NOAA FISHERIES

Bycatch Reduction Engineering Program

FY 2017 & 2018 Report to Congress

Funding Bycatch Reduction

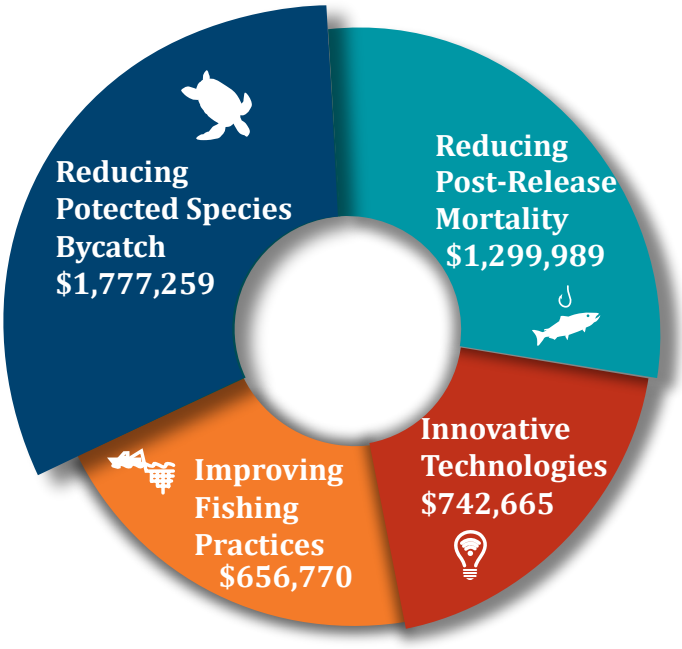
Bycatch occurs when fishermen discard catch of marine species, or when resources like marine mammals, seabirds, or protected fish are harmed or killed by fishing gear. Reducing bycatch in fisheries can improve the recovery of protected species and have positive biological, economic, and social impacts. NOAA's National Marine Fisheries Service (NOAA Fisheries) has long been committed to reducing bycatch through management, monitoring, research, enforcement, education, and communication efforts, as described in the 2016 National Bycatch Reduction Strategy.

The Bycatch Reduction Engineering Program (BREP) supports technological solutions and conservation engineering practices that minimize bycatch and bycatch mortality in managed fisheries. Since fiscal year 2012, NOAA Fisheries has supported 133 BREP awards worth more than $19 million to external partners including state governments, academia, and the fishing industry. The awards are geographically diverse and address four different priorities: reducing protected species bycatch, developing innovative technologies, improving fishing practices, and reducing post release mortality. From 2012 through 2017, over 40 percent of BREP dollars funded projects that resulted in management recommendations. Other projects focused on gathering baseline information needed to conduct more targeted research that could lead to future management actions. More than 90 percent of the work involved important collaboration with the fishing industry, which improves the likelihood of successful application of research findings in fisheries.

Highlights & Outcomes

This report summarizes the outcomes of 32 BREP awards, totaling $4,500,000, funded by NOAA Fisheries in fiscal years 2017 and 2018. Most of the work discussed here occurred during calendar years 2018 and 2019. This report shows that bycatch reduction research, as with any research, can result in a range of outcomes. Finding technological solutions to bycatch problems is a multi-year and multi-disciplinary endeavor requiring technical expertise, collaboration with fishermen, and effective communication with managers.

2017 & 2018 Funding by Priority



Reducing Protected Species Bycatch 2017

Five 2017 BREP projects addressed bycatch of protected Chinook salmon, false killer whales, sea turtles, and eulachon. These projects took place on the U.S. West and East Coasts and the Pacific Islands.

Gettysburg College ($169,969): Developing and testing a multisensory bycatch reduction strategy to reduce sea turtle bycatch in gillnet and pound net fisheries

An understanding of how animals perceive and respond to sensory cues in their environment can guide the development of successful bycatch reduction technologies. Researchers from Gettysburg College and Ocean Discovery Institute, in collaboration with NOAA Fisheries, examined the impact of low-frequency acoustic and visual cues on sea turtle and target fish catch in gillnets in Baja, Mexico, and in pound nets in coastal North Carolina. Researchers chose these sites to focus their work because they provided areas of high sea turtle interaction rates, access to commercial gillnet fisheries, and strong relationships with engaged fishery partners. Through their work, scientists found that acoustic and visual cues reduced sea turtle interactions with gillnets while maintaining target catch. Preliminary data suggested that visual cues were more effective in reducing sea turtle interactions with pound nets than acoustic cues. These results illustrate the potential for using sensory cues, and in particular, sound and light, to warn sea turtles of the presence of fishing gear and reduce sea turtle interactions.

Researchers from Gettysburg College and Ocean Discovery Institute examined the impact of low-frequency acoustic and visual cues on sea turtles.

Duke University ($119,804): Developing move-on rules to mitigate false killer whale depredation and bycatch in pelagic longline fisheries

False killer whales, which are endangered around Hawaii, frequently feed on bait and on tuna that have already been hooked in the Hawaii longline tuna fishery, a behavior known as “depredation.” This is an economic issue for fishermen, and also is risky for the false killer whales, as they can become hooked on or entangled in longline gear. The goal of this research was to identify patterns in bycatch and depredation that could help fishermen avoid overlap with false killer whales. Using observer-collected fisheries data and movement data from location-transmitting tags on false killer whales, researchers were able to provide guidance for fishermen on how to avoid regions of high depredation or bycatch probability. Researchers also estimated that the cost of false killer whale depredation on tuna lines commonly exceeds $1 million in lost catch value across the fleet. The results of this study have been presented to scientists and managers from federal agencies and the fishing industry.

Reducing Protected Species Bycatch 2017

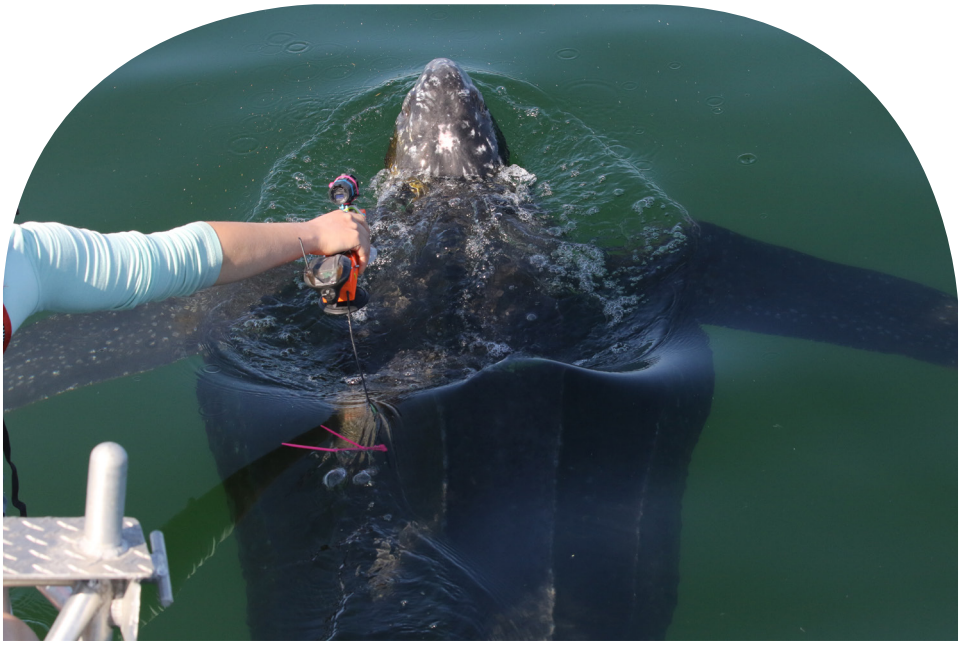
Pacific States Marine Fisheries Commission ($116,353): Measuring the overall effectiveness of LED lights to reduce eulachon and darkblotched rockfish bycatch in the ocean shrimp trawl fishery

Past research at the Pacific States Marine Fisheries Commission showed that putting artificial lights on trawl nets reduced bycatch of Chinook salmon. In 2017, the commission tested whether a similar system of artificial lights could be used to reduce bycatch of eulachon (an Endangered Species Act-listed species) and groundfish in the ocean shrimp trawl fishery. Using a trawler with a net on either side, researchers compared target catch and bycatch between illuminated and unilluminated nets. The illuminated net caught significantly less eulachon and yellowtail rockfish, with no reduction in catch of shrimp. In 2018, the states of Oregon and Washington both began to require use of illuminated nets to avoid bycatch in the ocean shrimp fishery.

Coonamessett Farm Foundation ($168,803): Improving the understanding of sea turtle entanglement in vertical lines

Fisheries where gear is stationary in the water instead of moving with a boat are called fixed-gear fisheries, and they include the valuable East Coast crab and lobster fisheries. However, fixed gears can be a hazard to sea turtles, which get entangled in the lines connecting the buoy to the gear. Leatherback sea turtles are at particular risk because their seasonal foraging grounds in the northeast overlap with these fixed-gear fisheries. Researchers at Coonamessett Farm Foundation studied sea turtle behavior to better understand how they interact with fixed gear and why they might become entangled. They fitted 28 camera tags on leatherback sea turtles, which provided video footage of turtle behavior and collected data on dive patterns, foraging behavior, and breathing events. They also surveyed fishermen about their view of turtle entanglements. This research is still in progress.

Note: The Wild Fish Conservancy was awarded funding in both 2017 and 2018. That project is discussed in the 2018 section of this report.



A leatherback sea turtle received a camera tag from Coonamessett Farm Foundation researchers in Cape Cod Bay, Massachusetts. Photo credit: Josh Hatch of NEFSC. ESA permit #22218

Reducing Protected Species Bycatch 2018

Six 2018 BREP projects addressed bycatch of protected Chinook salmon, sea turtles, whales, and dolphins. These projects took place on the U.S. West and East Coasts and internationally.

Wild Fish Conservancy ($199,689): Evaluation of pound nets for stock-selective harvest in Lower Columbia River spring chinook, summer chinook, and shad fisheries

Researchers from the Wild Fish Conservancy in the state of Washington tested a harvest method for salmon that would allow fishermen to separate hatchery-raised fish from wild fish with very low discard mortality of the wild fish. Several wild populations of salmon are listed under the Endangered Species Act (ESA), but hatchery-raised fish still provide a commercially viable fishery. Researchers constructed a pound net, a maze-like net anchored in the river, to study catch rates of hatchery salmon and mortality of wild salmon after release. Pound nets were historically used to catch salmon, but have not been used in this area for decades. Within the net, fishermen separate hatchery-raised from wild salmon by hand and release the wild salmon back into the river. By marking wild fish that were caught and measuring how many were recaptured later, researchers were able to calculate survival rates for released fish. The pound net was effective at catching hatchery-origin salmon while reducing wild salmon deaths after release, showing that this type of trap may be viable for commercial use. In the second year of this study, researchers modified the pound net to largely eliminate net contact, air exposure, handling, and crowding of fish in the net. Again, they calculated survival rates for released fish, which were higher in the second year, using the modified pound net, than they were in the first year. These results suggest that the trap modifications can achieve almost 100 percent survival of bycaught salmon, which may make the gear effective at addressing ESA constraints in the commercial fishery.

Researchers from the Wild Fish Conservancy use a pound net, a maze-like net anchored in the river, to study catch rates of hatchery salmon and mortality of wild salmon after release. Photo credits: Aaron Jorgenson.

Reducing Protected Species Bycatch 2018

Alaska Longline Fishermen's Association ($243,798): Adapting towed array hydrophones to reduce interactions between sperm whales and longline gear in Alaska

In Alaska, sperm whale depredation on approximately 200 commercial sablefish and halibut longline vessels in the eastern Gulf of Alaska increases harvesting costs and increases the risk of marine mammal entanglement. This project builds on previous NOAA-funded work developing acoustic monitoring systems to detect the presence of whales and help fishermen avoid them. Researchers updated acoustic detection software to automatically detect acoustic patterns that are likely to come from sperm whales and then display them on a new user interface so that fishermen can see where whales are and avoid fishing there. They also tested two configurations of underwater microphone systems used for detecting whales, and are developing a method of integrating acoustic detection of whales into an information sharing network for fishermen.

The research is still in progress.

Duke University ($189,899): Testing the applicability of sensory-based bycatch reduction technologies to reduce sea turtle bycatch in North Carolina coastal gillnet and pound net fisheries

Researchers from Duke University and NOAA Fisheries continued to examine the impact of low-frequency acoustic and visual cues on sea turtle and flounder catch in pound nets in coastal North Carolina. They also built upon relationships with fishermen to examine the impacts of visual cues on sea turtle and target fish catch in gillnets in an effort to support continued bycatch mitigation in the small-scale flounder fishery. Visual cues (green lights) were more effective in reducing sea turtle interactions with pound nets than acoustic cues, however both cues reduced sea turtle bycatch. Visual cues maintained flounder catch in coastal gillnets, however sea turtle interactions with experimental nets were rare. These results provide additional support for the idea that sensory cues can be used to warn sea turtles of the presence of fishing gear and reduce sea turtle interactions while maintaining target catch in coastal net fisheries.

Pacific States Marine Fisheries Commission ($144,792): Identifying the optimal level of artificial illumination necessary to achieve maximum Chinook salmon escapement rates out of a bycatch reduction device integrated into a Pacific hake midwater trawl

The Pacific hake midwater trawl fishery is the largest groundfish fishery off the U.S. West Coast by volume. Catches comprise mainly Pacific hake, however, bycatch of ESA-listed Chinook salmon can negatively affect the fishery. Researchers at the Pacific States Marine Fisheries Commission built on previous work by showing that Chinook salmon bycatch rates are lower in trawl nets illuminated with LED lights than in unilluminated trawls. Further comparison between trawls outfitted with 16 lights and trawls outfitted with 32 lights showed no effect of the amount of illumination on Chinook salmon bycatch. Catch of Pacific hake was similar between illuminated and unilluminated trawls. Outfitting Pacific hake midwater trawls with LED lights seems to be a promising avenue for reducing Chinook salmon bycatch. This finding may also be relevant to the Bering Sea walleye pollock midwater trawl fishery, which has challenges with salmon bycatch as well.

Reducing Protected Species Bycatch 2018

Newcastle University ($197,536): Low-cost solutions to cetacean bycatch in gillnet fisheries

Gillnets are used in many small-scale fisheries around the world, but cetaceans (whales and dolphins) are often bycaught in gillnet gear, threatening population health. Bycatch mitigation strategies that work for large commercial fisheries may not be workable in small-scale fisheries, so this project tested the effectiveness of a simple, low-cost bycatch reduction method known as glass bottle alarms in small-scale drift gillnet fisheries in Peru. These alarms, made from a glass drink bottle with a bolt inside, produce a sound that should allow dolphins using echolocation to more effectively detect a gillnet. Initial results suggest that glass bottle alarms do not significantly reduce bycatch of dolphins or turtles in gillnets. The alarms did not affect the catch of target fish except for a reduction in the catch of some sharks. Another promising low-cost technology, plastic bottle acoustic reflectors, will be tested in the coming months in the same fishery. This upcoming research could potentially be used in small-scale fisheries around the world, including in the United States.

Researchers from the New England Aquarium evaluated the operation of ropeless systems to reduce entanglements and lower the risk of extinction for the North Atlantic right whale.

New England Aquarium ($226,616): Testing a ropeless fishing prototype for eliminating large whale entanglements in pot fishing gear

Ropes used as buoy lines in crab and lobster pot fisheries off the east coast are the primary source of entanglements of the critically endangered North Atlantic right whale. This species is restricted to the coastal northwest Atlantic, has a population of fewer than 400 individuals, and has been in decline since 2010. The goal of this project was to evaluate the operation of ropeless fishing systems to reduce entanglements and lower the risk of extinction for the North Atlantic right whale. Ropeless fishing systems secure the end of the rope near the sea floor, then use an acoustic trigger to release the end of the rope, which floats to the surface so fishermen can haul the pot up. Because the rope is only in the water column during hauling, it poses virtually no entanglement threat to whales. Preliminary trials of this system with lobster fishermen showed that the systems operated reliably and that fishermen were satisfied with how well the systems worked. Researchers are now conducting fishing trials in deeper waters.

Innovative Technologies 2017

In 2017, three BREP-funded projects along the East Coast, Alaska, and in international waters focused on innovative technology, including testing new modeling methods and gear designs, to understand bycatch.

University of Mississippi ($82,121): Application of a new bycatch reduction device for use in the U.S. shrimp industry

While considerable progress has been made in the Gulf of Mexico shrimp fishery, it continues to have one of the highest bycatch rates of any fishery in the United States, including significant bycatch of red snapper, which is in a rebuilding plan. To reduce fish bycatch in the shrimp fishery, researchers created and distributed a cylindrical bycatch reduction device that attracts fish to escape openings in the trawl net. In previous at-sea certification trials, this device was shown to reduce finfish bycatch by 40-50 percent, with little effect on shrimp catch. In an effort to gauge industry acceptance for the new device, 24 were distributed to 16 shrimpers in the Gulf of Mexico, with the request that each vessel run 30 test trawls. Of the five captains who tried the device, two provided the requested 30 test trawls, and both continued to use the device despite it not being required.

Massachusetts Marine Fisheries Institute ($116,789): Developing and testing a pelagic species distribution model to forecast river herring bycatch hotspots

This project used already-existing data on environmental conditions and catch in the Atlantic herring mid-water trawl fishery to forecast hotspots of river herring bycatch. River herring is an important species in New England, both ecologically and culturally, and the stock has been declining in recent years. Researchers compared the modeled hotspots with reported river herring bycatch to evaluate the accuracy of the forecasting method. Using bycatch data from nearly a decade, researchers created a forecast method that included the highest river herring bycatch events while leaving at least half the core fishing area classified as at low risk of bycatch. Accuracy of the forecasts varied by time of year, but were generally good enough that researchers recommend integrating habitat models of bycatch hotspots into the state bycatch avoidance program.

Oregon State University ($73,051): Uncovering blind spots: Novel methods to assess fine-scale seabird-fisheries overlap to prioritize conservation management

To study the interactions between albatross and fishing vessels in international waters, researchers used data from GPS tags on albatross and satellite monitoring of fishing vessels. Combining these datasets allowed them to study the conditions under which interactions occur and how long they last. This project sheds new light on the problem of seabird bycatch, which is known to be an issue in the Hawaii longline fisheries but has been studied less on the high seas. Researchers found that a higher density of fishing vessels, as well as larger fishing vessels, made interactions more likely. Some species of albatross were more likely to interact with fishing vessels than others, and environmental conditions, such as wind speed, also played a role in determining the nature of interactions.

Innovative Technologies 2018

Three BREP-funded projects on innovative technologies took place along the East and West Coasts in 2018. These projects included building maps of cod and haddock abundance, use of electronic monitoring technology to identify bycatch species and hotspots, and using lighted nets to help fish avoid capture.

Pacific States Marine Fisheries Commission ($151,764): Use of LEDs to reduce Pacific halibut catches before trawl entrainment

Too much bycatch of Pacific halibut in the West Coast groundfish bottom trawl fishery can make it hard for some fishermen to fully utilize their groundfish quota shares. This project compared the catch of four groundfish species and of Pacific halibut between an unilluminated trawl and a trawl with lights on part of the net. Fewer Pacific halibut entered the illuminated trawl net, which means that 1) fewer halibut were caught and 2) fewer halibut were exposed to the stress of escaping the trawl net, which can lead to unobserved mortality. Groundfish catch was the same between the illuminated and unilluminated trawls, showing that artificial illumination can reduce Pacific halibut bycatch in the groundfish trawl fishery. This research may also be applicable in the Alaska groundfish fisheries where Pacific halibut bycatch constraints occur.

Massachusetts Division of Marine Fisheries ($142,395): Creating a bycatch avoidance tool for Cod in the Gulf of Maine recreational fishery

Due to overlapping habitat preferences, cod and haddock are frequently caught together in the Gulf of Maine recreational fishery. Despite a several year prohibition on keeping cod, recreational discards of cod caught as bycatch by haddock anglers is now a leading source of mortality for the cod stock. This has led to limits on harvesting the abundant haddock stock. Researchers at Massachusetts Division of Marine Fisheries used trawl survey data to create habitat maps for both haddock and cod, and identified locations where the abundance of haddock would be high and the abundance of cod would be low. They tested these maps with the help of 138 recreational anglers, who caught 33 percent less cod by fishing in the target areas. The maps were published as a Recreational Haddock Fishing Guide and as a smartphone application, both of which are available to the public. New funding in 2020 will allow the division to update cod and haddock distribution information using citizen science.

Researchers from the Massachusetts Division of Marine Fisheries created a bycatch avoidance tool for cod.

Innovative Technologies 2018

Mote Marine Laboratory ($176,545): Best fishing practices for the Gulf of Mexico reef fish fishery: developing bycatch reduction techniques through refined modeling of electronic monitoring data

The Gulf of Mexico reef fish fishery is highly complex, involving 42 species of target fish, multiple gear types, and several important bycatch species. This research used electronic monitoring to investigate the composition and fate of bycatch and assess the influence of fishing practices and environmental conditions on key bycatch species. Researchers placed electronic monitoring equipment on 18 commercial fishing vessels, which captured the location, condition, and fate of bycatch species. This data allowed them to model bycatch hotspots and the relationships among target catch, bycatch, fishing practices, and environmental conditions. They also placed a new underwater camera system on both charter fishing and commercial boats. This camera system can help researchers identify species that interact with fishing gear, but are not brought on board the boats, particularly large sharks and marine mammals. The results of this research will provide industry and management with recommendations for best fishing practices to reduce bycatch in the Gulf of Mexico reef fish fishery.

A sandbar shark photograph is captured through one of Mote Marine Laboratory's underwater camera systems.

Improving Fishing Practices 2017

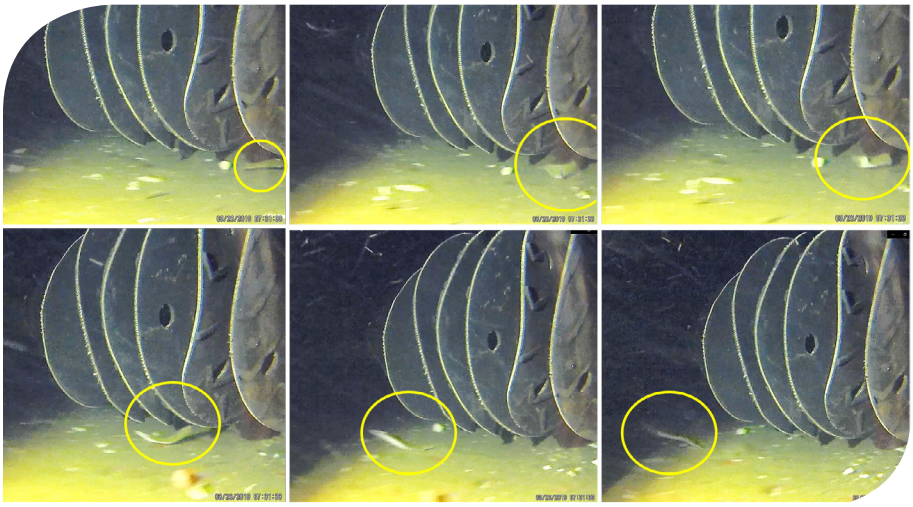
Five 2017 BREP-funded projects aimed to improve fishing practices along the West and East Coasts. Results from these projects will help reduce bycatch and improve fisheries' sustainability.

Coonamessett Farm Foundation ($130,400): A modified foot sweep for bycatch reduction in the limited access scallop fishery

The Coonamessett Farm Foundation developed a modified rubber disc sweep designed to exclude flatfish species from sea scallop dredges. Bycatch of groundfish can reduce access to sea scallops, one of the most commercially valuable seafood species in the United States. In testing of the modified rubber disc sweep, researchers found that bycatch of flounder and non-flounder species was significantly reduced and that the flounder sweep dredge was more selective than the control dredge. However, catch of sea scallops was lower using the modified sweep as well. Researchers recommend future fluid dynamics modeling to shed light on how the addition of forward sweeps impacts the retention of sea scallops and bycatch species.

Pfleger Institute of Environmental Research ($121,192): Developing radio and satellite smart buoys for bycatch mitigation

This project developed radio- and satellite-based technology to remotely monitor drifting buoys in the recently-authorized deep-set buoy gear swordfish fishery. By using buoys with transmitters in them, fishermen can remotely detect when bycatch species like sharks or marine mammals become entangled in their gear and respond right away. The use of smart buoy technology can increase post-release survivorship of bycaught species by allowing them to be released sooner, and also can minimize the potential for lost fishing gear. Researchers developed and tested satellite-based and radio-based smart buoys, and found that radio-based buoys are more cost effective, but have a transmission range that is limited by antenna height. In contrast, satellite-based smart buoys can transmit information anywhere in the world. The project made smart buoy specifications and user manuals available through an instrument company and an open-access website. While this project specifically examined the West Coast deep-set buoy gear fishery, smart buoys could be used in any domestic fishery that uses buoys in its daily operations.



During testing of a modified rubber disc sweep by the Coonamessett Farm Foundation a flounder was photographed above escaping a dredge.

Improving Fishing Practices 2017

Coonamessett Farm Foundation ($177,798): Testing selectivity and raised webbing gillnets on target and non-target species in the northeast haddock fishery

Bycatch of Atlantic cod restricts how much haddock fishermen are able to catch in the Gulf of Maine and Georges Bank. Because haddock are a much more abundant species than cod, and have significant economic potential, fishermen are extremely interested in ways to catch haddock without catching cod. In this project, researchers tested gillnets with slightly smaller mesh than the size currently allowed, and gillnets with the webbing raised above the lead line. Raising the webbing has the potential to reduce catch of cod, which are more often found in the lower portions of gillnets. This research is ongoing, but preliminary results suggest that raised nets do not improve catch of haddock relative to cod, and that mesh size has little effect on the catch.

Pacific States Marine Fisheries Commission ($145,900): Minimizing seafloor and impacts to bottom-dwelling species: An evaluation of elevated sweeps on a west coast groundfish bottom trawl

In the West Coast groundfish bottom trawl fishery, fishermen use long "sweeps," (cables attached to the front of the trawl net) that maintain contact with the sea floor. While the sweeps effectively herd fish into the net, they also have the potential to cause seafloor disturbances, including injury and unobserved mortality for bottom-dwelling organisms. Researchers with the Pacific States Marine Fisheries Commission found that using round "bobbins" to raise the sweeps up off the sea floor reduced interactions with bottom-dwelling organisms, like corals and sponges, and habitat, while having no effect on the catch of groundfish. Trawling using raised sweeps could therefore represent a way to protect habitat while maintaining fishermen's catch rates.

Researchers from the Coonamessett Farm Foundation tested selectivity and raised webbing gillnets in an attempt to reduce cod bycatch.

Improving Fishing Practices 2017

Florida Fish and Wildlife Conservation Commission ($81,480): Evaluation of alternative fishing technology and strategies to increase yield in the Florida spiny lobster fishery

The Caribbean spiny lobster fishery is the most valuable commercial fishery in the Caribbean and in Florida. Baiting practices and lobster trap design in this fishery cause the death of some sublegal-sized lobsters, which then lowers lobster abundance throughout the fishery. This research investigated the effectiveness of alternative baiting strategies and trap design in lowering mortality of sublegal lobster while maintaining legal-sized lobster catch. Researchers built traps with escape gaps large enough for sublegal lobsters to exit the trap while keeping legal lobsters in. Instead of the typical practice of baiting a trap with a sublegal lobster, they used a legal-sized lobster as bait. This new trap configuration nearly eliminated the mortality of sublegal lobsters in the traps, but the catch of legal lobsters was 27 percent lower as compared to the traditional trap configuration. However, when lobster abundance was high, catch rates for traps with escape gaps increased to be equivalent to catch rates in standard traps. Modeling of future landings suggests that, if escape gaps were required in all traps, landings would go down the first year but would recover in the second year, and increase every year after that due to increased lobster abundance.

An experimental lobster trap featured with an escape gap large enough to allow sublegal-sized lobsters out of the trap while allowing legal lobsters to stay in.

A researcher tests out the experimental lobster trap. Instead of the typical practice of baiting a trap with a sublegal lobster, researchers used legal sized lobsters as bait.

Reducing Post-Release Mortality 2017

Five BREP-funded projects in 2017 explored how to reduce post-release mortality in commercial and recreational fisheries from Maine to Hawaii. Results from these projects will help improve understanding and management of post-release mortality in species including sharks and fish.

New England Aquarium ($142,686): Closing data gaps on discard mortality and tactical capture and handling practices to reduce mortality in the Gulf of Maine recreational groundfish fishery

In the Gulf of Maine recreational groundfish fishery, anglers targeting haddock frequently catch and discard Atlantic cod, which are overfished and in a rebuilding plan. Catching too many cod may inhibit stock rebuilding efforts due to post-release mortality and also limits fishing for haddock. To reduce cod bycatch, researchers examined the effectiveness of different types of recreational fishing gear at catching haddock without catching cod. Volunteer anglers of varying experience levels were recruited to fish with different gear types to replicate real-life fishing conditions. The results of this research suggest that fishing with baited hooks, rather than jigs or teasers, can maintain haddock catch and reduce cod bycatch, while also minimizing injury and discard mortality in both species. To promote the long-term sustainability of the Gulf of Maine recreational fishery, anglers are advised to: 1) fish with baited hooks, not jigs, 2) ask for help unhooking fish if they are inexperienced, and 3) move to a different location if catching cod. Through partnerships and networks, researchers disseminated their recommended best practice guidelines for haddock fishing to regional stakeholders.

Researchers from the New England Aquarium document their findings.

University of Hawaii ($170,456): Assessing the efficacy of current and potential conservation and management measures for reducing mortality in a threatened shark species

Oceanic whitetip sharks were historically one of the most abundant species in tropical waters, but have recently been listed as threatened with extinction under the Endangered Species Act. Around Hawaii, this species has shown significant declines in abundance since 1995. As a result, conservation and management measures have been implemented by several of the tuna Regional Fisheries Management Organizations, which banned retention of oceanic whitetips and encouraged the implementation of discard practices that reduce injury to live animals. In this study, researchers tagged oceanic whitetip sharks with long-term pop-off archival tags to assess the efficacy of current no-retention measures by estimating post-release mortality rates for discarded sharks. Fourteen sharks were tagged, and only one died before the tag popped off. A number of tags malfunctioned or popped off early, so this project was unable to collect the data needed to measure the effect of the no-retention policy. However, the data that was collected can still be used to verify previous BREP-funded research on post-release survivorship in this species, and to inform environmental models of movement for this shark species.

Reducing Post-Release Mortality 2017

Marine Resources Research Institute, South Carolina Department of Natural Resources ($193,320): Post-release mortality of adult red drum caught by recreational anglers

Red drum are one of the most economically important sportfish in the U.S. South Atlantic. Their long life span, along with annual aggregations at the mouths of large estuaries that are easily accessible to recreational anglers, make adults vulnerable to overexploitation. Most red drum are released alive after being caught, but release does not ensure survival, and post-release mortality can vary widely. Understanding factors that influence post-release survival of red drum can contribute to the sustainability of this fishery. Researchers from the South Carolina Department of Natural Resources found that fewer than 5 percent of red drum die after release, although smaller fish may have a higher mortality rate. Due to the low mortality rate, researchers were unable to quantify the effects of environmental and physiological factors on post-release survival. They also found that the rate of recapture is relatively high, which raises further questions about the cumulative effects of repeated catch-and-release on the health of the red drum population.

University of New England ($37,976): Determining the discard mortality rate and "best capture and handing" methods for Atlantic cod captured in the Gulf of Maine lobster industry

The Gulf of Maine commercial lobster fishery has approximately 3.5 million actively fished traps and captures several non-targeted groundfish species, including Atlantic cod as bycatch, but little is known about the mortality rate for bycatch species in the lobster fishery. This work allowed researchers to estimate the mortality rates of cod captured and then discarded in the Gulf of Maine lobster fishery. Researchers observed cod caught in lobster traps and calculated their mortality rate, and also tagged cod with acoustic transmitters so that they could be observed after they were released. Both the number of cod captured and the mortality rate of cod were lower than expected.

Researchers from the University of New England worked to estimate the mortality rates of cod captured and then discarded in the Gulf of Maine lobster fishery.

Reducing Post-Release Mortality 2017

University of Hawaii ($118,524): Habitat use, movement behavior and residency of oceanic whitetip sharks found in association with fish aggregating devices in Hawaii: Identifying strategies to reduce mortality to a threatened species

Oceanic whitetip shark populations have undergone serious declines across the Pacific Ocean, but are seasonally abundant at anchored fish-aggregating devices (FADs) around Hawaii. FADs are used to attract tuna and billfish in the recreational and commercial fisheries, and sharks frequently eat these fish after they have been hooked, but before they can be retrieved. Fishermen trying to deter sharks from the area around FADs often end up killing the shark, intentionally or not. This project seeks to understand the behavior of sharks around FADs, and to educate and collaborate with fishermen on shark research. Researchers trained local fishermen to capture and tag oceanic whitetip sharks at FADs anchored around west Hawaii. They outfitted sharks with acoustic tags and FADs with acoustic receivers, so that they could tell how much time sharks are spending at each device. The program is ongoing and has enrolled more than 75 fishermen in the tagging effort, with more than 40 sharks tagged. Data shows that sharks spend short amounts of time near individual FADs, but will return to the same areas multiple years in a row.

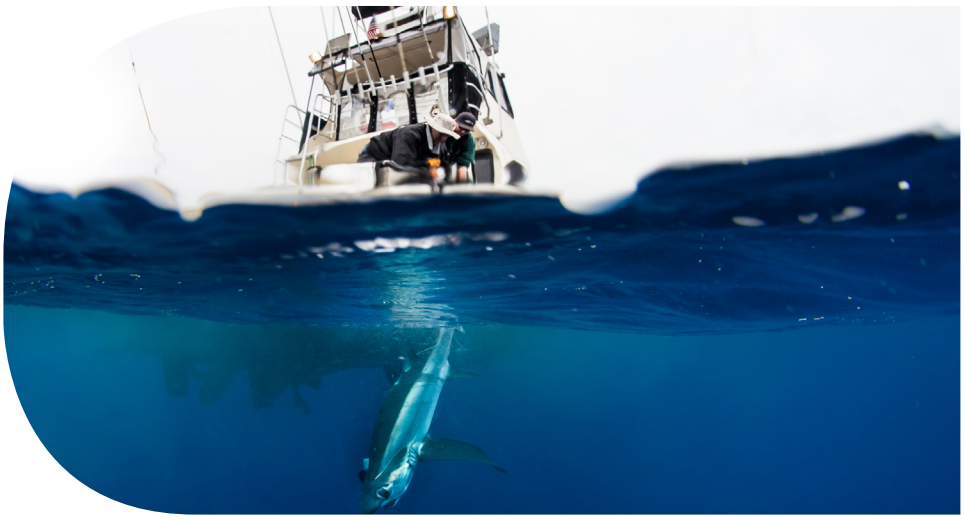
Researchers at the University of Hawaii sought to understand the behavior of sharks around fish-aggregating devices, and to collaborate with fishermen on shark research.

Reducing Post-Release Mortality 2018

Five BREP-funded projects in 2018 explored how to reduce post-release mortality in commercial and recreational fisheries in Hawaii and on the East and West Coasts. Results from these projects will help improve understanding and management of post-release mortality in species including sharks and fish.

Pfleger Institute of Environmental Research ($91,780): Documenting post-release survival and depth distribution of bigeye thresher sharks caught using linked buoy gear

Although the deep-set buoy gear swordfish fishery off the West Coast has consistently shown low bycatch rates, fishers routinely catch bigeye thresher sharks, a slow-growing species with low market value. Because bigeye threshers are typically released to save valuable hold-space for swordfish, researchers on this project worked with fishermen to document this shark's post-release survival and develop proper release protocols following capture in the deep-set buoy gear swordfish fishery. Researchers deployed 14 satellite-linked tags on bigeye thresher sharks captured during both research and exempted trials in order to study their post-release survival and movement. The work revealed only one mortality (94 percent survival), suggesting that this shark species is relatively resilient to capture stress. These results have been disseminated to fishermen in the form of regional presentations, a best-practices brochure, and presentations to the Pacific Fishery Management Council.



Researchers from the Pfleger Institute of Environmental Research documented post-release survival and depth distribution of bigeye thresher sharks. Photo credit: Ralph Pace.

University of Hawaii ($59,726): A community tagging program aimed at reducing mortality to sharks found in association with fish aggregating devices in Hawaii

Researchers from the University of Hawaii initiated a community tagging program to investigate shark depredation of tuna in small-scale tuna fisheries around Hawaii. The program included a telemetry study to provide insight into oceanic whitetip and silky shark behavior around fish aggregating devices, which are used to attract tuna. It also included a social science study to identify practical measures to reduce shark interactions with the tuna fishery. Fishermen were trained in tagging techniques during workshops, and were asked to place electronic tags on sharks captured during normal fishing operations. They were also asked to propose safe and non-lethal strategies for mitigating shark bycatch. The program is ongoing and has enrolled more than 100 fishermen who have tagged 115 sharks.

Reducing Post-Release Mortality 2018

New England Aquarium ($175,854): Implementation of emerging technology to estimate and mitigate the post-release mortality rate of prohibited sandbar sharks in a rapidly growing shore-based fishery

Many shark species are incidentally caught in the East Coast recreational fishery, including the sandbar shark, which is a prohibited species that must be released by recreational fishermen in such a manner as to ensure maximum probability of survival. Studies suggest that sharks caught from the shore may experience lower survival rates, particularly if they are removed from the water, and that survival can vary greatly based on the fishing gear and handling techniques used by the capturing fishermen. Researchers followed the activities of shore-based shark fishermen and tagged 14 captured and released sandbar sharks to monitor their survival and behavior. Data from the tags indicated that all sharks were swimming actively up until the time of tag detachment and therefore survived the catch and release event. These results indicate that sandbar sharks are resilient and are capable of surviving catch and release when fight times are less than 10 minutes and they are handled for less than 5 minutes without being brought completely out of the water.

South Carolina Wildlife Federation ($81,737): Changing recreational fishing practices through outreach to decrease post-release mortality of South Atlantic deep water species

Several years of red snapper closures in the South Atlantic have helped the population rebuild from low levels in the 1980s-1990s, although they are still listed as overfished. The increased population and red snappers' aggressive feeding behavior contribute to high levels of red snapper bycatch and dead discards as anglers pursue other species. Post-release mortality of red snapper is high, due in part to injuries caused by quickly bringing the fish to the surface, an issue known as barotrauma. Descending devices, which reduce barotrauma in released fish, are available, but underutilized in many fisheries. The goal of this project was to educate recreational anglers about best handling and release practices for red snapper and other deep reef fish. Researchers developed an online tutorial and an in-person presentation and hired educators to conduct trainings for fishing clubs in four states. Most participants were given a free descending device for use when fishing. To date, over 600 anglers have participated in either the online tutorial or an in-person training and have signed a pledge that they would employ all the best fishing practices learned, including rapid return to depth with a descending device for fish experiencing barotrauma.

A red snapper is released using a descending device to reduce mortality. Photo credit: Adrian Grey.

Reducing Post-Release Mortality 2018

University of Hawaii ($227,930): Illuminating the shark bycatch post-release mortality black box

Previous BREP projects showed that post-release mortality was high for blue sharks released in the commercial deep-set longline tuna fishery in Hawaii. Because most sharks captured in this fishery are released with 10 meters or more of trailing fishing gear, researchers investigated whether switching from braided wire to monofilament lines would reduce mortality, and whether this change in material would affect the catch of tuna. They found that fewer sharks were captured using monofilament gear than wire gear, and that gear material did not have an effect on the number of tuna caught. They also tagged 13 sharks to study the post-release mortality of sharks captured using the different materials. The tagging study is still ongoing. Finally, they tested how much force is required to break different types of hooks after the hooks were soaked in seawater, in order to assess how long it might take hooks to break off or rust out of a shark's body. Galvanized hooks appear to be more likely to break off or rust out than stainless steel hooks.

Researchers from the University of Hawaii investigated whether switching from braided wire to monofilament lines would reduce mortality for blue sharks. They also studied the post-release mortality of sharks captured using different material.

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