Bycatch Reduction Engineering Program

2015 Annual Report to Congress

Funding Bycatch Reduction

Bycatch occurs when fishermen discard catch of marine species, or when resources like marine mammals, seabirds, corals, sponges, sea turtles, or protected fish are harmed or killed by fishing gear. Reducing bycatch in fisheries can improve the recovery of protected species and have positive biological, economic, and social impacts.

NOAA Fisheries has long been committed to reducing bycatch. The Bycatch Reduction Engineering Program (BREP) supports technological solutions and conservation engineering practices that minimize bycatch and bycatch mortality in federally managed fisheries. BREP is also a key component of the 2016 National Bycatch Reduction Strategy. Since Fiscal Year 2012, NOAA Fisheries has supported 84 BREP awards to external partners including state governments, academia, and the fishing industry. This report summarizes the outcomes of BREP awards from Fiscal Year 2014. The majority of this work was done in Fiscal Year 2015, with results reported in Fiscal Year 2016.

Red snapper fitted with an acoustic transmitter to monitor activity after catch and release.

The four program priorities are:

Reducing Protected Species Bycatch

Innovative Technologies

Improving Fishing Practices

Reducing Post-Release Mortality

Highlights & Outcomes

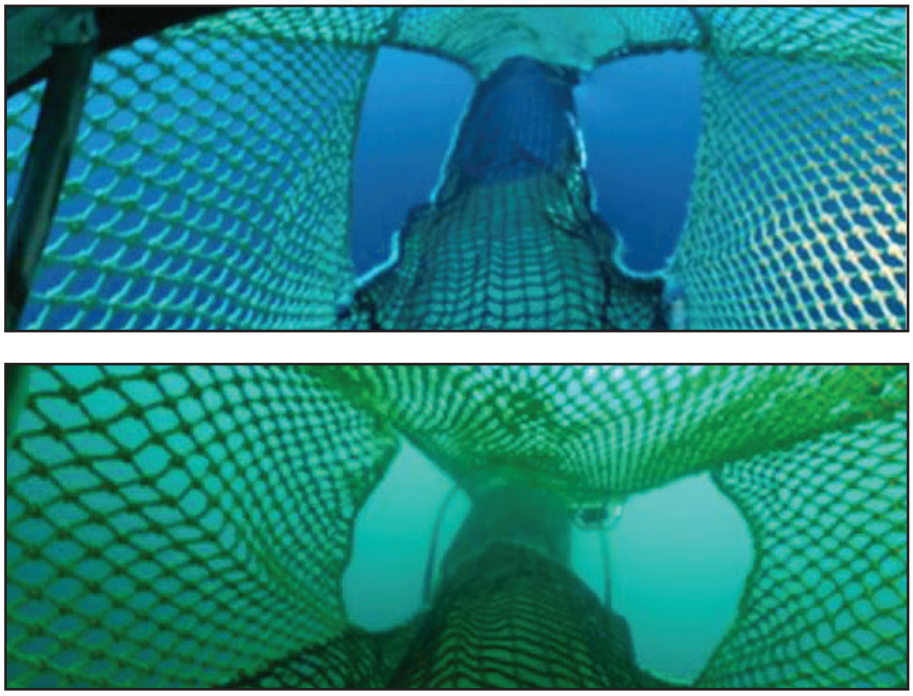
In Fiscal Year 2014, NOAA Fisheries awarded $2.41 million for 18 bycatch reduction projects. Highlights include:

- Installing escape windows and LED lighting on West Coast fishing gear reduced Chinook salmon bycatch in the Pacific hake mid-water trawl fishery by 70 percent.
- Using accelerometer technology similar to that found in your smartphone, researchers assessed the post-release outcomes of more than 200 sharks, providing crucial data for stock assessment and management at a dramatically reduced cost.
- Expansion of a successful East Coast network that identifies real-time river herring, shad, and butterfish "hot spots" helping the squid fishery reduce butterfish bycatch by more than 65 percent from 2012-2015.

Reducing Protected Species Bycatch

Two BREP-funded projects addressed bycatch of protected sea turtles and Chinook salmon along the East and West Coasts. BREP funding enabled grantees to provide insight into how gear modifications can help reduce protected species bycatch.

The Pacific hake midwater trawl fishery is the largest groundfish fishery by volume on the West Coast. While catch consists mostly of hake, bycatch of Chinook salmon can be an issue. If too many Chinook salmon are caught, the fishery must close early to conserve this protected species. In 2014, Pacific States Marine Fisheries Commission researchers examined the use of LED lights to help Chinook salmon escape through windows/openings in the nets. Using video cameras to collect data, the Commission found that 86 percent of escaped salmon used the well-lit openings.



Top & Bottom: Two illuminated nets with esacpe windows for Chinook salmon.

Sea turtle bycatch.

To better understand turtles and other protected species' interactions with fishing gear and evaluate effective gear modifications, researchers with the Marine Biological Laboratory and Maine Marine Composites, LLC used specially designed turtle models and computer-based simulations. The tool simulates the effects of a turtle's body and motions and mimics turtles' interaction with fishing gear, allowing researchers to test gear modifications without risking live turtles.

Innovative Technologies

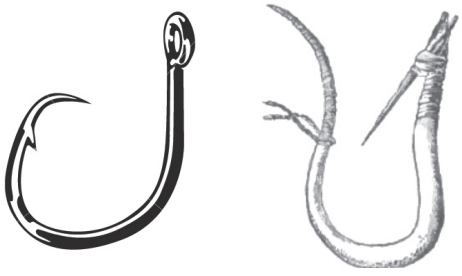
Three BREP-funded projects along the West Coast focused on improving technology and increasing understanding of animal behavior and gear interactions to reduce fish and marine mammal bycatch.

The West Coast groundfish bottom trawl fishery operates under annual catch limits for specific species. Because the fishery catches multiple species at once, bycatch of less abundant species can sometimes cause the fishery to close early. The Pacific States Marine Fisheries Commission is examining the effectiveness of various mesh sizes and net configurations to reduce bycatch. Results indicate that turning the netting 90 degrees reduces bycatch, allowing fishermen to keep fishing and maximize their economic benefit.

Sharks, sea turtles, and marine mammals can be caught as bycatch in pelagic longline fisheries when they are attracted to the bait or catch on longline hooks. University of California, San Diego researchers are designing a "smart hook" to release catch based on vibrations caused by bycatch. BREP supported similar research on pelagic longline gear in Hawaii and bottom-deployed longline gear in Alaska. In those studies, they detected false killer whales by line vibration. Researchers continue to refine the design of the "smart hook" to improve the sensitivity and accuracy of the vibration measurements.

Mortality of non-target fish species, such as yelloweye and canary rockfish, in the recreational halibut fishery can be a management concern. Using BREP funds, the Makah Tribal Council has tested fishing hooks to target halibut more effectively. They compared the Tribe's traditional halibut hook—called the čibu·d—to a contemporary circle hook. Field studies show that the čibu·d was seven times more likely to catch a halibut than a non-target fish. However, the catch rate of halibut was also much lower on the čibu·d than on the circle hook. Recreational anglers have responded positively but additional research is needed.

Prepping a net for sea testing on the West Coast.



Circle hook

Makah čibu·d

Improving Fishing Practices

Nine BREP-funded projects aimed to improve fishing practices along the East Coast, West Coast, Alaska, and Gulf of Mexico. These projects show promising results to help reduce bycatch and improve the sustainability of fisheries.

In the Northeastern United States, butterfish and longfin squid are often in the same areas, and as a result, butterfish is caught as bycatch in the squid fishery. Because there are caps on butterfish bycatch, the squid fishery will close early if they exceed the limit. Scientists at Cornell University's Cooperative Extension Marine Program used BREP support to expand their successful real-time bycatch avoidance network. So far, 61 vessels send and receive "hot spot" locations of river herring, shad, and butterfish through their vessel monitoring system. The fleet then uses this information to avoid fishing in these locations and avoid bycatch. From 2012-2015, butterfish bycatch was reduced by more than 65 percent. The outstanding reduction of butterfish bycatch is a direct result of coordination and collaboration between commercial fishermen and scientists.

Due to the poor condition of the Southern New England lobster stock, lobster fishermen are supplementing their income with marketable Jonah crabs. However, current lobster traps allow Jonah crabs to escape through vents. Researchers at Fisheries Specialists and the University of Rhode Island have collaborated with the lobster industry, state, and federal management agencies to develop escape vents that allow only the escape of lobsters and crabs that are too small to keep. Commercial lobstermen and fisheries managers are collaborating to develop protocols for laboratory and field studies to test modified vent sizes.

Researchers at FishNext Research and the Alaska Seafood Cooperative attached an altimeter to trawl gear to help fishermen measure the depth of their trawls and comply with regulations in sensitive areas with groves of seawhips. Trawl gear used for Pacific Ocean Perch can adversely affect invertebrates living on the seafloor. Researchers found that mounting an altimeter on the footrope of a rockfish trawl, effectively measures when the trawl was clear of the seafloor. Using the altimeter allows fishermen to trawl off the bottom and avoid sensitive habitat while still targeting Pacific Ocean Perch.

While there has been improvement through turtle excluder and other devices, bycatch can still be an issue in shrimp fisheries. At Environmental Trawling Solution Inc., researchers compared two different gear types—a wing trawling system and an otter trawl—to see if the wing trawling system is a good alternative to traditional shrimp capture methods in the Gulf of Mexico. They found that the wing trawling system reduced bycatch by 65 percent, but also reduced shrimp catch. During trials of the wing trawling system, bycatch reduction was greater during the day than at night, which suggests that fish and animals use daylight to avoid gear.

A wing trawl.

Pressure-related injuries, called barotrauma, can lead to low survival rates after catch and release of deep-sea reef fish. High discard rates and post-release injury and mortality may impact rebuilding of fisheries such as the Gulf of Mexico red snapper fishery. Texas A&M University researchers examined various strategies to reduce this discard mortality, including the use of fish descender devices that can reverse the complications resulting from barotrauma. Researchers tagged fish with an acoustic transmitter that monitored the levels of activity, depth, and fate after release. Tagged fish released at the seafloor using descender devices showed greater survival rates compared to fish released at the surface. Local recreational anglers helped test these devices on fishing trips. These descender

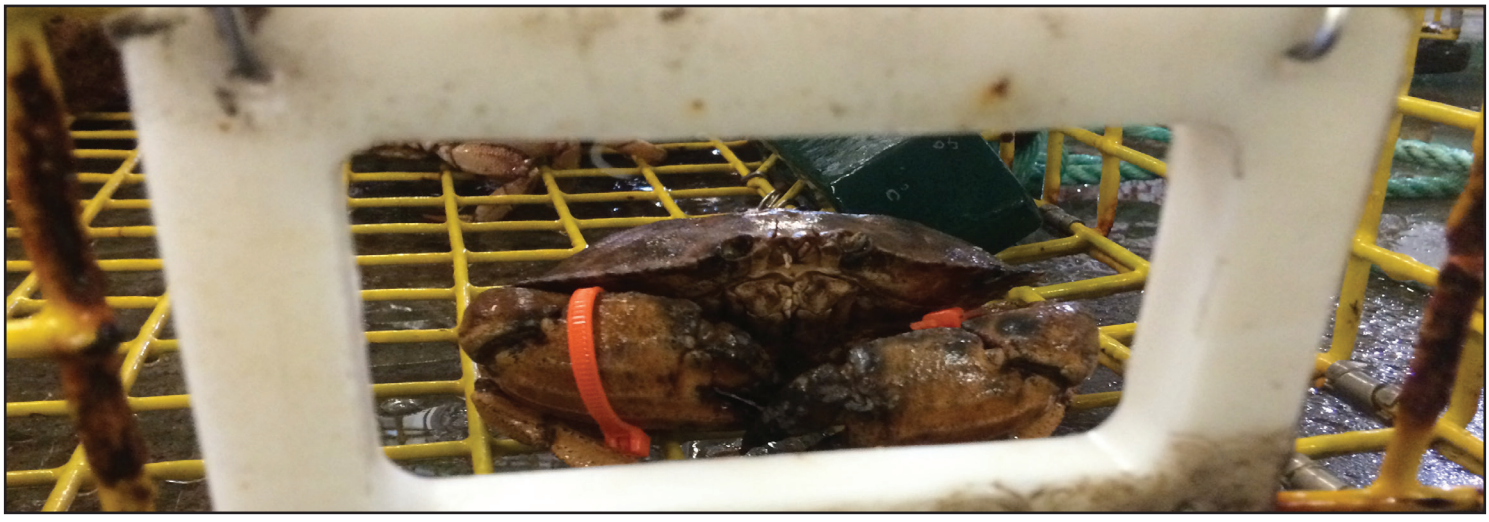
devices are showing great promise for enhancing the survival of discarded reef fish and represent an effective tool for reducing discard mortality in recreational and commercial fisheries.

On the East Coast, researchers at the University of Massachusetts tested trawl gear modifications to reduce bycatch of overfished flounder species, while harvesting haddock and other groundfish species. If too much flounder or other bycatch is caught, the groundfish fishery closes before catch limits for haddock and pollock are met. Researchers have modified traditional trawl gear to fish above the seafloor and to take advantage of the different depths at which species swim. The preliminary results suggest that the modified gear significantly reduced bycatch of yellowtail, winter and windowpane flounders, and undersized haddock.

Shrimp trawling in the Southeast and Gulf of Mexico can negatively impact endangered sea turtle populations. While there have been a number of improvements to fishing practices and the use of Turtle Excluder Devices (TEDs) is required, issues with compliance remain. The Gulf & South Atlantic Fisheries Foundation coordinated a NOAA Fisheries/Industry TED Enforcement and Compliance Workshop to share perspectives and improve the efficacy of TED usage. Members of industry and government in the Southeast received briefings on current regulatory activity and outreach, discussed issues and concerns, and brainstormed next steps.

Fishermen that target Atlantic swordfish and tunas use pelagic longline gear that sometimes catches non-target fish or other animals, including protected species. To address this issue, NOAA Fisheries has developed a line-cutting tool and protocol to improve survival of protected bycaught species. Currently, the tools are only effective within a short distance of the fishing boat and, there can be a lot of fishing line that remains on the bycaught animal. Research suggests that eliminating or greatly minimizing the length of this line on released bycatch significantly enhances its chance of survival. To improve the effectiveness of this tool, Vast Array Corporation conducted at-sea testing on prototype devices that cut the fishing line closer to the bycaught animal. These improved tools may help increase survival of hooked bycatch, especially pilot whales. The devices were tested in cooperation with Atlantic pelagic longline fishermen. Not only did the devices improve the condition of released bycatch but also improved fisherman safety compared to current practices.

Shark bycatch continues to be a challenge in any fishery that uses baited hooks. Researchers at Florida Keys Community College continue to test longer lasting chemical shark repellent to minimize this issue. Throughout the course of this project, thirty-six at-sea trials tested four prototype shark repellent baits in the Straits of Florida. The best result provided 40 percent reduction in shark bycatch overall. The greatest shark bycatch reduction was within the first 4 hours of gear deployment.



A Jonah Crab as seen through the escape vent of a lobster trap.

Reducing Post-Release Mortality

Four BREP recipients examined how to reduce post-release mortality in commercial and recreational fisheries on the West Coast, Atlantic, and Pacific Islands. The results of these projects will help improve estimates and management of post release-mortality in species, including sharks, rockfish, and false killer whales.

While targeting swordfish, the California drift gill net fishery encounters many non-target protected species such as leatherback sea turtles or California sea lions; and bycatch species of concern such as blue shark. Researchers at Stanford University, University of California Santa Cruz, The Nature Conservancy, and San Diego State University Foundation have been developing near-real-time catch and bycatch probability models to predict where species are in the California drift gill net fisheries. Researchers are also developing a website that will give fishermen and fisheries managers access to the information. The collaborators have also developed a smartphone and tablet app that allows fishermen to collect information about sightings of marine species.

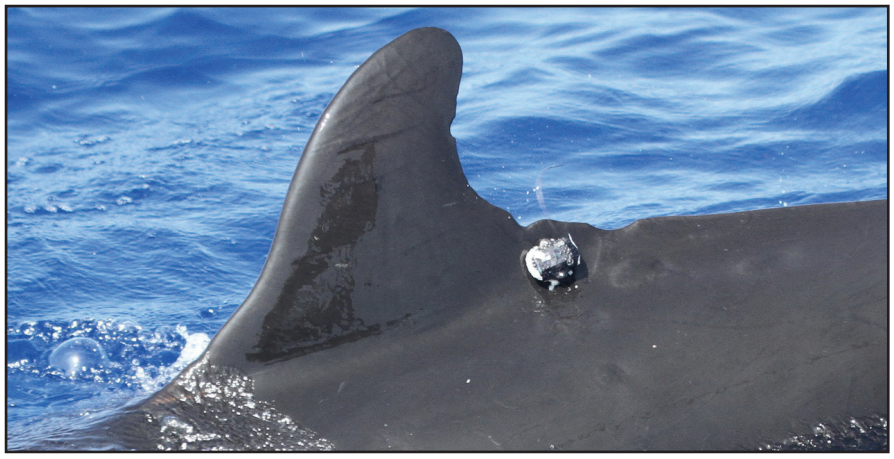
Many sharks are vulnerable to fishing pressures and impacts of post-release mortality due to their slow growth rate and late maturity. Scientists at the Mote Marine laboratory worked with commercial longline fishermen to tag sharks with data loggers. The data from those tags show whether the sharks survived after capture and release and provide additional information to estimate a recovery period after capture. Researchers have also been using a new accelerometer technology to look at the blood physiology of sharks at capture to predict post release mortality. By also measuring blood stress values at the time of capture, researchers can correlate those stress values with data from the tags to see whether the shark survives after release. Researchers have assessed the post-release outcome of more than 200 sharks and nine species providing crucial data for stock assessments and fishery managers. In addition, the accelerometer technology dramatically reduces the costs associated with collecting data on the post-release mortality of sharks.

Reducing bycatch of overfished rockfish species in West Coast recreational fisheries is a priority because many of the fish released alive suffer from barotrauma from anglers bringing them to the surface too quickly. Barotrauma is preventable with the proper tools. Outreach efforts by researchers at the University of California Santa Cruz and NOAA Fisheries have helped change how anglers release rockfish in the Central California recreational groundfish fishery. Survival of fish can be increased when fishermen use descending devices to release a fish at a specific depth, reducing the effects of barotrauma. By providing descending devices and teaching anglers how to use them, use of the devices has increased from 31 percent to 88 percent. In addition, 97 percent of fish released on a descending device returned to depth successfully.

False killer whales are the species of whale most frequently caught in the Hawaii-based longline fishery but little is known of the dynamics of the interactions between false

A shark being tagged with an acceleration data logger.

killer whales and longline gear. At the Cascadia Research Collective, researchers examined the relationship between movements of satellite-tagged, pelagic false killer whales and longline fishing. Of three groups of tagged, pelagic false killer whales, only one actively approached gear during the study period. This coincided with hauling of the longline gear. The whales remained in the area during the next set but left without further impact. Logbook entries showed that there was no obvious catch difference when whales were present. There were times when whales did not react to longlines at all, suggesting that they only use longlines as an opportunistic food source when other food is unavailable.



Top: False killer whale in pursuit of prey.
Bottom: Satellite tagged false killer whale.

Fishermen's Involvement

U.S. fishermen are involved with all aspects of BREP research, from designing and testing new gear to assisting with data collection. It is important that fishermen are involved at all levels of research, as commercial and recreational fishermen will use and implement the results of successful projects. Fishermen bring a unique perspective to the issue of bycatch and are knowledgeable about the solutions that may or may not work in their fisheries.
Here are some ways fishermen were involved in Fiscal Year 2014 projects:

- In the Gulf of Mexico, recreational fishermen helped Texas A&M University researchers test descending devices on red snapper.
- In California, recreational fishermen, including charter boat captains, are working with researchers to learn how to use descending devices to reduce post release mortality.
- On the East Coast, 61 fishing vessels have sent and received bycatch "hot spot" locations through their vessel monitoring system. This information helps them better avoid bycatch.
- In New England, fishermen and researchers worked together to develop an escape vent for lobster traps that allows the release of lobsters and crabs that are too small to keep.
- In the Southeast, fishermen participated in roundtable discussions with state and federal partners on the enforcement of turtle excluder devices.

Fiscal Year 2014 • 18 Projects • 5 Regions • $2.41 million

Reducing Protected Species Bycatch

Pacific States Marine Fisheries Commission (Oregon)—Use LED lights to help Chinook salmon escape Pacific hake trawls. **($113,227)**

Marine Biological Laboratory (Massachusetts)—Avoid bycatch/entanglement of turtles and whales with aquaculture gear. **($205,000)**

Improving Fishing Practices

Cornell University Cooperative Extension Marine Program (New York)—Avoid bycatch hot spots with a communication network. **($70,000)**

University of Rhode Island—Reduce bycatch of undersized Jonah crabs in the lobster fishery. **($190,000)**

Texas A&M University—Test techniques for minimizing discard mortality of Gulf of Mexico red snapper and validate survival with acoustic telemetry. **($205,000)**

University of Massachusetts, Dartmouth—Avoid overfished flounder with semi-pelagic trawling on Georges Bank. **($205,000)**

Vast Array Corporation (New Jersey)—Test prototype devices to reduce leader-line length on pelagic longline catch. **($51,935)**

Gulf and South Atlantic Fisheries Foundation (Florida)—Increase compliance and enforcement of turtle excluder and bycatch reduction devices in the southeastern shrimp fishery (NOAA Fisheries/ Industry workshop). **($83,632)**

Environmental Trawling Solutions, Inc. (Alabama)—Reduce bottom impact of shrimp fishery through the Wing Trawling System. **($105,434)**

Florida Keys Community College—Assess performance of a long-lasting shark repellent bait during commercial pelagic longline fishing. **($48,579)**

FishNext Research (Washington)—Explore approaches to avoid interactions with structure-forming invertebrates during Pacific Ocean perch fishing on the Bering Sea slope. **($52,570)**

Innovative Technologies

Pacific States Marine Fisheries Commission (Oregon)—Examine the effectiveness of netting turned 90 degrees to reduce bycatch in a multispecies bottom trawl fishery. **($137,384)**

Makah Tribe (Washington)—Test the Tribe's traditional fishing knowledge to reduce bycatch in recreational halibut fisheries. **($68,324)**

University of California, San Diego-Scripps Oceanography—Test the viability of a "smart" hook for reducing bycatch of shark, turtle, skates, and marine mammals in pelagic and demersal longline fisheries. **($190,000)**

Reducing Post-Release Mortality

Cascadia Research Collective (Washington)—Assess movements of false killer whales in relation to longline fishing interactions. **($158,066)**

Mote Marine Laboratory (Florida)—Use technology to assess and reduce large coastal shark bycatch mortality. **($180,000)**

University of California, Santa Cruz—Use outreach to change recreational rockfish practices to decrease post-release mortality of protected species. **($109,082)**

Standford University, University of California Santa Cruz, The Nature Conservancy, Marine Conservation Initiative & San Diego State University—Provide real-time fisheries management tools for ecological and economic sustainability. **($240,107)**

Fiscal Year 2015

In Fiscal Year 2015, NOAA Fisheries awarded 16 grants totaling more than $2.5 million as part of BREP. Find the complete list on our website: www.fisheries.noaa.gov/sfa/bycatch

This report responds to the requirements of Section 316(d) of Magnuson-Stevens Act.