Gear-based approaches to catch protection as a means for minimizing whale depredation in longline fisheries

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PURPOSE

To provide the RAB with a description of an ongoing study designed to identify and test new tools to minimize marine mammal depredation of hook captured Pacific halibut.

BACKGROUND

Removal of captured fish from fishing gear (known as depredation) is a growing problem among many hook-and-line fisheries worldwide. In the north Pacific Ocean, both Killer (*Orcinus orca*) and Sperm (*Physeter macrocephalus*) whales are involved in depredation behavior in Pacific halibut (*Hippoglossus stenolepis*), sablefish (*Anoplopoma fimbria*), and Greenland turbot (*Reinhardtius hippoglossooides*) longline fisheries. In 2011 and 2012, fisheries observers estimated that 21.4% of sablefish sets, 9.9% of Greenland turbot sets, and 6.9% of Pacific halibut sets were affected by whale depredation in the Bering Sea (Peterson et al. 2014). Reductions in catch per unit effort (CPUE) when whales were present ranged across geographic regions from 55%-69% for sablefish, 54%-67% for Greenland turbot, and 15-57% for Pacific halibut (Peterson et al., 2014). These impacts also incur significant time, fuel, and personnel costs to fishing operations. From a fisheries management perspective, depredation creates an additional and highly uncertain source of mortality, loss of data (e.g. compromised survey activity), and reduces fishery efficiency. Stock assessments of both Pacific halibut and sablefish have adjusted their analysis of fishery-independent data to account for the effects of whale depredation on catch rates. In the sablefish assessment, fishery limits are also adjusted downward to reflect expected depredation during the commercial fishery. In recent years, whale depredation has been limiting fishers' ability to harvest their Greenland turbot allocations and they have been well below (35-78% in the last 5 years) the total allowable catch for that fishery. Meanwhile, potential risks to the whales include physical injury due to being near vessels and gear, disruption of social structure and developing an artificial reliance on food items that can be affected by fishery dynamics.

Many efforts have been made over the years to mitigate this problem, with fishers generally limited to simple methods that can be constructed, deployed, or enacted without significantly disrupting normal fishing operations, or without violating gear regulations. Existing approaches include catch protection, physical and auditory deterrents, and spatial or temporal avoidance. These approaches have had variable degrees of success and ease of adoption in each fishery but none have solved the problem. Terminal gear modification and catch protection have been identified as an avenue with the highest likelihood of 'breaking the reward cycle' in depredation behaviors.

Pacific halibut and Greenland turbot are prohibited in trawl fisheries, are difficult to capture efficiently in pots, and therefore new approaches to protection of longline catch are necessary.

This project focuses on investigating strategies aimed at protecting longline-caught fish, through low cost, easy to adopt gear modifications. Recent developments in physical catch protection methods include: development of underwater shuttles that unhook and transport catch to the

surface (e.g. Patagonian toothfish: Sago Solutions), light and expandable spring coils (e.g., the underlying mechanism of 'slinky' pots used in the Alaska sablefish fishery: Cod Coil), and triggerable spokes or mesh panels attached to the gear to obscure catches of tuna (Paradep). Some of these approaches may have elements that are suitable to be adapted for the protection of longline captured Pacific halibut.

DISCUSSION

This project will be structured in two parts. First, in early 2022 we will conduct a virtual workshop with industry (affected fishers, gear researchers, scientists) to identify methods to protect fishery catches from depredation. Participants have been identified to highlight their work on underwater shuttles, expandable coils, and "umbrella like" shrouding devices. Each research group will outline what their product is, it's mode of action, method of interaction with the gear, functionality, costs (catch rates, money, time, safety, storage), modifications to consider, critical considerations, and ease of modification for flatfish fisheries. Brainstorming exercises will be used to fully develop these ideas and come up with designs for initial trials. Secondly, the top two or three catch protection design outcomes from the workshop will be incorporated into functional prototypes and field-tested in longline sea trials targeting flatfish in the summer of 2022.

RECOMMENDATION

That the RAB:

1) **NOTE** paper IPHC-2021-RAB022-12, which described studies designed to investigate whale depredation mitigation strategies through catch-protection in longline fisheries.