

**Project Title: Fishing Technology and Conservation Engineering to Reduce Bycatch**

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**Overview:** The Conservation Engineering project of the AFSC conducts an ongoing program of cooperative research with Alaska fishing groups to improve fishing gear and methods to achieve bycatch reduction, measure mortalities from all kinds of bycatch and address the effects of fishing gear on seafloor habitats. The program combines its scientific techniques and direct observation tools with the gear and fishing expertise of industry partners to design and test solutions to these issues. Funding is needed for fishing vessel costs, freight, travel, field personnel costs and supplies necessary to pursue these opportunities, as the Division is only able to support the labor associated with these activities. Partner organizations include the North Pacific Fisheries Research Foundation, The Groundfish Forum, Alaska Pacific University, Alaska Seafood Cooperative, Dantrawl, NET Systems, and United Catcher Boats. Other projects may be pursued with individual fishermen or gear designers. This project contributes to NOAA Fishery Research Goal 2, Objective 2.1, 2.4, and 2.6 and Goal 5, Objectives 5.1 and 5.2.

**Research Description:** Conservation Engineering scientists of the AFSC perform research in cooperation with industry partners to improve fishing gear and methods for bycatch reduction. These studies follow a cycle of: a) meetings and informal discussions with industry experts on how to use fish behavior and gear performance information to reduce bycatch, b) observations of relevant fish behavior in the field, c) design and physical testing of net modifications, d) field tests of prototypes, including bycatch performance and relevant fish behavior, e) design and field test new and improved trawl cameras and instrumentation and f) analysis of data and presentation of results and their application back to the next cycle.

Each of these activities address issues that put substantial limitations on subject fisheries, having been identified by fishermen as areas where the proposed technologies could make significant improvements. Government participation requires funding for fishing vessel costs, travel, shipping, supplies and overtime at sea to conduct trials. Limited AFSC funds will require Conservation Engineering scientists to exploit a mix of funding sources, including national programs for Cooperative Research (NCRP), and occasionally grants, such as from the North Pacific Research Board. Each year's projects are scalable and pursued to the extent that funding is provided by those programs. As the most recent grant is nearly expended, ***CE will have to rely heavily on Cooperative Research funding in 2016.***

*Below is a prioritized list in order of importance and level of funding required for Cooperative research projects within the CE group:*

**Excluder Development at the Flume tank in St. John's Newfoundland**

Work on salmon excluders and halibut excluders continues as current levels of bycatch have the potential to shut down target fisheries. The Council has already reduced bycatch allocations for both salmon and halibut and will likely continue to be under pressure to further reduce the halibut bycatch allocation. Salmon excluder work is for the pollock

fishery in both the Bering Sea and the Gulf of Alaska. The current over/under design was very successful in the Gulf of Alaska pollock fishery and has been tested under an ongoing EFP in Bering Sea. The preliminary results for the over/under excluder in the Bering Sea have not been as promising and there is no real understanding as to why there is such a difference. Additionally, the Council has significantly reduced the allocation of halibut bycatch for the Amendment 80 fleet forcing them to experiment with multiple strategies for reducing their bycatch one of those strategies is to be more proactive about using halibut excluders. There is one primary excluder out there to exclude halibut that the Amendment 80 fleet has been using but it too has issues. CE scientists in collaboration with John Gauvin, members of the Amendment 80 fleet, United Catcher Boats and other members of the Pollock fleet, are planning a trip to the flume tank in St. John's Newfoundland in March/April 2016 to test and refine different designs for both salmon and halibut excluders.

**Continued design and development of trawl camera and instrumentation systems:** most bycatch studies have required the use of trawl mounted cameras and sonar imaging systems to assess modifications of the gear and the reaction of marine species to that gear. The AFSC CE project has been an international leader in the development of compact and rugged systems specifically suited for bycatch studies and observations of fishing gear during commercial operations. This year's work continues on improving and ruggedizing the compact, extreme low-light analog video systems and the development of systems using higher resolution digital cameras. The AFSC digital stereo cameras will be evaluated for bycatch studies, and an effort is underway to reduce the size, cost and complexity of future stereo systems by exploring alternative strategies for stereo image capture. With the availability of new smaller and cheaper embedded PCs, the AFSC recording sonar imaging systems (Didson and imagenix) will be upgraded to improve operational efficiency during field studies.

**Develop devices to reduce halibut bycatch in both pollock and bottom trawls:** Capture of near-seafloor pollock also raises concerns over increased halibut bycatch. Halibut populations in the North Pacific are being closely watched due to shrinking size at age. Additionally, last year the IPHC cut the TAC by 11% overall. While a raised footrope should prevent some halibut capture, more complete exclusion is necessary and will be pursued by developing a halibut excluder for the pollock fisheries, using designs like those CE has cooperatively developed for flatfish and cod fisheries. A similar device has been recently tested for reducing rockfish bycatch in Pacific Coast hake fisheries and new devices are being developed for Bering Sea use. Results from testing a halibut excluder in the pollock fishery in the 2015 A season showed the excluder device did not work and the gear manufacturer had to redesign the excluder. Results for the redesigned excluder are unknown at this time. CE will continue to keep in touch with the manufacturer and offer to assist in any way possible to help move the design and testing process along.

The Amendment 80 fleet had their halibut bycatch allocation reduced by 25%. They have been using the Greenline excluder for a couple years, but it too has issues, one of which being too a very high a loss of target. They continue to use it despite having increased

towing times because it does seem to reduce some halibut bycatch. In 2015 Nor' eastern Trawl systems came out on the CE research cruise to test a different design for a halibut excluder, while these tests demonstrate halibut escape they also revealed design issues that must be addressed before it is used by the fleet. There is still much work to be done to improve halibut excluder designs, and a trip to the flume tank would help to move the design process along significantly.

**Develop devices to reduce salmon bycatch in pollock fisheries:** Salmon bycatch is a critical issue facing one of the largest and most valuable fisheries of the United States, the Alaska pollock fishery. There is a strict cap on the number of salmon that can be taken in the pollock fishery and boats actively avoid fishing in areas where salmon by catch is a problem. Several tools are being applied to reduce salmon bycatch, including allocation of bycatch at the vessel level by, near-real-time monitoring of bycatch rates, leading to targeted closures and the development of salmon excluders, devices that allow salmon to escape from trawl nets while pollock are retained. Since 2001, the AFSC Conservation Engineering project has collaborated on the development of salmon excluders with United Catcher Boats and the North Pacific Fisheries Research Foundation, with support from several other fishing companies, trawl manufacturers and related organizations. A new design, tested in late 2012 improved chum salmon escape. These tests used new camera systems, developed at AFSC, to evaluate escapes. Fieldwork for a project to transition salmon excluder technology to the Gulf of Alaska pollock fleet, in cooperation with the Alaska Groundfish Data Bank (AGDB) was conducted from 2013 to 2014. Both the excluders and testing techniques required significant adaptation for the Gulf of Alaska due to the smaller, lower-powered vessels operating in that fishery. AFSC CE plays a largely supporting role in these projects, assisting with monitoring equipment and analysis.

**Develop devices to reduce salmon bycatch in Gulf of Alaska bottom trawl fisheries:** The Council recently established tight limits on salmon bycatch in the bottom trawl fisheries of the Gulf of Alaska. In 2015 the non-pollock/non-rockfish fishery was temporarily closed due to reaching the salmon bycatch allocation limit. This has generated significant interest in development and testing of salmon excluder designs for these trawls. While the basic principles of the excluders for the pollock fishery may apply, this development project will need to account for the much smaller size of those nets and less well-known behavior of the target species for those fisheries. In 2014, CE established a contract with Alaska Groundfish Data Bank (AGDB) to obtain video of relevant fish behavior in commercial trawls. Lots of good video was obtained and processed through AGDB, a brief summary of the finding is coming and will be distributed back to the fleet. This contract continues into 2016 and we will continue to support that effort, hopefully progressing to designing and installing prototype excluders into commercial nets and observing fish reactions to the modified gear.

**Develop alternative trawl designs to effectively capture pollock concentrated against the seafloor while reducing bycatch and damage to benthic fauna:** Current regulations require the Alaska pollock fishery to use pelagic trawls for all pollock fishing. During some periods of the pollock fishery, pollock concentrate against the seafloor and,

to capture them, fishermen put pelagic trawls, designed for midwater capture, onto the seafloor. Concerns over the potential negative habitat and bycatch effects of this practice have been raised during Council consideration of Essential Fish Habitat and Bering Sea Canyons issues. Experience from trawling before the current regulations requiring pelagic trawls were put into place indicated that smaller opening nets may have less salmon bycatch and require substantially less fuel to deploy, while still effectively catching pollock. Also, recent tests with footropes raised slightly off the seafloor indicate the potential to reduce effects on seafloor habitats relative to the continuous, heavy footropes (generally chains) required on pelagic trawls. Research in 2012 showed that pollock could be effectively captured with a conventional bottom trawl equipped with such a raised footrope. In 2013, we made observations of pollock reactions to sweeps, which will be used to optimize gear configurations ahead of the trawls. In 2014, we assessed the seafloor effects of a raised-footrope pollock trawl in Bering Sea habitats where pollock are commonly fished. CE cooperative research remaining for 2016 and beyond includes work with industry to adapt the prototype footropes tested in 2014 for regular commercial use and full scale tests of the resulting designs to confirm commercial effectiveness. Results from the testing of a prototype footrope in 2014 showed to reduce impacts to the seafloor. Going forward CE has the materials required for that prototype footrope and would try and find a vessel to test that footrope for a trip or two with a CE scientist riding along with cameras during that testing to document net performance and seafloor contact.

**Summary:**

While there are a number of projects cited here, many of them will be led by industry collaborators. In these projects CE either loans equipment or provides scientific expertise to design rigorous testing and analysis procedures. Thus the demands of CE are less than that if they were responsible for the entire project. A short research cruise is planned to conduct gear trials and behavior observations where needed to move concepts forward in ways that would not be feasible on vessels during commercial fishing. This plan envisions a lower activity level relative to previous years by a reduced CE staff due to temporary staff transitions in the group and represents the level needed to keep CE as a participant in these ongoing projects. Some funds could be used for travel to conferences to present the results of any of the listed projects. This funding request is affected by the lack of significant funding from other external grants, which have supplemented our cooperative efforts in recent years.

**Note on timing of funding:**

For several years now, funding from proposals to the NCRP program has arrived too late in the year to fully fund field research efforts, particularly vessel time, in the fiscal year in which it is received. If a large contract needs to be established, procurement requirements have allowed work in the last month of the fiscal year at best, which introduces additional administrative problems for travel, salary and shipping expenses. The CE project has successfully dealt with this issue by a combination of establishing multi-year charters and funding some vessel time each year for the following year. Funding was established in a grant with the Pacific States Marine Fisheries Commission (PSMFC) for 10 days of vessel time in 2015 from its 2014 and 2015 allocation. Almost all of the funds in the

PSMFC grant were exhausted from the 10-day research cruise in 2015. However the vessel contract included two option years and once FY16 funding is secured, we can place them in the existing contract. We are requesting funding for our 2016 field work in order to follow up on the projects listed above. Lack of such funding will severely constrain or prevent field research by this on-going project in 2016.

Also, as mentioned above, some research opportunities occur in seasons that do not fit the recent timing of allocation of AFSC's NCRP funding. The opportunity for the flume tank work will require a very small amount of funding in March or April. For that, we will fund one day of flume tank time and travel for one CE employee to St. John's Newfoundland. We hope that arrangements can be made to make this small amount available in time to access this opportunity.

**Performance Indicators:**

1. Completion of research aboard a chartered research vessel in the May - September period.
2. Participation in collaborative fishery tests of fishing gear improvements, including salmon bycatch reduction methods.
3. Use of excluders and gear modifications in the fisheries.

**Deliverables:**

1. Conduct presentations and discussions with Alaska trawl captains and net manufacturers to explain results of 2015 research and solicit participation in planning of 2016 studies.
2. A report of 2016 cooperative research activities and results will be provided to industry and management by December 2016.
3. Reports of the results of individual projects will be prepared and distributed to collaborating groups.
4. New smaller compact underwater camera system and recording sonar imaging systems (Didson and imagenix) will be upgraded to improve operational efficiency during field studies.

**V. Budget:**

Vessel charter (10 days)	100 K
Fuel for charter	10 K
Overtime salary for fieldwork (charter and ride alongs)	15 K
Travel (Flume tank, charter, conference, and ride alongs)	15 K
Contracts/Flume Tank	10 K
Freight	15 K
Supplies	17 K
Total funds requested	<u>182 K</u>

Partial funding over a minimum \$100K could be used to fund only some of these projects. This level of funding is required for a 10 day charter given CE has no other sources of external money for 2016. If the full amount is not granted to do a charter, there have been talks with industry partners to do more "ride alongs" to collect fish behavior

information in different parts of trawl nets and to potentially help with testing any new excluder designs.