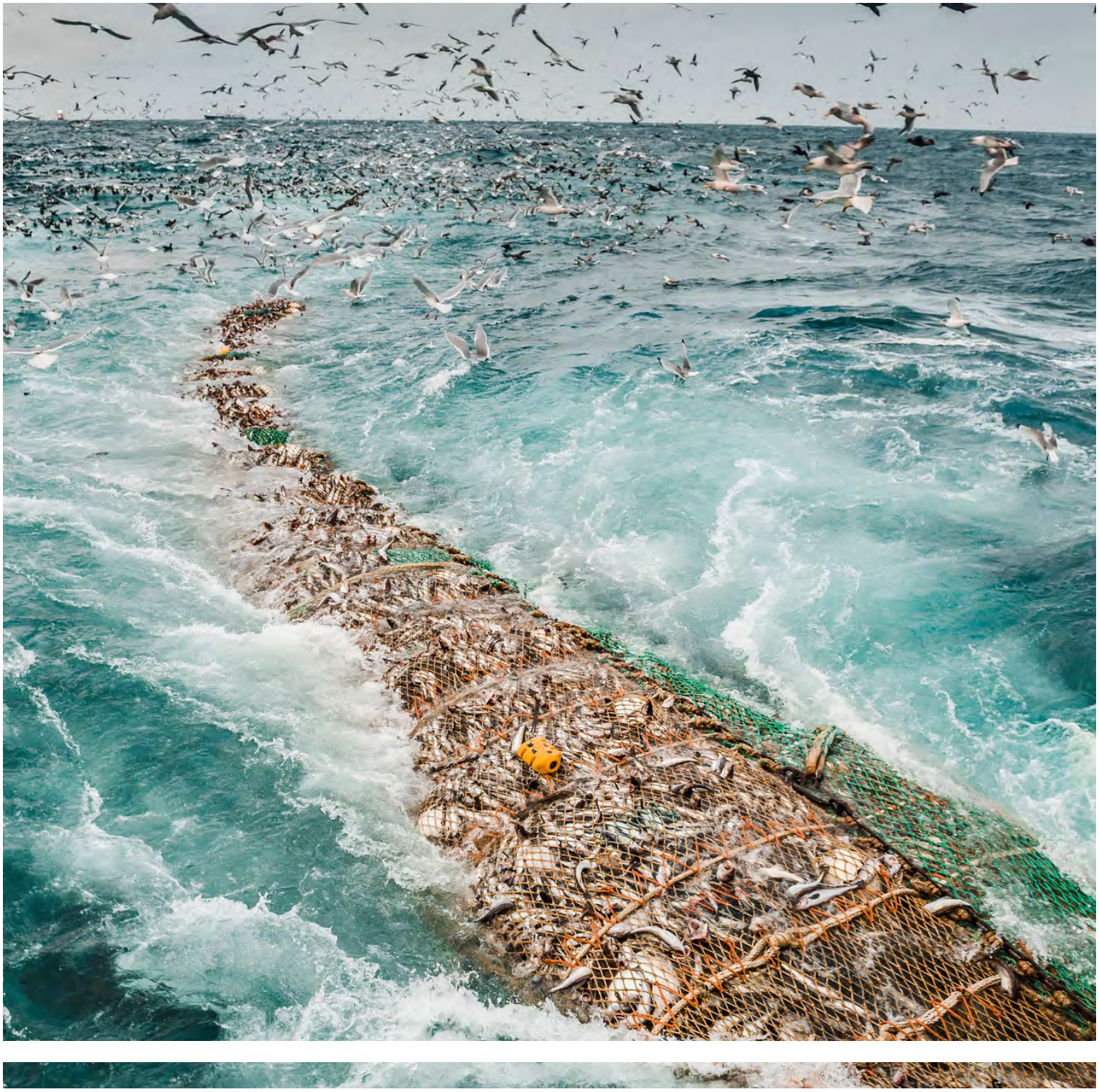


REDUCING SALMON BYCATCH IN THE ALASKA POLLOCK TRAWL FISHERY

A PILOT PROJECT USING LIGHTS

JANUARY 2023

INTRODUCTION

Minimizing bycatch is an important component of modern, profitable, and sustainable Alaska fisheries.

The purpose-built Pisces bycatch reduction light from SafetyNet Technologies was tested in the nets of three Alaska pollock trawl vessels in the summer of 2022.

The project took place between June and August 2022, where approximately 52 multi-day trips were completed with more than 35 million pounds of pollock harvested. Approximately 161 Chinook and 6,183 chum salmon were incidentally harvested.

Results indicate a slight correlation between use of the lights and bycatch reduction. Results are not statistically significant. Further research is needed and recommended to confirm light technology as a viable bycatch reduction tool.

Although the research team would have preferred stronger results, this project is considered a success.

The $100k project was relatively inexpensive and consistent with the model of rapid experimentation to develop solutions to industry challenges.

The technology survived difficult working conditions, was described as “easy to use,” and gathered valuable information that can be used to support further deployments and engineering refinements.

The project is an example of the Denali Commission partnering with legacy industry and a technology start-up to test the viability of novel technology unlikely to be funded exclusively by industry.

In addition to lights, active excluders, trawl modifications, increased information sharing, ecosystem modeling, and new operating practices offer the potential to reduce bycatch.

PARTNERS & FUNDING

This project was developed and managed by the Alaska Ocean Cluster and the Bering Sea Fishermen's Association. The mission of Alaska Ocean Cluster is to support early-stage companies and the maritime industry to deploy new technologies that improve the profitability and sustainability of Alaska fisheries.

The Alaska Ocean Clustered partnered with Coastal Villages Regions Fund (CVRF), an Alaska Community Development Quota Group. CVRF is one of six non-profits dedicated to benefiting 65 Western Alaskan communities through ownership of Alaska seafood industry quota, vessels, and other maritime assets. The three pollock trawl vessels used in this project are partially owned by CVRF.

The project was funded by CVRF and the Denali Commission, an independent federal agency dedicated to economic development in Alaska.

Garrett Evridge was the Project Manager and primary author of this report. Taylor Holshouser, Kyle Belleque, Tom Rossiter, and Craig Syms contributed, among others.

METHODOLOGY

THE PLAN

- Illuminate the trawl excluder with a light
- Use lights every other trip
- Compare catch rates among the lit and unlit trips to see if there is a reduction in salmon bycatch

A simple on/off methodology was used to test the efficacy of the lights. Simplicity was prioritized to minimize disruption to fishing operations and match the modest budget.

Lights were oriented in a way to illuminate the trawl excluder. All three vessels used a double-hood design, which provides two escape routes.

We were guided by the hypothesis that salmon may swim out of the excluder when they see the difference in contrast between the trawl webbing and open ocean.

Relevant academic literature was reviewed and researchers in the field were interviewed.

Vessels were instructed to use the lights every other trip over the entire B season. We anticipated this approach would generate at least 32 lit trips and 32 unlit trips.

Having at least 30 comparable observations was expected to be sufficient to comment on the efficacy of the lights.

Captains followed a communication protocol that involved notifying the research team on Whatsapp at the start and end of every trip. These time stamps were later correlated with catch/bycatch data.

PROJECT REPORT

WHAT HAPPENED

- One vessel used lights all season
- Two vessels left for tendering due to the record-breaking Bristol Bay salmon harvest
- The technology was durable
- Pollock harvest efficacy appeared to be unaffected
- Results indicate some efficacy

Our methodology helped guide the project, but thing didn't go exactly as planned.

One of the three vessels elected to follow an always-on methodology instead of the alternating methodology. This reduced the amount of data to compare against other vessels.

Because of the record-breaking Bristol Bay salmon harvest, two of the three vessels in the project were called away to tender.

These unanticipated developments reduced the total number of trips to 52, down from the goal of at least 65. The total number of comparable on/off trips was also limited to 36.

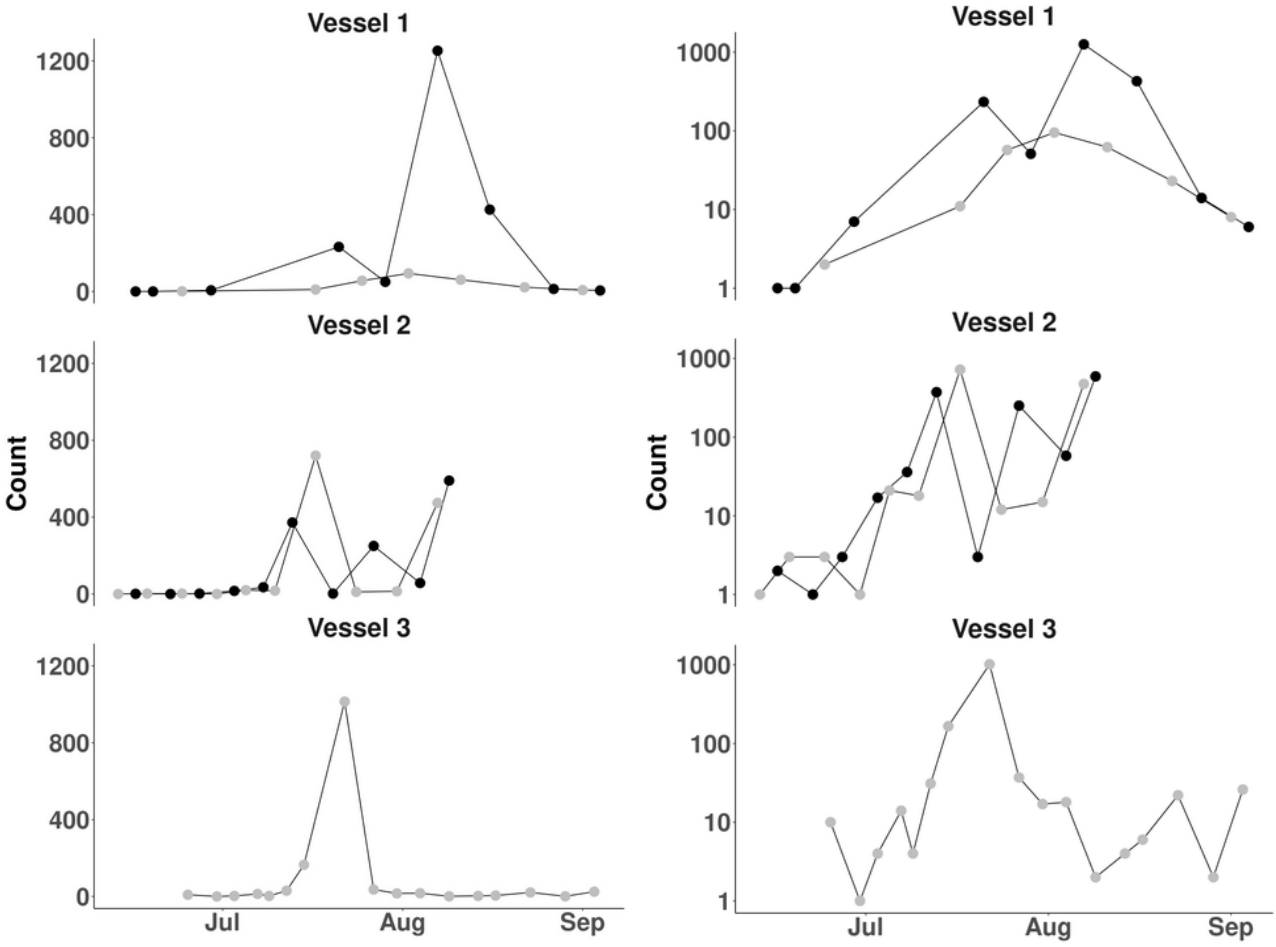
The technology proved durable and reliable. Of the 30 total lights deployed, just one stopped working.

Our goal of conducting a simple, minimally disruptive project was generally met. This was achieved in large part thanks to the easy-to-use design on the Pisces light, which turned on and off when entering and leaving the water.

The remote used to change light settings was a point of feedback from the crew who asked for longer-range capability.

PROJECT REPORT

Figure 1. Chum catches per vessel, July - September 2022
Linear and logarithmic scale



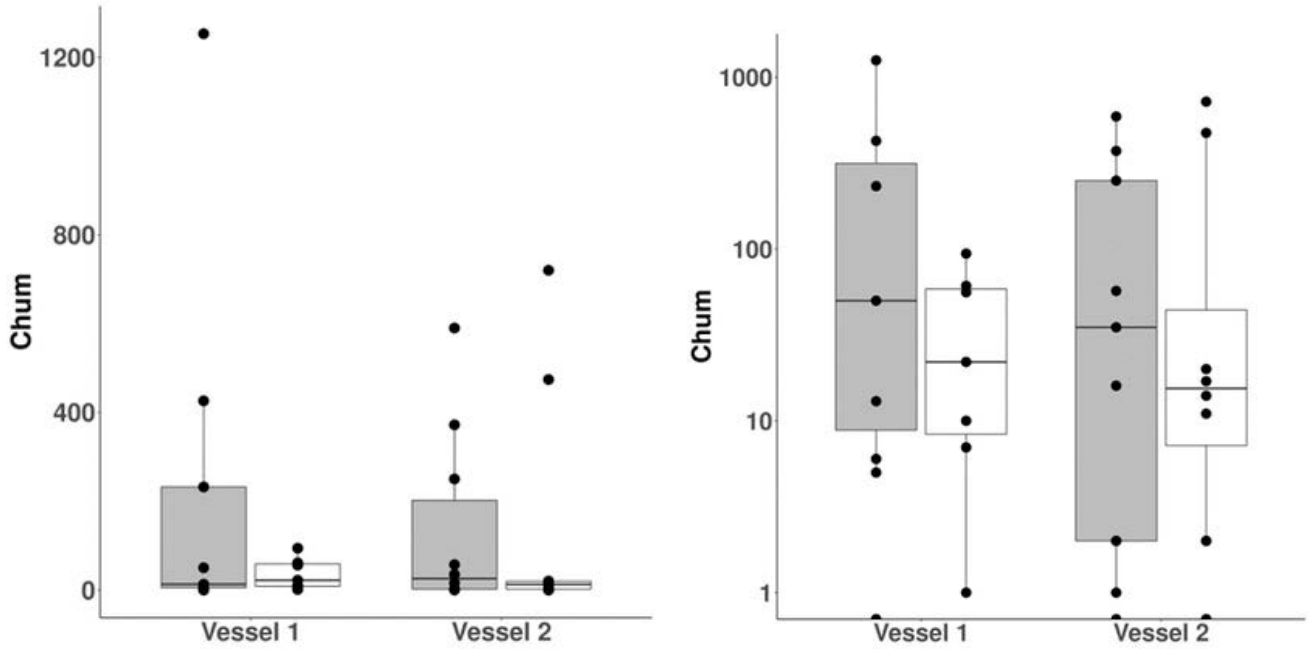
Grey symbols are Light-On; black symbols are Light-Off.

The first thing we notice is the significant variance in chum salmon catch, both across time and in magnitude. Use of a log scale helps us interact with the volatility in magnitude.

No definitive relationship between the use of lights and chum bycatch can be concluded from this data. We do see an interesting correlation in the Vessel 1 data where bycatch appears to be lower when the lights are in use. We also may be observing a seasonal effect in bycatch rates in Vessel 1 and Vessel 2.

PROJECT REPORT

Figure 2. Chum catch for Vessel 1 and Vessel 2, July - September 2022
Linear and logarithmic scale



The boxplots display the median (horizontal line) and quantiles (top and bottom of boxes). The points are the individual sample values. Grey boxes are Light-Off; white boxes are Light-On.

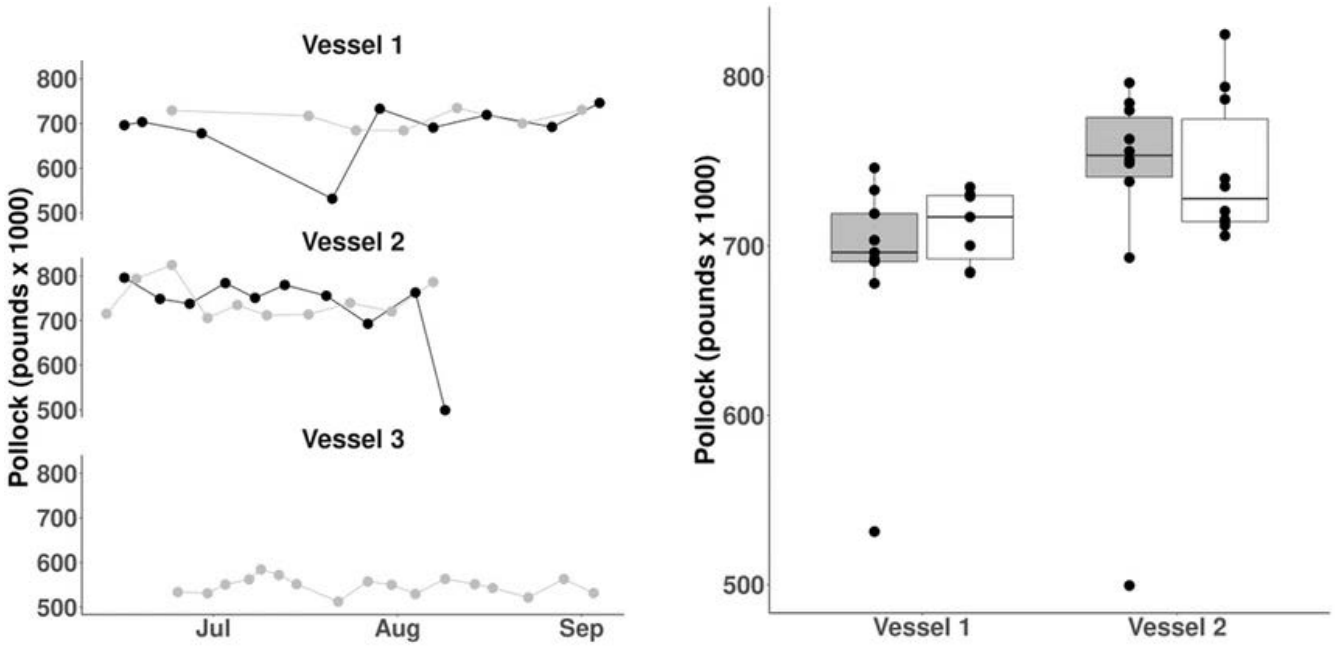
Across the season, there is some indication that chum catches were lower when the lights were on. We see this most clearly in the logarithmic scale where the median chum catch is lower on lighted trips. However, note that lights were being used when Vessel 2 saw its highest chum catch of the season.

It's possible that lights are reducing bycatch rates at times, with any effect in the data overpowered by periodic and magnitudes larger chum harvest.

PROJECT REPORT

Figure 3. Pollock Harvest

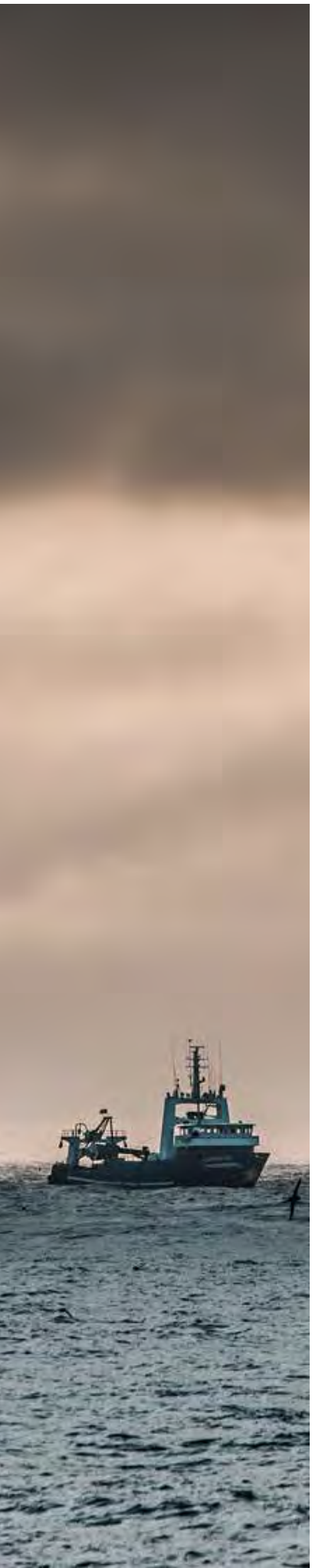
Linear Scale



Left: Time series of catches for each vessel. Right: Season-wide comparison between Light-On and Light-Off regimes. Colors as above.

There was no noticeable difference in pollock harvest when lights are used. This is seen most clearly in the box plot on the right where the median values move in opposite directions, indicating no relationship.

Future research should continue to consider the impact of any bycatch reduction device on target harvest.



FUTURE RESEARCH

Results show some promise, but additional research is needed to improve understanding of lights as a viable tool for reducing bycatch.

A key challenge when trying to prove causality for bycatch reduction tools is the relatively low frequency of incidental catch. For every Chinook harvested incidentally, more than 215,000 pounds of pollock were harvested. Another challenge is the "patchy" nature of chum salmon bycatch. Vessels were observed making trip after trip with less than 50 chum harvested, punctuated by rates that would rise to ten times that.

The best strategy to overcome these observed patterns is to increase the amount of data available for analysis.

Recommendations:

- Repeat the trial with more vessels following the prescribed on-off regime. There appears to be no detrimental effect on Pollock catch, and with more boats, the effect could be identified at a sufficient level of statistical significance.

- Video should be deployed alongside lights to identify whether the lights are placed correctly/optimally, and how placement can be improved. The bycatch reduction mechanism is an interaction between gear, light, visual environment, and fish behavior. These elements need to be considered and researched further.

- Video should also be used to provide visual evidence that bycatch species are indeed using the escape panel, and that this is due to the lights. An escapement net could be used as well.

- Expectations should be managed. It's unlikely that any one bycatch reduction solution will solve the problem of incidental harvest. Instead, we should be ready for a sustained focus on identifying and deploying multiple solutions that can meaningfully improve bycatch.

ADDITIONAL STRATEGIES

The use of lights aboard trawl vessels is only one of many strategies to reduce bycatch. Interviews with the fishing industry and other researchers were conducted to understand other strategies currently being used and which strategies might be viable in the future.

Trawl net designs. Changes to the structure of trawls and how they engage in harvesting are among the most common strategies to reduce bycatch. Conversations with industry participants indicate there are several possible changes to nets, doors, excluder panels, and foot ropes, among other elements, that should be considered.

Fishing practices. Changes in rates of haul, tow speed, and other parameters are an existing strategy to reduce bycatch. Bycatch rates can be higher in vessels that tow faster, reducing tow speed may be helpful. Once a net is full, captains describe different strategies to aid Chinook salmon release. Changing the rate of net retrieval — starting slow and ramping up to normal speed — is an example.

Shifting harvest time or location. Capitalize on the propensity for bycatch to occur follow seasonal and geographical patterns. Fishermen already regularly shift harvest activity among these patterns to minimize bycatch.

Active excluders. Potential exists to have a dynamic opening in a trawl net which opens to release bycatch species, before closing to maintain target species harvest. The optimal design would function automatically and have minimal pollock loss.

Information sharing & dynamic closures. Information sharing in the Alaska pollock fishery is among the best in the world, but there are likely opportunities to improve the ability to rapidly respond to and avoid bycatch concentrations.

Ecosystem modeling & surveying. We lack the ability to know the approximate location of target and bycatch species. Improved ecosystem modeling, supported by surveying, could support the development of tools which will improve understanding of where fish are likely to be located.

Please contact Garrett Evridge for more information: garrett@alaskaoceancluster.com

Photos courtesy of Alaska seafood (Alaska Seafood Marketing Institute) and Garrett Evridge

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