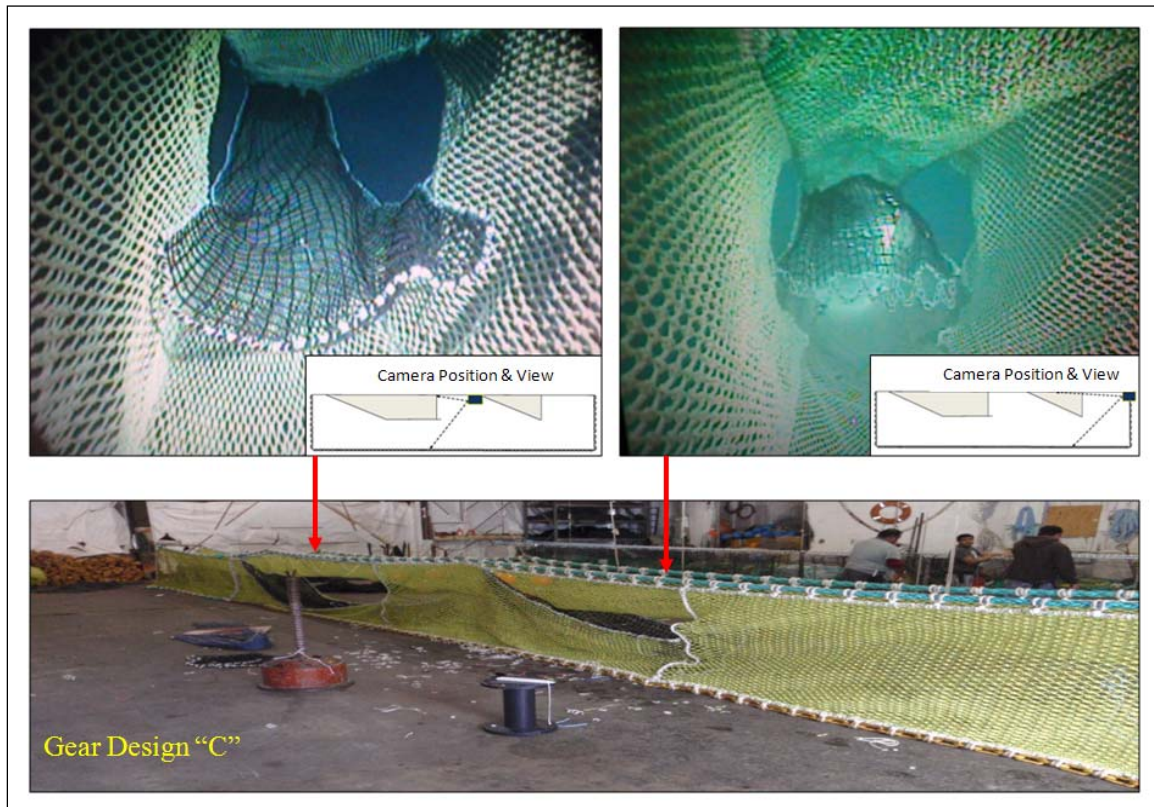
*Project Summary*

Beginning in 2009, the Pacific States Marine Fisheries Commission (PSMFC) and the NMFS Northwest Fisheries Science Center developed and began field testing a bycatch reduction device (BRD) to reduce bycatch of Chinook salmon and overfished rockfish species (e.g., darkblotched, canary, and widow) in the Pacific hake fishery. The basic design of this BRD consists of two mesh panels that direct actively swimming fish towards open escape windows on each side of the net (Figure 10). The concept is that fish displaying strong swimming abilities (e.g., salmon and rockfishes) can escape through the open windows, whereas fish exhibiting weak swimming abilities (e.g., Pacific hake) will pass into the codend.

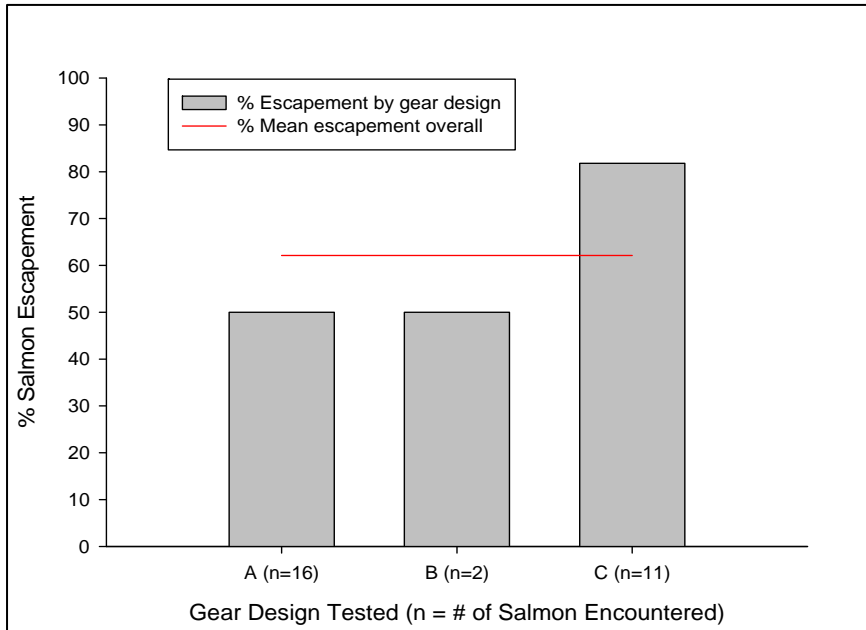
Since 2009, three versions (A, B, and C) of the open escape window BRD have been field tested. Fish behavior and gear performance were observed using autonomous high-resolution low-light color video camera systems. The BRD has been shown to reduce Chinook salmon bycatch on the order of 50 to 81% and widow rockfish bycatch by 26% (Table 2, Figure 11). Further, this study noted a significant result as far as which escape window salmon utilized. Over 82% of the Chinook salmon that escaped exited out the escape window illuminated by the autonomous video system's light. A significant difference in the mean escape time of salmon between gear designs A and C also was observed, with the quickest mean escape time noted in gear design C (Figure 12). Too few Chinook salmon were observed in gear design B; therefore, data from this gear design were not used in the analysis of mean time to escape.

**Table 2.** Summary of Chinook salmon and widow rockfish bycatch reduction by gear design examined.

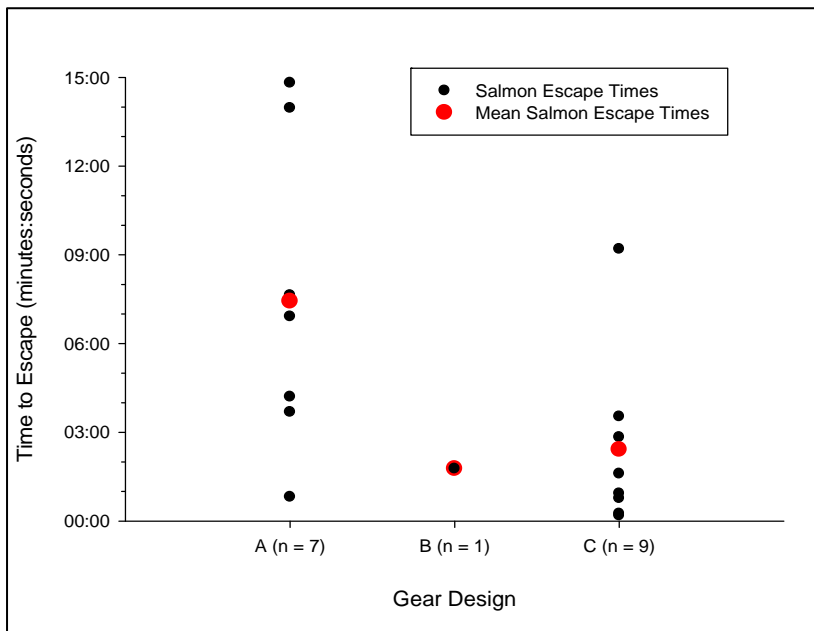
Gear design	Chinook salmon			Widow rockfish		
	# encountered	# escaped	% reduction	# encountered	# escaped	% reduction
A	16	8	50.0	53	0	0.0
B	2	1	50.0	0	-	-
C	11	9	81.8	45	12	26.7



**Figure 10.** Most recent BRD (gear design C) tested during 2010. The upper images depict both the port and starboard side escape windows, whereas the bottom image only depicts the port-side escape windows.



**Figure 11.** Chinook salmon escapement rates by gear design tested



**Figure 12.** Chinook salmon escape times by gear design tested.

*Developments in Gear Technology Achieved*

During this study, a promising BRD was developed for application in the Pacific hake fishery. It has undergone several phases of testing that have shown the device to reduce Chinook salmon bycatch on the order of 50 to 81% and widow rockfish bycatch by 26%.

*Improvements and Reduction in Bycatch Associated with This Project*

In addition to the encouraging results in bycatch reduction from the current study, interactions between researchers and the fishing industry have resulted in a technology transfer whereby variations of this BRD design have been used as a salmon excluder in both the Pacific hake and Bering Sea walleye pollock trawl fishery. Results from these tests and lessons learned are continuously being exchanged and are stimulating discussions within the industry that have expanded out into other fisheries (e.g., applying BRDs to reduce Pacific halibut bycatch in bottom trawls). Collaborations with conservation engineers at the NMFS Alaska Fisheries Science Center (notably Dr. Craig Rose) have provided NWFSC and PSMFC researchers with valuable information that has helped with the success of this project.



*Project Title*

**Commercial Longline Sea Turtle Mitigation**

*BREP Funding Provided*

\$62,691

*Location of Research*

NMFS Southeast Fisheries Science Center

*Resource Challenge*

The NMFS Southeast Fisheries Science Center (SEFSC) continues to work toward the development of solutions to prevent the incidental capture and mortality of sea turtles in the Southeastern U.S commercial longline fishery. NOAA has promulgated regulations requiring the use of circle hooks and careful release and handling methods for sea turtles by the longline industry. To ensure best-use practices of these technologies, regular industry outreach activities are conducted.

*Project Summary*

As a component of this project, the SEFSC has developed a Gear Monitoring Team (GMT) whose purpose is to provide direct training to fishers and marine law enforcement on the technical requirements of federally required gear in the Southeast region. During 2010, GMT personnel conducted multiple outreach events and dockside visits at primary Southeastern fishing ports to promote turtle-safe gear and handling techniques. Instruction focused on proper use of turtle de-hooking gear, as well as how-to information on gear fabrication. SEFSC gear specialists held workshops for Federal (U.S. Coast Guard) and State marine enforcement agencies to provide information on the technical aspects of the gear requirements and tips on inspecting vessels for compliance.

Also related to this project, the SEFSC Harvesting Systems Unit is conducting a pilot study using BREP funds to investigate the potential of reduced gear soak times as method of reducing sea turtle interactions and mortality in the Gulf of Mexico bottom longline reef fish fishery (7). As a first step, research is being conducted to characterize the catch rate of target species as a function of bait soak time.

*Developments in Gear Technology Achieved*

New sea turtle mitigation techniques for the bottom longline reef fish fishery were trialed under a BREP-funded study reported here separately (see page 7).

*Improvements and Reduction in Bycatch Associated with This Project*

To ensure fishery compliance and best-use practice of turtle mitigation gear and techniques in the longline fishery, efforts related to this project were focused on outreach and training. During 2010, the GMT conducted 6 training workshops for marine law enforcement as well as 12 dockside visits and workshops for fishers participating in the reef fish bottom longline and pelagic longline fisheries throughout the Southeast region.

*Project Title*

**Gear Technician and Bycatch Reduction Gear Research**

*BREP Funding Provided*

\$48,146

*Location of Research*

NMFS Northwest Fisheries Science Center

*Resource Challenge*

Bycatch of overfished species in the Pacific coast groundfish fishery constrains the fishery such that a substantial portion of available harvest is left in the ocean. The 2011 implementation of a catch share program for groundfish trawl fisheries will create increased demand for bycatch solutions across many sectors of the Pacific coast fishing industry. Currently, there is no dedicated staff or permanent funding at the NMFS Northwest Fisheries Science Center (NWFSC) to conduct bycatch research, which places severe limits on the NWFSC's ability to pursue conservation engineering projects relevant to reducing bycatch and habitat impacts from fishing gear in the groundfish trawl fishery.

*Project Summary*

In 2010, the NWFSC sought funding for continuation of a fishing gear technician to work with the NWFSC Habitat and Conservation Engineering (HCE) group. Since December 2008, with BREP funding, the NWFSC was able to hire and maintain a Pacific States Marine Fisheries Commission (PSMFC) fishing gear technician to focus on gear research, assist the HCE group coordinator in the continued development of the NWFSC bycatch reduction research, and collaborate with other NMFS and regional gear researchers and the fishing industry. Through contracting of a PSMFC staff member and ongoing collaborations with the conservation engineering group at Oregon Department of Fish and Wildlife (ODFW), the NWFSC has been able to pursue a wide-ranging array of conservation engineering projects relevant to reducing bycatch and habitat impacts from mobile fishing gear in the groundfish trawl fishery.

*Developments in Gear Technology Achieved*

With continued support for a fishing gear technician, several developments have been achieved. The NWFSC has tested an open escape window bycatch reduction device (BRD) to reduce bycatch of Endangered Species Act (ESA)-listed Chinook salmon and overfished rockfish species (e.g., darkblotched, canary, and widow) in the Pacific hake fishery. During this study a promising BRD has been developed that has shown to reduce salmon bycatch on the order of 50 to 81% and widow rockfish bycatch by 26%. Results from this work are currently being drafted into a manuscript. Project details appear on page 35.

The NWFSC also has tested footrope and rigid grate modifications designed to reduce the bycatch of groundfishes (including juveniles of overfished species), megafaunal invertebrates, and ESA-listed Pacific eulachon (an anadromous smelt), as well as reduce

physical impacts on benthic communities in the ocean shrimp trawl fishery. An experimental footrope, modified by removing the central one-third of the trawl groundline, reduced eulachon bycatch by 16.6%, by weight. The footrope also reduced bycatch of slender sole, other small flatfish, and juvenile darkblotched rockfish by 95.9%, 96.5% and 79.6%, respectively. However, the experimental groundline also reduced the catch of ocean shrimp by 22.2%. Reducing bar spacing in a rigid-grate BRD from 25.4 mm to 19.1 mm (1" to ¾") reduced eulachon bycatch by 16.6% by weight, with no reduction in ocean shrimp catch. It also reduced bycatch of slender sole, other small flatfish, and juvenile darkblotched rockfish by 36.8%, 71.8% and 76.3%, respectively. Results from this work are currently being drafted into a manuscript.

The gear technician funded under this project helped provide direct observation video camera systems to fishermen for their use in evaluating industry-designed BRDs. These camera systems were scheduled for use by the fishing industry starting in November 2010. Project details appear on page 62.

Finally, the NWFSC has conducted planning and development for a Pacific halibut excluder to be used in the groundfish trawl fishery. This work is in response to the fishing industry's increasing concerns about an individual bycatch quota of Pacific halibut allocated in the Groundfish Trawl Rationalization Catch Share Program.

#### *Improvements and Reduction in Bycatch Associated with This Project*

With the addition of a temporary gear technician, the NWFSC has been able to initiate a new and significant project aimed at reducing bycatch of ESA salmon and rockfishes in the Pacific hake midwater trawl fishery, while continuing ongoing collaborative studies with ODFW on the behavior of fish and commercially important shrimp interacting with fishing gear, using video and ultrasonic cameras. Results from 2009 and 2010 have demonstrated the capability of the open escape window BRD to release Chinook salmon from midwater trawls employed in the shoreside Pacific hake fishery. The experimental footrope and modified rigid grate, tested in 2010, reduced ESA-listed Pacific eulachon bycatch as well as bycatch of small flatfishes and juvenile darkblotched rockfish. Darkblotched rockfish are currently overfished with the potential to constrain Pacific coast groundfish fisheries.

*Project Title*

**The Double Shot TED: Incorporating a TED and a BRD into a Single Device to Improve Debris Exclusion and Shrimp Retention**

*BREP Funding Provided*

\$42,600

*Location of Research*

NMFS Southeast Fishery Science Center

*Resource Challenge*

The Southeast U.S. shrimping industry must continuously deal with debris during trawling operations. Debris is the chief turtle excluder device (TED)-related complaint by shrimp fishers and a problem that is exacerbated during post-hurricane periods, leading to NMFS regulatory actions that provide TED exemptions to affected areas. The fishers' concern is the obvious and hard-hitting loss of product that has been pushed out of the trawl opening by a clogged or blocked TED. In optimum, clean fishing conditions, a properly installed TED should be at least 97% effective in allowing sea turtles to escape. If the TED becomes clogged with debris (i.e., buckets, tires, and sponges), the function of a TED is compromised. In situ observations of turtles escaping through TEDs show that it is easier for a turtle to escape from a top-opening TED. However, a top-opening TED is less efficient for debris exclusion.

NMFS Southeast Fisheries Science Center (SEFSC) gear researchers and shrimp fishers alike feel it is time to focus on a device that will be more effective in eliminating debris, increasing TED effectiveness for shrimp retention and the chances of turtle escapement in areas and during times of abundant debris.

*Project Summary*

SEFSC Harvesting Systems and Engineering Branch gear specialists constructed and evaluated a prototype TED called the Double Shot TED (Figure 13), which is designed to address the industry's struggle with debris as well as maintain the proper fishing angle of the TED. The project objectives were to (1) obtain certification of the device for industry use through testing for turtle exclusion efficacy via the NMFS TED certification testing protocol, and (2) design and evaluate the potential for incorporating finfish bycatch reduction technology into the grid design.

**Double Shot Grid**



**Figure 13.** The double-shot TED frame prior to installation in webbing extension tube.

*Developments in Gear Technology Achieved*

The new TED is designed to improve shrimp retention by eliminating heavy and unwieldy debris that would present problems for conventional TEDs and by fixing the fishing angle of the TED deflector bars through a dual-angle design. The new grid design provides escape openings in both the top and bottom of the trawl extension, allowing for

the discharge of dense benthic debris while the providing a clear top opening escape route for turtles.

Additionally, the Double Shot TED design allows for easier incorporation of Federal and State-required bycatch reduction devices (BRDs) directly to the TED frame. Extensive underwater video footage obtained through this project revealed the behavior of finfish in relation to the TED frame. This footage shows that the area directly behind the TED deflector bars is a moderately slow water flow zone and is a common collection point for swimming fish. Fish that draft behind the TED deflector bars may be drawn out of the TED by water deflector panels in the frame of the grid. Through gear team diver observations of the fishing configuration and water flow characteristics of various BRD designs, the Double Shot TED was configured with a fisheye-type BRD in each side for fishery-independent proof-of-concept testing and subsequent fishery-dependent BRD certification testing (Figure 14).

#### *Improvements and Reduction in Bycatch Associated with This Project*

The Double Shot TED underwent a preliminary small turtle evaluation in 2009 with 5 out of 5 turtles escaping from the TED. A full TED certification test was completed during turtle testing in June 2010 following the standardized small turtle testing protocol. All 25 turtles escaped through the top escape opening. The mean escape time was 74.84 seconds and ranged from 15 to 231 seconds. This effort will result in the approval of this TED design for use in the Southeastern U.S. shrimp fishery.



**Figure 14.** Fisheye BRDs incorporated into the Double Shot TED.

Proof-of-concept testing was conducted aboard the *R/V Caretta* in August and September 2010. In a paired test, nine tows were conducted comparing the Double Shot TED to a standard top shooting grid (test 1), and six tows were conducted comparing two Double Shot TEDs, one with BRDs and one without (test 2). The results from test 1 showed an 11.6% reduction in finfish with a 5.5% reduction in shrimp. The finfish reduction rate for test 2 was 5.5% with an increase in the catch of shrimp by 2.3%. A BRD certification test for the Double Shot TED was scheduled to be conducted aboard a commercial shrimp trawler during the winter of 2010.

*Project Title*

**Reducing Bycatch in the Southeast U.S. Penaeid Shrimp Fishery: A Pilot Study to Assess Catch Rates of Shrimp and Finfish Bycatch using TEDs with Reduced Bar Spacing**

*BREP Funding Provided*

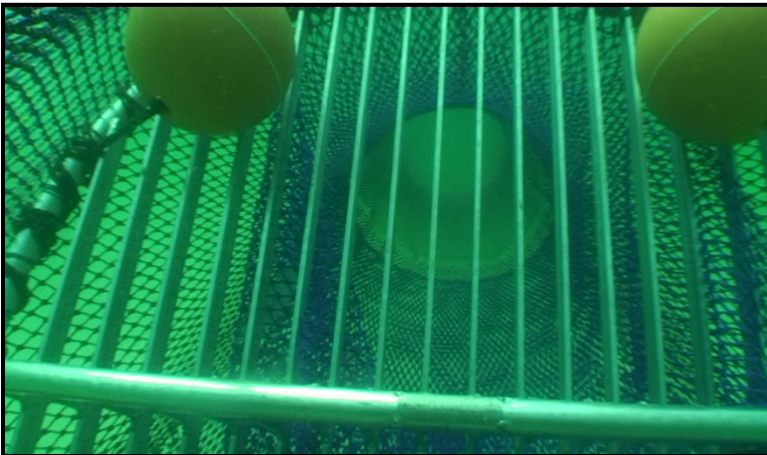
\$42,100

*Location of Research*

NMFS Southeast Fisheries Science Center

*Resource Challenge*

Measures to reduce finfish bycatch in the Southeastern U.S. shrimp fishery have led to the development of bycatch reduction devices (BRDs). Currently approved BRDs rely on the swimming behavior of fish to affect escapement through the device and out of the trawl. Due to differences in the swimming behavior of bycaught finfish and elasmobranchs, current BRD designs do not effectively exclude all species. The turtle excluder device (TED), a required component of most shrimp trawls fished in the Southeastern United States, is effective in eliminating larger fish from the catch. However, exclusion may be enhanced with reduced deflector bar spacing (Figure 15). Species of concern that may benefit from TEDs with reduced bar spacing include juvenile sharks, such as the blacknose shark (*Carcharhinus acronotus*), and sturgeon (Acipenseridae). Recently, high fish bycatch to shrimp ratios during late summer and fall fishing periods in the Gulf of Mexico have spurred interest from fishers in evaluating TEDs with reduced bar spacing as a means of excluding fish from the catch.



**Figure 15.** Turtle excluder device with reduced deflector bar spacing.

*Project Summary*

The project conducted comparison tows between a TED with 2-inch deflector bar spacing and a traditional TED with 4-inch bar spacing as a means of assessing differences in bycatch and shrimp catch rates. The current study is focusing on inshore areas of Mississippi and Alabama state waters. To date, comparison tows have been conducted aboard inshore commercial shrimp trawlers in Mississippi, Alabama, and Louisiana.

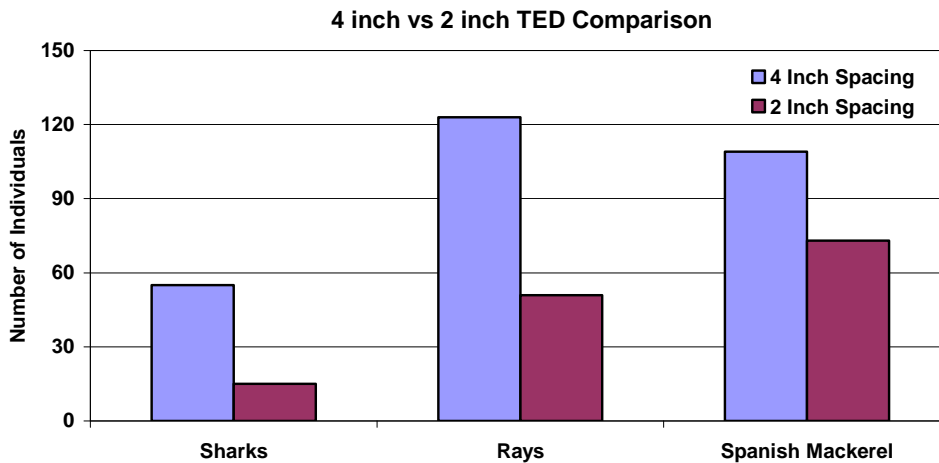
Additionally, the project is collecting comparative catch data from a commercial shrimp trawler fishing in the offshore waters of Texas utilizing NMFS Southeast shrimp fishery observers.

*Developments in Gear Technology Achieved*

The use of TEDs with reduced bar spacing has not been explored by the shrimp fishery in the Gulf of Mexico. Preliminary results from this study are encouraging, showing an 80% reduction by weight in some species of elasmobranches. Through this project we hope to quantify the bycatch reduction that may be expected through smaller deflector bar spacing, and the effect such a modification may have on targeted shrimp catch.

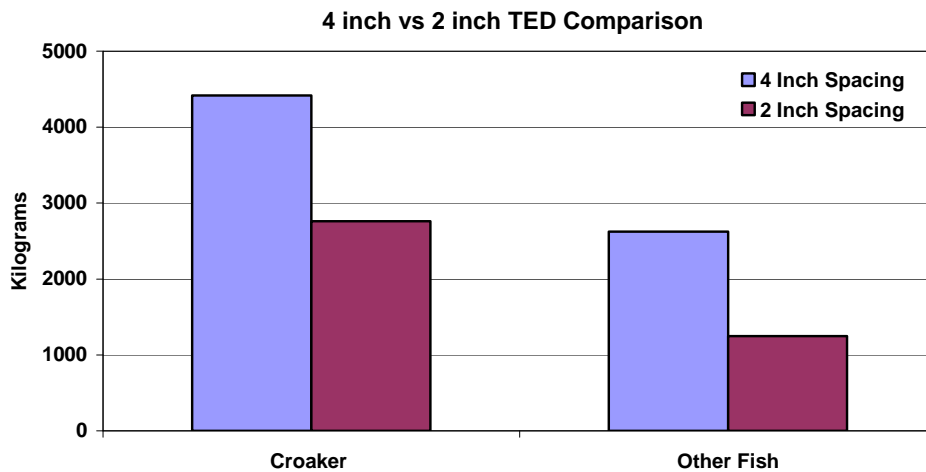
*Improvements and Reduction in Bycatch Associated with This Project*

As of October 2010, 40 tows have been conducted comparing shrimp and finfish catch rates between TEDs with 2-inch (experimental) and 4-inch (control) deflector bar spacing. These tows accounted for 85 hours of tow time in State waters of Mississippi and Louisiana. These results show that the experimental TED reduced shark bycatch (all sharks combined) 72.3% by number (55 vs. 15) and 78.0% by weight. Shark species caught in the control trawl included 47 Atlantic sharpnose sharks (*Rhizoprionodon terraenovae*) and 8 bonnethead sharks (*Sphyrna tiburo*). Additionally, the experimental trawl showed a 59.5% reduction in the capture of rays by number and 80.6% reduction by weight. Species of rays captured in control trawl included 73 Atlantic stingrays (*Dasyatis Sabina*), 37 cownose rays (*Rhinoptera bonasus*), and 13 southern stingrays (*Dasyatis americana*) (Figure 16).



**Figure 16.** Comparison of number of individuals for select species captured during 4-inch vs. 2-inch deflector bar TED comparisons (n=40).

The most prevalent bycatch species in the inshore tests were Atlantic croaker (*Micropogonias undulates*), which accounted for 52.8% of the total catch by weight in the control trawl. The experimental TED reduced Atlantic croaker catch 37.5% by weight (Figure 17). Trout species (*Cynoscion sp.*) were reduced 35.7% by weight in the experimental TED. Other recreational and commercially important species included Spanish mackerel (*Scomberomorus maculates*), which had reduction rates of 34.0% by number (109 vs. 73). Shrimp loss for the experimental TED was 6.3% by weight. Based on the results of a paired t-test, this loss was statistically significant with a p value of <0.042, and a power 51.5%. In order to achieve a statistical power of 80%, an additional 37 tows are needed. A portion of these tows will be conducted in November and December 2010 with FY10 BREP project funds.



**Figure 17.** Total weight (kgs) of Atlantic croaker and other finfish captured during 4-inch vs. 2-inch deflector bar TED comparisons (n=40).

We hope to continue this work in 2011 through a BREP-funded proposal. If funded, the study will aim to acquire better precision of our catch estimates through the completion of additional comparative tows. Additionally, we would like to examine methods of reducing the observed loss of shrimp through an evaluation of TED modifications such as a webbing funnel positioned ahead of the TED to direct shrimp away from the turtle escape exit hole.



Project Title

**Determination of Alternate Fishing Practices to Reduce Mortality of Prohibited Dusky Shark in Commercial Longline Fisheries**

BREP Funding Provided  
\$39,357

Location of Research  
NMFS Southeast Fisheries Science Center

*Resource Challenge*

Investigate alternative measures such as reduced soak time, restrictions on the length of gear, and fishing depth restrictions to reduce mortality of overfished and prohibited dusky sharks, and determine post-release survivorship of longline-caught dusky sharks.

*Project Summary*

The primary gear type used to harvest coastal sharks in the U.S. Atlantic shark fishery is bottom longline. Longline characteristics vary regionally, with gear normally consisting of about 8-24 km of longline and 500-1,500 hooks. Gear is generally set at sunset, allowed to soak overnight before hauling back in the morning. Currently, there are no restrictions on the bottom longline fishing gear used in this fishery (i.e., length of set, number of hooks, soak time).

The status of the western North Atlantic Ocean population of dusky shark (*Carcharhinus obscurus*) was assessed using multiple stock assessments models. In 2006, NMFS determined that the dusky shark population was being overfished and that overfishing was occurring. The size of this population was estimated to have been depleted by about 80% from virgin stock size. NMFS has not allowed dusky sharks to be harvested commercially or recreationally in U.S. western North Atlantic waters since 2000.

Despite being prohibited, dusky sharks are regularly caught in commercial longlines targeting sharks, and they are incidentally caught on a variety of other gears such as surface pelagic longline gear targeting tunas and tuna-like species and bottom longline gear targeting groupers and snappers. These catches have important implications for the managed recovery of this species because evidence suggests hooking mortality is high for dusky sharks. Alternative measures such as reduced soak time, restrictions on the length of gear, and fishing depth restrictions could reduce mortality of dusky sharks and allow fishers to release unwanted species to the water alive, while still effectively catching targeted species. In order for such management measures to be considered, data concerning the correlation between soak time and fishing mortality, and capture time by depth and temperature, are needed.

*Developments in Gear Technology Achieved*

NMFS' Panama City Laboratory conducted a series of fishing experiments using commercial fishing vessels participating in the Sandbar Shark Research Fishery. Vessels set an average of 317 gangions with 18/0 Lingren Pitman Circle hooks with a 10 degree

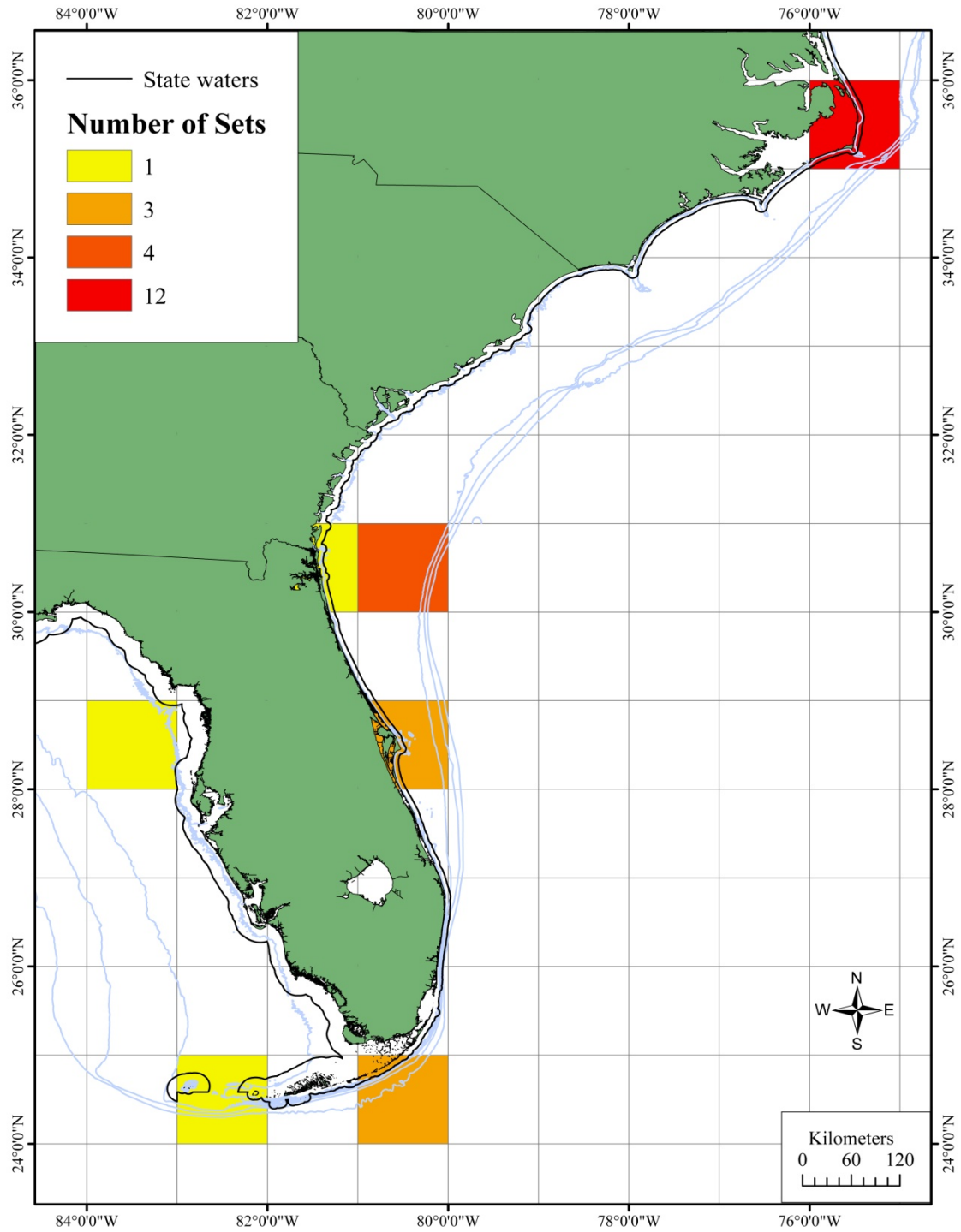
offset. Soak times averaged 15.0 hours. Fishers provided the bait and selected the fishing locations.

Hook timers (HT 600, Lindgren-Pitman Inc.) were attached to every fourth hook. Hook timers were set out at time 0 (initial deployment of the longline gear) and became activated when a shark bit the hook, thereby pulling the magnet and activating the digital clock. Time of capture was calculated as the elapsed time on the digital clock. Length of time the hooks were in the water before being bitten was estimated by subtracting hook time from total soak time. Time depth recorders (LAT-1100, Lotek Wireless Inc.) were set to record temperature and depth at two-minute intervals and were attached to the beginning, middle, and end of the mainline to obtain temperature and depth information along the length of the mainline. Time depth recorders were programmed through a communication box and laptop personal computer before the recorders were attached to the gear. Data collected by the recorders were downloaded after the haulback was complete.

During the haulback, we recorded whether the hook timer was activated, the time the shark was brought alongside the vessel and the time indicated on activated hook timers. We also identified the captured species, noted whether the shark was alive or dead when brought aboard, measured fork length, and recorded sex of the shark. Dusky sharks brought alive to the vessel are tagged with archival satellite tags to assess long-term survivorship.

#### *Improvements and Reduction in Bycatch Associated with This Project*

Data are still being collected as part of this program, which will continue through 2011. A total of 25 sets were completed in 2010 in areas off the east coast of the United States and the Gulf of Mexico (Figure 18). In addition to dusky shark, data also are being collected on 13 other species (Table 3). For all species, preliminary results indicate the mean time for hook timers to be activated (i.e., time to bite the hook) was 6.6 hrs. Sharks remained on the hook for an average of 10.3 hours. For dusky shark captured with hook timers (n=3), all were reported dead at the vessel after a mean time on the hook of 13 hours. A full analysis of the data will be performed after data collection is complete in 2011.



**Figure 18.** Distribution of hook timer sets performed in 2010.

**Table 3.** Summary of species captured, size, time on hook, and time to bite hook for all hook timer experiments conducted in 2010.

Species	Status at vessel	n	Fork length (cm)				Time on hook (hr)				Time from set to bite (hr)			
			Mean	Min.	Max.	St. Dev.	Mean	Min.	Max.	St. Dev.	Mean	Min.	Max.	St. Dev.
Dusky shark	Alive	0												
	Dead	3	158	116	220	54.81	13.02	10.88	16.63	3.15	4.54	1.78	6.97	2.61
Great hammerhead shark	Alive	0												
	Dead	2	240	210	270	42.43	8.40	6.40	10.40	2.83	5.11	1.17	9.05	5.57
Lemon shark	Alive	1		205	205			17.95	17.95			3.58	3.58	
	Dead	0												
Nurse shark	Alive	7	177	150	210	17.99	9.92	3.27	14.08	4.58	5.57	1.03	15.28	5.48
	Dead	0												
Atlantic sharpnose shark	Alive	4	81	76	86	4.99	4.62	0.88	10.87	4.50	4.95	0.27	13.88	6.13
	Dead	23	83	54	110	14.30	9.04	1.72	16.63	4.72	5.11	0.25	14.53	4.06
Blacktip shark	Alive	2	135	120	150	21.21	15.40	13.03	17.77	3.35	4.97	2.03	7.90	4.15
	Dead	8	142	130	152	9.11	10.36	5.02	17.78	4.25	9.38	4.00	14.93	4.70
Blacknose shark	Alive	0												
	Dead	2		98	98		10.39	4.53	16.25	8.28	8.17	5.78	10.55	3.37
Bull shark	Alive	1		180	180			11.73	11.73			3.57	3.57	
	Dead	0												
Scalloped hammerhead shark	Alive	0												
	Dead	1		330	330			11.78	11.78			1.80	1.80	
Sandbar shark	Alive	43	154	120	181	12.46	11.14	1.72	20.60	4.69	7.16	0.35	18.50	5.28
	Dead	13	152	136	171	9.34	13.70	8.57	19.17	3.86	5.33	2.10	12.48	3.65
Sand tiger shark	Alive	1		180	180			6.40	6.40			13.15	13.15	
	Dead	0												
Smalltooth sawfish	Alive	1		250	250			14.07	14.07			4.40	4.40	
	Dead	0												
Tiger shark	Alive	17	165	120	240	33.52	7.68	1.02	18.80	5.86	9.70	1.12	18.23	5.63
	Dead	1		180	180			18.60	18.60			6.13	6.13	

*Project Title*

**Evaluating the Physiological Status of Large Pacific Blue Marlin Captured in the Pacific Longline Fisheries: II. Biochemical Correlates of Morbidity and Mortality**

*BREP Funding Provided*

\$34,000

*Location of Research*

NMFS Pacific Islands Fisheries Science Center

This project is integrated with the BREP funded project entitled Evaluating the Post-Release Survival of Large Pacific Blue Marlin Captured in the Pacific Longline Fisheries: I. PSAT Studies (see page 26).

*Resource Challenge*

Management strategies for mitigating effects on the bycatch of large-scale commercial fisheries require accurate estimates of post-release survival in captured teleosts, elasmobranchs, and sea turtles. High mortality from industrial fishing has the potential to reduce parental biomass and ultimately the ability of the stock to rebound. The uncertainty about post-release survival in many pelagic species is challenging for management, but this information is absolutely critical to develop conservation measures.

*Project Summary*

The project was designed to determine the post-release survival of large Pacific blue marlin (*Makaira nigricans*) released from pelagic longline gear using biochemical correlates of morbidity and mortality from tissue plugs and blood. This project will enable the development of biochemical techniques that are portable and applicable to the rapid analyses of post-release survivorship in many pelagic species. Analysis of the first biochemical samples commenced at Queens University (Ontario, Canada) in 2010. As this project concludes in early 2011, the tissue samples will be assayed for biochemical correlates of stress and morbidity. Plasma samples will be analyzed for ion concentrations ( $Mg^{2+}$ ,  $Ca^{2+}$ ,  $K^{+}$ ); metabolite levels (such as lactate); and hormone levels (cortisol). For the molecular analysis of muscle samples, consensus primers for genes that are a measure of stress response (members of the heat shock protein family) were designed and will be used to generate species-specific primers. These primers in turn will be used to measure relative mRNA levels in target animals.

*Developments in Gear Technology Achieved*

This project is developing the necessary tools and methodology to estimate post-release mortality of istiophorid billfish released from commercial longline fishing gear.

*Improvements and Reduction in Bycatch Associated with This Project*

This project will provide estimates post-release mortality of istiophorid billfish released from commercial longline fishing gear in the Hawaii-based commercial longline fishery. Although PSATs can provide unequivocal results on the fate of released animals, cost precludes their widespread application in survival studies. A biochemical approach reduces experimental bias and increases sample size. To achieve sufficient sample sizes,

it is imperative to conduct this biochemical study in parallel with the PSAT deployment study (see page 26).

*Project Title*

**Gulf of Mexico Pelagic Longline Bluefin Tuna Bycatch Mitigation**

*BREP Funding Provided*

\$32,966

*Location of Research*

NMFS Southeast Fisheries Science Center

*Resource Challenge*

Pelagic longline fisheries for tuna and swordfish in the Gulf of Mexico catch several non-target species such as blue and white marlin, sharks, and bluefin tuna, which are managed under international rebuilding plans and are experiencing overfishing. The bycatch of these species by pelagic longline fisheries is of concern to management agencies, and the United States has implemented several time/area closures in an effort to reduce bycatch mortality of these species in U.S. fisheries. The Gulf Mexico is a spawning area for the western Atlantic bluefin tuna stock and has become an area of concern due to bycatch mortality of spawning bluefin tuna. NMFS is evaluating additional time/area closures in the Gulf of Mexico to mitigate bycatch mortality of spawning bluefin tuna. Modifying fishing gear and/or fishing practices to reduce mortality of bluefin tuna, while maintaining catches of yellowfin tuna in the Gulf of Mexico directed yellowfin tuna fishery, is being investigated as an alternative to additional time/area closures.

*Project Summary*

This project focused on utilizing the difference in the size and relative strengths of bluefin tuna as compared to the targeted yellowfin tuna to reduce bluefin takes (Figure 19). Anecdotal information from fishers indicates spawning bluefin tuna, which are much larger than yellowfin tuna, are capable of straightening some types of hooks used in the yellowfin tuna fishery. During the year one of the research (2007), fishery-independent experiments were conducted to collect data on the relative force exerted by bluefin and yellowfin tuna when captured on pelagic longline gear. Treatments of three different breaking strengths of monofilament leader (140, 200, and 250 lbs.) were tested to determine which would effectively release bluefin tuna yet retain yellowfin tuna. Based on the data collected, 140-lb. and 200-lb. monofilament leader were determined to be capable of releasing bluefin tuna of the sizes of fish captured in the fishery. In year two of the project (2008), a fishery-dependant experiment was initiated to investigate the potential of a newly designed hook as a potential mitigation measure for reducing bluefin tuna capture on pelagic longlines. The objective of the study was to evaluate the efficacy of a weaker 16/0 circle hook (experimental) in reducing bycatch of bluefin tuna by comparing experimental hook catch to catch by a standard 16/0 circle hook (control) used in the pelagic longline fishery (Figure 20). The experimental hook retains the dimensions of a 16/0 hook but has less tensile strength, causing it to bend or straighten at loads that would not bend a conventional 16/0 hook.



**Figure 19.** Size of bluefin tuna typically caught Gulf of Mexico yellowfin tuna pelagic longline fishery



**Figure 20.** The control and experimental hook.

#### *Developments in Gear Technology Achieved*

Research was conducted from 2008 to 2010 by the Engineering and Harvesting Branch of the NMFS Southeast Fisheries Science Center, Mississippi Laboratories, to evaluate the efficacy of a new 16/0 “weak” circle hook design in reducing the bycatch of bluefin tuna in the Gulf of Mexico yellowfin tuna fishery. Five commercial vessels completed 260 pelagic longline sets. Experimental hooks and standard 16/0 circle hooks were alternated on the longline with a total of 172,573 hooks set. A total of 33 bluefin were caught during the experiment, of which 10 were caught on the experimental hook (56.5% reduction). The difference in bluefin catch was statistically significant. Vessels landed a total of 1,785 yellowfin tuna. The difference in yellowfin catch rate for standard and experimental hooks was not significant.



*Improvements and Reduction in Bycatch Associated with This Project*

The estimated takes of spawning-size bluefin tuna by the Gulf of Mexico pelagic longline fishery have raised concerns that this fishery may be impacting efforts to recover the western Atlantic bluefin tuna stocks. Data gathered through this multiyear project suggest that a weaker circle hook design has the potential to mitigate bluefin tuna bycatch while maintaining a high retention rate for the target catch of yellowfin tuna.

The directed fishing of large bluefin tuna by commercial fleets in the Gulf of Mexico has been prohibited since the early 1980s. As a result, fishers tend to avoid concentrations of bluefin tuna due to loss of gear, time, and target catch associated with large catches of bluefins. This study has not addressed the potential economic benefit that may result from reducing interactions with bluefin on pelagic longlines. However, the majority of the vessels involved with this study continue to use the new hook design. Additional vessels not involved in the study also have purchased experimental hooks for use.

*Project Title*

**Estimation of Seabird Bycatch in Northeast Commercial Fisheries**

*BREP Funding Provided*

\$32,500

*Location of Research*

NMFS Northeast Fisheries Science Center

*Resource Challenge*

Observed seabird bycatch in commercial fishing trips is a rare event, which makes it difficult to observe and even more difficult to quantify. To help overcome these difficulties, observer coverage of fisheries in the Gulf of Maine area has increased in the last couple of years, and NMFS Northeast Fisheries Science Center (NEFSC) staff has begun to develop analytical methods that can deal with these types of data. These analytical methods should eventually result in bycatch estimates for seabird species, although some estimates will have to be at a gross taxa level, e.g., for shearwaters in gillnets.

*Project Summary*

The objective of this project was to develop methodologies for expansion of observed takes to total takes by fishery and species, if possible. This project used a generalized additive model/generalized linear model (GAM/GLM) approach for estimating bycatch and identifying fishing practices, gear configurations and environmental factors that are associated with high bycatch rates. In 2010, the NEFSC published bycatch estimates and factors associated with high bycatch rates of common loons (*Gavia immer*) and red-throated loons (*Gavia stellata*) in U.S. North Atlantic commercial gillnets from 1996-2007 (Warden, M. 2010. Aquatic Biology 10:167-180).

*Developments in Gear Technology Achieved*

This project did not directly achieve any developments in gear technology.

*Improvements and Reduction in Bycatch Associated with This Project*

In 2010, the NEFSC analyzed seabird bycatch, beginning with common and red-throated loons, which are of greatest concern for seabird bycatch along the northern U.S. Atlantic coast. Using gillnet fisheries observer data from 1996-2007, this analysis resulted in average annual common loon bycatch estimates of 74 loons in the Northeast (95% CI = 29–189) and 477 in the Mid-Atlantic (95% CI = 370–615). Average annual red-throated loon bycatch in the gillnet fishery was estimated at 897 loons (95% CI = 620–1297), entirely in the Mid-Atlantic. Using GLM statistical methods, these analyses also identified several fishing practices, gear configurations, and environmental factors associated with high bycatch rates. These fishing practices and gear configurations might be candidates for future bycatch mitigation approaches. Specifically, for these two loon species, the factors most commonly associated with the bycatch rates were bottom depth and sea surface temperature. In addition, in the Northeast, the common loon bycatch rate for gillnet strings without spaces between nets was about 4.6 (95% CI = 2.2–10.0) times

higher than the bycatch rate for strings with spaces. In the Mid-Atlantic, the common loon bycatch rate was higher for strings that were fished for 24 hours or longer versus strings that were fished for less than 24 hours, and for haul times of less than 30 minutes versus haul times of 30 minutes or more.

*Project Title*

**Evaluating Gear Modifications to Prevent Marine Mammal Depredation in the California Halibut Trawl Fishery in Southern California**

*BREP Funding Provided*

\$32,350

*Location of Research*

NMFS Southwest Regional Office

*Resource Challenge*

Almost all coastal commercial and recreational fisheries along the coast of California interact with pinnipeds, primarily California sea lions (*Zalophus californianus*) and harbor seals (*Phoca vitulina*). These pinnipeds become entangled and/or are captured in fishing gear, damage fishing gear, or damage the catch when trying to feed on fish caught in the gear (i.e., depredation). Fish that have been damaged by the pinnipeds are often discarded at sea, and are considered an economic discard, which is a form of bycatch. Significant depredation by pinnipeds can result in (1) a direct economic loss from damaged fish that are discarded or sold at lower prices, (2) damage to fishing gear, and (3) a potential increase in fishing effort and mortality on target and bycatch species to compensate for economic losses caused by depredation. Additionally, successful acquisition of prey through depredation could result in pinniped dependence on human fishing activities, which may increase the risk of pinniped injury or mortality through interactions with fishing gear and increase the number of conflicts with frustrated fishers.

One commercial fishery in southern California that has been experiencing frequent pinniped depredation is the California halibut trawl fishery. This fishery provides live fish to market, so fishers take great care to avoid injuring the catch as damaged fish receive lower prices or are discarded. In the spring of 2009, two commercial fishers approached the NMFS Southwest Region to ask whether the agency could help explore solutions to what they described as significant pinniped depredation in this fishery (Figures 21-22), primarily from harbor seals that are locally abundant near some of the important fishing areas. Specifically, the fishers requested NMFS' assistance in documenting and studying the problem, as well as in collaboratively developing and testing strategies to minimize or eliminate the bycatch of damaged and lost fish due to the pinnipeds.



**Figure 21.** A California halibut with pinniped bite and scratch marks.



**Figure 22.** A flatfish missing its head due to pinniped depredation.

### *Project Summary*

The objective of this project was to evaluate the effectiveness of modifying a trawl net using a small mesh extension or “protection panel” (Figure 23) to reduce or prevent pinniped depredation on California halibut trawl gear, while also minimizing, or at least not increasing, bycatch of other species. The idea put forward by the fishers was that use of a smaller mesh extension might prevent pinnipeds from reaching through with their

claws and mouths in an attempt to remove or damage fish from this area of the net. Because the target of this fishery is live California halibut, fishers take care to avoid injuring fish in the net and codend using slow tow speeds and short tow times.



**Figure 23.** The small-mesh net extension used in this study.

In the summer of 2010, an experimental fishery protocol was established to compare the effectiveness of a halibut trawl net using a 3.0-inch mesh size modification to the performance of the 5.5-inch mesh size trawl net extension normally used in the fishery. This comparison focused on catch performance and depredation rate, including documentation of the behavioral response of pinnipeds during fishing activities with the aid of an underwater video camera system. The combination of catch performance and video will be used to determine success of this modification and will help provide guidance and focus to future research efforts on depredation in this and other fisheries.

Comparative research tows were conducted aboard the *F/V Cecelia* in the coastal waters near Santa Barbara and Oxnard, California, during the months of August, September, and October 2010. To date, about one-half of the expected 50 paired-tow comparisons have been successfully completed. Video monitoring of the trawl net and pinniped behavior during normal fishing was completed as part of two separate days of research. Fishing conditions were poor during most of this time period, and halibut catch was unusually low. In addition, pinniped activity was significantly less than what is anecdotally typical for the area, and observation of depredation events did not occur at anticipated levels. A likely factor in the unexpected conditions was the sustained presence of unseasonable cold water in the area throughout the summer. As a result, research efforts have been hampered to this point but will continue into FY11 as more normal fishing and depredation activity likely develops. Engineering of a new underwater video system has been completed and is expected to become an important part of the second half of this project.

*Developments in Gear Technology Achieved*

It is too early to assess the performance of this gear modification in minimizing pinniped depredation or the impact of this modification on the total catch/bycatch of other species. There are some preliminary indications that the catch of other non-target species may be higher, suggesting the small-mesh extension may not be functioning well for the objectives of this project. Future research may focus on testing square-mesh extensions or changing the diameter or placement of the extension tube.

*Improvements and Reduction in Bycatch Associated with This Project*

The effectiveness of this gear modification in reducing pinniped depredation, and the potential for implementation of this modification as a regular part of the California halibut trawl fishery, cannot be fully evaluated until research is completed under conditions representative of the depredation problem facing this fishery.

*Project Title*

**Providing Direct Observation Video Camera Systems to Fishermen for Use in Evaluating Industry-Designed Approaches to Reducing Bycatch and Impacts to Benthic Habitats**

*BREP Funding Provided*

\$28,564

*Location of Research*

NMFS Northwest Fisheries Science Center

*Resource Challenge*

In August 2010, NMFS adopted a catch share program for Pacific coast groundfish trawl fisheries. The new program, which began in January 2011, established individual fishing quotas for shore-based trawl fleets as well as fishing cooperatives for the at-sea mothership and catcher/processor sectors. NMFS anticipates that these complex fishery management measures will create increased demand for bycatch solutions across all sectors of the fishing industry. Currently, bycatch of overfished species in the groundfish fishery constrains the fishery such that a substantial portion of available harvest is left in the ocean. Reducing this bycatch would result in more fish becoming available to fishermen and potentially higher annual catch limits. In addition, fishing opportunities may be limited by hard caps or individual bycatch quotas for non-groundfish species, e.g., Endangered Species Act-listed Chinook salmon in the Pacific hake fishery and Pacific halibut in the bottom trawl fishery.

*Project Summary*

The NMFS Northwest Fisheries Science Center (NWFSC) received funding to build two video imaging systems and make these systems available to commercial fishers and other sectors of the industry for their use in evaluating industry-designed bycatch reduction devices. The NWFSC has completed the video systems (Figure 24) and is in the process of implementing the video loaner program. As part of an outreach effort surrounding the loaner program, the NWFSC and Pacific States Marine Fisheries Commission (PSMFC) met with fishing industry representatives from California, Oregon and Washington at an October 2010 workshop. Attendees included 15 from the fishing industry and 6 agency scientists. At this successful workshop and a subsequent meeting, the NWFSC developed a dialogue focusing on how the NWFSC's Conservation Engineering Program, working in collaboration with PSMFC and other agencies, might assist the fishing industry with bycatch reduction solutions under the new annual catch shares program.

*Developments in Gear Technology Achieved*

During 2010, the loaner video camera systems were developed and fabricated. Meetings with the fishing industry and collaborating agencies were conducted to obtain feedback on best practices for deploying the loaner video systems to the industry, and to create a forum for discussion of the role of conservation engineering in a catch share management environment.





**Figure 24.** One of two autonomous direct observation video camera systems developed at the NWFSC with 2010 BREP funding.

*Improvements and Reduction in Bycatch Associated with This Project*

Anticipated impacts from this project will begin in early 2011 with the deployment of the loaner video camera systems to the fishing industry.

*Project Title*

**Alaska Fisheries Science Center Coordinated Seabird Studies**

*BREP Funding Provided*

\$26,500

*Location of Research*

NMFS Alaska Fisheries Science Center

*Resource Challenge*

The NMFS Alaska Fisheries Science Center (AFSC) attempts to address two primary resource challenges with regard to seabirds. The first involves a suite of issues relative to seabird interactions with commercial fisheries. Basic challenges here are how to monitor and provide viable estimates of seabird bycatch; reduce seabird bycatch; address Endangered Species Act (ESA)–related fishery interaction issues (e.g., with short-tailed albatross, *Phoebastria albatrus*); and address the linkage between seabirds and food provided by the commercial fisheries in the form of offal and discards. The second resource challenge is how to best make use of seabirds as a valuable tool for an improved understanding of marine ecosystem processes and changes brought about by annual variation in or potential long-term effects from climate change. In both cases, resources are needed to interact with other partners and collaborators, especially the U.S. Fish and Wildlife Service (USFWS), which has management authority for seabirds.

*Project Summary*

The AFSC operates the Coordinated Seabird Studies Program and leverages a variety of funding sources and limited resources to complete work on seabird interactions with fisheries in collaboration with other NMFS Offices, academia, Sea Grant, non-governmental organizations such as environmental groups and fishing industry groups, and other federal agencies (USFWS and U.S. Geological Survey) or states.

BREP funds received in 2010 were used to support these activities in four ways: (1) continuation of research into trawl-related mortality, (2) investigation of seabird food habits, (3) use of stable-isotope analysis of feathers to examine the impact of fisheries on albatross foraging strategies and demographics, and (4) representation of NOAA's work on seabird bycatch, fisheries interactions, and marine ecosystem management at the First World Seabird Conference (which took place in September 2010 in British Columbia).

*Developments in Gear Technology Achieved*

The first of the 2010 projects continued the analysis of data from a pilot project started in a previous year. The project began the development of mitigation gear for net-monitoring devices known as paravanes, which are employed by some groundfish trawl vessels. The other component of this project used observer monitoring information to evaluate additional sources of seabird mortality and ascribe those sources to fleet components, areas, and geographic regions. This work was begun with other funding sources but needs additional funds to finish the analysis and reporting component.

Part 2 of the 2010 projects will allow a consultant to continue to identify food items from bycaught birds into 2011. Preliminary reports provided an understanding of the ratio by which birds rely on food from commercial vessels as opposed to natural prey items. This information has been lacking in the past and constrains managers' ability to evaluate the effects that fisheries management strategies may have on seabirds. This improved understanding is important to support of National Environmental Policy Act processes. Data from this research will be reported at conferences and in publications as results are analyzed.

Part 3 of the 2010 projects supported an emerging technology, stable isotope analysis, to improve our understanding of how albatross interact with fishing fleets, how they are dependent on commercial fisheries for food versus natural prey items, and how they may respond to climate change over time. Because seabird bycatch numbers are directly related to the food provided by processing at sea, these interactions are important to understand and may be a key to further reducing bycatch. Some research on these interactions has been performed in southern hemisphere fisheries, most notably in New Zealand.

Finally, part 4 of the 2010 BREP funds supported four scientists to report on successful NMFS projects related to seabirds at the First World Seabird Conference. Due in part to the papers, posters, and participation supported by these funds, NOAA's leadership in marine stewardship and science was communicated to participants from around the globe. It is important to note that food habits and stable isotope research also will lead to an improved understanding of seabirds' role in the ecosystem and how NOAA can better employ seabird observations as part of its marine stewardship responsibilities.

#### *Improvements and Reduction in Bycatch Associated with This Project*

These activities support core activities of the AFSC Coordinated Seabird Studies Program, provide valuable funds that are leveraged with other funding sources, and lay the groundwork for how to design and implement future bycatch reduction projects. No direct bycatch reduction was achieved as part of these activities. Components of this work parallel activities that occurred prior to the experimental work that led to 80% and greater reductions in seabird bycatch in the Alaskan demersal longline fleets.

In September 2010 AFSC Processed Report 2010-04 was released. This report described results of earlier work supported by BREP funds through the National Seabird Program. Based on this report, collaborative work with the Seattle-based Freezer Longline Coalition led to changes in how the Coalition manages its internal reporting of seabird bycatch numbers and rates. (This report can be found at <http://www.afsc.noaa.gov/Publications/ProcRpt/PR2010-04.pdf>)

*Project Title*

**Developing a California Sea Lion Bycatch Reduction Strategy Based on Visual Cues**

*BREP Funding Provided*

\$16,000

*Location of Research*

NMFS Pacific Islands Fisheries Science Center

*Resource Challenge*

California sea lions (*Zalophus californianus*) interact with a variety of fishing gear, in a variety of fisheries, and often become a component of a fisheries bycatch. In the Gulf of California, sea lion populations have declined by 20% in the past decade in part due to the increase in gillnet fisheries. Estimates indicate that bycatch rates of up to 0.61 sea lions/fishing day/boat may occur. Fishermen in Bahía de los Angeles (BLA), a small fishing town on the Gulf of California, report that during the late fall, winter, and early spring fishing seasons, extremely large numbers of sea lions are unintentionally caught with numbers at times exceeding 10-15 animals per day. Entangled sea lions are often dead, or if still alive, they are killed so fishermen can safely remove them from the nets. As such, exploring additional options to reduce sea lion bycatch in gillnets is a priority for fishermen and fisheries managers alike.

*Project Summary*

Trials to examine the effects of illuminated gillnets (using LED lightsticks) on sea lion and finfish catch rates were scheduled to commence in January 2011, lasting through March 2011. This period coincides with historically high interaction rates between the gillnet fishery at BLA and California sea lions. As of the end of 2010, research gear had been purchased and was being transferred to the research site, and fishermen on four vessels had been trained in experimental procedures. In addition, data collection and management protocols had been established.

*Developments in Gear Technology Achieved*

In addition to testing a potential strategy to reduce sea lion bycatch in gillnet fisheries, we also are developing an experimental model that can test a variety of potential sea lion deterrents and determine their usefulness in gillnet fisheries.

*Improvements and Reduction in Bycatch Associated with This Project*

This project has not yet directly achieved improvements and reduction in bycatch.

*Project Title*

**Seabird Distribution in the Hawaiian Archipelago**

*BREP Funding Provided*

\$16,000

*Location of Research*

NMFS Southwest Fisheries Science Center

*Resource Challenge*

A growing concern exists over the long-term ecosystem effects of seabird bycatch in fisheries conducted in many areas of the world's oceans. NMFS conducts a number of projects and programs to address this concern including development and maintenance of seabird avoidance regulations, mitigation research (often in conjunction with the fishing industry), observer training, preparation and dissemination of education and outreach materials for fishermen and the public, and participation in international efforts at regional fishery management organizations, bilateral meetings, fishers fora, and various fisheries observer and scientific conferences. In addition to these concerns and associated activities, NMFS contributes to seabird assessments in order to address other seabird-fishery interactions, both direct and indirect. These efforts are especially supported through the seabird component of the marine mammal and ecosystem assessment cruises conducted by the NMFS Southwest Fisheries Science Center (SWFSC) since 1988. These data on seabird distribution and abundance allow for investigation of overlap between seabird species and various fisheries operating in the geographic area surveyed. This 2010 BREP project is a continuation of these efforts.

*Project Summary*

The project's objective was to collect data on distribution, abundance, and behavior of seabirds in Exclusive Economic Zone waters of the Hawaiian Archipelago. This 2010 survey is a repeat of an identical survey conducted in 2002 and will provide a valuable data set for evaluating changes since that time.

Seabird survey data are being collected aboard two NOAA research vessels using standard 300-m strip transect methods and a data entry and edit program run from a laptop computer. Seabird identification, numbers, behavior, and interspecific associations are recorded in real time during all daylight hours, weather permitting.

Data are being collected by Michael P. Force, Sophie Webb, Dawn Breese, and Scott Mills, contracted by the SWFSC. All four have worked as seabird observers on SWFSC marine mammal and ecosystem assessment surveys previously, some for over 10 years. The protocols, equipment, and software have been a part of the SWFSC ecosystem cruises since 1988.

The project began in August 2010 and ended in early December 2010. Monthly reports from the field were posted at the following website: <http://swfsc.noaa.gov/prd-hiceas.aspx>

*Developments in Gear Technology Achieved*

This project did not directly achieve any developments in gear technology.

*Improvements and Reduction in Bycatch Associated with This Project*

An important highlight of this project was the provision of data for investigation of changes in the seabird community of the Hawaiian Archipelago since the last survey in 2002. The survey also will provide data for estimating abundance of threatened and endangered seabirds (e.g., Newell's Shearwater) and for (potentially) investigating overlap of seabird distribution with fisheries.

*Project Title*

**Free Streamer Line Program**

*BREP Funding Provided*

\$15,000

*Location of Research*

Pacific States Marine Fisheries Commission

*Resource Challenge*

Commercial vessels using hook-and-line gear (i.e., longliners) in Alaska have the potential to catch seabirds in their gear, in particular species of special concern such as the endangered short-tailed albatross. As a result, NMFS in conjunction with the U.S. Fish and Wildlife Service (USFWS) developed regulations in 1997 that required commercial fishers to employ bird deterrent devices while fishing. In most cases, the use of streamer lines is required. In 2000, the Pacific States Marine Fisheries Commission in collaboration with the Seattle-based large boat longline fleet, the Alaska and Washington Sea Grant Programs, NMFS, and the USFWS, designed and distributed streamer lines for free for use on longline vessels. These streamer lines were very effective in deterring seabird attacks on bait in the large boat longline fleet. When the regulations were revised in 2004, smaller vessels obtained these free lines and used them on their vessels as well.

*Project Summary*

In order to reduce bycatch of the endangered short-tailed albatross and other seabirds, federal and state regulations now require most longline vessels to use bird avoidance devices and techniques when longline fishing in state and federal waters off Alaska. Seabird avoidance requirements vary depending on vessel length, area fished, type of gear used, and vessel superstructure. The Pacific States Marine Fisheries Commission distributes free streamer lines, designed for effective use on both large and small longline vessels, through established distribution centers throughout Alaska, Washington, and now in Oregon. The free streamer lines, constructed using a design developed by marine fishery advisors with the Washington and Alaska Sea Grant Programs and longline fishermen, serve as an incentive for fishermen to use seabird avoidance gear that is known to keep seabirds off their hooks.

*Developments in Gear Technology Achieved*

In response to changes in federal regulations for longline fisheries off Alaska that established construction standards for streamer lines used on smaller longline vessels (26-55 ft length overall), the Washington and Alaska Sea Grant Programs and longline fishermen developed a streamer line design more suited to the smaller longline vessel and its particular gear and setting speeds. Four different styles of streamer lines are now available to suit the vessel types and gear and setting operations of the array of vessels that operate in longline fisheries off Alaska and the Pacific Northwest.

*Improvements and Reduction in Bycatch Associated with This Project*

Estimates of seabird bycatch in Alaska groundfish longline fisheries have decreased by 80% since improved streamer lines been made available to and used by Alaska longline vessels. It is very likely that this reduction is tied in part to the easy availability of effective streamer lines supported through these BREP funds.



*Project Title*

**Seabirds in the Western North Atlantic and Interactions with Fisheries**

*BREP Funding Provided*

\$15,000

*Location of Research*

NMFS Southeast Fisheries Science Center

*Resource Challenge*

Observer coverage rates are major factors affecting the accuracy and precision of annual seabird bycatch estimates. These rates need to be increased, especially in the area between latitudes 31.3°N to 41.0°N and between longitudes 66.4°W and 79.0°W, where seabird bycatch is concentrated.

*Project Summary*

Objectives of this project, as in previous years since 2004, were to (1) characterize and quantify the bycatch of U.S. longline fisheries in the Western North Atlantic, (2) evaluate the bycatch in relation to estimated regional seabird populations, (3) improve the precision and accuracy of seabird bycatch identification by longline observers, and (4) improve the awareness of marine seabirds as components of the southeastern seaboard coastal ecosystem.

Observers have recorded a bycatch of 150 seabirds in eight species in the U.S. pelagic longline fishery since 1992. The greater shearwater (21%), followed by the northern gannet (7.3%) and the great black-backed gull (6.7%), have been the seabird species most numerous in terms of bycatch.

*Developments in Gear Technology Achieved*

This project did not directly achieve any developments in gear technology.

*Improvements and Reduction in Bycatch Associated with This Project*

As a result of this ongoing project, longline fishermen have an increased awareness of seabirds as an important component of the marine ecosystem, and fisheries observers have enhanced knowledge of seabird species identification. These improvements serve to enhance general knowledge of seabird issues and the importance of reducing impacts to these important apex predators of marine ecosystems.

*Project Title*

**Seabird Bycatch Avoidance for West Coast Groundfish Fisheries**

*BREP Funding Provided*

\$12,000

*Location of Research*

University of Washington, Washington Sea Grant, Oregon State University, and NMFS Northwest Fisheries Science Center

*Resource Challenge*

Recognizing that the distribution of endangered short-tailed albatross (*Phoebastria albatrus*) (STAL) overlaps the U.S. west coast fishing grounds, NMFS and the U.S. Fish and Wildlife Service initiated a process under the Endangered Species Act (ESA) to evaluate and minimize the effect of west coast groundfish fisheries on this species. New regulations to minimize seabird mortality in west coast fisheries could emerge from this process. Furthermore, a recent analysis of data from the west coast Groundfish Observer Program indicates that black-footed albatross (*Phoebastria nigripes*) (BFAL) are being incidentally killed in west coast longline fisheries. BFAL are being considered for listing under ESA. A determination of their status is expected in 2011.

*Project Summary*

This is a collaborative project between the University of Washington/Washington Sea Grant and Oregon State University. The objectives of this project are to map the distribution of albatrosses and other seabirds along the U.S. west coast to determine where seabirds may be at risk of mortality from west coast groundfish fisheries, and to initiate outreach on the need for seabird conservation. These seabird maps will provide the NMFS Northwest Regional Office with critical information for the endangered STAL section 7 consultation process under the ESA. Project objectives will be accomplished by gathering and mapping seabird distribution data and conducting port-to-port workshops for the west coast fleet.

As of late 2010, we have acquired, compiled, and standardized all seabird data sets and are ready to integrate these data sets with fisheries data once the latter are available. Oregon State University's contribution has primarily been standardizing and integrating satellite tracking data from various contributors. Albatross tracking data within the U.S. Exclusive Economic Zone (EEZ) off California, Oregon, and Washington include 6 STAL and 48 BFAL. All tracking data were acquired using the Argos system and included numerous models of transmitters operating on varying duty cycles. A standard forward-backward speed filtering algorithm set to a maximum of 80 km/hr was applied to cull erroneous positions. To standardize data obtained from varying transmitter duty cycles and position acquisition rates, tracks from all individuals were linearly interpolated at 1 hr intervals for periods between position fixes of  $\leq 24$  hr (we did not interpolate during periods of  $> 24$  hr between fixes). Albatross hours were then summed within each 10 km X 10 km grid cell within the EEZ and then standardized by dividing by the number of individual birds per grid cell. Grid cell size was selected based on the spatial

resolution of the aggregated line transect survey data with which the tracking data will be integrated.

For birds tagged outside the EEZ, both STAL and BFAL showed a northerly distribution. Preliminary results indicated that albatrosses spent a greater percentage of time over shelf break/slope waters compared to shelf and oceanic waters, relative to their availability. We are now poised to integrate the tracking and ship-based survey data with those from demersal fisheries.

*Developments in Gear Technology Achieved*

Our primary goal is to first assess which fisheries along the U.S. West Coast have the greatest potential temporal and spatial overlap with albatrosses and other seabirds of conservation concern. This has allowed us to establish the needed dialogue with participants in those fisheries. These initial efforts do not require development of new deterrent technologies; rather, introducing proven deterrents used in Alaskan demersal fisheries should also work for west coast fleets. Based on conversations between fishers and University of Washington/Washington Sea Grant collaborators, however, there may be some gear-specific modifications that could be beneficial, and these possible modifications are undergoing further consideration.

*Improvements and Reduction in Bycatch Associated with This Project*

Collaborators with the University of Washington/Washington Sea Grant conducted visits of selected ports in Washington and Oregon to meet with local longline fishers and distribute streamer lines. The extent of bycatch reduction from fishers voluntarily using streamer lines is not known.

*Project Title*

**Coastal Observation and Seabird Study Team**

*BREP Funding Provided*

\$7,491

*Location of Research*

University of Washington

*Resource Challenge*

From California north to Alaska, nearly 100 marine bird species utilize coastal waters for feeding, breeding, and migration. Cumulatively, over 100 million birds are found throughout these waters. Coastal systems pose a variety of threats to resident and migrant birds, most notably food stress due to climate and ecosystem shifts; disease; predation from native and introduced predators; pollution and toxins from natural (e.g., harmful algal blooms) and manmade (e.g., oil spills, floating debris) sources; and fishery bycatch. In the latter category, different fishery sectors affect different functional groups. For instance, longline fisheries often affect open-ocean species that forage on the surface (e.g., albatross, fulmars, petrels, shearwaters) whereas gillnets affect diving species (e.g., murres, puffins, auklets, loons, shearwaters).

Beached bird surveys offer one method for documenting bycatch incidents in the Pacific Northwest and Alaska without costs associated with at-sea work. In areas in which sampling is adequate in space and time, data collected can provide estimates of mortality from bycatch and other sources, sensitivity to bycatch by entanglement type, and information on the distribution of bycatch-sensitive species.

The Coastal Observation and Seabird Survey Team (COASST) is a geographically diverse (northern California to Alaska) beached bird survey in which volunteers assess taxon-specific encounter rates on a monthly basis. In 2009-10, over 500 trained volunteers collected data on beached birds at more than 300 sites throughout the Pacific Northwest and Alaska. “Normal” or background data collected in the COASST program can be used as a baseline against which fishery-associated mortality events can be contrasted, both in terms of species composition and overall intensity and severity.

*Project Summary*

The COASST project collects data on seabird mortality patterns in the Pacific Northwest and Alaska, including information on species sensitive to fisheries bycatch. Funds have supported the expansion of data collection efforts, supplies, and materials for documentation of entangled seabirds across over 500 kilometers of coastline and aboard fishing vessels along the West Coast.

*Developments in Gear Technology Achieved*

This project did not directly achieve any developments in gear technology.

*Improvements and Reduction in Bycatch Associated with This Project*

Within this reporting period (July 2010 to October 2010), 393 volunteers cumulatively conducted 897 surveys and contributed more than 4,036 hours (2,659 survey hours, 1,377 travel hours) to the program. Participants found 1,090 carcasses of 57 different seabird species.

COASST is the largest program of its kind in the world and the only program to photograph and individually mark carcasses, allowing quantification of persistence and scavenging rates, as well as confirmation of species identification and incidents of fisheries bycatch from recreational and commercial gear. From July to October 2010, COASST volunteers recorded information on 229 species of longline and trawl bycatch importance, including 2 Laysan albatross, 6 black-footed albatross, 34 sooty shearwaters, 6 short-tailed shearwaters, 4 pink-footed shearwaters and 177 northern fulmars. In addition, data were recorded on 255 common murre (3 line entanglements), 33 rhinoceros auklets, and 14 loons, for a total of 302 species commonly found entangled in coastal gillnets.

*Project Title*

**Fisheries-Independent Marine Bird Surveys at the Northwest Fisheries Science Center**

*BREP Funding Provided*

\$5,000

*Location of Research*

NMFS Northwest Fisheries Science Center

*Resource Challenge*

Seabird bycatch reduction gear in the West Coast fishing fleet is in initial phases of voluntary deployment and sea trials. Spatially explicit data concerning the spatial and temporal overlap between fisheries and seabird species at sea will be required to target bycatch reduction actions. BREP funding provided to this project is being used to grow a NMFS program that will provide quantitative, fisheries-independent surveys of seabirds at sea. These data will be used to generate maps of overlap between the West Coast fishing fleet and seabirds most vulnerable to conflict with fishing gear (e.g., black-footed albatross *Phoebastria nigripes*).

*Project Summary*

This proof-of-concept project placed a newly trained marine bird observer onboard a NOAA shipboard survey during July-August 2010. The observer collected fisheries-independent, quantitative data on marine bird distribution and abundance. Fisheries-independent data are in demand for bycatch-reduction projects already funded by the National Seabird Program (see page 28). The intent of this pilot training program was to develop recommendations on how to best develop a pool of bird observers to deploy aboard NMFS research operations in Washington, Oregon, and northern California. In addition to providing data on potential overlap between seabird distributions and fishing fleet activity, an increasing number of NOAA ocean cruises are moving toward collecting whole-ecosystem data sets and are therefore asking for marine bird observers to collect data on upper-trophic-level predators. To meet the growing need for fisheries-independent data and ecosystem data, NMFS must develop the capacity to collect such data during at-sea surveys of marine birds.

Development of this capacity also would address a data gap in knowledge of marine bird distributions off the coasts of Oregon and Washington by building geographical continuity between California and Alaska data sets. Such data are necessary to address coastal marine spatial planning needs for responsible development of renewable energy options in the Pacific Northwest (e.g., wave energy, tidal energy, wind energy). These data also provide geo-referenced bird sightings needed to analyze spatial overlap between marine bird distributions and Washington/Oregon/California fisheries, an important and proactive step in identifying fisheries and species most likely to benefit from bycatch reduction actions.

*Developments in Gear Technology Achieved*

This project did not directly achieve any developments in gear technology.

*Improvements and Reduction in Bycatch Associated with This Project*

We are collaborating with Washington Sea Grant to provide fisheries-independent data on seabird distribution that will be used to generate maps of overlap between West Coast fisheries and seabirds. It is expected that once the maps are generated, NMFS will have data on which to base proactive recommendations for bycatch reduction in specific fishing fleets for vulnerable species or species groups (e.g., procellariiforms, or albatrosses and petrels). The overall goal of this project is to strategically deploy bycatch-reduction gear before seabird bycatch impacts a fishery or bird populations of concern.

*Project Title*

**Contribution to World Seabird Conference**

*BREP Funding Provided*

\$5,000

*Location of Research*

NMFS Southwest Fisheries Science Center

*Resource Challenge*

Networking, communication, and outreach with international colleagues on global seabird topics are essential for NMFS to stay abreast and informed of key advances and information in the seabird field.

*Project Summary*

NMFS staff and contractors whose work contributes to the NMFS National Seabird Program (NSP) (see page 28) attended the First World Seabird conference in Victoria, British Columbia, on September 7-11, 2011. NMFS staff presented work on a wide array of topics that illustrated the focus of the NSP, namely, seabird bycatch and seabirds as ecological indicators. NMFS was a major sponsor of the Conference, and NMFS staff and contractors contributed with posters and oral presentations and served as invited speakers in special symposia. NMFS professionals also participated in the meeting by staffing a NMFS booth in the Conference exhibit hall. This Conference represented the most coordinated, cross-agency representation of the NSP at an international meeting since the NSP's inception in 2001. NMFS staff and contractors in attendance represented nine NMFS Regional Offices and Science Centers. Additional information about the World Seabird Conference is available at <http://www.worldseabirdconference.com> Abstracts of the presentations and posters can be seen at the NMFS bycatch website: <http://www.nmfs.noaa.gov/bycatch.htm>

*Developments in Gear Technology Achieved*

This project did not directly achieve any developments in gear technology.

*Improvements and Reduction in Bycatch Associated with This Project*

Attendance at this Conference by a wide geographic array of NMFS staff and contractors provided an excellent opportunity to enhance the knowledge and information available to NMFS to carry out objectives related to reduction of seabird interactions in fisheries and development of knowledge of components of the marine ecosystem.



## **Proposals to Address Bycatch or Seabird Interaction Problems**

NMFS has undertaken a bycatch reduction strategic planning effort to identify bycatch or seabird interaction problems that should be addressed by NMFS through 2015. These identified bycatch or seabird interaction problems are described by NMFS Regions and Programs below.

### *Northeast Region*

The NMFS Northeast Region and Northeast Fisheries Science Center have identified the following proposals:

- Seabird bycatch reduction through completing gillnet seabird bycatch estimation analysis (2011-2012)
- Seabird bycatch reduction through completing seabird bycatch estimation analysis for gear type(s) other than gillnets (2011-2013)
- Turtle bycatch reduction in non-scallop trawl fisheries (2011-2015)
- Continuation of the estimation of bycatch of turtles and marine mammals in northwest Atlantic trawl, gillnet, pot, dredge and longline fisheries (2011-2015)
- Finfish bycatch reduction in squid, herring, and Northeast multispecies trawl fisheries (2011-2015)
- Atlantic large whale take reduction in fisheries that entangle whales, through the development of gear modifications and other technologies to reduce takes (2011-2015)

### *Southeast Region*

The NMFS Southeast Region and Southeast Fisheries Science Center have identified the following proposals:

- Bluefin tuna bycatch reduction in Gulf of Mexico yellowfin tuna fishery (2011-2012)
- Snapper and grouper mortality reduction through the use of modified circle hooks in recreational fisheries (2011-2013)
- Seabird bycatch reduction through enhanced observer coverage to assess potential protected species interactions with fisheries in the Atlantic (2011-2015)
- Turtle bycatch reduction in non-shrimp trawl fisheries (Atlantic flynet fishery, Atlantic whelk trawl fishery, Gulf butterflyfish fishery (2011-2015)
- Turtle excluder device and bycatch reduction device refinement in shrimp trawl fishery (2011-2015)
- Turtle bycatch reduction in various Atlantic and Gulf of Mexico gillnet fisheries (2011-2015)
- Turtle entanglement/bycatch reduction through development of weak links for the vertical lines used for buoys in a variety of pot fisheries (2011-2015)

### *Atlantic Highly Migratory Species(HMS)*

The Atlantic HMS Management Division in the NMFS Office of Sustainable Fisheries has identified the following proposals:

- Billfish, bluefin tuna, and sea turtle bycatch reduction in Gulf of Mexico longline fisheries through investigation and characterization of green-stick gear (2011-2013)
- Sea turtle bycatch reduction in Atlantic shallow-set longline using techniques developed in experiments in the Pacific Ocean (2011-2013)
- HMS rod and reel bycatch reduction through investigation and characterization of bycatch in that fishery (2012-2015)

#### *Southwest Region*

The NMFS Southwest Region and Southwest Fisheries Science Center have identified the following proposals:

- Shark bycatch and bycatch mortality reduction in drift gillnet and pelagic longline fisheries (2011-2012)
- Rockfish mortality reduction through the use of recompression cages and devices (2011-2012)
- Evaluation of gear modifications to prevent marine mammal depredation in the California halibut trawl fishery in Southern California (2011-2013)
- Shark bycatch mortality reduction in recreational catch-and-release fishery (2011-2014)
- Seabird bycatch reduction through enhanced collection of seabird distribution and abundance data on cetacean and ecosystem assessment cruises, action at international regional fishery management organizations, and information and outreach to fishery participants (2011-2015)

#### *Northwest Region*

The NMFS Northwest Region and Northwest Fisheries Science Center have identified the following proposals:

- Pacific coast roundfish bycatch reduction by improving performance of already proven bycatch reduction gear types, e.g., selective flatfish trawl to reduce rockfish bycatch in flatfish fishery (2011-2012)
- Endangered Species Act-listed salmon and rockfish (*Sebastes*) bycatch reduction through refinement and implementation of open escape window bycatch reduction devices in the Pacific hake fishery, as well as development of applications of flexible sorting grids in bottom trawl fisheries (2011-2015)
- Seabird bycatch reduction through continuation of Seabird Bycatch Research Project to reduce potential fisheries interactions with short-tailed albatross and other seabird species (2011-2015)
- Seabird bycatch reduction in Alaska and Northwest longline fisheries by providing free streamer lines and cost-sharing on integrated weight lines (2011-2015)

### *Alaska Region*

The NMFS Alaska Region and Alaska Fisheries Science Center have identified the following proposals:

- Salmon bycatch reduction in Alaska pollock fisheries through development of trawl modifications (2011-2014)
- Pacific halibut bycatch reduction in Gulf of Alaska and Eastern Bering Sea groundfish (cod, flatfish, pollock) trawl and longline fisheries through development of fisheries-specific bycatch reduction devices (2011-2015)
- Crab bycatch reduction in groundfish fisheries through development of gear modifications (although trawl bycatch is a higher volume issue, bycatch of blue king crab in cod pots (baited traps) has a higher priority due to concern over potential overfishing of that species) (2011-2015)
- Seafloor habitat and Essential Fish Habitat impact reduction by modifying trawls and trawling methods (2011-2015)
- Seabird bycatch reduction in Alaska trawl fisheries by further developing effective seabird mitigation gear, enhancing bycatch monitoring, exploring the role of vessel attraction and providing free seabird bycatch reduction gear (2011-2015).
- Seabird bycatch reduction in Alaska and Northwest longline fisheries by providing free streamer lines and cost-sharing on integrated weight lines (2011-2015)
- Reduction of unobserved crab mortality due to trawl encounters through development and implementation of modified trawl groundgear (2011-2015)
- Development of a more efficient method for identifying incidentally caught Pacific halibut that are live-release candidates (i.e., high survival rate), and development of methods consistent with observer program protocols for sorting, accounting, and discarding halibut rapidly to reduce bycatch mortality (2011 - 2015)
- Development of trawl modifications to reduce cod bycatch in trawls targeting flatfish (2011-2015).

### *Pacific Islands Region*

The NMFS Pacific Islands Region and Pacific Islands Fisheries Science Center have identified the following proposals:

- False killer whale take reduction in the Hawaii-based pelagic longline fishery (2011-2015)
- Turtle bycatch reduction through continued operation and analysis of “TurtleWatch,” which provides fishing area advisory charts indicating turtle avoidance areas to Hawaii longliners (2011-2015)
- International sea turtle, shark, and gamefish bycatch reduction through testing and promoting longline bycatch mitigation methodologies including: (1) continued testing of circle hooks to reduce sea turtle bycatch and maintain target catch; (2) continued testing of stiffer lines to reduce turtle entanglements in longlines; (3) testing chemical methods of reducing shark bycatch (now under domestic

- development); and (4) testing of operational alterations to reduce marlin catches (2011-2015)
- Seabird bycatch reduction in longline fisheries by providing free safe-lead gear and cost-sharing for side-setting vessel conversions (2011-2015)

*National Seabird Program*

The NMFS National Seabird Program has identified the following proposals:

- Seabird bycatch reduction through outreach related to a Seabird Carcass Collection Program that would coordinate information on seabird bycatch composition in fisheries (2011-2015)
- Seabird bycatch reduction through outreach to fishery participants regarding seabird species distribution on fishery survey cruises (2011-2015)
- Seabird bycatch reduction seabird interaction actions at regional fishery management organizations (2011-2015)
- Seabird bycatch reduction through research and data analysis on relationship of endangered short-tailed albatross distribution and potential fishery interactions off Alaska (2011-2015)

## Economic Importance of Reducing Bycatch

Federal regulations developed by Regional Fishery Management Councils and approved and/or implemented by NMFS in 2010 highlighted the need for bycatch reduction engineering solutions to avoid costly fishery closures. Major U.S. fisheries in the Mid-Atlantic and off Alaska face closures if solutions are not found to bycatch problems.

In order to address overfishing of butterfish in the *Loligo* squid fishery, the Mid-Atlantic Fishery Management Council, in cooperation with NMFS, developed Amendment 10 to the Atlantic Mackerel, Squid and Butterfish FMP (Amendment 10). The final rule to implement Amendment 10, published in the Federal Register on March 11, 2010, established a butterfish rebuilding program with a butterfish mortality cap in the *Loligo* fishery. Under this program, the *Loligo* fishery would close if the cap is met. Amendment 10 economic analyses indicated that the limited access *Loligo* fleet could lose up to \$16 million as a result of this cap. When the estimated multiplier effect that takes into account revenue losses from all related sectors (e.g., processors, dealers, boat repair, insurance, ice) is considered, total losses as a result of this bycatch cap could be up to \$49 million.

Similarly, on August 30, 2010, NMFS and the North Pacific Regional Fishery Management Council implemented Amendment 91 to the FMP for Groundfish of the Bering Sea and Aleutian Islands Management Area (Amendment 91). The amendment established two Chinook salmon prohibited species catch (PSC) limits (60,000 and 47,591) for the Bering Sea pollock fishery. The higher cap is available to pollock sectors that participate in an incentive plan agreement (IPA), an innovative approach for fishery participants to design industry agreements with vessels to avoid Chinook salmon bycatch at all times and thus reduce bycatch below the PSC limit. Vessels that do not participate in an IPA would fish under the 47,591 Chinook salmon cap. In addition, if a sector of the fleet exceeds its PSC limit three or more times within seven consecutive years, that sector will be permanently allocated a portion of the 47,591 Chinook salmon PSC limit, rather than a portion of the 60,000 Chinook salmon PSC limit. Under Amendment 91, IPAs could take a variety of forms, including imposing rewards for avoiding Chinook salmon bycatch and penalties for failure to avoid Chinook salmon bycatch.

Economic analyses of the proposed regulation indicated that the potential of foregone pollock wholesale gross revenue, based on a 2007 high bycatch year, would have been \$363 million under the 60,000 Chinook salmon hard cap and \$453 million under the 47,591 Chinook salmon hard cap. Although the implications of these hard caps are economically severe, Chinook salmon is a culturally and economically valuable species, where more than half of the Chinook salmon bycatch in the Bering Sea pollock fishery may be destined for river systems in western Alaska. Western Alaska Chinook salmon stocks declined sharply in 2007 and remained low in 2008 and 2009. Consequently, the in-river harvest of western Alaska Chinook salmon has been severely restricted.

The BREP has contributed to the effort to find solutions to butterfish and Chinook salmon bycatch problems through projects funded in 2010 (see pages 9 and 20,

respectively). Funding for the BREP can help position the program to be ready to provide solutions when bycatch challenges appear, and can help the BREP address bycatch issues before they become crises that threaten to shut down major U.S. fisheries.

**Appendix 1. NMFS Bycatch Reduction Engineering Program Policy Directive**

Department of Commerce • National Oceanic & Atmospheric Administration • National Marine Fisheries Service

<b><i>NATIONAL MARINE FISHERIES SERVICE POLICY DIRECTIVE POLICY DIRECTIVE 01-107 EFFECTIVE DATE</i></b>	
<b><i>Fisheries Management</i></b>	
<b><i>BYCATCH REDUCTION ENGINEERING PROGRAM</i></b>	
<b>NOTICE:</b> This publication is available at: <a href="http://www.nmfs.noaa.gov/directives/">http://www.nmfs.noaa.gov/directives/</a> .	
<b>OPR:</b> F/SF3 (Benaka) <b>Type of Issuance:</b> Initial	<b>Certified by:</b> F/SF (Risenhoover)
<b><i>SUMMARY OF REVISIONS:</i></b>	

Section 316 of the Magnuson-Stevens Fishery Conservation and Management Act, as amended through January 12, 2007 (MSA), requires the Secretary of Commerce (Secretary), in cooperation with the Councils and other affected interests, and based upon the best scientific information available, to establish a Bycatch Reduction Engineering Program (BREP), including grants, by mid-January 2008 to develop technological devices and other conservation engineering changes designed to minimize bycatch, seabird interactions, bycatch mortality, and post-release mortality in federally managed fisheries. According to the MRA, the BREP will:

1. be regionally based;
2. be coordinated with projects conducted under the cooperative research and management program established under MSA;
3. provide information and outreach to fishery participants that will encourage adoption and use of technologies developed under the BREP; and
4. provide for routine consultation with the Councils in order to maximize opportunities to incorporate results of the BREP in fishery management plans (FMPs) developed by the Councils.

Section 316 also:

- authorizes FMPs prepared by a Council or the Secretary to establish a system of incentives to reduce total bycatch and seabird interactions;
- authorizes the Secretary, in coordination with the Secretary of the Interior, to undertake projects in cooperation with industry to improve information and technology to reduce seabird interactions; and
- requires the Secretary to submit an annual report to Congress that describes funding provided to implement Section 316, developments in gear technology

achieved under Section 316, and improvements and reduction in bycatch and seabird interactions associated with implementing Section 316.

This policy directive implements the BREP to carry out the objectives of Section 316 of the MSA, and national bycatch reduction coordination activities that have been carried out by the Office of Sustainable Fisheries over the past several years, including long-term planning and outreach and funding of bycatch research critical to management objectives. This policy directive establishes the following authorities and responsibilities for the BREP:

#### Provide National Coordination

- Provide guidance to ensure that the results of bycatch reduction engineering and post-release injury and mortality projects supported by NOAA are responsive to management needs and can be used to support management decisions.
- Solicit and review annual updates of action items and progress for Regional Bycatch Implementation Plans. The Regional Bycatch Implementation Plan updates have included, and will continue to include, action items related to not only bycatch reduction engineering and other research but also to monitoring, management (including international efforts), and education and outreach.
- Track results of projects funded by the BREP.
- Advocate, coordinate, and support, to the extent practicable, incentives to reduce bycatch of fish and protected species as well as bycatch mortality, including providing guidance on best practices for incentive programs as necessary.
- Ensure that appropriate bycatch reduction policies are incorporated into the NOAA Policy Directives System.
- Serve as a liaison to the National Observer Program for purposes of its National Bycatch Report.
- Collaborate with the Office of Habitat Conservation to implement the Deep Sea Coral Research and Technology Program required by Section 408 of the MSA.
- Provide a forum, as appropriate, to help develop solutions to regional and national bycatch issues.
- Serve as a point of contact among NOAA managers, the NMFS National Seabird Program, and regionally based bycatch reduction engineering programs.
- Ensure that BREP annual performance milestones are tracked and met consistently.

#### Allocate Funding

- Develop funding allocations for annual BREP spending plan, based on review of proposals submitted and the approved BREP spending plan process.
- Facilitate the timely distribution of national funds to enhance implementation of bycatch reduction engineering efforts.
- Coordinate long-term budgeting processes to ensure full funding for the BREP.
- Help ensure that programs affected by technologies developed through the BREP have sufficient resources to facilitate or accommodate their application.



### Coordinate Planning and Policy Development

- As appropriate, conduct long-term strategic planning to identify regional and national bycatch reduction engineering priorities, develop incentive programs to reduce post-release mortality and injury, and provide assistance to the Regions in identifying fisheries for which gear technology may provide solutions and fisheries for which gear technology solutions may not be feasible.
- Ensure that fisheries of bycatch concern identified through the National Observer Program's National Bycatch Report receive bycatch reduction engineering resources as appropriate.
- Coordinate with Regional Administrators and Science Center Directors to brief Regional Fishery Management Councils on BREP work at least once a year and receive feedback from Councils on bycatch reduction concerns and priorities.
- Represent bycatch reduction efforts in NOAA and NMFS strategic planning activities.

### Enhance Communication

- Compile, coordinate review of, and manage clearance of the annual BREP Report to Congress.
- Regularly brief NOAA leadership groups and stakeholder groups such as the Council Coordinating Committee, the Marine Fisheries Advisory Committee, and the Marine Fish Conservation Network on the successes of and challenges for the BREP and solicit feedback on bycatch reduction concerns.
- Respond to requests as appropriate from NOAA, the Department of Commerce, Congress, and other members of the public regarding bycatch reduction engineering, incentives to reduce post-release injury and mortality, and other bycatch reduction issues.
- Compile and distribute information on BREP activities to constituent groups, fishery managers and scientists, and other organizations with an interest in bycatch reduction through presentations at professional meetings and publication of articles in journals and NMFS publications such as the annual business report.

### Conduct Outreach Activities

- Develop and enhance collaborative partnerships with other NOAA programs including the National Observer Program, National Cooperative Research Program, the National Sea Grant College Program (especially its fisheries extension agents), Regional Bycatch Committees and Action Teams<sup>1</sup>, and the Offices of Protected Resources (including the National Seabird Program), International Affairs, Habitat Conservation, and Science and Technology, to leverage bycatch reduction engineering resources.
- Manage and regularly update the NMFS Bycatch Feature website.
- Collaborate with the National Observer Program, the National Sea Grant College Program, and other NOAA bycatch stakeholders to ensure a consistent and

---

1. When NMFS published its National Bycatch Strategy in the *Federal Register* on March 11, 2003, some Regions, including the Northeast Region, responded by creating Regional Bycatch Committees and Action Teams. Some of these teams and committees may still exist, even though they have been relatively inactive in recent years.

effective message is provided to the public regarding NOAA's bycatch reduction engineering efforts and to encourage adoption and use of technologies developed through the BREP.

- Support and track, to the extent necessary, international technology transfer and capacity building efforts based on successful technologies developed through the BREP for federally managed fisheries.

The mission of the BREP is to develop technological solutions and investigate changes in fishing practices designed to minimize bycatch of fish (including sponges and deep sea and shallow, tropical corals) and protected species (including marine mammals, seabirds, and sea turtles) as well as minimize bycatch injury and mortality (including post-release injury and mortality).

### **Organization and Reporting:**

The BREP will be administered by a National Coordinator in the NMFS Office of Sustainable Fisheries, in conjunction with a Science Lead and Management Lead. The Office of Sustainable Fisheries, in consultation with the Offices of Protected Resources, Science and Technology, and International Affairs, will provide policy oversight and overall coordination of activities through the National Coordinator. Coordination activities include providing staff support to the BREP, documenting BREP activities, managing the annual spending plan process, serving as primary point of contact for the annual BREP Report to Congress, and any other activity deemed necessary by the BREP or NMFS leadership.

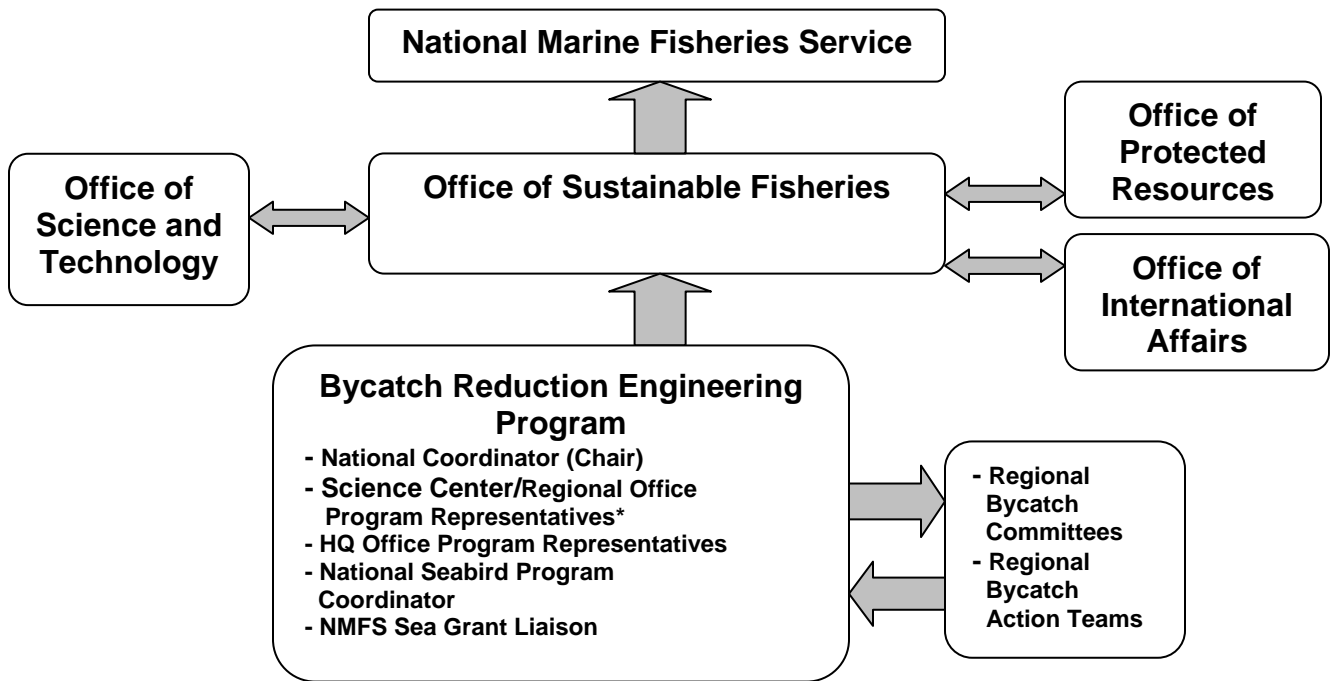
The Science Lead and Management Lead will be identified by the BREP National Coordinator from among the six Regional representatives described below. The Leads will rotate on a regular basis. The Science Lead and Management Lead will work with the National Coordinator to help coordinate BREP activities and develop final BREP recommendations on spending plans, policy issues, and other topics. These Leads also will help ensure that the BREP focuses on Regional issues as it carries out its work. If all primary Regional representatives come from Science Centers, then the Management Lead may be selected from among alternate Regional representatives (see below).

The BREP will include, along with the National Coordinator, the following program representatives:

- One representative with hands-on bycatch reduction engineering and post-release injury and mortality experience from each Regional Fisheries Science Center/Regional Office (i.e., six total Regional representatives);
- The NMFS Sea Grant Liaison (or other Sea Grant designee);
- The NMFS National Seabird Program Coordinator;
- One representative each from the headquarters Offices of Protected Resources, Science and Technology, Habitat Conservation, and International Affairs; and
- One representative from the Highly Migratory Species Management Division in the Office of Sustainable Fisheries.

Regional representatives will be responsible for representing their entire Region, rather than a Regional Office or Science Center perspective. The Regional Administrator and Science Center Director should not only nominate a primary Regional representative, but also an alternate representative. If the primary representative comes from a Science Center, then the alternate representative should come from a Regional Office. In addition, if the primary representative is someone who focuses mostly or exclusively on protected species or fisheries bycatch, then the alternate representative should be, to the extent practicable, someone who focuses on the other area (either protected species or fisheries). The Regional representatives should serve as liaisons between the BREP and already existing Regional Bycatch Committees and Action Teams, to the extent such Committees and Teams are active.

**BREP organization and Line Office/Group oversight**



\*Two of these Program Representatives will be designated the BREP Science and Management Leads.

The Office of Sustainable Fisheries, in consultation with the Offices of Protected Resources, Science and Technology, and International Affairs, will designate a Science Lead and a Management Lead from among the Science Center/Regional Office Program Representatives.

The BREP should attempt to develop consensus recommendations whenever possible. The standard for reaching consensus is that all BREP members can accept the proposed recommendation. If the BREP cannot reach consensus, it may be necessary to vote in order to determine where differences of opinion exist. In the event voting is necessary, each member of the BREP shall have only one vote. The vote will be considered by the

National Coordinator, Science Lead, and Management Lead, who will attempt to reach a consensus. If consensus cannot be reached, all perspectives will be forwarded to the Directors of the Offices of Sustainable Fisheries, Protected Resources, and Science and Technology for their advice.

The BREP shall periodically meet or have conference calls. When a member of the BREP cannot attend a meeting or conference call, it is his or her responsibility to either appoint an alternative to attend, or to communicate his or her views to other members of the BREP prior to the meeting. Minutes of all meetings and conference calls will be developed by the National Coordinator in coordination with Science and Management Leads.

No quorum is needed for the BREP to conduct business; however, every effort will be made to schedule meetings so that most members can attend. The BREP will meet via conference call whenever possible, and the BREP began to meet on an annual basis in FY09. Agendas for all meetings will be developed by the National Coordinator in coordination with the BREP Science and Management Leads. Agendas will be distributed to BREP members for review and input prior to all meetings. Materials will be distributed prior to all meetings via the BREP intranet site whenever possible. Meetings of the BREP may include presentations of projects funded by the BREP, with feedback on the projects provided and discussions of how the results of these projects can meet management needs.

### **Funding Processes:**

In addition to funds in the Reducing Bycatch line, the BREP will strive to leverage other sources of bycatch reduction engineering funding in NOAA to help achieve the mission of the BREP.

BREP funds are allocated on an annual basis based on technical review and recommendations from the BREP. The annual fund allocation process will include the following characteristics:

- The request for proposals will be sent by the BREP National Coordinator to the Regional Administrators, Science Center Directors, and HQ Office Directors in mid-September. Members of the BREP will be cc'ed on the request.
- The request for proposals will include several criteria, which may change from year to year, upon which the proposals will be evaluated, for example, the relation of the proposed project to current action items in a Regional Bycatch Implementation Plan, or whether the proposed project builds on results from a successful pilot project previously funded by the BREP or Reducing Bycatch budget line.
- Prioritized Regional proposals will be sent by Regional Administrators and Science Center Directors jointly, as well by as the Director, Office of Sustainable Fisheries (for Atlantic highly migratory species), to the BREP National Coordinator by the end of October.

- The BREP National Coordinator will preview proposals by mid-November to ensure no major required components are missing.
- The BREP will review proposals and finalize a draft spending plan by mid-January.
- The final spending plan will be approved by the Director, Office of Sustainable Fisheries.

The preceding schedule will be compressed if a NOAA budget was available soon after the beginning of the fiscal year. The request for proposals will require that:

- Proposals be no longer than five pages in length;
- Proposals address scalability and specify whether the proposal is for a multi-year project;
- Investigators for proposals that receive funding submit progress reports six months after receiving funding as well as final reports within a specified period of time after projects are completed; and
- Proposals primarily related to electronic monitoring or observer data analysis be submitted to NOPAT.

When the BREP becomes fully funded, a portion of BREP funding will be allocated as grants through existing national and regional NOAA grant programs, which could include Sea Grant, the Marine Fisheries Initiative, and the Cooperative Research Partners Program. The BREP will require prospective grantees to submit proposals, and the BREP will evaluate proposals based on conformance with the BREP mission and other criteria. The BREP will publicize grant opportunities through the Federal Register, the NMFS Bycatch Feature website, and other means. When fully funded, the BREP will distribute a significant portion of available BREP funding, including grant funding, among the Regions, which will develop Regional spending plans. However, spending plans will be subject to comment and/or approval by the BREP.

The duration of the BREP will be indefinite because the MSA does not indicate a limit to the BREP's duration.

This policy directive's objective will be attained when the above-listed responsibilities are carried out effectively on a routine basis. Additional performance measures will include number of bycatch reduction projects developed and number of new bycatch reduction technologies adopted by industry.

Procedural directives will be issued to implement this policy as needed.

John Oliver  
Assistant Administrator for Fisheries

January 11, 2008  
Date

**Appendix 2. Section 316 of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006**

H. R. 5946—31

**SEC. 116. BYCATCH REDUCTION ENGINEERING PROGRAM.**

(a) IN GENERAL.—Title III (16 U.S.C. 1851 et seq.), as amended by section 113 of this Act, is further amended by adding at the end the following:

**“SEC. 316. BYCATCH REDUCTION ENGINEERING PROGRAM.**

“(a) BYCATCH REDUCTION ENGINEERING PROGRAM.—Not later than 1 year after the date of enactment of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, the Secretary, in cooperation with the Councils and other affected interests, and based upon the best scientific information available, shall establish a bycatch reduction program, including grants, to develop technological devices and other conservation engineering changes designed to minimize bycatch, seabird interactions, bycatch mortality, and post-release mortality in federally managed fisheries. The program shall—

“(1) be regionally based;

“(2) be coordinated with projects conducted under the cooperative research and management program established under this Act;

“(3) provide information and outreach to fishery participants that will encourage adoption and use of technologies developed under the program; and

“(4) provide for routine consultation with the Councils in order to maximize opportunities to incorporate results of the program in Council actions and provide incentives for adoption of methods developed under the program in fishery management plans developed by the Councils.

“(b) INCENTIVES.—Any fishery management plan prepared by a Council or by the Secretary may establish a system of incentives to reduce total bycatch and seabird interactions, amounts, bycatch rates, and post-release mortality in fisheries under the Council’s or Secretary’s jurisdiction, including—

“(1) measures to incorporate bycatch into quotas, including the establishment of collective or individual bycatch quotas;

“(2) measures to promote the use of gear with verifiable and monitored low bycatch and seabird interactions, rates; and

“(3) measures that, based on the best scientific information available, will reduce bycatch and seabird interactions, bycatch mortality, post-release mortality, or regulatory discards in the fishery.

“(c) COORDINATION ON SEABIRD INTERACTIONS.—The Secretary,

in coordination with the Secretary of Interior, is authorized to undertake projects in cooperation with industry to improve information and technology to reduce seabird bycatch, including—

“(1) outreach to industry on new technologies and methods;

“(2) projects to mitigate for seabird mortality; and

“(3) actions at appropriate international fishery organizations to reduce seabird interactions in fisheries.

“(d) REPORT.—The Secretary shall transmit an annual report to the Senate Committee on Commerce, Science, and Transportation and the House of Representatives Committee on Resources that—

“(1) describes funding provided to implement this section;

“(2) describes developments in gear technology achieved under this section; and

“(3) describes improvements and reduction in bycatch and seabird interactions associated with implementing this section, as well as proposals to address remaining bycatch or seabird interaction problems.”

# **Annual Report to Congress on the Bycatch Reduction Engineering Program**

**U.S. Secretary of Commerce  
Gary Locke**

**Administrator of National Oceanic and Atmospheric Administration  
and Under Secretary of Commerce  
Jane Lubchenco, Ph.D.**

**Assistant Administrator for Fisheries  
Eric C. Schwaab**

**[www.nmfs.noaa.gov](http://www.nmfs.noaa.gov)**

**National Marine Fisheries Service  
1315 East-West Highway  
SSMC 3, F/SF, Room 13362  
Silver Spring, MD 20910**

**U.S. Government - 2011**

