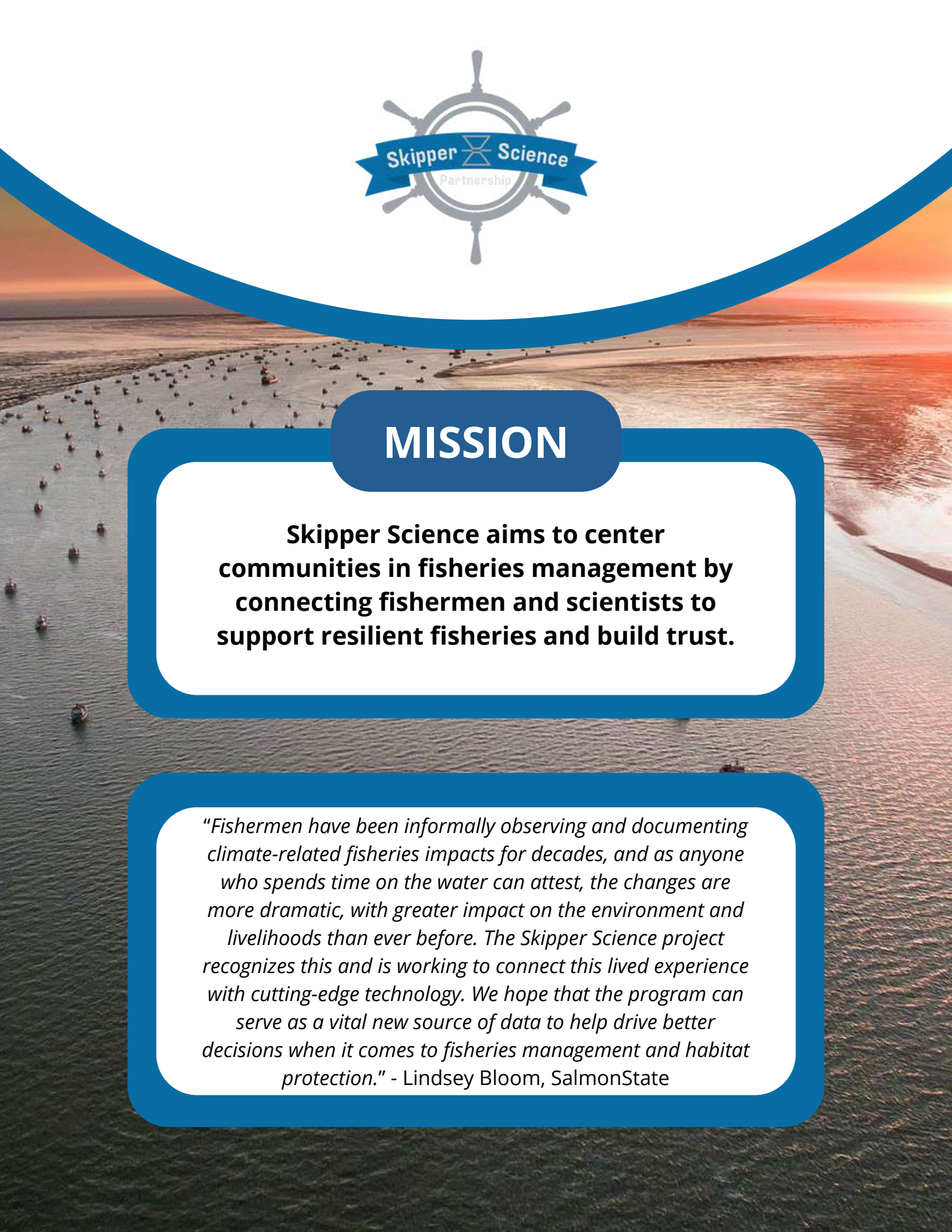
SKIPPER SCIENCE PARTNERSHIP

SEASON REPORT

2023

SUGGESTED CITATION:

M. Reda-Williams, H.M. Garcia, B.W. Robson, L.M.Divine, L. Bloom, H. Bauscher, A. Poe. 2023. Skipper Science Annual Report: 2023 Season. Accessible from: www.skipperscience.org/reports



MISSION

Skipper Science aims to center communities in fisheries management by connecting fishermen and scientists to support resilient fisheries and build trust.

"*Fishermen have been informally observing and documenting climate-related fisheries impacts for decades, and as anyone who spends time on the water can attest, the changes are more dramatic, with greater impact on the environment and livelihoods than ever before. The Skipper Science project recognizes this and is working to connect this lived experience with cutting-edge technology. We hope that the program can serve as a vital new source of data to help drive better decisions when it comes to fisheries management and habitat protection.*" - Lindsey Bloom, SalmonState

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Acknowledgements

The Skipper Science Partnership operates on the lands and waters of many Indigenous Peoples, the First Stewards of what is today called Alaska. The Skipper Science Partnership is so grateful to the committed and substantial community of fishermen and women, as well as support organizations, for making the Skipper Science Partnership what it has become today. We would like to express our deepest appreciation and gratitude to the Skipper Science Partnership community, and we also want to acknowledge that this work occurs on Indigenous lands and waters, which have been responsibly cared for by Alaska Native Peoples since time immemorial. We hold deep respect and appreciation for these lands and waters, as well as the varied connections between these environments and the Peoples who have and continue to steward them for generations.

Partner Statements

Motivations and Vision for Skipper Science

Aleut Community of St. Paul Island

The Aleut Community of St. Paul Island (ACSPI) is a founding partner of Skipper Science. The Skipper Science Partnership is critical to us as an organization because it is an effective way to facilitate the bridging of science, fishermen, and policy-making. We aspire to see Skipper Science have a critically important role in strengthening local voices in ways that facilitate the sustainable management of federal fisheries and achieving equitable conservation of marine ecosystems. Through the Skipper Science Partnership, we implement activities that leverage knowledge and data to enhance collective understanding of the ecological changes occurring in Alaska's water and develop actionable strategies and policies that prioritize the long-term well-being of communities and vibrant fishing industries. Specifically, we own and operate mobile and web-based apps for data collection; participate in ongoing training and communications with participants; partnership development and developing targeted research programs; fundraising for the sustainability of the program; and conducting outreach and education activities for a variety of audiences. We aspire to create mutually beneficial relationships where all voices are heard, respected, and integrated into the decision-making processes surrounding the management of marine resources. Ultimately, ACSPI's involvement in Skipper Science is driven by our unwavering commitment to the well-being of Alaska Native and fishing-dependent communities, the preservation of cultural connections to fisheries and the sea, and the responsible stewardship of Alaska's marine ecosystems.

Salmon State - Salmon Habitat Information Program (SHIP)

Salmon State's Salmon Habitat Information Program (SHIP) deeply values its role within the Skipper Science Partnership. As a key collaborator, SHIP recognizes Skipper Science as an instrumental platform for centering maritime community voices in scientific research, fisheries management, and policy formulation. Our commitment stems from the belief that Skipper Science is a

significant strategy for amplifying local perspectives, thereby fostering sustainable management practices for federal fisheries and ensuring equitable conservation measures for marine ecosystems in Alaska. Our involvement in Skipper Science spans various activities, including assisting in communication strategies, supporting training efforts, fundraising initiatives, and extensive outreach and educational events across coastal communities. By advocating for inclusive decision-making processes, SHIP endeavors to establish mutually beneficial relationships where every voice is valued, contributing to the responsible management of marine resources. Our dedication to the Skipper Science Partnership reflects our commitment to the well-being of Alaska's Native and fishing-dependent communities and the sustainable stewardship of Alaska's marine ecosystems.

Aleutian Bering Sea Initiative (ABSI) with the Northern Latitudes Partnerships (NLP)

The Aleutian Bering Sea Initiative (ABSI) is one of three partnerships comprising the Northern Latitudes Partnerships (NLP), which seeks to sustain Northern lands, waters, and ways of life for generations to come. ABSI's collaborative efforts to support the stewardship of our lands and waters involve various partners, including federal, state, and Tribal governments, and academia, all working towards the common goal of advancing equitable relationships, improving research, and fostering unique solutions to environmental challenges. Through Skipper Science, we support fundraising initiatives, outreach, and education, as well as assisting with partnership development and relationship building between maritime communities and researchers. ABSI’s efforts focus on developing science, providing knowledge-sharing opportunities, and crafting partnerships that can address unprecedented environmental changes affecting the Bering Sea and Aleutian Islands. ABSI supports Skipper Science’s commitment to the stewardship of our fisheries, guiding our efforts to ensure the sustainable management of natural resources and the preservation of cultural heritage in coastal communities.

Alaska Ocean Observing Systems (AOOS)

The Alaska Ocean Observing System (AOOS) is a pivotal partner in the Skipper Science Partnership, dedicated to providing accurate and reliable coastal and ocean data and information products to the public through collaborative networks and services. AOOS's mission aligns closely with Skipper Science's goal of fostering sustainable management practices and enhancing understanding of ecological changes in Alaska's waters. AOOS actively supports Skipper Science by supporting fundraising efforts, leveraging its expertise in data analysis to provide valuable insights on project outcomes, and playing a crucial role in partnership development. Furthermore, AOOS fosters collaboration by partnering with Skipper Science on planning workshops and educational events, ensuring the dissemination of scientific knowledge and local community perspectives with diverse stakeholders. Through their shared values of environmental stewardship and scientific integrity, AOOS and Skipper Science work together to address the challenges facing Alaska's fisheries and marine ecosystems, striving towards a future of sustainable resource management and thriving coastal communities.

A note on terms used in this report:

Various terms are used by those involved in environmental monitoring programs, such as citizen science, observing networks, contributory research, and participatory monitoring (Sigman 2015). In this report, we use the term "community-driven monitoring" (CDM) to encompass all the collaborative efforts undertaken by Skipper Science, involving commercial fishing members and partners, to support the design of research efforts and the management and utilization of data collected. Throughout this report, the terms "observations" and "data" are used interchangeably to refer to any information collected through the program. All observations and data collected in the Skipper Science Partnership are the property of the voluntarily participating community of fishermen across Alaska.

EXECUTIVE SUMMARY

Alaskan communities and fisheries are disproportionately affected by climate-related ecosystem impacts including ocean acidification and temperature changes, extreme weather, and coastal hazards (e.g., harmful algal blooms, sea level rise, and erosion). Many Alaska fishing grounds host long-term stock assessment surveys and other monitoring efforts to help understand changes in the marine ecosystem, but they often are only snapshots of particular seasons (e.g., summer months) or are narrow in their scope. The Skipper Science Partnership program taps into the knowledge and observations of Alaska's fishermen, fishing communities, and fishing support industries, filling important data gaps. The Skipper Science Partnership has completed three successful seasons since our wide-scale pilot launch in 2021, each season is building on the momentum and outcomes of the previous years. Since implementation, the Skipper Science Partnership program efforts have grown immensely. Skipper Science continues to facilitate effective scientific research that has filled identified gaps in understanding and provides critical monitoring through active engagement with Alaska's premier fishing communities and individual fishing vessels.

This 2023 Skipper Science Annual Report reflects the program's significant contributions to community-driven monitoring and fisheries management in Alaska. Launched in 2016 and expanded statewide in 2021, Skipper Science engages diverse stakeholders, including fishermen, scientists, and policymakers, to gather ecological observations crucial for understanding Alaska's marine ecosystems. Through partnerships with organizations like ACSPI, SHIP, ABSI, and AOOS, Skipper Science has demonstrated cost-efficient data collection and real-time reporting using a smartphone application. This approach empowers fishermen to document environmental phenomena, contributing to informed fisheries management decisions.

With specific objectives focused on community-driven monitoring, climate adaptation, and collaboration, Skipper Science aims to bridge the gap between scientific research and local knowledge. By fostering trust and engagement among stakeholders, the program enhances resilience in Alaskan fisheries faced with rapid climate change. Throughout the 2023 season, Skipper Science engaged over 300 participants across Alaska through data collection efforts, five specific targeted data collection programs, numerous outreach events, conferences, and information booths, facilitating the collection of essential observations. The report highlights the program's commitment to transparency, partnership, and data-driven decision-making in promoting sustainable fisheries and ecosystem stewardship.

Introduction

Background

Initiated in 2016 and officially launched statewide in 2021, the Skipper Science Partnership is an impactful community-driven monitoring program that actively engages fishermen, mariners, scientists, researchers, managers, and other partners. The program was initiated in partnership with the Aleut Community of St. Paul Island Tribal Government (ACSPI), SalmonState's Salmon Habitat Information Program (SHIP), and the Aleutian Bering Sea Initiative (ABSI). Additionally, beginning in 2022, Alaska Ocean Observing System (AOOS) became a partner within the program continuing to fund elements of Skipper Science work. Skipper Science serves as a platform for gathering ecological observations including those associated with ocean conditions, fishing activities, anomalous observations, distribution and abundance of species, phenomena like algal blooms or oil slicks, and others, which contribute to a deeper understanding of the ever-evolving dynamics in Alaska's fisheries and marine ecosystems.

Additionally, Skipper Science has demonstrated cost-efficiency and savings in data collection efforts related to research by engaging Alaskans already working on the water in fisheries. Participants in the program typically contribute to Skipper Science by using a smartphone application ("app") that allows them to record observations in real-time directly from fishing grounds, even without wifi or cell signal access, or anytime the participant is back in port or returns from a trip out on the water. All collected data are securely uploaded to a centralized protected online database once internet connectivity is available. The power of Skipper Science is that the community of fishermen owns all the data. The support team, composed of ACSPI, SHIP, and ABSI, provides technical support and liaises between the Skipper Science community and scientific researchers, managers, and policymakers to advance mutual goals and objectives, detailed below.

Skipper Science provides a platform for fishermen to document physical and biological phenomena they encounter during their fishing activities using a smartphone application ("app") to document text, photos, waypoints, audio recording, and other relevant data that can be recorded on either iOS or Android mobile devices. The technology utilized by Skipper Science is adapted from the Indigenous Sentinels Network (ISN), which is an enterprise software that has been operating successfully in remote communities for over two decades across Alaska. Skipper Science creates unique opportunities to maximize data collection for use in action-oriented collaboration, turning observations into real-time and essential data for informed and responsive management of our ocean ecosystems.

Goals and Objectives

Since its inception, Skipper Science's mission has been to center fishing communities in fisheries management by connecting fishermen with scientists and managers to build the trust needed to effectively address critical data gaps in understanding and detecting changes in Alaska's marine ecosystems. By actively involving fishing communities in data collection efforts, Skipper Science strives to create a robust framework for community empowerment and provide methods to contribute to more locally informed approaches to fisheries management and ecosystem stewardship.

Our specific objectives for the 2023 season were:

1. Continue community-driven monitoring and citizen science programs for real-time data collection on ecosystems, fisheries, species at risk, and climate trends;
2. Provide flexible data collection tools for environmental monitoring, and utilize local expertise and diverse knowledge to better understand climate-driven changes in Alaska;
3. Foster trust and collaboration among fishermen, communities, tribes, resource managers, and academia to showcase collaborative and co-produced scientific partnerships; and,
4. Aid scientists and managers in identifying priority areas for climate adaptation in frontline Alaskan fishing communities.

Skipper Science Partnership as a Method for Contributing to Climate Resilient Fisheries

Having warmed an average of 1.5°C over the last 60 years, more than twice as fast as the continental U.S., Alaska is experiencing the most rapid climate change in the United States.[1] These changes are causing rapid shifts in the marine ecosystems that have profound implications for subsistence, commercial, and sport fisheries.[2-3] With these rapid changes occurring, there is a need to respond to and expand methods for the increased resiliency of Alaskan fisheries. Skipper Science contributes to this expansion in multiple ways through connecting policy, science, and fishermen; making a flexible data collection tool accessible to fishermen and partners; and through the practice of partnership itself, which strengthens our communications, relationships, and responses to better understand our changing oceans and its impact. During virtually every day of the year, fishermen are transiting and fishing in Alaskan waters with 8600+ vessels and thousands of fishermen observing and working with ocean conditions daily.[4] Data gaps related to the health of our ocean ecosystems can be filled by working with fishermen who have decades and even multi-generational knowledge about ocean environments, the interest in being collaborative in the science and policy realm of fisheries, and access to consistent ocean observations and data collection due to the nature of their profession. We see the work and design of the Skipper Science Partnership as just one method and catalyst for increasing the resiliency of Alaskan fisheries through collaboration, connection, and standardized data collection done by fishermen.

1 US Global Change Research Program (USGCRP) (2014) National Climate Assessment. Washington, D.C., USA. Accessed 10 December 2017 from: https://nca2014.globalchange.gov/report

2 Hollowed, AB, Planque B, Loeng H (2013) Potential movement of fish and shellfish stocks from the sub-Arctic to the Arctic Ocean. Fisheries Oceanography 22 (5): 355-370.

3 Arctic Council, Protection of the Arctic Marine Environment (PAME) (2009) Arctic Marine Shipping Assessment 2009. Project Report. Protection of the Arctic Marine Environment Working Group. 194 pp.

4 Welch, L. (2021) FISH FACTOR: Alaska fishing industry economics report offers some surprising numbers. Alaska Journal of Commerce. https://www.alaskajournal.com/2022-01-26/fish-factor-alaska-fishing-industry-economics-report-offers-some-surprising-numbers.

2023 Season Summary

All of the data that are collected through general observations and targeted research are accomplished by the over 300 current participants in Skipper Science across Alaska, most of which are commercial fishermen engaging in a variety of fisheries using different gear types. The Skipper Science outreach season begins in March and concludes in late fall when staff of the Skipper Science partnership travel across the state and to the Lower 48, hosting and participating in a variety of outreach and engagement strategies such as:

- Organizing “mug-up” events, offering invaluable training and engagement opportunities for participants over a cup of coffee;
- Walking the docks in fishing communities, enabling direct interaction with community members;
- Attending industry and research conferences and delivering presentations to share insights and collaborate with stakeholders from diverse backgrounds; and,
- Establishing information booths during various events to showcase research findings and promote scientific awareness.

Each of these activities plays a crucial role in achieving the overarching mission of Skipper Science to bridge the gap between scientific research and public understanding, fostering a culture of engagement and collaboration for the resilience of Alaskan fisheries (See Appendix 4 for a detailed list of our 2023 outreach efforts).

General Season Outcomes

In 2023, Skipper Science continued to employ existing smartphone and web technology to facilitate data collection and observations from the fishing grounds of Southeast Alaska and Bristol Bay, Alaska. During the season, we received several observations considered “general” which span a range of environmental and ecological foci. See Table 1 for a summary of observations collected from March 1- September 30th.

Table 1. The observations logged during the 2023 Skipper Science season are generally categorized into broad categories

Observation Category	Total Observations
Marine Mammals	61
Fish	54
Birds	36
Marine Invertebrates	15
Other	7
Total	173

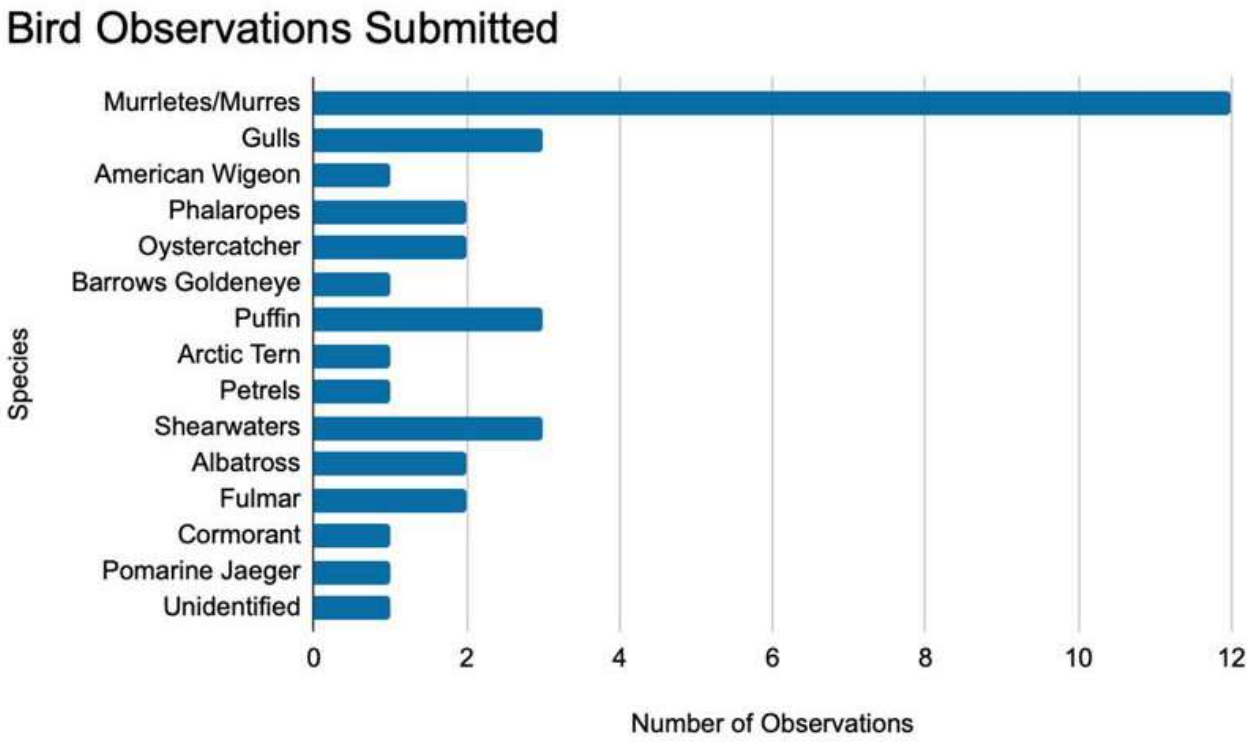


Figure 1. There were a total of 36 observations of various bird species logged in the Skipper Science database during the 2023 season. Most observations were focused on murres and/or murrelets, followed by gulls, puffins, and shearwaters.

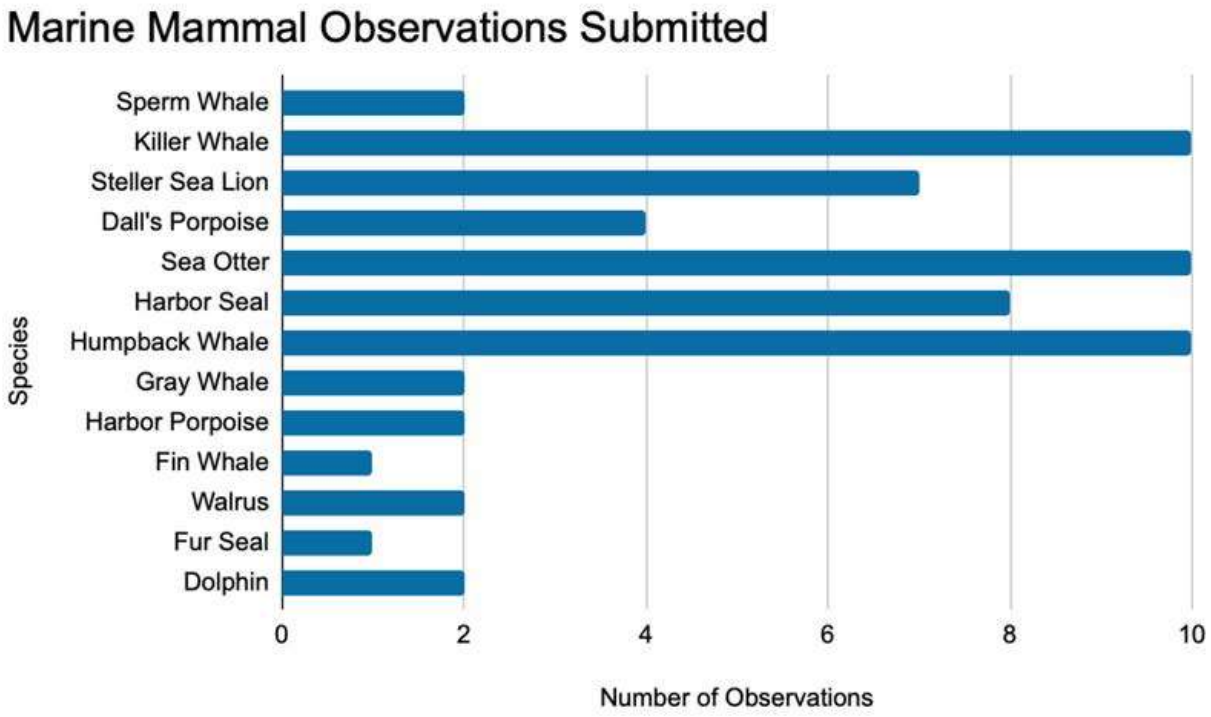


Figure 2. There were a total of 61 observations of marine mammals logged in the Skipper Science database during the 2023 season. Killer whales, sea otters and humpback whales received the highest frequency of observations; followed by harbor seals, Steller sea lions and Dall's porpoise.

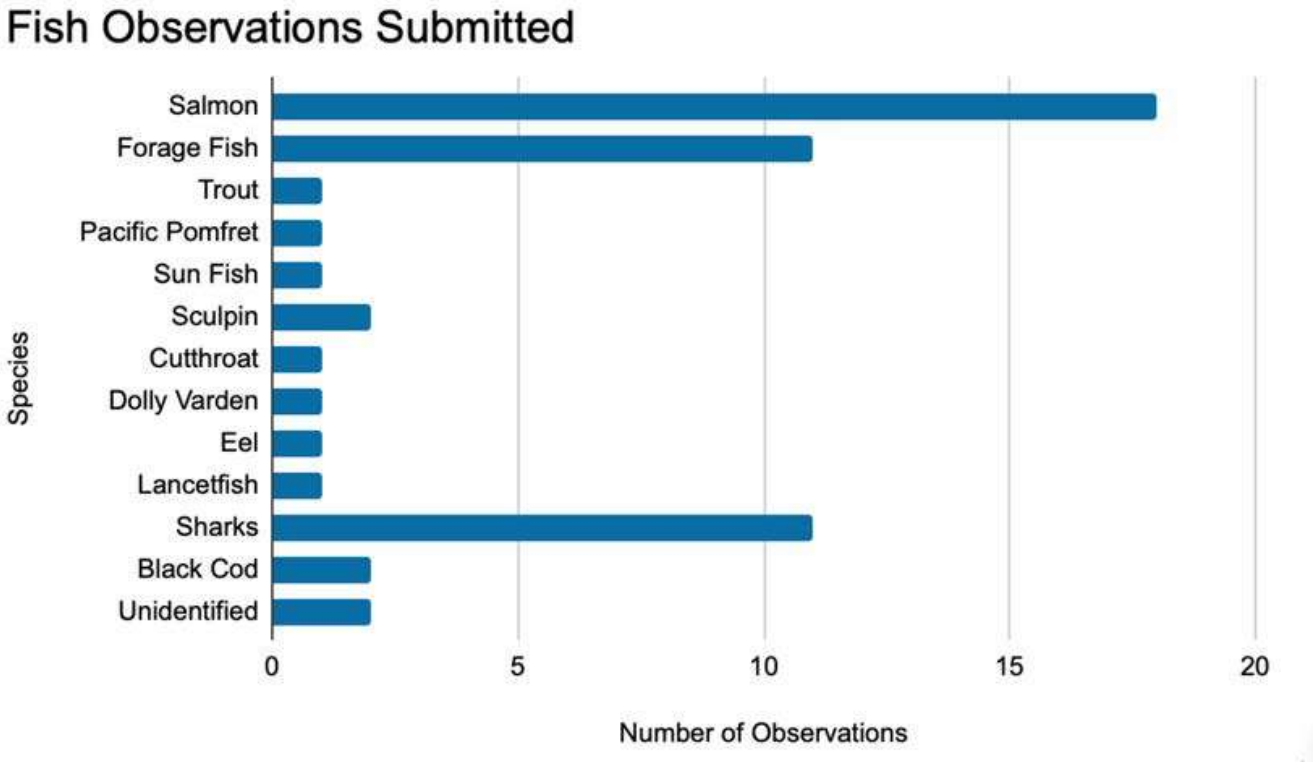


Figure 3. There were a total of 54 observations of fish logged in the Skipper Science database during the 2023 season. Salmon received the most observations, followed by "forage fish"and observations of sharks.

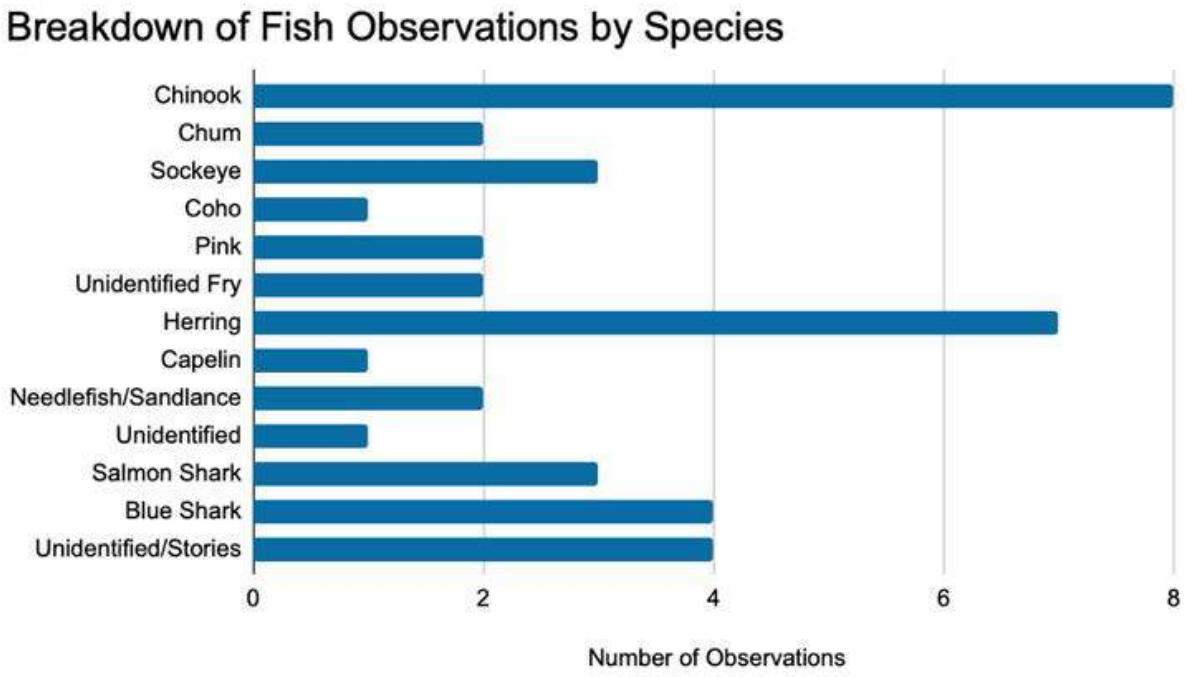


Figure 4. This figure further breaks down salmon, forage fish, and shark observations by species with chinook salmon being the most observed out of the three groupings.

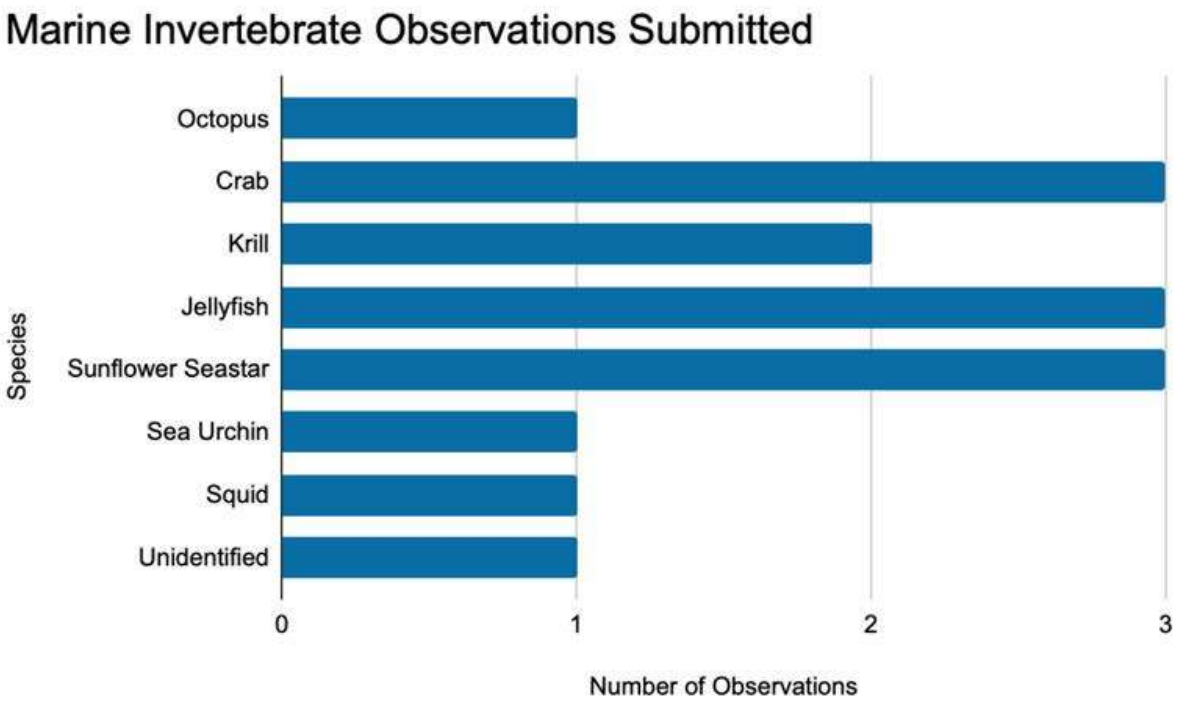


Figure 5. There were a total of 15 observations of marine invertebrates, including species of crab, jellyfish, sea stars, krill, octopus, urchins, squid and unidentified species.

Sunstars of Ketchikan

I miss the sunstars of Ketchikan,
relics of a wild past;
memories like a drink half full
emptied into a larger glass.
Without them I am alone
wondering what will be;
and I try not to cry
while starring
starry-eyed into the sea.

-Santiago Of Southern Southeast

Photo Credit: Sunflower Seastar, Kåre Telnes

The poem above was submitted to Skipper Science as a response to a call for sunflower seastar observations that was requested by NOAA. What we consider an observation is co-defined by what people are inspired to send in and share with us. Observations can illustrate many things about our environment, including what our relationship to it is.

Targeted Research Projects

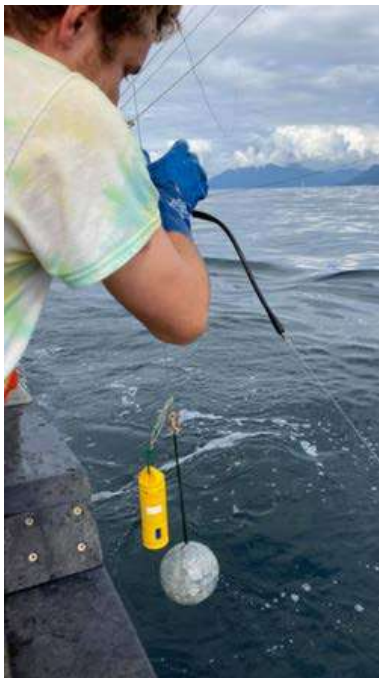
Our 2023 season produced observations specific to several targeted research projects seeking specific data collection across a variety of topics. Skipper Sciences targeted research projects are often the result of co-creating projects based on local input and priorities. For example, many of the projects are developed in workshops that Skipper Science hosts to bring researchers and fishermen together to discuss questions about sustainable fishing practices, ecosystem health, marine biodiversity conservation, and the impacts of climate change on fisheries. Below we detail the results of each of this season's targeted research projects.

Additionally, it is important to note that in our targeted research programs, we prioritize honoring the time, expertise, and contributions of all participants. We recognize the importance of exploring different rates of compensation, especially when collaborating with communities in co-creating research projects. We have found that providing honorarium in various forms (i.e., fuel for travel, monetary compensation, etc.) has been a vital component of effective community-driven monitoring (CDM). Each targeted research program's payment structure varies based on the nature of the work and available funding. In 2023, payments for research participation ranged from $500 to $2,000 per person, reflecting our commitment to compensating participants fairly. The general observation programs offered participating fishermen the opportunity to win one of three $500 raffle prizes, while some other targeted research projects that require more complex data collection strategies (i.e., collecting samples of black cod stomachs; installing equipment; etc.) were offered $1000 for 10 samples, or $1500 for installing a sensor on their vessel for up to 12 months. Each of the sections below will describe the type of targeted research project and its associated compensation efforts.

Moana Near-Shore Water Temperature at Depth Data Collection Program

The Moana Temperature Depth Sensor Program is a program that collects water temperature at depth in real time through the use of unobtrusive sensors. This targeted research project in Skipper Science is conducted in collaboration with the Ocean Data Network (ODN). Skipper Science purchased 6 sensors from ODN and received support from ODN for installation services and data management for the temperature sensors themselves and the resulting data.

Image Above: Solar-powered deck unit that receives the data from the Moana Sensor
Image Below: Sensor being deployed on a Salmon Trolling vessel line in Southeast Alaska



The Monana sensors are entirely self-sufficient and do not require any extra steps when deployed to collect data. The unique solution that the Moana Temperature Sensor Program offers is a cost-effective and passive way to collect water temperature at depth and in near-shore areas. As noted earlier in this report, ocean data is the key foundational ingredient in climate monitoring, weather forecasting, marine sciences, and more. However, collecting temperature data, especially in more remote and vast areas, is technically challenging and expensive. Data is lacking where needed most - shelf and coastal seas - and this is where fishing activity in coastal communities can effectively fill gaps in subsurface ocean data. The MOANA Project based out of New Zealand is an ocean temperature and conditions monitoring research project. Moana TD temperature sensors are built in New Zealand by ZebraTech which started as an effort to enhance comprehension of coastal ocean circulation, marine heat waves, and overall temperature trends, to bolster the sustainability and expansion of seafood industries. These sensors have been used by fishermen around the world in New Zealand, the US East Coast, and Greenland.

Fishermen who sign up to participate in the Moana Sensor Program supported by Skipper Science receive the sensor itself that gets connected to a pot, line, net, etc., and the solar-powered ZebraTech Deck Unit that gets mounted on the vessel itself and stores all the data that is transmitted via Bluetooth once the sensor

surfaces after being submerged. The sensors collect temperature data every meter up to 200m, and then every 4m from 200 m-1000 m. The deck unit processes data via cellular network or wifi once either is available.

During the 2023 season, Skipper Science collaborated with two fishing vessels to deploy the sensors. The first vessel collected water temperature data from 14 tows while fishing in one fishery and gear type from July to August 2023 (See Image 2). The second vessel collected water temperature data from 674 tows while fishing various fisheries and gear types from July to September 2023 (See Image 3).

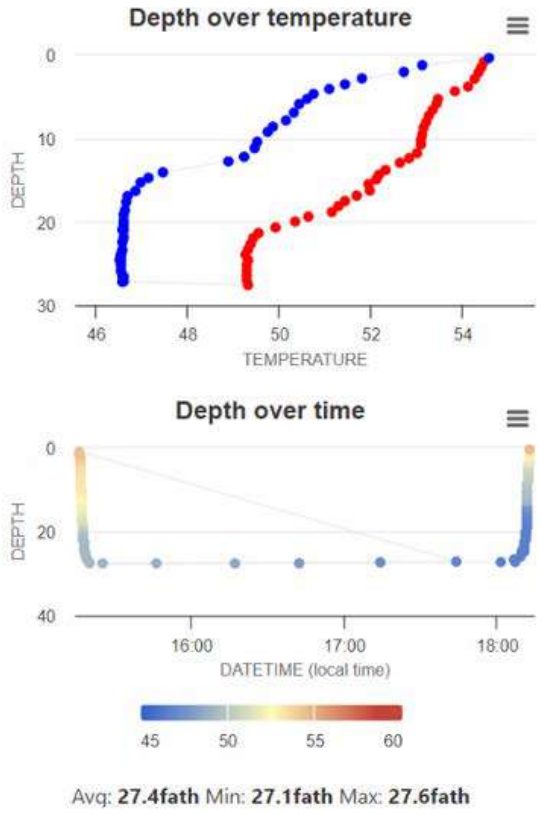


Figure 5. Temperature profile from a tow that occurred in August 2023 at 6:12 p.m., Temp: 48.0ºF, Depth: 27.4fath, Gear sinking time: 3min 39sec, Fishing time: 2h 56min 47sec.

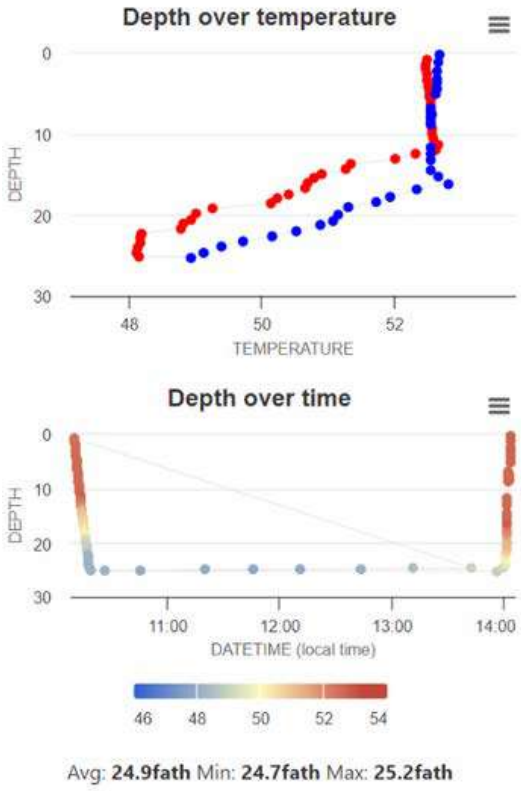


Figure 6. Temperature profile from a tow that occurred in September 2023 at 2:03 p.m., Temp: 48.2ºF, Depth: 24.9fath, Gear sinking time: 8min 1sec, Fishing time: 3h 53min 21sec.

This targeted research project is an example of how Skipper Science Partnership and Ocean Data Network are working together to bring Moana sensors to Alaskan fishermen to collect ocean temperature. This project offered a stipend of $1500 for the use of the sensor for up to 12 months for fishermen who gave their time and effort to install and use the sensors. Importantly, the use of these types of monitoring tools and sensors has the potential to benefit the fishing industry by empowering communities to contribute to climate science, sustainable fisheries management, and research that meets their needs and priorities.

Black Cod Stomach Sampling Project

The Black Cod Stomach Content Collection project is a partnership with National Ocean and Atmospheric Administration (NOAA) scientists from the Resource Ecology and Fisheries Management (REFM) Division at the Alaska Fisheries Science Center (AFSC). The project examines feeding habits and food web shifts from recent strong-year classes of Black Cod (Aka: sablefish, Anoplopoma fimbria) in Southeast Alaska and the Gulf of Alaska. The project was first piloted in the Fall of 2022 as a result of a workshop dialogue between fishermen and researchers from REFM. We wrapped up our second year of this data collection program during the fall Black cod season in 2023. Six boats participated in the program in 2023 and collected a total of 68 samples and pieces of data submitted through the Skipper Science app.

Data collected during the sampling process included information such as date and time, location, bait, sex, age class, fork length, and a photo of the stomach contents from each fish spread out on a standard-sized bucket lid. Prey species in each sample are identified from the photos by scientists at the AFSC. Of the 68 samples submitted, some of the most common stomach contents seen included shrimp, fish, and squid. Data analysis for the 2023 season is still ongoing and more results will be released after data quality control and analysis are completed in collaboration with AFSC.

Image 4. Two examples of samples sent in by program participants of a fish head and shrimp recently consumed.

Training for the Black Cod Stomach Content Collection project included digital instructional videos and demonstrations for how to retrieve the stomach sample from the fish, written instructions (see Appendix 2), as well as providing "data collection kits" that included bucket lids and rulers for the sample collection. Stomach samples were not saved and sent to the lab; the example photos below illustrate the method that was co-developed between NOAA scientists and Skipper Science which includes emptying the contents of the stomach of a randomly selected fish onto the lid of the bucket provided and taking a picture of the contents (See Image 4). This method alleviates some of the difficulties in collecting black cod stomachs and stomach contents to bring back to the lab for analysis that must be frozen or chemically preserved, or can get damaged in transit and cannot always be stored in facilities. The 2023 data that was submitted paints a geographic and taxonomic picture of what Black Cod are eating in the fall season in diverse locations and times. This project offered a stipend of $100 per sample up to 10 samples (total of $1000) for fishermen who gave their time and effort to collecting and submitting samples.

Seabird and Gillnet Interaction Project

The Seabird Interaction Observation Project is a collaborative effort between the Skipper Science Partnership and the Alaska Fisheries Development Foundation (AFDF). Fishermen actively participated in 2023 by using the Skipper Science Smartphone App, contributing crucial data for the project. The project focused on understanding seabird interactions in the Alaska salmon gillnet fishery. Engaging fishermen in collecting near real-time observations, the Seabird and Gillnet Interaction Project aimed to shed light on the dynamics between gillnetting activities and seabird presence, addressing potential ecological concerns. Real-time data collection is another source of information for the Marine Stewardship Council (MSC) sustainability certification process for Alaska salmon fisheries. The project provided another mechanism for verifying interactions between gillnetters and seabirds, contributing to the ongoing sustainability considerations and certification process of certain fisheries. Data collected through this collaboration project between Skipper Science and the Alaska Fisheries Development Foundation will be used to explore interactions between gillnetters and seabirds. Results from this year included a total of 9 vessels from Southeast and Prince William Sound that actively uploaded data entries (a total of 563 data points) over 3 months, demonstrating the success of the pilot project.

Exit interviews were conducted with all fishermen who participated in the program which took place over the phone and lasted anywhere from 10 minutes to 30 minutes. The questions ranged from semi-structured open-ended questions, specifically directed questions, and questions that were answered on a scale of 1-5 (see Appendix 5). These interviews were an opportunity for us to get to know the fishermen better, learn some of their bycatch avoidance techniques and recommendations, verify data, get their feedback on the experience of the program and data collection form/process, how the program can be improved in the future, and gauge interest for future directions of the project. As this project was specifically centered around the reporting of bycatch, two of the exit interview questions asked of the participants of the program were: 1. "How did they avoid seabird bycatch and interactions?" and 2. "What recommendations are there for how Alaska gillnet fishermen can best avoid seabird bycatch and interaction?". The most common answers for both questions were to **not set the net at night, wait and be patient, and pay attention to where the seabirds are and adjust your activities accordingly.**

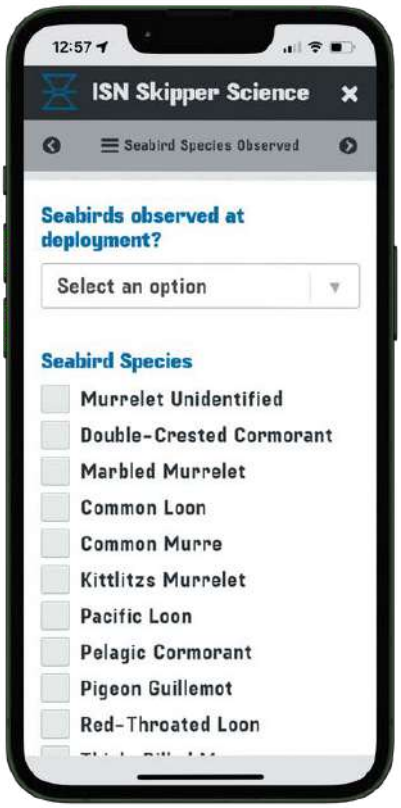


Image Above is an example of a page in the data collection mobile application that fishermen see when logging data for the seabird gillnet interactions targeted research project.

The combination of both the real-time seabird data conducted by the fishermen themselves and the interviews offer context into methods for gillnetting in avoidance of seabirds, is helpful for us to continue to offer the project in ways that do not inconvenience fishermen, as well as communicate their context and knowledge to those who are not always aware of these practices and insights. Almost all participants in this program have been fishing most of their lives and came from fishing or gillnetting families, with others beginning later in life but still with family connections to fishing. The full analysis of data from these 9 vessels that are serving as a reference fleet is still ongoing, and a more detailed report on this project is forthcoming and will elaborate more on the insights gained from this seabird interactions project. In the future, the project aims to continue providing valuable insights for MSC certification, fostering sustainable practices in the Alaska salmon fishery. Future directions of this project include piloting electronic monitoring as an addition to the survey form reported by fishermen as a way of verifying reported data. If you're a gillnet fisherman and interested in participating in this program, please contact us at info@skipperscience.org

Nushagak King Mapping Project

The Nushagak King Mapping Project was the first of its kind and was a collaborative effort involving Skipper Science, the Bristol Bay Regional Seafood Development Association (BBRSDA), and the University of Washington's Alaska Salmon Program. The pilot project ran from May through August of 2023 and aimed to address the challenge of fishery closures resulting from low king salmon returns in the Nushagak and Bristol Bay regions of Alaska. The project focused on understanding the temporal and spatial patterns of Nushagak King salmon. Gaining first-hand knowledge from fishermen about king salmon's presence in the Nushagak district is crucial. One of the hopes for the project was that the data collected could help establish king salmon corridors, allowing for earlier openings of sockeye fishing in areas outside these migration corridors. The participation of community members and fishermen was vital for developing a comprehensive dataset, ensuring informed and effective long-term management decisions while ensuring adequate Chinook escapement. While the project successfully met outreach and training goals. However, the project team faced significant challenges in this pilot project (i.e., time constraints, complicated data collection protocols, etc.), so the ultimate goal of enhancing understanding of temporal and spatial patterns was not achieved in the pilot season due to not enough participation from fishermen on the grounds. Lessons learned include the importance of effective outreach strategies and addressing technical and training barriers. If this program were to run again, future expectations involve refining the approach based on feedback received, incorporating different data entry methods, and exploring additional incentives for participant engagement. This project offered incentives for participation including a $1000 gift certificate to either LFS or SeaMar; a trip to Brooks Camp; a trip to the University of Washington’s Aleknagik Research camp; and BBRSDA hoodies and hats.

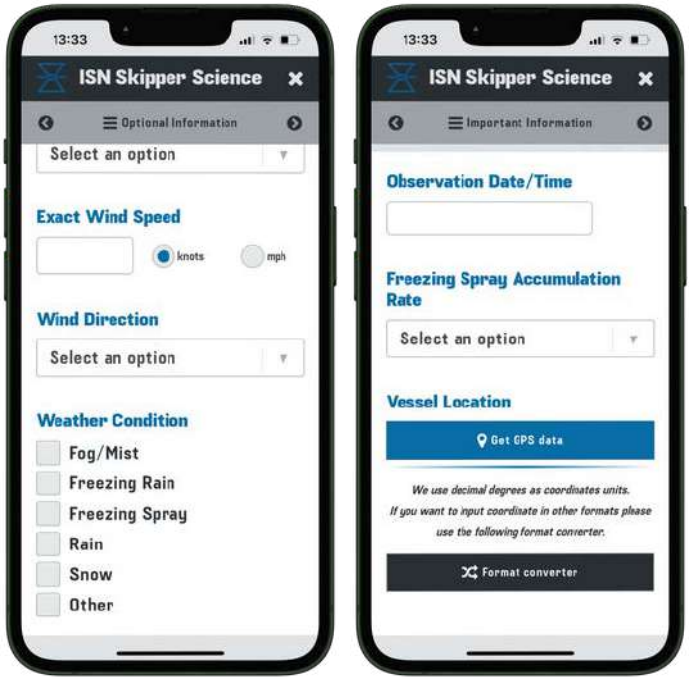
Preview of Pilot 2024 Targeted Research Project

Freezing Spray Forecasting Project

The Freezing Spray Guidance Improvement Project ("Freezing Spray Project") involves collaboration between the Skipper Science Partnership, the National Weather Service (NWS), the Marine Exchange of Alaska, Alaska Ocean Observing System (AOOS), and Axiom Data Science. This project launched in early 2024 and will run for 3 years. The project aims to address the issue of vessel sinking due to vessel ice accumulation, which is the leading cause of marine fatalities in Alaska waters. Specifically, it targets the improvement of Freezing Spray Guidance for higher latitude marine areas, focusing on the Bering Sea and Gulf of Alaska. Collecting observational data through the Skipper Science Partnership program in addition to other methods is crucial for improving and ground-truthing forecasts of freezing spray events. The project seeks to help with the following: (1) validate modeling algorithms used by NWS to create forecasts and (2) identify biases in the existing Freezing Spray Guidance algorithms. The ultimate goal is to enhance the forecasting of freezing spray events, reducing risks to vessels while ensuring maritime safety.

Environmental Conditions Observation Fields	
Field Name	**Type**
Date/time	Date Time
Reported by	Varchar 255 (single line text)
Weather Method	Dropdown / List / Select one
Weather Condition	List / Select multiple
Wind Speed	Dropdown / List / Select one
Wind Direction	Dropdown / List / Select one
Air Temperature	Number (decimal)
Air Temperature Unit	Boolean (Fahrenheit / Celsius)
Tide	Dropdown / List / Select one
Sea State/River Level	Dropdown / List / Select one
Water Measurement Type	Dropdown / List / Select one
Water Temperature	Number (decimal)
Water Temperature Unit	Boolean (Fahrenheit / Celsius)
Comments	Varchar 255 (multi line text)
Audio comments	Audio recording
Latitude	Coordinate
Longitude	Coordinate
Altitude (m)	Number (decimal)
Location Accuracy (m)	Number (decimal)
Altitude Accuracy (m)	Number (decimal)
Images	File(s)

The table above is an example of the list of potential data fields in the Freezing Spray project protocol that was co-created in the design phase of the project.



Images Above are examples of pages in the data collection mobile app that fishermen see when logging data for the Freezing Spray targeted research project.

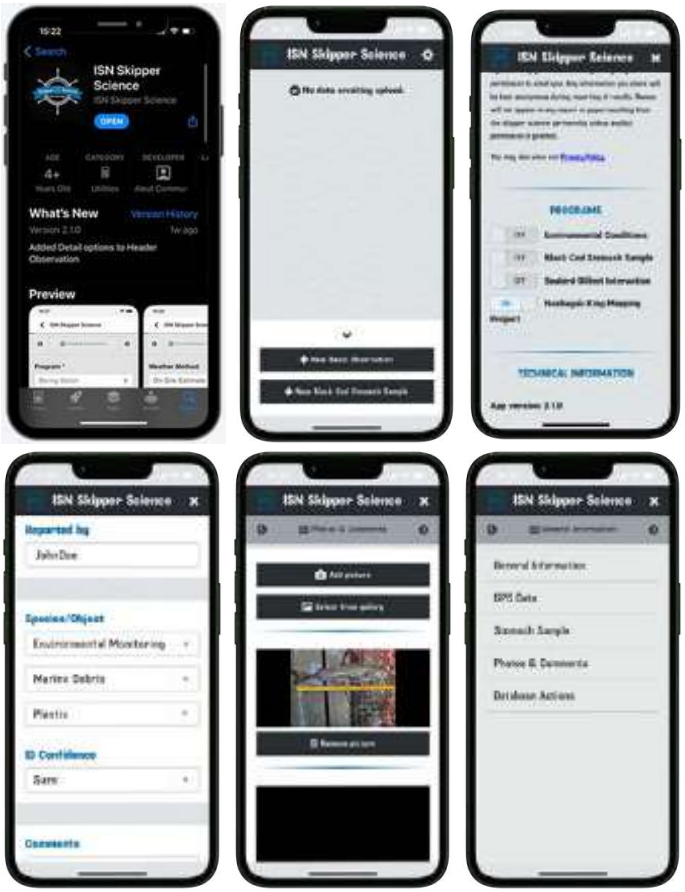
Observational data gathered through the Skipper Science program and data pulled from sensors used by the Alaska Marine Exchange will be utilized for modeling algorithm validations. The insights gained will guide adjustments and improvements to the existing Freezing Spray Guidance algorithms employed by NWS, thereby enhancing the accuracy of forecasts. While planning and collaborations among partners began in Fall 2023, the project officially launched in early 2024 and will run for three years in the Bering Sea and Gulf of Alaska. The collaboration aims to establish a community-driven monitoring program, leverage unique expertise within commercial fisheries, and demonstrate a model of collaborative science for addressing environmental challenges in Alaska. Future expectations include refined forecast modeling algorithms, enhanced maritime safety, and strengthened relationships between the fishing industry and scientists/managers in the face of climate-driven changes.

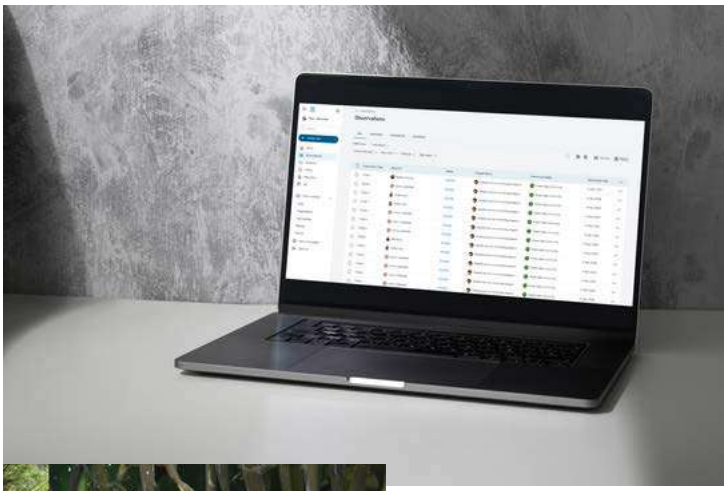
A Canadian Coast Guard Ship in the Arctic Ocean. Original public domain image. CCO 1.0 DEED. CCO 1.0 Universal

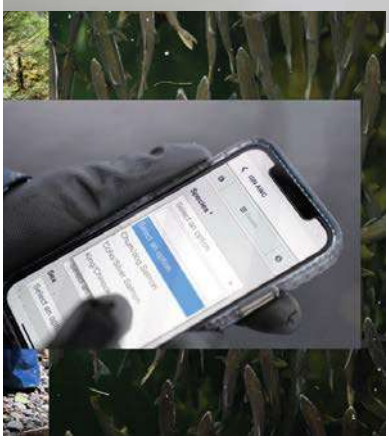
Software and Technology

The Skipper Science app is available for free download for either iOS or Android devices from the Apple App Store and via Google Play, respectively. Skipper Science's technology platform (both the mobile apps and the online community-owned database) is powered by and adapted from the Indigenous Sentinels Network (ISN). During the 2023 season, the Skipper Science app provided participants with a single platform to systematically document physical and biological phenomena on the water. Fishermen who register and sign up to participate in the program receive a secure, unique login with a username and password. The app and database are designed to ensure that user information and sensitive knowledge are protected (i.e., fishing spots, personal information, etc.). The app is designed to guide the user through a series of pages that highlight what information may be valuable to collect. As discussed above, project protocols can range from seabird data collection to weather observations, and methods are co-created and developed in collaboration with researchers, scientists, and community member input.

It is important to note that users can either record information while out on the water or input information once they are back on land. The app does not require wifi or a cell signal to use; rather, information just needs to be saved after data is collected. All data is saved safely on a user's device until it can be securely uploaded with a steady wifi or cell signal. See the images below as examples of the Skipper Science data collection platform.







INDIGENOUS
SENTINELS NETWORK

Conclusion

The activities and projects described throughout this 2023 Skipper Science Annual Report underscore the program's pivotal role in advancing community-driven monitoring and climate-resilient fisheries in Alaska. By leveraging partnerships and engaging stakeholders, Skipper Science has become a trusted program and platform for gathering ecological data and fostering collaboration among fishermen, scientists, and policymakers. Through innovative technology and outreach efforts, the program empowers fishermen to contribute to real-time data collection, enhancing our understanding of marine ecosystems. As Alaska faces unprecedented climate challenges, Skipper Science will continue to catalyze adaptive management and local stewardship. Moving forward, the program remains committed to its mission of promoting sustainable fisheries and ecosystem resilience through community empowerment and scientific collaboration.

THANK YOU

CONTACT US :

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Skipper Science Partnership

Appendices

Appendix 1

Skipper Science in the Press in 2023

"In Depth Alaska: Skipper Science" Podcast
Alaska's News Source Channel 2
"App creators hope to fold more local voices into the fishing council process"
"Skipper Science hosts mug-up in Cordova"
"Skipper Science Partnership brings focus to Bristol Bay's king salmon"
"Fishers Encouraged To Participate In App-Based Scientific Research Project"
"Pilot project focuses on gillnet, seabird interactions in fisheries"
Skipper Science in National Fisherman

Appendices

Appendix 2

Black Cod Sample Protocol Guide

Skipper Science Fish Stomach Content Imaging Protocol

Updated: Oct. 17th 2022

Start here

Log into ISN Skipper Science app, and click " + New Observations"
In a sampling session use the arrows or the menu bar to navigate to the following pages in the app and fill them out:

- GPS Location
- General Information
- Observation Details
- Images
- Database Actions (Save)

Select a fish to sample: this should be fairly random process – you decide how to implement it (grab every 10th fish, reach into a bin and grab one, etc). Track the number of empty stomachs between stomachs with prey and record the number discarded in the Comments box in the "General Information" page of the app.

When you find a stomach with contents record the relevant information on the Observation Details page of the app.

- Species/Object – Fish & Wildlife > Fish > Sablefish
- Presence/Absence – present
- ID Confidence – Sure
- Sex – Male or Female
- Age Class – Adult (or another category if relevant)
- Exact Count – 1

Measure the fork length of the fish to be sampled and its location if possible and record in the Comments box on the Observation Details page of the app.

Remove the stomach cutting as close to the gill arches as possible and between the stomach and intestine. Cut open the stomach and place the contents on the bucket lid for imaging, use the underside of lid. If there is obvious bait in the stomach, remove it. Then place the ruler above the contents on the bucket and snap a picture using the "Add picture button" in the Images page of the app

IMPORTANT – When you are finished recording the information for a sample be sure to hit the blue Save button on the Database Actions page of the app to save your observation.

After you save the observation, it should be listed on the Landing Page of the SS app. The observation will be saved on your mobile device until you have a signal or wifi and upload it to the Skipper Science database.

See the back/next page for examples photos.

Need help? Call Hannah-Marie Garcia at (843)991-9427
Or email info@skipperscience.org

INDIGENOUS SENTINELS NETWORK

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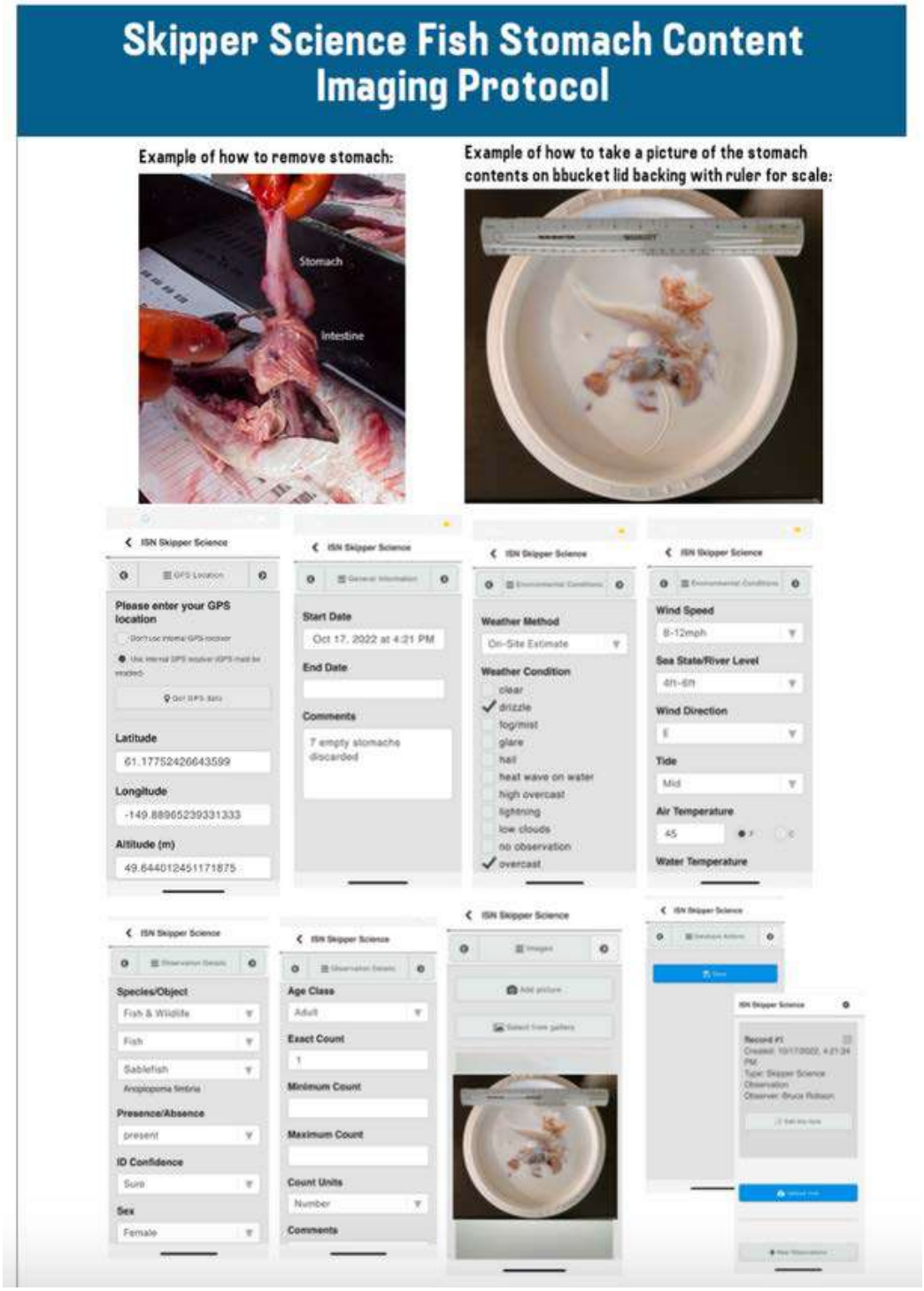
Appendix 2

Black Cod Sample Protocol Guide



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Appendix 3

2023 Collaborators and Sponsors

Skipper Science is incredibly grateful to our 2023 Season Collaborators and Sponsors:

- Alaska Fisheries Development Foundation, Inc.
- Alaska Longline Fishermen's Association
- Alaska Marine Conservation Council
- Alaskans Own
- Aleut Community of St. Paul Island Tribal Government
- Aleutian Bering Sea Initiative
- Bristol Bay Regional Seafood Development Association
- Central Bering Sea Crabbers
- Central Bering Sea Fishermen's Association
- Commercial Fishermen for Bristol Bay
- Copper River Seafood Marketing Association
- Cordova District Fishermen United
- Indigenous Sentinels Network
- NOAA
- SalmonState's Salmon Habitat Information Program (SHIP)
- Sitka Conservation Society
- Su Salmon Co.
- Taku River Reds
- United Cook Inlet Drifters Association
- Yakobi Fisheries LLC. Wild Caught Alaskan Seafood

Appendices

Appendix 4

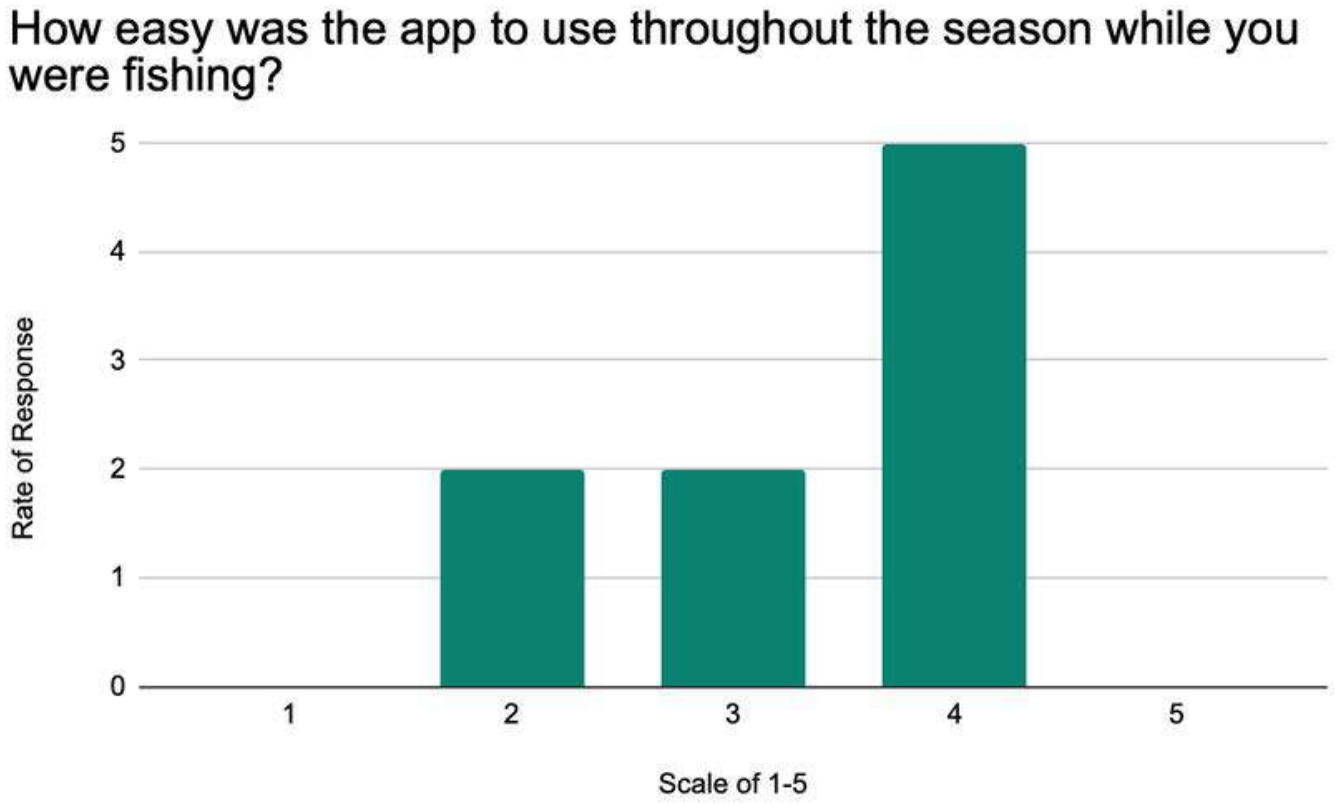
2023 Outreach Activities			
Event	**Date**	**Location**	**Engagement Type**
ComFish	March 16-18th	Kodiak	Booth and Presentation
BBRSDA Presentation	June 8th	Naknek	Presentation
Naknek Outreach	June 13th	Naknek	Mug-up, Dockwalking, Booth
Dillingham Outreach	June 15th	Dillingham	Mug-up
Gustavus Outreach	May 4th	Gustavus	Mug-up
Cordova Outreach	May 17-19th	Cordova	Mug-up
Petersburg Outreach	May 18th	Petersburg	Mug-up
Juneau Outreach	June 30th	Juneau	Mug-up
Homer Outreach	June 22nd	Homer	Mug-up
Homer Summer Solstice Festival	June 21st	Homer	Booth
UCIDA Presentation	June 23rd	Soldotna	Presentation
Kake Kids Fishing Derby	August 5th	Kake	Booth
Pacific Marine Expo	November 7-10th	Seattle	Booth

Appendices

Appendix 5

Answers ranked 1-5 from all nine participating fishermen in the seabird gillnet interaction project

The following figures are the visualization of quantitative interview questions that were a part of the seabird gillnet interaction project exit interviews. The heading to each figure is the question asked, the y axis identifies how many interviewees answered a certain number for their response, and the x axis is the numerical answers from 1-5. The purpose of these questions was to gauge this cohort's experience with the program and the Skipper Science app, interest in future participation, and how the MSC certification influenced their participation in the program. As these interviews were semi-structured, individuals were given the opportunity to give longer responses contextualizing their answers if they wished to do so.



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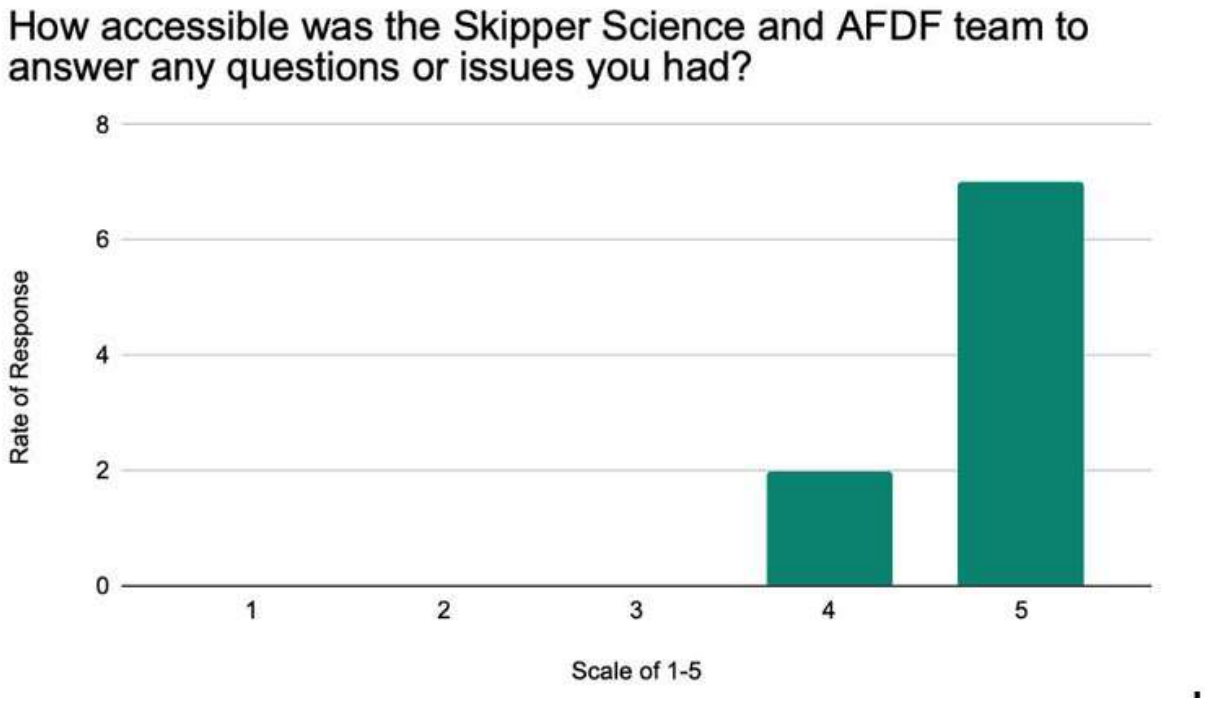
Appendix 5



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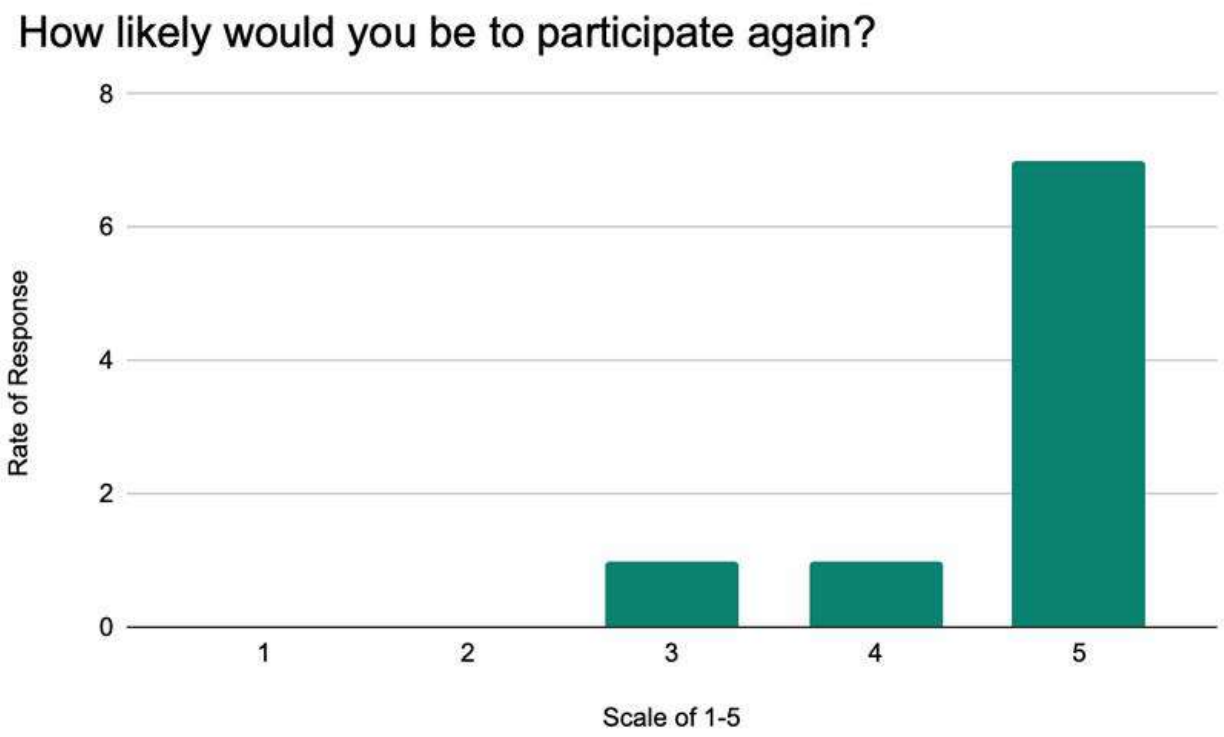
Appendix 5



THANK YOU

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