Cooperative Research

Strategies for integrating industry perspectives and insights in fisheries science

Program and Abstracts
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Alaska Sea Grant
College of Fisheries and Ocean Sciences
University of Alaska Fairbanks
PO Box 755040
Fairbanks, AK 99775-5040 USA
alaskaseagrant.org
seagrant.meetings@alaska.edu
Cooperative Research: Strategies for integrating industry perspectives and insights in fisheries science

Program and Abstracts

32nd Lowell Wakefield Fisheries Symposium
Hotel Captain Cook
Anchorage, Alaska USA | May 7–9, 2019

After the symposium, please fill out the evaluation survey at https://www.surveymonkey.com/s/cooperative-research
Overview
The registration desk will be open at 7:00 am on Tuesday, May 7, at the Hotel Captain Cook, for name badge and symposium materials pick-up. Presentations will begin on Tuesday morning.

A breakfast buffet will be available each morning at the conference “Mid Deck” from 7:15 to 8:30 am. On Tuesday evening a reception with buffet dinner will be 6:00 to 9:00 pm at the nearby 49th State Brewing Co., 717 W 3rd Ave. On Wednesday evening, 6:00 to 9:00 pm, there will be hors d'oeuvres and a cash bar during the poster session in the Aft Deck at the hotel. All other meals are on your own.

Oral presentations and posters on Cooperative Research: Strategies for Integrating Industry Perspectives and Insights in Fisheries Science will be presented in the following sessions:

Session 1: Industry and Community Engagement
Session 2: Assessments and Surveys
Session 3: Improving Methods and Reducing Impacts
Session 4: Information Exchange and Directed Research
Session 5: Informing Management

Invited Speakers

Robert Foy is the Science and Research Director of the NOAA Fisheries Alaska Fisheries Science Center. He received a B.S. in Biology from the University of Michigan and an M.S. in Fisheries and a Ph.D. in Oceanography from the University of Alaska. He has spent over 20 years conducting marine biological and ecological research and 10 years working on stock assessment and fisheries management. He has participated in and led numerous cooperative research projects with agencies, coastal communities, and commercial industries. is the Science and Research Director of the Alaska Fisheries Science Center. Bob joined NOAA Fisheries in 2007 as the Director of the Center's Kodiak Laboratory and Program Manager for the Shellfish Assessment Program. He led the program on assessment, biological, and ecological research of commercial crab species in Alaska. Bob earned a Bachelor of Science in Biology from the University of Michigan, a Master in Science in Fisheries and Ph.D. in Oceanography from the University of Alaska.

Mr. Scott Goodman has over 23 years’ experience in cooperative research projects along the Pacific West Coast and Alaska. Scott is a partner and current President at Natural Resources Consultants, Inc. (NRC) and draws from experience working with founding and prior partners, Lee Alverson, Steve Hughes and Jeff June, on hundreds of NRC research and legal projects over the years. Scott’s strong focus over the last 10 years has been on cooperative crab research in the Bering Sea, working with fishermen and government researchers on large scale crab research and management issues. Currently, he is the Executive Director for the Bering Sea Fisheries Research Foundation (BSFRF) helping lead industry-supported, cooperative research focused on improving science for sustainable crab management in the Bering Sea. Under Scott’s oversight, BSFRF prioritizes and conducts approximately $1 million in cooperative crab research, annually. Scott has appreciated tackling some of the more difficult issues that are important to continue improving sustainable fisheries management, especially projects that include close stakeholder involvement. He continues NRC research on several ongoing projects that rely on a working knowledge of the industry, monitoring of U.S. commercial fisheries, quota asset valuations for Alaska/West Coast interests, and spatially sensitive analyses of global fishing trends. Scott is a western Washington native, lives in Everett with his family and greatly enjoys being on the water for both work and play.
**Dr. Claus Reedtz Sparrevohn** is the Chief Science Officer for the Danish Pelagic Producers Organisation. He is a trained fishery biologist holding a PhD degree from Wageningen University on coastal fish ecology. Dr. Sparrevohn worked as a researcher at the Technical University of Denmark, DTU Aqua until 2013, where he moved to the position as chief-scientist for the 11 largest Danish pelagic vessels. In his present position, Dr. Sparrevohn disseminate the scientific advice to the industry, and industry knowledge to the scientific community. He is also responsible for engaging industry in scientific projects and data collection initiatives, aiming at longterm sustainable fisheries management. Throughout his career Dr. Sparrevohn has been a member of several ICES expert groups and participated in numerous ICES Management Strategy Evaluations and benchmarks.

**Professor Kevin D. E. Stokesbury** received his B.Sc. and M.Sc. degrees from Acadia University, his Ph.D. from Universite Laval, and is the former Chair of the Department of Fisheries Oceanography at the University of Massachusetts Dartmouth. His research focuses on the principles of marine and estuarine ecology, fisheries biology, population dynamics, and marine ecosystems. A continuous theme is spatial and temporal distributions, on various scales, of marine invertebrates and fish, and how these distributions relate to community structure and habitat. Since 1999 his laboratory with members of the commercial sea scallop industry have completed over 200 video cruises surveying Georges Bank and the Mid-Atlantic (>1000 days at sea) covering the entire scallop resource (70,000 km2) from 2003 to 2018. These data provide assessments of scallop and other macroinvertebrate densities, and sediment and habitat distributions in closed and open areas in US and Canadian waters. This work aided in developing limited fisheries in the closed areas of Georges Bank, which resulted in a catch worth $30 million in 1999 and $25 million in 2000. In 2003, the video survey expanded to cover the entire scallop resource; this doubled the estimate of abundance, worth approximately US $2.4 billion. The survey protocol has been accepted by the National Marine Fisheries Service as a complete independent stock assessment, one of only 6 in the nation. It has been published in over 30 peer-reviewed scientific papers. Over 200 student, scientists and fishermen have worked together on this project. For the past 18 years New Bedford, MA, has been the number one fishing port in the United States for value landed because of the sea scallop harvest.

Twenty years experience as a commercial rock lobster fisherman on the southern north island coast of New Zealand gave **Daryl Sykes** both inspiration and enthusiasm to pursue a new career in fishery research and management planning. Frustrated at the levels of communication and response between working fisherman and fisheries managers Daryl has paid particular attention to facilitating improved levels of understanding and respect between fisheries stakeholder groups and agency scientists and managers, leading to well informed and better directed decisions and outcomes. Daryl became actively involved in the politics of the New Zealand fishing industry in 1984 when he was elected to the executive of a national industry organisation. In 1991 he came ashore to pursue full time industry representation and advocacy. After several years as rock lobster industry coordinator for the NZ Fishing Industry Board, Daryl was contracted as Executive Officer of the NZ Rock Lobster Industry Council in 1996 and is currently the Chief Operating Officer. The Council provides a range of policy, advocacy, technical, promotional and administrative services to the industry and is a stock assessment research provider to industry and to the New Zealand Ministry for Primary Industries. In his role as an independent fisheries consultant Daryl has also completed contracts for industry groups and Government agencies in New Zealand and overseas. The contribution to local communities and local economies made by commercial fishermen and their families is a particular focus of the advocacy and strategic planning undertaken by Daryl on behalf of industry. Self governance, voluntary compliance, industry generated research, and collective commercial harvest initiatives within a secure property rights based management framework are recurring themes of presentations that Daryl has made to national and international conferences from 1984 to the present.
Cooperative Research: Strategies for integrating industry perspectives and insights in fisheries science

TUESDAY, MAY 7

07:00–08:30 Registration and Breakfast  
Breakfast provided at 07:15, Mid Deck, Hotel Captain Cook

08:30–08:45 Welcome  
S. Bradley Moran, Dean, College of Fisheries and Ocean Sciences, University of Alaska Fairbanks  
Melissa Good, Unalaska Extension Agent, Alaska Sea Grant  
Matthew Baker, North Pacific Research Board;  
Chair, Wakefield Symposium Steering Committee

08:45–09:15 Invited Speaker  
Daryl Sykes, Chief Operating Officer, NZ Rock Lobster Industry Council  
Collaboration, or Collusion?—the New Zealand Rock Lobster Fisheries Experience

09:30–10:00 Invited Speaker  
Kevin Stokesbury, Professor, School for Marine Science and Technology, UMass Dartmouth  
Danny Ellertsen, Captain/Owner Liberty, Nordic Inc.  
“Gonna Change My Way of Thinking...”—Collaborative Research in the New England Scallop and Groundfish Fisheries

10:00–10:20 Break

Session 1 — Industry and Community Engagement

10:20–10:40  
Aubrey Ellertson, Commercial Fisheries Research Foundation  
The Commercial Fisheries Research Foundation: Engaging Fishermen to Support Science

10:40–11:00  
Tommy Sheridan, Sheridan Consulting, Inc., Cordova, Alaska  
Alaska Hatchery Research Project: Collaborative Salmon Fishery Research in Alaska

11:00–11:20  
Keith Criddle, University of Alaska Fairbanks  
The Pollock Conservation Cooperative Research Center (PCCRC): A Successful Model of Industry–University Cooperative Research

11:20–11:40  
Owen Nichols, Center for Coastal Studies  
Community-Based Collaborative Fisheries Research: Successes, Challenges and Management Implications

11:40–12:00  
Rachel Donkersloot, Coastal Cultures Research & Consulting  
Advancing Indigenous Collaborations in Fishery Science and Management

12:00–12:20  
Courtney Lyons, University of Alaska Fairbanks  
Qualitative Network Modeling and Integration of Socio-Cultural Stakeholder Perspectives

12:20–13:00 Lunch on your own

13:00–13:30 Invited Speaker  
Claus Reedtz Sparrevohn, Chief Science Officer, Danish Pelagic Producers Organization  
Reflections on Industry Engagement in Science and Science Engagement in Industry—Experiences from Europe

13:30–13:50  
Owen Nichols, Center for Coastal Studies  
Addressing Rebounding Marine Mammal Populations through Community Science

13:50–14:10  
Syverine Bentz, University of Alaska Anchorage Kachemak Bay  
Fisheries Resilience Index: Adapting to Environmental Change through Business Self-Assessments
Session 2 — Assessments and Surveys

14:10–14:30
Pat Malecha, NOAA Fisheries, Alaska Fisheries Science Center
Cooperative Research on the Alaska Fisheries Science Center’s Longline Survey

14:30–14:50
Thomas Heimann, Commercial Fisheries Research Foundation
Using Industry Collaboration to Improve Black Sea Bass Management

14:50–15:10 Break

15:10–15:30
Matt Siegle, ESSA Technologies
Improving In-Season Acquisition of Sockeye Catch-per-Set Information from Commercial Seine Fisheries

15:30–15:50
Josep Planas, International Pacific Halibut Commission
Sex Marking at Sea by the Directed Pacific Halibut Fleet

16:00–17:00 Panel Discussion I
What is Cooperative Research? Where is it Useful?
Panel Facilitator:
Edward Poulsen, Bering Sea Crab Vessels
Panel Participants:
Ruth Christiansen, United Catcher Boats
Danny Eilertsen, Captain/Owner Liberty, Nordic Inc.
Scott Goodman, Bering Sea Fisheries Research Foundation
Leigh Habegger, Seafood Harvesters of America
Kevin Stokesbury, School for Marine Science and Technology, UMass Dartmouth
Daryl Sykes, NZ Rock Lobster Industry Council

18:00–21:00 Wakefield Reception
49th State Brewing Co, 717 W 3rd Ave
Buffet dinner, includes 2 drinks

End Day 1

WEDNESDAY, MAY 8

07:15–08:30 Breakfast provided
Mid Deck, Hotel Captain Cook

08:30–09:00 Invited Speaker
Scott Goodman, Executive Director, Bering Sea Fisheries Research Foundation

Session 3 — Improving Methods and Reducing Impacts

09:00–09:20
Susan Zagorski, North Pacific Fisheries Research Foundation
Collaboration to Develop a Salmon Excluder for the Pollock Fishery

09:20–09:40
Lauren Wild, University of Alaska Fairbanks
Southeast Alaska Sperm Whale Avoidance Project: A Fifteen-Year Collaboration

09:40–10:00
Michael Long, Commercial Fisheries Research Foundation
Preparing for Offshore Wind—A Collaborative Approach to Environmental Monitoring

10:00–10:20 Break

Session 4 — Information Exchange and Directed Research

10:20–10:40
Matthew Baker, North Pacific Research Board
Investments in Cooperative Research with Industry in the North Pacific

10:40–11:00
Mark Chandler, NOAA Fisheries
NOAA Fisheries Cooperative Research Program

11:00–11:20 schedule change
Cheryl Barnes, University of Alaska Fairbanks
Comparative Resource Use by Two Groundfishes in Nearshore Southeast Alaska

11:20–11:40
Christie Lang, NOAA Fisheries, Alaska Fisheries Science Center
Growth per Molt of EBS Tanner and Snow crab

11:40–12:00
Susanne McDermott, NOAA Alaska Fisheries Science Center
Alaska Fisheries Science Center Tagging Studies: 20 Years of Cooperative Research
**Session 5 — Informing Management**

13:30–13:50
Madison Shipley, University of Washington, Bering Sea Fisheries Research Foundation
Risk Avoidance—MSE Collaboration for Eastern Bering Sea Tanner Crab

13:50–14:10
Linda Shaw, NOAA/National Marine Fisheries Service
Best Management Practices to Minimize Spread of Vessel Biofouling from Multiple Vectors: A Practicality Review and Dialogue

14:10–14:30
Brooke Wright, School for Marine Science & Technology, UMass Dartmouth
Projecting Scallop LPUE in the Northeast US with Fishermen’s Help

14:30–14:50
Cara Rodgveller, National Marine Fisheries Service, Alaska Fisheries Science Center
The Evolution of the Sablefish Fishery Logbook Program in Alaska

14:50–15:10 Break

15:10–16:00 Case Study I and Facilitated Discussion
Robert Foy, Director, Alaska Fisheries Science Center
Scott Goodman, Bering Sea Fisheries Research Foundation
Bering Sea Crab Research: A Case Study on the Results of a Successful Cooperative Research Program

16:00–16:50 Case Study II and Facilitated Discussion
Rob Suryan, Auke Bay Laboratories, Alaska Fisheries Science Center
Robert Alverson, Fishing Vessel Owners’ Association
A Case History of Seabird Bycatch Reduction in Alaskan Longline Fisheries

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**Poster Session**

**Poster setup 15:00–18:00**
Aft Deck, Hotel Captain Cook
hors d’ouvres & cash bar

18:00–21:00
Tracy Sylvester, Alaska Longline Fishermen’s Association
ALFA’s Fishery Conservation Network
Josep Planas, International Pacific Halibut Commission
Electronic Monitoring Applications in the Directed Pacific Halibut Longline Fishery

Josep Planas, International Pacific Halibut Commission
Using Hydrophones to Reduce Interactions Between Whales and Longline Gear

Matthew Baker, North Pacific Research Board
Collaborative Research on Species Interactions: Salmon Predation on Sand Lance and Herring

Matthew Baker, North Pacific Research Board
Beneath the Surface—Commercial Submersibles to Research Sand and Sand Lance

Gay Sheffield, Alaska Sea Grant
Line Entanglements on Western Arctic Bowhead Whales—Next Steps

Kate Echave, NOAA/NMFS/AFSC/ABL/TSMRI
AFSC Groundfish Tag Program: Cooperative Research by NOAA and Industry

Stan Kotwicki, NOAA Alaska Fisheries Science Center
Observing Fish Response to Trawls

Jacob Argueta and Syverine Bentz, Kachemak Bay National Estuarine Research Reserve
Fish Need Land Too: Science to Stewardship in Salmon Watersheds

Mark Lomeli, Pacific States Marine Fisheries Commission
Collaborative Conservation Engineering Research in Eastern North Pacific Trawl Fisheries

End Day 2
THURSDAY, MAY 9

07:15–08:30 Breakfast provided
Mid Deck, Hotel Captain Cook

08:30–09:00 Invited Speaker
Robert Foy, Director, Alaska Fisheries Science Center
Cooperative Research at the Alaska Fisheries Science Center: A Requirement for Sustainable Fisheries Management and Protected Resource Conservation

Session 5 – Informing Management
(continued)

09:00–09:20
Alexander Hansell, UMass Dartmouth - School for Marine Science and Technology
Incorporating Fishermen’s Knowledge into an Index of Abundance for Atlantic Halibut (Hippoglossus hippoglossus) in the Northwest Atlantic

09:20–09:40
Christopher Oliver, Alaska Seafood Cooperative
Reducing Halibut Bycatch Mortality through Industry/Government Cooperative Research

09:40–10:00
Aubrey Ellertson, Commercial Fisheries Research Foundation
Bringing in the Experts: CFRF’s Lobster/Jonah Crab Research Fleet

10:00–10:20
Matthew Seeley, Mid-Atlantic Fishery Management Council
Collaborative Research by the Mid-Atlantic Fishery Management Council

10:20–10:40 Break

10:40–11:40 Panel Discussion II
Successful Approaches and Challenges in Cooperative Research: Aligning Interests and Objectives and Facilitating Engagement
Panel Facilitator:
Matt Robinson, Bristol Bay Economic Development Corporation
Panel Participants:
Robert Alverson, Fishing Vessel Owners’ Association
Robert Foy, NOAA Alaska Fisheries Science Center
Nicole Kimball, Pacific Seafood Processors Association
Rebecca Skinner, Alaska Whitefish Trawlers Association
Claus Reedtz Sparrevoth, Danish Pelagic Producers Organization

11:40–12:30
Discussion and next steps

Symposium concludes
PRESENTATIONS

Collaboration, or Collusion?—The New Zealand Rock Lobster Fisheries Experience
Daryl Richard Sykes Chief Operating Officer
NZ Rock Lobster Industry Council, Private Bag 24-901, Wellington 6142, New Zealand, lobster@nzrocklobster.co.nz

The science which has informed management decisions for the valuable New Zealand rock lobster fisheries since the early 1990's has mostly been generated by the lobster industry or conducted in a collaboration between fishermen and fisheries stock assessment personnel. A range of industry-funded stock monitoring initiatives has provided an extensive data base of rock lobster fisheries information which informs operational management procedures used to guide catch setting on a seasonal basis. The often combative and confrontational relationships between industry and management agencies do not apply. Industry has increasingly asserted a management role and responsibility. Industry initiatives in this regard extend across the chain of custody for rock lobster catches—from the ocean to the consumer—and encompass a range of ecological, social and product quality standards. The historical barriers between industry and science are no more; and as a consequence of Government policies, carefully constructed professional collaborations, and the ongoing support of the catching sector, the New Zealand rock lobster industry is a research provider to Government in its own right. This situation has come about in the main as a consequence of the transition to a rights-based management regime in 1990 and the willingness and inventiveness of the industry to invest in taking the custodial and stewardship roles intended of rights holders. The core components have been information, organization, communication and response. The experience provides useful insights and lessons for scientist, managers and for industry participants elsewhere.

“Gonna Change My Way of Thinking...“—Collaborative Research in the New England Scallop and Groundfish Fisheries
Kevin D. E. Stokesbury
School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA, USA

The scallop stocks of New England are a fisheries success story. For 2018 the stock is estimated at 482 million lbs. (scallop meat weight) with a projected harvest of 63 million lbs. For the last 10 years the average landings were 50 million lbs. values at $460 million, for the last 20 years the average landings were 46 million lbs. valued at $345 million, and from 1970 to 1996 the average landings were 20 million lbs. valued at $81 million (NOAA data). This success is the result of nature providing the right conditions for the scallops to produce large numbers of offspring, scientists and the fishing industry working together to develop new ways to document the numbers of scallops, their distribution, size and biomass, and agencies being open to new ideas on rotational management and flexible enough to act on the new scientific data. From the start, fishermen were involved at all levels. The SMAST Fishermen's Steering Committee meets regularly to discuss issues facing the industry and the resource, and how science can help address these questions. The scallop industry also set aside a portion of their quota, which the National Marine Fisheries Service now distributes through the RSA program (Research Set-Aside). The results have been a sustainable fishery with reduced environmental impact, and economic prosperity. Now these ideas on cooperative research are being applied to the groundfish industry of New England.
The Commercial Fisheries Research Foundation: Engaging Fishermen to Support Science

Anna Malek Mercer  
Commercial Fisheries Research Foundation, Kingston, RI, USA, amalek@cfrfoundation.org

Fred Mattera  
Commercial Fisheries Center of Rhode Island and F/V Travis & Natalie, Point Judith, RI, USA, fredmattera@cfcri.org

David Spencer  
F/V Nathaniel Lee, Newport, RI, USA, drspencer1@gmail.com

Aubrey Ellertson  
Commercial Fisheries Research Foundation, Kingston, RI, USA, aellertson@cfrfoundation.org

The Commercial Fisheries Research Foundation (CFRF) was established in 2004 to provide fishermen with opportunities to contribute to the science and management of key fisheries resources. Founded and led by members of Rhode Island’s fishing community, the CFRF develops practical solutions to scientific and supply chain challenges, such as providing fishermen with specialized apps to collect biological and environmental data while at sea, and developing digital maps of seafood access points in Rhode Island. While doing so, the CFRF has engaged over 150 fishermen and over 300 scientists and seafood professionals across the East Coast in its work. Since inception, the CFRF has focused on building a community of collaboration among fishermen, scientists, managers and food professionals that promotes sound science, sustainable seafood and vibrant fishing communities in Southern New England. The CFRF’s initiatives have been successful in reducing bycatch through conservation engineering, improving data for stock assessments, and growing markets and consumer awareness of underutilized species. The CFRF is also well known for their fishermen-based Research Fleets for lobster, Jonah crab, quahog, and black sea bass which engage fishermen in collecting data at-sea during routine fishing practices to inform assessment and management efforts. This presentation will review the collaborative strategy that has enabled the CFRF to address the concerns of the fishing community as well as the needs of scientists and fisheries managers, and will review the measures that CFRF has taken to ensure the effective use of data collected by the fishing industry.

Alaska Hatchery Research Project: Collaborative Salmon Fishery Research in Alaska

Tommy Sheridan  
Silver Bay Seafoods, Sitka, AK, USA, tommy.sheridan@silverbayseafoods.com

Bill Templin  
Alaska Department of Fish and Game, Anchorage, AK, USA, bill.templin@alaska.gov

The Alaska Hatchery Research Project (AHRP) is a large-scale collaborative research project taking place in Alaska exploring potential interactions between hatchery and wild salmon. Conceived in 2011, the project was designed by a Science Panel composed of retired and current scientists from Alaska Department of Fish and Game (ADF&G), University of Alaska, the state's private nonprofit salmon hatchery operators, and the National Marine Fisheries Service (NMFS). Initial involvement of industry representatives in project design and implementation was pursued due to a broad and shared interest in ensuring that the state’s hatchery programs were not detrimental to wild salmon stocks, and to develop trust among fishery stakeholders. However, as the State of Alaska’s budget crisis worsened in 2014, financial support from industry partners became necessary for project completion. Investigations of university- and/or agency-industry collaborative research describes an increasing importance to government functions, although such partnerships should take steps to ensure social acceptance. Despite such efforts, public criticism of industry involvement with the project emerged in 2018, leading to the resignation of two industry representatives from the AHRP Science Panel. Given the far-reaching policy implications of the AHRP, it is imperative that the project maintains the support of all fishery stakeholders. It is hoped that further reflection on these efforts as made possible through inclusion in the 2019 Wakefield Fisheries Symposium will increase the AHRP’s capacity to anticipate and effectively respond to the challenges associated with the project’s conclusion, while also increasing stakeholder trust in its processes and outcomes.
The Pollock Conservation Cooperative Research Center (PCCRC): A Successful Model of Industry–University Cooperative Research

Keith Criddle
University of Alaska Fairbanks Fisheries, Juneau, AK, USA, kcriddle@alaska.edu

The Pollock Conservation Cooperative Research Center (PCCRC) is an industry-funded research center managed by UAF. Since 2000, the PCCRC has supported $15.6 million in peer-reviewed competitive faculty research grants and graduate fellowships. Research priorities are recommended by industry and honed by an Advisory Board that includes three industry representatives, three university leaders, and representation from a federal or state management agency. Research priorities include: (1) research dedicated to improved biological data and statistical models of the pollock stock; (2) research to improve biological data and statistical models of species incidentally caught in North Pacific groundfish fisheries to better quantify potential effects on those stocks and to improve estimates of discard mortality; (3) research to assist in the evaluation of habitat and ecosystem considerations pertinent to the pollock fishery; (4) research to evaluate current fisheries management strategy and the potential need for regulatory flexibility to adapt to ever-changing environmental conditions; (5) research to investigate factors influencing the sustainability of protected species; and (6) research to create additional products and derive greater product value from existing harvests.

Community-Based Collaborative Fisheries Research: Successes, Challenges and Management Implications

Owen C. Nichols
Center for Coastal Studies, Provincetown, MA, USA, nichols@coastalstudies.org

Community-based collaborative research involving fishermen, scientists and other stakeholders holds great promise for practical, science-based solutions to fisheries management challenges. Stakeholder and partner engagement are critical throughout this process. Three community-based collaborative research case studies from Cape Cod (Massachusetts, USA) are discussed: fish and shellfish habitat investigations in a coastal lagoon; development and testing of a modified sea scallop dredge for flatfish bycatch reduction; and a study of the effects of hydraulic clam dredging in a dynamic nearshore system. Management issues, scientific questions and the stakeholder engagement process were unique to each case study. Community partners were involved in all aspects of projects, from hypothesis development to dissemination of results. Participants in each study experienced successes and challenges associated with communication of management issues and study findings. Transparency in the engagement process was critical; a thorough understanding of stakeholder motivations for participation was required for effective implementation and application to management. Iterative approaches to project development and implementation allowed for expanded engagement of the fishing and management communities. Project partners were accessible to local communities and invested considerable time in outreach and engagement. Lessons learned from stakeholder and partner engagement in community-based collaborative research can be applied to fisheries management.
Advancing Indigenous Collaborations in Fishery Science and Management

Rachel Donkersloot  
Coastal Cultures Research and Consulting, Palmer, AK, USA, rachel@coastalculturesresearch.com

Courtney Carothers  
College of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Anchorage, AK, USA, clcarothers@alaska.edu

Jessica Black  
Department of Alaska Native Studies and Rural Development and Tribal Management, University of Alaska Fairbanks, Fairbanks, AK, USA, jcbblack@alaska.edu

Danielle Ringer  
College of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Kodiak, AK, USA, djringer@alaska.edu

Jesse Coleman  
College of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Fairbanks, AK, USA, jmcoleman2@alaska.edu

AlexAnna Salmon  
Department of Alaska Native Studies and Rural Development and Tribal Management, University of Alaska Fairbanks, Igiugig, AK, USA, asalmon2@alaska.edu

Collaboration, co-production, and incorporation of local, traditional and Indigenous knowledge are increasingly identified as goals of fishery research and management. Greater integration of Indigenous ways of knowing with science can greatly improve understandings of rapidly changing marine ecosystems in the North Pacific. Yet attempts to move beyond extractive approaches that treat Indigenous knowledge as decontextualized data points remain limited. This paper draws on current research in Alaska to highlight best practices and strategies for ensuring ethical research collaboration with and for Indigenous communities through inclusion of multiple ways of knowing and Indigenous methodologies in contemporary research and management. Key questions considered here include: 1) What do we learn about the strengths and weaknesses of current research and management systems when viewed from Indigenous experiences and perspectives?, and 2) How can Indigenous values, knowledge, management and governance mechanisms be better included in current or alternative research and management systems?

Qualitative Network Modeling and Integration of Socio-Cultural Stakeholder Perspectives

Courtney Lyons  
University of Alaska Fairbanks, College of Fisheries and Ocean Sciences, Juneau, AK, USA, cdlyons@alaska.edu

Jesse Coleman  
University of Alaska Fairbanks, College of Fisheries and Ocean Sciences, Fairbanks, AK, USA, jmcoleman2@alaska.edu

Courtney Carothers  
University of Alaska Fairbanks, College of Fisheries and Ocean Sciences, Anchorage, AK, USA, clcarothers@alaska.edu

Matt Reimer  
University of Alaska Anchorage, Institute of Social and Economic Research, Anchorage, AK, USA, mreimer2@alaska.edu

Jonathan Reum  
University of Washington, School of Aquatic and Fishery Sciences, Seattle, WA, USA, jonathan.reum@noaa.gov

Qualitative network modeling (QNM) is gaining attention as a methodological approach for integrating socio-culturally relevant stakeholder perceptions into management decision-making. The process of model development is participatory and requires relatively little data. Information collected via interviews and focus groups are translated with stakeholder input into conceptual models which are represented as a signed-digraph, showing the directionality of relationships among system components (positive, negative, and neutral). The signed-digraph is, in turn, used to populate an interaction matrix, which then serves as the basis for analysis, generating qualitative predictions of system responses to perturbations. The products of the QNM process are thus two-fold: (1) mathematically rigorous predictions of system responses to perturbation scenarios, and (2) a concise summary graphic in the form of the signed-digraph itself. While the former is of obvious utility, the effectiveness of signed-digraphs in summarizing and communicating complex socio-cultural data has not been tested. In this presentation, we will therefore walk through the QNM process using examples from our research with the Amendment 80 fleet and several rural Alaskan communities. Then, via audience participation activities, we will test the effectiveness of signed-digraphs as communication tools.
Reflections on Industry Engagement in Science and Science Engagement in Industry—Experiences from Europe

Claus Reedtz Sparrevohn
Danish Pelagic Producers Organization

Martin Pastoors
Pelagic Freezer-trawler Association

Steven Mackinson
Scottish Pelagic Fishermen Association

Within the fishing sector in Europe, especially the pelagic, there has during the last 15 years been a gradual increase in industry involvement in science parallel to an increased understanding of the importance and role of science for future fishing opportunities. Several fishing sectors have within the last 5 years taken their engagement in science a step further by hiring scientists, not in the role as policy officers or representatives but as scientist. The authors have all changed from a career within (fisheries) science to a position of science within the industry. Based upon the combined experiences, this talk will address three main topics: (1) Improving data and information by engaging in data collection, self-sampling and re-estimating historical catch data; (2) Knowledge transfer and uptake from industry to science and back. How to increase the industry trust in science and the scientific ability to deal with “fishermen” knowledge; (3) Dilemmas and potential conflicts of being an industry affiliated scientist: code of conduct, conflict of interest and interactions within the existing scientific community and advisory process. Ideas and food for thoughts will be put forward on how future fishery science and advice process could change with increasing industry involvement. Is this the start of a paradigm change in how fishery, science and advice are interacting?

Addressing Issues of Rebounding Marine Mammal Populations Through Community Science

Andrea Bogomolni
Woods Hole Oceanographic Institution, Woods Hole, MA, USA, andreab@whoi.edu

Owen C. Nichols
Center for Coastal Studies, Provincetown, MA, USA, nichols@coastalstudies.org

Under the protection of the Marine Mammal Protection Act (1972), harbor and gray seals, once bounty hunted and extirpated in northeast US waters, are now rebounding to near historical population numbers. While their return is hailed as a conservation success story, this success also brings many challenges in regions where seals were not seen for generations. The recognition of these challenges led to the formation of the Northwest Atlantic Seal Research Consortium (NASRC). Since 2008, biennial meetings and workshops of NASRC have brought scientists, fishermen, researchers, students and business operators together to discuss issues. Following the recommendations of NASRC, several programs have developed to address fishery and seal bycatch, depredation, marine organism health risks for fishermen and general education on seals based on fishing community needs and interests. As a community we are working together to identify and address challenges and to understand the ecological role of seals, as well the role of these rebounding species as sentinels of ocean health. We will share our collaborative experiences, successes and lessons learned with a focus on the results of a recent workshop held and research underway to address fishery/marine mammal bycatch issues.
Fisheries Resilience Index: Adapting to Environmental Change Through Business Self-Assessments

Syverine Bentz  
*University of Alaska Anchorage, Kachemak Bay National Estuarine Research Reserve, Homer, AK, USA, syverine@alaska.edu*

Grace Allan  
*University of Alaska Anchorage, Kachemak Bay National Estuarine Research Reserve, Homer, AK, USA, gdallan@alaska.edu*

Davin Holen  
*University of Alaska Fairbanks, Alaska Sea Grant, Anchorage, AK, USA, dlholen@alaska.edu*

Fisheries businesses are an important economic and cultural component of Alaska’s coastal communities that are affected by a rapidly changing environment. The goal of the Alaska Fisheries Resilience Index is to strengthen local fishery related businesses, in order to buoy coastal communities in the face of natural hazards and disasters. This project collaboratively tailors a Resilience Index business self-assessment developed by the Mississippi-Alabama Sea Grant Consortium in the Gulf of Mexico, to be beneficial to Alaskan fisheries businesses. The project team and partners, including fishery industry leaders, fishery managers, business owners, non-profits, and resilience experts, collaboratively adapted the self-assessment for Alaska businesses using best available science, local issues and resources, and commercial fishermen perspectives. Focus groups with diverse fisheries related businesses were conducted to ensure that the final self-assessment meets local needs and allows room for consideration of both the biophysical and socioeconomic characteristics of the end users. Business resilience workshops using the updated Alaskan Fisheries Resilience Index and published resources will be distributed for additional trainings in communities state wide. By generating tools and highlighting resources, the self-assessment will reduce the impacts of environmental change on fisheries businesses in Alaska, through increased awareness and understanding of climate change science research and monitoring needs and business strategic planning.

Cooperative Research on the Alaska Fisheries Science Center’s Longline Survey

Pat Malecha and Chris Lunsford  
*NOAA Fisheries, Alaska Fisheries Science Center Auke Bay Laboratory, Juneau, AK, USA, pat.malecha@noaa.gov, chris.lunsford@noaa.gov*

The Alaska Fisheries Science Center (AFSC) has annually completed a demersal longline survey off the coast of Alaska since 1978. Data from the survey are used to assess sablefish and other groundfish species. The survey began as a joint endeavor between the US and Japan and is now operated by the National Marine Fisheries Service, who contracts with a freezer longliner from the domestic fleet. The cooperative nature of the relationship between the AFSC and industry allows for a novel contract arrangement whereby the government receives a no-cost charter and the vessel retains and sells survey catches to offset operational costs. The longline survey has a long history of partnering with industry on original research, including whale depredation avoidance, bycatch reduction, and gear performance. This presentation provides an overview of the history of the AFSC longline survey and selected research projects cooperatively executed by the AFSC, the survey vessels and industry stakeholders.
Using Industry Collaboration to Improve Black Sea Bass Management

Anna Malek Mercer
Executive Director, Commercial Fisheries Research Foundation, Kingston, RI, USA, amalek@cfrfoundation.org

Thomas Heimann
Research Associate, Commercial Fisheries Research Foundation, Kingston, RI, USA, theimann@cfrfoundation.org

Jason McNamee
Chief, Rhode Island Department of Environmental Management, Marine Resource Management, Jamestown, RI, USA, jason.mcnamee@dem.ri.gov

Black sea bass is an ecologically and economically important species, but assessment and management efforts have not been reflective of the shifting distribution and growing abundance of this species, in part due to a dearth of data throughout the species range. As a result, thousands of pounds of black sea bass are discarded and economic opportunities are lost. To address this issue, a Black Sea Bass Research Fleet was constructed to engage fishermen from a multitude of gear types to collect critical biological black sea bass data. Research Fleet participants use a specialized app to collect data about fishing effort, catch, and bycatch, including the length/sex of individual black sea bass. Black sea bass are also retained for analysis of sexual maturity, diet, and age. To date, the Research Fleet has sampled over 11,000 black sea bass at sea and collected over 1,300 black sea bass for laboratory analysis. By virtue of the Research Fleet’s wide variety of gear types, vessel sizes, and consecutive years of sampling, the data are seasonally and spatially comprehensive, providing a unique perspective into the fishery and population. This presentation will explore the data collected by the Black Sea Bass Research Fleet, including gear selectivities, catch characterizations, and diet compositions. Finally, the Research Fleet will be assessed as a case study of effective industry collaboration to increase trust in management and assessment of a species through direct contribution to management and fisheries science.

Improving In-Season Acquisition of Sockeye Catch-per-Set Information from Commercial Seine Fisheries

Brian Ma
ESSA Technologies, Vancouver, BC, Canada, bma@essa.com

Matthew Siegle
ESSA Technologies, Vancouver, BC, Canada, msiegle@essa.com

Catherine Michielsens
Pacific Salmon Commission, Vancouver, BC, Canada, michielsens@psc.org

Rob Morley
Canadian Fishing Company, Vancouver, BC, Canada, rob.morley@canfisco.com

Marc Nelitz
ESSA Technologies, Vancouver, BC, Canada, mnelitz@essa.com

Marine test fisheries provide valuable in-season estimates of timing and run size of Fraser River sockeye salmon. Previous work using post-season logbook information demonstrated a strong relationship between commercial catch-per-set data and daily sockeye abundance estimates that can be integrated with test fishery data to improve in-season assessments and decision-making. Here, we report on a pilot project to assess the feasibility and usefulness of acquiring in-season catch-per-set information from Area B Johnstone Strait Individual Transferable Quota (ITQ) purse seine fisheries. Collaboration between Fisheries and Oceans Canada (DFO), the Pacific Salmon Commission (PSC), commercial harvesters, and ESSA Technologies resulted in a successful project demonstrating that collecting in-season ITQ catch data is feasible and of high value. ITQ catch-per-set data was strongly correlated with test fishery catch-per-set data (R^2 = 0.75), and showed a stronger correlation with daily abundance estimates relative to the test fishery catch-per-set data (R^2 = 0.70 vs. 0.57). ESSA was able to conduct the in-season analyses within an hour of receiving the data from the DFO and PSC, which could be completely automated if desired. This project represents the first step in a longer-term process to better facilitate integration of commercial fisheries data into the in-season assessment and decision-making process of the Fraser River Panel. Moving forward, the project team recommend looking for opportunities to increase participation within the commercial fleet to ensure predictive power is maintained, continue to improve reporting and data transfer processes, and look for opportunities to extend this pilot to other fisheries.
Sex Marking at Sea by the Directed Pacific Halibut Fleet

Ian Stewart¹, Timothy Loher¹, Anna Simeon¹, Lara Erikson¹, Orion McCarthy¹, Claude Dykstra¹, Daniel P. Drinan², Lorenz Hauser² and Josep V. Planas¹

¹International Pacific Halibut Commission, Seattle, WA, USA
²School of Aquatic and Fishery Sciences, University of Washington, Seattle, WA, USA, josep.planas@iphc.int

Decreased size-at-age of Pacific halibut (Hippoglossus stenolepis) since the 1970s in conjunction with larger size-at-age in females and a constant minimum size limit have led to the expectation that directed Pacific halibut harvests have become increasingly composed of females. Understanding the sex ratio of commercial catches is critical for accurate estimation of female spawning stock biomass; however, sex data cannot be obtained from commercial landings due to the requirement that Pacific halibut be dressed at sea. In 2014, the International Pacific Halibut Commission (IPHC) initiated a program to generate commercial sex ratio data that included: 1) the development of at-sea sex-marking protocols for commercial vessels, 2) testing of sex-marking methods suitable for use on commercial vessels based on making sex-specific cut marks on the opercula and dorsal fins of males and females, respectively, and 3) the use of a genetic sex assay for validation of the sex markings. This program was first tested on a voluntary basis in a single port (Homer, AK; 2015), subsequently in a single IPHC Regulatory Area (2B: British Columbia, Canada; 2016), and finally implemented coastwide (2017). To date, the data from the sex marking program have suggested that commercial vessels may capture Pacific halibut that are larger at-age than are encountered in the IPHC’s fishery-independent setline survey, resulting in a higher proportion of female catch that would be predicted using those survey data. This indicates a critical need for ongoing monitoring the sex ratio of the landed commercial catch.

Collaboration to Develop a Salmon Excluder for the Pollock Fishery

John Gauvin
North Pacific Fisheries Research Foundation, Seattle, WA, USA, gauvin@seanet.com

Susie Zagorski
North Pacific Fisheries Research Foundation, Seattle, WA, USA, susiezagorski@gmail.com

John Gruver
United Catcher Boats Association, Seattle, WA, USA, jgruver@ucba.org

Noelle Yochum
Alaska Fisheries Science Center, Seattle, WA, USA, noelle.yochum@noaa.gov

Craig Rose
Fishnext Research, Seattle, WA, USA, fishnextresearch@gmail.com

Incidental catch rate of Chinook salmon (Oncorhynchus tshawytscha) in the Bering Sea pollock fishery is exceedingly low. In 2018, bycatch rate was approximately one Chinook per 422,000 pollock, but magnitude of pollock harvest means numbers of bycaught Chinook have at times been concerning for regional fishery managers and western Alaskan communities. Hence time and area closures and vessel bycatch caps have been implemented. To reduce operational inefficiencies of bycatch controls, fishermen have devoted considerable effort to development of gear modifications that allow salmon to escape their nets. Typical trawl bycatch gear modifications function through differences in size/shape of target and bycatch species. Salmon excluders utilize differences in behavior and swimming ability and salmon escape without touching the netting or excluder. Developing an effective excluder has been challenging given towing speeds, rarity of salmon encounters, and volume of fish moving through the net with pollock catch rates often exceeding 100 mt per hour. Despite this, salmon escapement rates of 50% have been achieved and average rates are ~30%. Our talk traces the pathway to current excluser performance and details the cooperative research process since 2003 wherein fishermen/gear manufacturers lead the evolution of excluser design elements and conservation engineering experts focus on assessment of fish behavior and testing methods. Exempted fishing permits closely resembling actual fishing are used to allow access to closed areas to increase probability of salmon encounters and testing power. Funding is provided through industry donations to a research foundation and in-kind support from industry and AFSC’s RACE Division.
Southeast Alaska Sperm Whale Avoidance Project: A Fifteen-Year Collaboration

Lauren Wild  
University of Alaska Fairbanks, Sitka, AK, USA, lowild@alaska.edu

Linda Behnken  
Alaska Longline Fishermen's Association, Sitka, AK, USA, alfafish@acsalaska.net

Victoria O'Connell  
Sitka Sound Science Center, Sitka, AK, USA, victoria.oconnell@gmail.com

Dan Falvey  
Alaska Longline Fishermen's Association, Sitka, AK, USA, myriadfisheries@gmail.com

Aaron Thode  
Scripps Institution of Oceanography, La Jolla, CA, USA, athode@ucsd.edu

Russel Andrews  
MarEcoTel, Seattle, WA, USA, russel.d.andrews@gmail.com

Janice Straley  
University of Alaska Southeast, Sitka, AK, USA, jmstraley@alaska.edu

Since 2003 the Southeast Alaska Sperm Whale Avoidance Project (SEASWAP) has cooperatively studied sperm whale depredation on commercial fishing gear in the Gulf of Alaska (GOA). Commercial fishermen initiated this research to enlist help developing effective tools to mitigate interactions. Over the past decade and a half, Alaska longline fishermen have worked with scientists to collect data and design and test deterrents. SEASWAP has focused on: (1) understanding behavior and ecology of the whales associating with vessels in the GOA; (2) using acoustics to study and evaluate an acoustic metric of depredation; (3) testing deterrents and avoidance strategies to reduce interactions between whales and vessels. Research findings include discovery of whales’ ability to remove fish from hooks without leaving any trace of bait or target catch, classification of shallow and deep depredation diving behavior that differs from natural foraging dives, and an abundance estimate of 135 individuals (CI: 123-153) in the eastern GOA. Acoustic work has explored use of creaks by whales as prey capture attempts, identification of an acoustic cue that alerts whales to fishing activity, and localization with acoustic recorders to 35km. Deterrent testing has focused on gear modifications and acoustic deterrents, with some promising techniques such as avoidance strategies and an acoustic decoy. Current research includes exploring dietary preferences of whales, modeling habitat use and movement of whales in the GOA, and testing a fishermen friendly acoustic array as an avoidance tool. This successful collaboration provides a model for effective partnerships between researchers and fishermen.

Preparing for Offshore Wind—A Collaborative Approach to Environmental Monitoring

Jeremy Collie  
University of Rhode Island Graduate School of Oceanography, Narragansett, RI, USA, jcollie@uri.edu

Anna Malek Mercer  
Commercial Fisheries Research Foundation, Kingston, RI, USA, amalek@cfrfoundation.org

Michael Long  
Commercial Fisheries Research Foundation, Kingston, RI, USA, mlong@cfrfoundation.org

Joseph Langan  
University of Rhode Island Graduate School of Oceanography, Narragansett, RI, USA, joseph_langan@uri.edu

Over 2,000 square miles of ocean have been leased for offshore wind energy development in the northeastern United States; however, there is uncertainty surrounding how fisheries resources will be impacted by the installation, operation, and decommissioning of offshore wind turbines and power cables. To address these uncertainties, the University of Rhode Island and Commercial Fisheries Research Foundation, in partnership with commercial lobstermen, conducted the Southern New England Cooperative Ventless Trap Survey (SNECVTS) from 2014 – 2018. This baseline survey aimed to assess the seasonal abundance, distribution, movement, and habitat use of American lobster and Jonah crab in one of the first offshore wind energy lease sites off the coast of New England. Twenty-four lease blocks within the Cox’s Ledge Wind Energy Area were selected for the survey based upon their importance to the lobster and Jonah crab fisheries and wind energy development timeline. Survey components consisted of at-sea biological sampling, mark-recapture tagging, and habitat characterization, all conducted by teams of commercial lobstermen and scientific samplers. Results show a decline in lobster abundance and highly variable Jonah crab abundance through the monitoring period. Overall, SNECVTS has provided a multi-year record of pre-construction conditions at one of the first offshore wind energy lease sites in the United States. Further, the survey was designed to be replicable during all phases of wind energy development, as well as at other offshore wind energy sites, which will enable assessment and potential mitigation of the impacts of offshore wind energy development on fisheries resources.
Cooperative research that integrates the effort and skills of industry representatives and scientists has had an important contribution to marine science, particularly in the North Pacific. Done right, it entails identifying common questions of interest, leveraging industry insights, experience and platforms, and applying rigorous scientific methods and analysis. These efforts not only support marine observations and science, but often address pressing management needs and improve understanding between the research community, management agencies, and industry. The North Pacific Research Board strongly encourages cooperative research with industry and has funded 26 projects in this area since 2002. Research has included stock assessment, gear modification, electronic monitoring of fleet activity, monitoring for marine disturbance, tracking and movement studies, marine mammal depredation on fishing gear, and bycatch. Here we document past and present work. Most projects entail active engagement of industry partners, insight, and infrastructure to implement marine science, understand ocean processes, and inform resource assessment and fishery management. We analyze past work in this area and propose strategies to enhance these types of projects. Suggestions include approaches to communicate interests and incentives for both science and industry partners, establish common objectives, facilitate knowledge sharing and exchange, enhance effective implementation, and develop robust results.

NOAA Fisheries Cooperative Research Program

The NOAA Fisheries' Cooperative Research Program carries out collaborative projects via a diverse nationwide network. This work involves regional partnerships with a broad range of external stakeholders, including State and tribal managers and scientists (including interstate fishery commissions), fishing industry participants (including commercial and recreational fishermen), and educational institutions. Benefits of cooperative research include increased quantity and quality of data, inclusion of stakeholders’ knowledge in science and management, improved relevance of research to fisheries management, and reduced costs of science through leveraging of funds and sharing of costs. In addition, the cooperative research program promotes shared understanding of science and support for management decisions by stakeholders and improves relationships with constituents. This talk will provide an overview of the program's legislative mandate, goals, priorities, structure, funding, and linkages to other agency efforts.
The wide-spread availability of high quality, commercially available, echosounders in the 1990’s opened the door for use of commercial fishing vessels as acoustic data collection platforms. In the North Pacific the use of acoustic vessels of opportunity (AVO) has been developing over four broad themes. The first application is collection of AVO data from commercial fishing vessels during normal operations resulting in a 17-year time-series and a diverse array of publications. A second application is in conducting directed acoustic surveys in areas and/or times outside the range of standard agency surveys. This effort has been aimed at either supplementing existing surveys or evaluating co-management systems in areas and times of interest to the fishing fleet. The last two applications use acoustic data collected from fishing vessels contracted for periodic surveys. One effort has been to develop groundfish abundance indices from these data for application in stock assessments. Another application has been to use these data to evaluate bottom conditions and classify large swaths of habitat where directed acoustic surveys would be prohibitively expensive. Here we will review AVO data collection efforts in the North Pacific considering both the success and failures in their development and application in fisheries management. Efforts in the North Pacific demonstrate that AVO data collections can contribute positively to fisheries science if the benefits and limitations of using these platforms is carefully weighed and their application is conducted in consideration of both practical issues, such as fisher time constraints, and data quality limitations on commercial platforms.

**Growth per Molt of EBS Tanner and Snow Crab**

Christie A Lang  
NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA, USA, christie.lang@noaa.gov

Robert J Foy  
NOAA Fisheries, Alaska Fisheries Science Center, Kodiak, AK, USA, robert.foy@noaa.gov

Growth per molt as measured by carapace width for eastern Bering Sea Tanner crab (*Chionoecetes bairdi*) and snow crab (*C. opilio*) are incorporated into stock assessment and fishery evaluation models to provide important ecological and economic data used to manage these fisheries. Studies of individual growth per molt provide a better growth fit for these models. From 1994 to 2017 laboratory and field studies were conducted to assess growth per molt for both *C. bairdi* and *C. opilio*. With assistance from the Bering Sea Fisheries Research Foundation and Alaska Department of Fish and Game, over 4,700 *C. bairdi* and *C. opilio* were collected, and growth per molt was assessed on 3,069 *C. bairdi* and on 299 *C. opilio* crabs. The growth increment for *C. bairdi* ranged between 7.60 to 48.89%, with the mean growth increment was 26.59%. The growth increment for *C. opilio* ranged between 4.37 to 79.60%, with the mean growth increment was 30.25%. The largest percent growth increment for both species and sex occurred on crabs less than 20.0 mm carapace width.
Alaska Fisheries Science Center Tagging Studies: 20 Years of Cooperative Research

Susanne McDermott  
AFSC, Seattle, WA, USA, susanne.mcdermott@noaa.gov

Kimberly Rand  
AFSC, Seattle, WA, USA, kimberly.rand@noaa.gov

David Bryan  
Pacific States Marine Fisheries Commission, david.bryan@noaa.gov

We will present several long-term cooperative research projects conducted at the Alaska Fisheries Science Center: A longterm (1999–2018) Atka mackerel tagging study in the Aleutians, and a new satellite tagging study for Pacific cod. In both studies the fishing industry has provided vessel platforms at reduced or no cost and has been involved in all aspects of the study. We will present challenges and successes of this type of research. In addition, we will present results of our studies and discuss potential future collaborations with the commercial fishing industry. The Atka mackerel tagging study examined the potential effects of the commercial fishery on Atka mackerel, one of the main prey item for the endangered Steller sea lion. We assessed the local abundance, movement and exploitation rate of Atka mackerel in areas close to Steller sea lion rookeries by releasing over 100,000 tagged fish in all Aleutian Island subareas. Results from this study were used to help define management boundaries in areas of high exploitation rates such as Amchitka and Kiska. During the most recent studies in 2011–2014 annual local exploitation rates were found to be low, indicating that management measures (Trawl exclusion zones and TAC reduction) were effective at mitigating fishing impacts. We found however, that Atka mackerel were less abundant, further away from rookeries, and slower growing in the Western Aleutian subareas where sea lions are declining the most. The Pacific cod study is starting field work this spring. Preliminary results will be presented.

Comparative Resource Use by Two Groundfishes in Nearshore Southeast Alaska

Cheryl L. Barnes  
College of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Sitka, AK, USA, cheryl.barnes@alaska.edu

Anne H. Beaudreau  
College of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Juneau, AK, USA, abeaudreau@alaska.edu

Richard N. Yamada  
Alaska Reel Adventures, Juneau, AK, USA, richard@alaskareel.com

Pacific Halibut (Hippoglossus stenolepis) have supported culturally and economically important fisheries in the Gulf of Alaska for over a century. However, recent decreases in mean size-at-age have generated concerns among those who depend upon and manage the resource. Intensified competition with an increasing Arrowtooth Flounder (Atheresthes stomias) population has been identified as one potential mechanism for decreased halibut productivity. We compared resource use between Pacific Halibut and Arrowtooth Flounder as a first step toward addressing their potential for competition in nearshore Southeast Alaska. In collaboration with fishing lodge captains and private recreational anglers, we collected site-specific data on the size frequencies, catch rates, and diet compositions of 2,383 Pacific Halibut and 1,572 Arrowtooth Flounder (2015 and 2016). Arrowtooth Flounder had much larger gape widths (mm) at fork lengths (cm) comparable to Pacific Halibut. Thus, we used gape width as the measure of size for comparing resource use of these groundfish predators. We found site-specific differences in relative abundances and diet compositions, both within and between species. Arrowtooth Flounder were generally caught in deeper, more protected waters than Pacific Halibut. Prey consumed by Pacific Halibut were typically more diverse and benthic-associated than Arrowtooth Flounder, though fishes (e.g., Pacific Herring [Clupea pallasii] and pollock/cod [Gadus spp.]) were important to the diets of both predators. Our fine-scale comparisons of spatial and dietary overlap elucidate some of the dimensions over which Pacific Halibut and Arrowtooth Flounder may partition resources in nearshore habitats and can be used to inform patterns observed at broader spatial scales.
Eastern Bering Sea Tanner crab (Chionoecetes bairdi) is one of the State of Alaska’s more variable fisheries and experiences large fluctuations in annual abundance, which has led to multiple closure years since its establishment. In 2014 to 2015, Tanner crab harvest went from 20 million pounds to 0, and uncertainty surrounding the performance of the current harvest control rules (HCR) lead to interest in modifying them to better account for stock status and potentially reduce large-scale changes in catch. Management Strategy Evaluation (MSE) is a powerful tool used to identify and quantify effects of uncertainty within a managed fishery. MSE accounts for assessment error and process error in population dynamics, involving simulating a managed system to provide information for decision-makers tasked with selecting a management strategy for implementation. MSE performed without stakeholder input may fail to address key issues. A collaborative workshop featuring stakeholders, university affiliates, and managers was convened where MSE based on the current Tanner crab assessment model was deemed the most appropriate way to test candidate HCRs. To ensure a cooperative and transparent development process, there has been substantial communication among industry representatives, managers, and scientists. Objectives of the MSE and corresponding performance statistics were determined collaboratively to report results in terms meaningful to decision makers while considering stakeholder input on risks to the fishery and trade-offs. This project represents a case study in collaboration, highlighting how concerted interactions with industry, managers, and scientists can distill highly technical processes into coherent and tractable results.

Marine invasive species pose a significant risk to ecosystems, economies and human health worldwide. On the western and northern Pacific coasts of North America, Alaska is relatively uninvaded but facing increased risk from climate change and increasing vessel activity as the Arctic becomes more accessible due to shrinking ice presence. A significant vector for the spread of marine invasive species is biofouling on vessels and mobile marine structures. As a region, West Coast states and provinces implement varying to no regulations on biofouling at the state and federal levels. The Coastal Committee of the Western Regional Panel on Aquatic Invasive Species has drafted best management practices on biofouling for recreational and commercial fishing vessels, and marine mobile structures to bring some consistency among region-wide guidelines. These guidelines are intended to encourage efforts to minimize the spread of marine invasive species throughout the region and therefore must be practical to understand and implement. A practicality review is being conducted to receive feedback from the targeted audiences regarding activities to maximize success of use and effectiveness.
Projecting Scallop LPUE in the Northeast US with Fishermen’s Help

Brooke L. Wright
School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA, USA, brooke.wright@umassd.edu

Catherine E. O’Keefe
Massachusetts Division of Marine Fisheries, New Bedford, MA, USA, catherine.okeefe@state.ma.us

Benjamin Galuardi
Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service, Gloucester, MA, USA, benjamin.galuardi@noaa.gov

Jonathon Peros
New England Fishery Management Council, Newburyport, MA, USA, jperos@nefmc.org

Steven X. Cadrin
School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA, USA, scadrin@umassd.edu

Accurate projections of landings per unit effort (LPUE) are important for management of the northeast US sea scallop fishery. The fishery is partly managed based on fishing effort through Days-at-Sea (DAS) allocations, which are determined by dividing target landings by the projected LPUE. In consultation with fishermen for their insight on potential factors that influence catch and effort, we developed generalized linear models (GLMs) to estimate LPUE as a function of fishing behavior and environmental factors. Our models used data from vessel trip reports, dealer, and observer reports from 2007 to 2016 – the period of spatial fishery management when data from the three sources were available. The selected model of LPUE included significant effects for year, month, fishing region, market price, permit type, region of sale port, and proportion of the largest market category in landings. Performance of the model for forecasting LPUE was based on comparison of retrospective projections to the realized LPUE for 2010 to 2016. Despite some relatively naïve assumptions in the retrospective evaluation (e.g., status quo conditions) and some changes in open area management that would have been anticipated, the average absolute value of prediction error in the LPUE model is comparable to the method that has been used for management. With further development and refinement, this tool could be used with expert judgment to provide an alternate approach for projecting LPUE.

The Evolution of the Sablefish Fishery Logbook Program in Alaska

Cara Rodgveller
National Marine Fisheries Service, Alaska Fisheries Science Center, Auke Bay Laboratories, Juneau, AK, USA, cara.rodgveller@noaa.gov

Chris Lunsford
National Marine Fisheries Service, Alaska Fisheries Science Center, Auke Bay Laboratories, Juneau, AK, USA, chris.lunsford@noaa.gov

The National Marine Fisheries Service (NMFS) groundfish logbook program was initiated in Alaska in 1998 and is only a requirement for vessels >60 feet. In the NMFS logbooks there was a lack of detailed fishing effort data needed for stock assessment. The International Pacific Halibut Commission (IPHC) developed a logbook program in 1932, which includes dockside collection. This longstanding program fostered relationships between the IPHC and the Pacific halibut and sablefish fleet. In 1999 the IPHC, industry organizations, and NMFS designed a new NMFS logbook that could be used by Pacific halibut or sablefish vessels. The logbooks include catch and effort data that are incorporated into the stock assessment. In 1999 the IPHC partnered with NMFS and began collecting sablefish logbooks dockside. Even when logbooks are required by NMFS (vessels >60 ft), all data is given to the IPHC voluntarily. In 2002 the program was expanded to include vessels <60 ft, which are not required to fill out a NMFS logbook. The fishing organizations have been instrumental in increasing the participation of vessels <60 foot, which are a major component of the fleet. The majority of the <60 ft vessels do not carry observers, so in many years logbooks are the only source of data. The success of this program stems from the long-standing relationship between the IPHC and the sablefish industry, the dockside collection program, the support and participation of industry groups, and the voluntary participation by the fleet to collect the data needed for sablefish stock assessment.
A Case History of Seabird Bycatch Reduction in Alaskan Longline Fisheries

Edward F. Melvin  
Washington Sea Grant, University of Washington, Seattle, WA, USA, edmelvin@uw.edu

Kimberly S. Dietrich  
5091 Starfish Drive SE, St. Petersburg, FL, USA, kim@kimdietrich.com

Robert M. Suryan  
Auke Bay Laboratories, Alaska Fisheries Science Center, NOAA Fisheries, Juneau, AK, USA, rob.suryan@noaa.gov

Shannon M. Fitzgerald  
Resource Ecology and Fisheries Management Division, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, Seattle, WA, USA, shannon.fitzgerald@noaa.gov

Anne Marie Eich  
Sustainable Fisheries Division, NOAA Fisheries, Alaska Regional Office, Juneau, AK, USA, annemarie.eich@noaa.gov

Although bycatch of seabirds is a critical conservation issue in world fisheries, case studies documenting significant bycatch reductions are rare. We studied progress toward seabird conservation in Alaskan longline fisheries, one of the largest and most diverse demersal fisheries. Alaskan longline fisheries have a two decade history of seabird bycatch reduction. Industry and agencies supported initial research trials that were conducted on commercial fishing vessels during standard fishing operations, trials were large in scale (>7.5 million hooks in 2 fleets and 8 vessels), and controls (no deterrent) were used to yield unambiguous results in 2 years. The streamer-line solution was affordable, safe, and applicable to all vessel classes and did not negatively affect target fish catch. Furthermore, fisheries observer data allowed post-implementation assessment of bycatch reduction efforts. Analysis of seabird bycatch per unit effort (BPUE) from 23 years of fisheries observer data demonstrated that following fleet-wide adoption of streamer lines, at first voluntarily and then mandatorily, seabird BPUE was reduced by 77–90%, preventing mortality of thousands of birds per year. Despite success in reducing seabird BPUE overall, BPUE increased significantly in 2 of 4 target fisheries over the 14 year period post streamer line adoption. Reasons for increased BPUE are unknown and will require further collaborative research to resolve. Our case study demonstrates that successful bycatch reduction efforts require fishery-specific solutions, strong industry support and collaboration, vigilance in analysis and reporting of observer data, and outreach to fleets, especially to vessels with anomalously high BPUE.

Electronic Monitoring Applications in theDirected Pacific Halibut Longline Fishery

Claude L. Dykstra, Timothy Loher, Ian J. Stewart, Allan C. Hicks and Josep V. Planas  
International Pacific Halibut Commission, Seattle, WA, USA, josep@iphc.int

Due to regulatory requirements, all Pacific halibut (Hippoglossus stenolepis) that are of sublegal size in the directed fishery cannot be retained and must be returned to the sea with minimal injury. Through the process of capture and release, Pacific halibut incur a range of injuries and exposures that will affect their survival potential after release. Accurate understanding of the types and relative levels of injuries and stresses that Pacific halibut are exposed to during the discarding process in relation to the biological characteristics of the fish can be instrumental in helping better estimate the probability of mortality resulting from the discarding process. Discard mortality rates (DMRs; a measurement of potential mortality) in the Pacific halibut longline fishery are currently estimated from injury or vitality data obtained on observed trips. The small vessel (<57’) longline fleet in Alaska is currently developing electronic monitoring (EM) capabilities, but determining vitality codes requires handling of the animal, something that cannot be achieved with cameras. EM provides information on hook release techniques for close to 95% of events; however, the suite of injuries incurred by each hook release technique is unknown. The IPHC has conducted a field study to develop an injury profile for different hook release techniques (e.g. careful shake, gangion cut, etc.) with associated physiological condition measures, which could then be used to calculate DMRs on vessels carrying EM systems rather than observers. The results of this study will be used to further refine the estimation of DMRs by each hook release category.
Incorporating Fishermen’s Knowledge into an Index of Abundance for Atlantic Halibut (Hippoglossus hippoglossus) in the Northwest Atlantic.

Alex Hansell¹, Greg DeCelles², Mike Kersula³, Steven X. Cadrin¹

¹ Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA, USA, ahansell@umassd.edu
² Massachusetts Division of Marine Fisheries, New Bedford, MA, USA
³ Maine Department of Marine Resources, West Boothbay Harbor, ME, USA

Recent stock assessments of Atlantic halibut (Hippoglossus hippoglossus) in the United States have been unable to determine stock status. A major source of uncertainty is the index of abundance provided by the Northeast Fisheries Science Center offshore bottom trawl survey, which catches few halibut. Fishery standardized catch per unit effort (CPUE) time series can be used as an index of abundance and are especially valuable in the absence of analytical stock assessments and reliable surveys. Fishermen report the catch and effort data for CPUE and are expected to have faith in the results. Fishermen are also knowledgeable about their fishery and target species and can provide valuable information on factors effecting catch rates and patterns in catch rates. Atlantic halibut fishermen in Maine were interviewed to determine which covariates influence catch rates. Identified covariates were then incorporated as predictor variables in the CPUE standardization process. Fishermen identified significant covariates (location and interaction of depth and month) that accounted for 71% of the total deviance explained. The standardized time series shows a stable or increasing trend in Atlantic halibut catch rates, which is consistent with fishermen’s perspectives. The results from this study highlight the value of collaborative research and provide information for management as a relatively empirical indicator or input to analytical stock assessment models.

Reducing Halibut Bycatch Mortality through Industry/Government Cooperative Research

Christopher Oliver
Alaska Seafood Cooperative, Seattle, WA, USA, christophero@seanet.com

John Gauvin
Alaska Seafood Cooperative, Seattle, WA, USA, gauvin@seanet.com

Beth Concepcion
Alaska Seafood Cooperative, Seattle, WA, USA, daudistel@seanet.com

Brian Mason
National Marine Fisheries Service Alaska Region, Fisheries Monitoring and Analysis, Seattle, WA, USA, brian.mason@noaa.gov

Under existing federal regulations, Pacific halibut taken as bycatch in the non-pelagic groundfish catcher/processor trawl fisheries of the North Pacific must be made available for Federal observer sampling below deck before being returned to the sea. This process necessitates extended periods of time out-of-water for a species that is often robust and lively when first caught, causing mortality to be high. The Alaska Seafood Cooperative and National Marine Fisheries Service therefore launched a collaborative study under a series of exempted fishing permits to sort halibut from target catch on deck and expedite their return to the sea. After five years of research, this study now includes the entirety of the fleet and a large proportion of groundfish catch is sorted on deck. This lengthy effort has seen deck sorting refined many times in an iterative process, with AKSC and NMFS regularly collaborating to solve problems and improve design features such as statistical sampling protocols, observer/crew coordination, and others. Halibut bycatch mortality when sorting routinely averages around 50%, compared to a default rate of around 80% that would otherwise be expected. This difference translated to over 1,000 metric tons of halibut savings in 2018, and the participants are now working on final steps to implement deck sorting into the federal regulations and make it a standard option for catch handling when prosecuting this fishery.
Cooperative Research at the Alaska Fisheries Science Center: A Requirement for Sustainable Fisheries Management and Protected Resource Conservation

Robert Foy
Alaska Fisheries Science Center, NOAA Fisheries, Juneau, AK, USA, robert.foy@noaa.gov

NOAA Fisheries’ Alaska Fisheries Science Center is a partner in the stewardship of the living marine resources and their habitats in the coastal oceans of Alaska. Our goal is to support productive and sustainable fisheries, safe sources of seafood, recovery and conservation of protected resources, and healthy marine ecosystems. Cooperative relationships between agencies and stakeholders are necessary to sustainably manage the nearly 1.5 million square miles in the Gulf of Alaska, Bering Sea, Aleutian Islands, Chukchi Sea, and Beaufort Sea. The Alaska Fisheries Science Center is engaged in many cooperative research activities including multi-agency research programs with limited industry and community involvement in data collection to highly collaborative relationships with specific industry sectors and coastal regions in Alaska co-producing research. The primary goal of cooperative research related to fisheries and protected resource management must be the integrity of the science. This includes incorporation of western science, local knowledge, and traditional knowledge into a framework that leads to a sustainable and representative research program. Further, the increasing effects of environmental variability on marine resources in Alaska necessitate an ecosystem approach to identifying and prioritizing marine research. In this presentation I will highlight the types of cooperative research conducted by scientists at the Alaska Fisheries Science Center, with a message of how to engage and sustain collaborative partnerships.

Bering Sea Crab Research: A Case Study on the Results of a Successful Cooperative Research Program

Robert Foy
Alaska Fisheries Science Center, NOAA Fisheries, Juneau, AK, USA, robert.foy@noaa.gov
Scott Goodman
Bering Sea Fisheries Research Foundation, Everett, WA, USA

NOAA Fisheries’ Alaska Fisheries Science Center (AFSC) crab scientists and the Bering Sea Fisheries Research Foundation (BSFRF) have partnered to work cooperatively on research relative to Bering Sea king, snow, and Tanner crab surveys, biology, and assessment since 2004. The BSFRF is an industry group representing commercial fishing interests and the AFSC assesses commercial crab stocks in the Exclusive Economic Zone around Alaska. Research projects were prioritized by joint agreement between the BSFRF and AFSC scientists based on level of importance for the assessment of crab stocks in the eastern Bering Sea consistent within the framework set by the North Pacific Fisheries Management Council. This research is a cooperative effort not only with the commercial industry, but also with other agencies cooperatively managing these crab stocks. In this presentation we will highlight the development, execution, and results of research priorities toward sustainable management of crab stocks in Alaska. We will present results from cooperative projects focused on the experimental determination of the trawl efficiency in the AFSC annual bottom trawl survey and on estimates of crab handling mortality. We will emphasize the importance of the cooperative agreement to ensure that the science is credible and informative to the crab management process.
Bringing in the Experts: CFRF’s Lobster/Jonah Crab Research Fleet

Aubrey Ellertson  
Commercial Fisheries Research Foundation, Kingston, RI, USA, aellertson@cfrfoundation.org

Anna Malek Mercer  
Commercial Fisheries Research Foundation, Kingston, RI, USA, amalek@cfrfoundation.org

David Spencer  
F/V Nathaniel Lee, Newport, RI, USA, drspencer1@gmail.com

Despite the economic and cultural importance of the lobster and Jonah crab fisheries in the Northeast, scientists, managers and fishermen agree that the data being used to assess these resources lack sufficient spatial and temporal coverage. The Commercial Fisheries Research Foundation developed the Lobster and Jonah Crab Research Fleet in 2013 to address these data gaps, increase transparency of the assessment process, and promote industry members' belief in the validity of the data sources used. Fishermen use a specialized tablet app, digital calipers, and wireless water temperature sensors to record information about their lobster and Jonah crab catch and the environment as part of their routine fishing practices. Since its inception, the Lobster and Jonah Crab Research Fleet has collected biological data from over 120,000 lobsters and 62,000 Jonah crabs as well as coupled bottom water temperatures from the Gulf of Maine to the Mid-Atlantic Bight. The data collected are integrated into federal biosamples databases and used extensively in the lobster stock assessment and Jonah crab management plan to characterize catch, explore recruitment patterns, and understand the impacts of a changing ocean environment. Different from other sampling programs, participant fishermen retain ownership of their data and receive personalized data reports. The Research Fleet has demonstrated a cost-effective and efficient way for members of the fishing industry to contribute critically needed data to stock assessments. This presentation will review the key elements that have enabled the Lobster and Jonah Crab Research Fleet to succeed, including technology, communication, and scientific partnership.

Collaborative Research by the Mid-Atlantic Fishery Management Council

Matthew Seeley  
Mid-Atlantic Fishery Management Council, Dover, DE, USA, mseeley@mafmc.org

The Mid-Atlantic Fishery Management Council’s (the Council’s) collaborative research program is designed to inform fishery management decisions and improve stock assessments. In 2001, the Council established the research set-aside (RSA) program to support research in the Mid-Atlantic. The RSA program allowed a percentage of quota to be auctioned off to the highest bidders and then harvested by fishermen to generate funds to pay for the research. Analysis of the program in 2014 indicated that the costs of the program far outweighed the benefits. As a result, the Council suspended the program and has not proposed any RSA quota since then. Following the suspension of RSA, the Council continues to: 1) expand its collaborative efforts by using internal funding (when available) to improve research on Council managed fisheries, 2) participate in the prioritization and review of the Saltonstall-Kennedy Grants, and 3) act as an advisory body to the Northeast Cooperative Research Program. Through expansion of these collaborative efforts the Council has revitalized its Collaborative Research Program.
POSTERS

ALFA's Fishery Conservation Network
Linda Behnken
ALFA Executive Director Sitka, AK, USA, alfafishak@gmail.com
Tracy Sylvester
ALFA Fishery Conservation Network Coordinator, Sitka, AK, USA, alfafcn@gmail.com

The Fishery Conservation Network (FCN) engages fishermen in research and conservation. It encourages collaboration between fishermen and scientists. Now in it's tenth year, the Fishery Conservation Network has grown to include 105 fishermen, over 100 different fishing vessels, and seven fishermen-led projects.

Using Hydrophones to Reduce Interactions Between Whales and Longline Gear
Linda Behnken¹, Dan Falvey¹, Lauren Wild², Claude L. Dykstra³, Josep V. Planas³
¹ Alaska Longline Fishermen's Association, Sitka, AK, USA
² Southeast Alaska Sperm Whale Avoidance Project, Sitka, AK, USA
³ International Pacific Halibut Commission, Seattle, WA, USA

Long-term management and ecosystem changes have resulted in increasing depredation by sperm whales (Physeter macrocephalus) in the longline Pacific halibut (Hippoglossus stenolepis) and sablefish (Anoplopoma fimbria) fisheries. Depredation is economically costly to fishermen and presents risk of injury or mortality to whales. The Alaska Longline Fishermen's Association (ALFA) and Southeast Alaska Sperm Whale Avoidance Project (SEASWAP) with funding from the NOAA Bycatch Reduction and Engineering Program (BREP) are developing a user-friendly tool that assists fishermen with detecting sperm whales to avoid depredation on longline gear. The tool is a plug- and-play towed hydrophone array that can locate whales up to eight miles away through detection of their vocalizations and share this information between a network of fishermen. The project is an interdisciplinary collaboration of fishermen, NOAA fishery managers, the International Pacific Halibut Commission (IPHC), biologists, and hydrophone equipment developers. The three-stage project will: 1) use 2016 field data to improve automated detection/localization, improve the user interface, incorporate automated real time sharing of whale detection data; 2) field test the upgraded software/hardware on commercial and research fishing vessels; and, 3) incorporate the upgraded systems into ALFA's whale avoidance network. In the summer of 2019 vessels under contract to the IPHC as part of their Fishery-Independent Setline Survey will tow the arrays while transiting from station to station as platforms for field testing the deployment, functionality and robustness of the equipment. This multi partner project endeavors to create an end product readily used by small boat fishermen to minimize or avoid whale depredation.
Collaborative Research on Species Interactions Across Spatial and Trophic Scales: Pacific Salmon Predation on Pacific Sand Lance and Pacific Herring

Matthew Baker
Science Director, North Pacific Research Board, Anchorage, AK, USA, matthew.baker@nprb.org

Andy Derksema
Captain, Licensed Owner/Operator, San Juan Island Fishing Charters, Friday Harbor, WA, USA, andy.dersema14@gmail.com

Eva Hasegawa
Student, Friday Harbor Laboratories, University of Washington, Friday Harbor, WA, USA, clione.hasegawa@gmail.com

Forage fishes are often in concentrated schools that are dispersed across wide spatial areas in the pelagic environment. This poses challenges to assessment and research. Research cruises designed to capture these fishes are often expensive and result in low returns and limited data. Acoustics surveys provide more comprehensive coverage on relative fish densities, but require additional effort with nets to confirm species identification or acquire physical samples. In an ongoing university-industry partnership, we used charter-caught salmon to provide new insights on the relative prevalence of forage fishes (Pacific herring and Pacific sand lance) in salmon diets and the correlation between the location of known prey habitat and the location of capture of the predator. We also used this research to better understand the mechanisms through which salmon access these prey (e.g., pelagic capture, flushing from benthic sediments). This research was conducted through the University of Washington and San Juan Island Fishing Charters to enhance ongoing analyses on pelagic ecosystems and food webs and to characterize the dynamics of forage fishes and their predators. University researchers were interested in applying an alternate sampling approach—using predators to sample the system for forage fish and to further our understanding of trophic interactions. Recreational charter anglers have an interest in knowing where to direct effort and aspects of prey behavior and attributes that might be used to increase catch rates. This talk will discuss results as well as elements that lead to a successful partnership and effective means to communicate insights and expertise.

Beneath the Surface—Commercial Submersibles to Research Sand and Sand Lance

Matthew Baker1,2, Heather Lopes3, Kresimir Williams4, H. Gary Greene4, John Aschoff*  
1 North Pacific Research Board  
2 University of Washington  
3 NOAA Alaska Fisheries Science Center  
4 Moss Landing Marine Lab

Forage fishes, such as the Pacific Sand Lance (PSL, Ammodytes personatus), are important components of marine food webs, transferring energy from lower to upper trophic levels. As a result, the distribution and abundance patterns and biomass fluctuations of forage fishes have profound impacts on ecosystem processes, including the energetics and breeding success of a variety of fishes, seabirds, and marine mammals. Despite the importance of the PSL to the structure and functioning of North Pacific marine ecosystems, not much is known about the deep-water habitat of this species. Through support provided by OceanGate and collaboration with the University of Washington and NOAA Alaska Fisheries Science Center, we used a manned submersible to collect oceanographic, sonar, stereo camera, and video data on a submerged benthic sand wave field to observe and quantify fish abundance, distribution, movement, response to diel and tidal signals, and behavioral attributes, related to schooling, movement in and out of benthic substrates, and response to disturbance. These fish have an obligate association with sediment and use benthic substrates regularly for rest, to avoid predation, and for protection and energy conservation throughout an extended period of winter dormancy. We have identified and explored a set of benthic sand wave fields and have mapped these features, using multibeam acoustics. We have also surveyed these substrates regularly throughout the past 10 years, using surface-based sampling with Van Veen grabs. Demographic and life history attributes for fish in these sites has been well documented through these studies. The work presented here represents an alternate view on this system, using sonar, video, and stereo-image data processed through automated software to characterize the topography of this 2x1 km benthic feature, document sediment movement across tidal movements, and quantify fish abundance, distribution, movement, and behavior. Estimates of abundance suggest 20–100 million fish use this particular benthic habitat feature. Initial analyses suggest diel vertical movement out of sediments, related to foraging. Analyses also provide new insights on unique behavioral attributes associated with dissociated distribution for dispersal and burial in sediments and aggregating patterns, merging into dense schools for foraging and movement.
Line Entanglements on Western Arctic Bowhead Whales—Next Steps
Gay Sheffield
Alaska Sea Grant, Nome, AK, USA, gay.sheffield@alaska.edu
J. Craig George
North Slope Borough Dept. of Wildlife Management, Utqiagvik, AK, USA, craig.george@north-slope.org

For over 30 years, biologists in northern and western Alaska have conducted postmortem examinations on bowhead whales either stranded or harvested for subsistence purposes. Scar patterns on these carcasses provide evidence of line entanglement, ship strikes, killer whale predation attempts, and other injuries. Based on the data from these whales as well as comparative photo-documentation of live whales with diagnostic scarring, we estimate that ~10% –12% of bowhead whales show evidence of entanglement scars. Similarly about 1–2% exhibit ship strike injuries. At least 14 bowheads since 1990 have been observed actively entangled in heavy line with several whales entangled in confirmed commercial pot gear. Currently, entanglement and ship injury rates in Arctic waters appear low compared with other large whale populations. The northern Bering Sea/Bering Strait region is experiencing a transformative ecological maritime shift with an expanding open water season which is concurrent with increasing industrial ship traffic within bowhead whale habitat. A diverse group of management, researchers, industry, and consumptive users will have the best skills and technology needed to develop best strategies and minimize entanglement risks.

AFSC Groundfish Tag Program: Cooperative Research by NOAA and Industry
Katy B. Echave
NOAA/NMFS/AFSC/ABL/TSMRI, Juneau, AK, USA, katy.echave@noaa.gov

The Alaska Fisheries Science Center Groundfish Tag Program has released nearly 447,000 tagged sablefish, lingcod, Greenland turbot, shortspine thornyhead, and several shark species since 1972. Over 38,000 of those fish have been recovered by members of the fishing industry. It is one of the longest ongoing tagging programs in the nation, and is an example of successful cooperative research with industry. Although a small reward is given for each returned tag, the main motivation for many people turning in tags is interest in the resource and the data associated with the recovered fish; in addition to the reward, a letter is provided with the tag release location, total distance traveled, and the growth of the fish. This data is now available through an interactive website that utilizes mapping software allowing the public to visually track where specific tags were released and recaptured and to also view more general movement patterns. We hope this website will keep members of the industry engaged, encouraging continued participation. Additionally, the Black Cod Almanac, an annual newsletter, is released at the start of each year as a way to improve communication and increase dialogue between scientists and members of industry. This newsletter has proven to be a popular resource for information regarding highlights of the groundfish longline survey and sablefish stock assessment, North Pacific Fishery Management Council meetings, relevant research, and news of interest to those involved with the federal sablefish fishery.
Observing Fish Response to Trawls

Stan Kotwicki  
NOAA Alaska Fisheries Science Center, Seattle, WA, USA, stan.kotwicki@noaa.gov

Liz Dawson  
NOAA Alaska Fisheries Science Center, Seattle, WA, USA, liz.dawson@noaa.gov

Alex De Robertis  
NOAA Alaska Fisheries Science Center, Seattle, WA, USA, alex.derobertis@noaa.gov

Kresimir Williams  
NOAA Alaska Fisheries Science Center, Seattle, WA, USA, kresimir.williams@noaa.gov

Lyle Britt  
NOAA Alaska Fisheries Science Center, Seattle, WA, USA, lyle.britt@noaa.gov

Noëlle Yochum  
NOAA Alaska Fisheries Science Center, Seattle, WA, USA, noelle.yochum@noaa.gov

Direct observations of semipelagic walleye pollock (Gadus chalcogrammus) in front of the survey bottom trawl were conducted on chartered vessels in the eastern Bering Sea in 2017 and 2018 using a remotely operated catamaran (ROC) system. The ROC design and deployment methods were developed with cooperation among Alaska fishermen and NOAA scientists. The ROC is a new acoustic observation system that can be towed behind any trawling vessel, and is remotely steered to acoustically image locations between the vessel and the front of the trawl. This system can collect acoustic data on any semipelagic fish. The ROC combined with equivalent vessel-mounted acoustic systems allowed for a comparison of pollock vertical distribution and density under the survey vessel and at pre-determined distances in front of the trawl. We present results of this first study using ROC. This study will help in combining bottom trawl and acoustic survey data to improve pollock abundance estimates in the Bering Sea. Additionally, we seek potential industry collaborators and feedback on ways to apply this technology to observe pollock or other species in front of commercial trawls to better understand fishing gear performance. Industry collaboration will help to identify optimal ways to use the ROC technology in support of understanding fish behavior in response to trawls, and to better understand selectivity and catchability differences between commercial fishery and survey gear.

Fish Need Land Too: Science to Stewardship in Salmon Watersheds

Coowe Walker  
University of Alaska, Kachemak Bay National Estuarine Research Reserve, Homer, AK, USA, cmwalker9@alaska.edu

Jacob Argueta  
University of Alaska, Kachemak Bay National Estuarine Research Reserve, Homer, AK, USA, jmarguetajacobs@alaska.edu

Syverine Bentz  
University of Alaska, Kachemak Bay National Estuarine Research Reserve, Homer, AK, USA, syverine@alaska.edu

Denise Jantz  
Kachemak Heritage Land Trust, Homer, AK, USA, denise@kachemaklandtrust.org

Malcolm Milne  
North Pacific Fisheries Association, Homer, AK, USA, milnemarine@yahoo.com

The Kachemak Bay National Estuarine Research Reserve (KBNERR) has employed collaborative research methods to construct a body of work that demonstrates the importance of various landscape elements in the survival and success of Kenai Lowland salmon. Recently, synthesis of this body of work with stakeholder collaboration was made possible through a State of Alaska Salmon and People workgroup. Engagement strategies developed with the synthesis saw the success of field trips targeted for specific audiences, including commercial fishermen groups. Kachemak Heritage Land Trust’s (KHLT) “Fish Need Land Too” initiative, aimed at highlighting the importance of land conservation for salmon through field excursions, naturally integrated with KBNERR’s field program allowing for the two organizations to provide a wide range of information to participants. The field trip approach conveyed complex ecosystem functions that support salmon to the men and women who depend on this resource for their livelihoods. Commercial fishermen were able to engage in hands on learning and small, open-ended conversations with experts including researchers, educators, and communicators from both KBNERR and KHLT. As a direct result of these field trips, fishermen have become ambassadors for maintaining watershed connectivity. Salmon Sisters Inc. has highlighted the field trips in their outreach, and the North Pacific Fisheries Association began the process, in conjunction with KHLT, of exploring stewardship and conservation actions, including potential purchase of lands. The strong response from these field trips highlights the importance of scientists and fishermen investing time and energy to cooperate and communicate ways to promote healthy salmon populations.
Alaska Sea Grant has selected six research projects for funding during 2018–2020, with the majority of the work getting underway next month.

The researchers will receive $1.3 million to study a diverse range of topics intended to help Alaskans understand, conserve and sustainably use the state’s rich marine and coastal resources. The research will advance knowledge in Sea Grant’s main focus areas: healthy coastal ecosystems, sustainable fisheries and aquaculture, and resilient communities and economies. Six graduate students are involved, contributing to the next generation of science professionals in Alaska.

“We received 47 pre-proposals and 18 full proposals. The six that we funded ranked highest in a rigorous peer-review process and will address critical needs for Alaska marine and coastal research,” said Ginny Eckert, Alaska Sea Grant’s associate director of research. “The investigators work within the University of Alaska system as well as Alaska agencies and nonprofits with expertise in marine and social sciences.”

Alaska Sea Grant is part of the College of Fisheries and Ocean Sciences at the University of Alaska Fairbanks and the National Sea Grant Program, a division of the National Oceanic and Atmospheric Administration.

Funded projects:
- Integrating local ecological knowledge and survey data to improve assessment and management of rockfishes in Alaska
- Kelp reproduction and harvest rebound in Kachemak Bay, Alaska
- Metabolic and growth physiology of early life history stages of the northern spot shrimp, *Pandalus platyceros*
- Potential for resilience—examining the effects of ocean acidification on native Alaska bivalves
- Arctic Risk Management Network: Linking regional practitioners and researchers to improve mitigation through participatory action research by community monitors about erosion, surges, and nearshore sea ice loss as mutual priorities
- Assessing the resilience of Southeast Alaska salmon to a shifting freshwater environment

CONTACT: Ginny Eckert, 907-796-5450