A Retrospective of Rasmuson Fishery Fellows

2020-2025

Rasmuson Fisheries Research Center

COLLEGE OF FISHERIES AND OCEAN SCIENCES

UAF
COLLEGE OF FISHERIES AND OCEAN SCIENCES
University of Alaska Fairbanks

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College of Fisheries and Ocean Sciences
University of Alaska Fairbanks
Fairbanks, Alaska 99775-7220

Mission

The Rasmuson Fisheries Research Center's mission is to promote excellence in research related to fisheries and to develop young fisheries scientists.

Research Goals

Selected research areas identified as high priorities by the Advisory Board:

- Ecology, biology, distribution, and systematics of species of fish, shellfish, and seaweeds affected by fisheries, both target and nontarget species;
- Responses of fish, shellfish, and seaweeds to environmental variability;
- Genetic structure of Alaskan fish and shellfish populations and seaweeds;
- Fluctuations of fish and shellfish stocks and seaweeds, interactions of forage species with consumers including mammals and birds, and the ecosystems in which they occur;
- Development of the shellfish aquaculture and mariculture industry in Alaska;
- Impacts of emerging and legacy contaminants and diseases on the health of water-based ecosystems and human populations;
- Human dimensions of fishery systems, e.g., community and socio-cultural relationships;
- Impacts of climate change on marine and riverine fisheries and their communities.

The Rasmuson Fisheries Research Center was founded in 1994 by Elmer E. Rasmuson with an endowment to the University of Alaska Fairbanks (UAF). A second major endowment in support of the Center was created through a bequest from Mr. Rasmuson’s estate in 2001. The University of Alaska Foundation manages the endowments, and interest on the principal is used to support the research of graduate students that contributes toward the scientific or applied knowledge base of Alaska’s marine waters and resources. The fellowships also include tuition, insurance, and fees. More details on the Rasmuson Fisheries Research Center can be found on the UAF College of Fisheries and Ocean Sciences website:
https://www.uaf.edu/cfos/research/rasmuson-fisheries-resear/index.php

Rasmuson Fisheries Research Center

Advisory Board

Elmer E. Rasmuson, Founder

Current Board Members

Trent Sutton, Director
Jessica Black
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Lara Horstmann
Franz Mueter
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Former Board Members

D. Lee Alverson (2000–2005)
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Denis Wiesenburg, Director (2004–2010)
David Witherell (2017–2022)

Rasmuson Fellows 2020-2025

Marina Washburn-Alcantar	Major Advisor: Dr. Amanda Kelley PhD Marine Biology “Characterizing Ocean Change Impacts On Three Marine Species Vital To Recreational, Subsistence, And Commercial Fisheries In Alaska”
Kelly Cates	Major Advisor: Dr. Shannon Atkinson PhD Fisheries “Current And Novel Tools In The Health Assessment Of Large Whales”
James Crimp	Major Advisor: Dr. Schery Umanzor MS Marine Biology “Effect Of Macroalgae Diet On Growth Rate And Nutrition Of The Pinto Abalone, Haliotis Kamtschatkana”
Josie Haag	Major Advisor: Dr. Amanda Kelley PhD Oceanography “Investigating Mariculture-Associated Ecosystem Services In The Northern Gulf Of Alaska”
Julia McMahon	Major Advisor: Dr. Peter Westley MS Fisheries “Ocean and stream ecology of adult hatchery and wild pink salmon”
Mary Spanos	Major Advisor: Dr. Trent Sutton MS Fisheries “Evaluating The Viability Of The Use Of Two Tag Types On Prespawn Arctic Lamprey”

Research Abstracts

From Rasmuson Fellows
Who Completed Their Degrees
2000-2025

Characterizing Ocean Change Impacts On Three Marine Species Vital To Recreational, Subsistence, And Commercial Fisheries In Alaska

Marina Washburn-Alcantar
Summer 2024

Global climate change, facilitated by increased greenhouse gas production, is driving physical and chemical alterations to the marine environment, including a long-term decrease in oceanic pH, referred to as ocean acidification (OA), and an increase in global marine temperature, referred to as ocean warming (OW). Alterations to the chemistry and temperature of the marine environment may result in bottom-up community restructuring mediated by changes in food web dynamics. In Alaska, there are many species-specific knowledge gaps, thus necessitating an assessment of the potential sensitivity of said species to climate change-related conditions. Pacific razor clams (Siliqua patula), bidarkis (Katharina tunicata), and pink salmon (Oncorhynchus gorbuscha) are prominent species utilized by Alaska's recreational, subsistence, and commercial fisheries, respectively. This dissertation examines how, and to what extent, anthropogenically forced ocean change impacts these organisms, while simultaneously bridging knowledge gaps regarding their development and biomineralogy. This research 1) characterized the embryonic and early larval development of S. patula, and 2) examined the developmental and biomineralogical responses of S. patula in Alaska to elevated and variable pCO2 conditions. Additionally, I 3) investigated the impact of future OA and OW conditions on bidarki physiology, biomineralogy, and behavior, and 4) assessed the impact of both elevated pCO2 and reduced food availability on juvenile pink salmon. My research yielded several novel discoveries. Firstly, shell development in S. patula involves a unique concretion development process, which could leave this species vulnerable to dissolution in an acidic environment, and the developmental rate of S. patula concretions is accelerated under future OA conditions. Secondly, results suggest that bidarkis are resilient to future conditions of OA and OW. In addition, bidarkis exert a strong level of biomineralogical control under OA conditions, as calcification increased within the pleural shell margin (despite observed de-silicification) and display no evidence of dissolution in the jugal lamina. This robust response could position bidarkis as particularly successful grazers in the rocky intertidal of a future warmer and more acidic ocean. Juvenile pink salmon displayed the most sensitivity to ocean change of the species investigated here, experiencing significant reductions in conditional index and mass, significant increases in cortisol levels and routine metabolic rate, while producing significantly larger otoliths (mass-corrected) under elevated pCO2 conditions. The interaction between elevated pCO2 and reduced food availability also altered caudal fin morphology significantly.

Current And Novel Tools In The Health Assessment Of Large Whales

Kelly Cates
Summer 2021

Alaskan marine ecosystems are undergoing unprecedented change and species are facing increasingly variable and potentially inhospitable habitats. As top predators, marine mammals serve an important role as sentinels of ecosystem health. With their high site fidelity, abundant numbers, coastal presence and role as a top predator, humpback whales (Megaptera novaeangliae) provide a meaningful view into current ecosystem conditions and processes. In order to tap into their usefulness as bioindicators the basic physiology of humpback whales needs to be understood. Physiological indices can provide valuable information about fecundity, survival, health and population age structuring which is fundamental to cetacean research and population management. However, such information is often difficult to obtain from wild cetaceans as they surface infrequently and often live in remote or logistically challenging locations. As such, few methods currently exist for the assessment of physiological parameters of free ranging, large cetaceans. This dissertation paired existing methods of physiological examination with novel approaches in order to better understand the basic physiology and overall health of humpback whales. Specifically, six enzyme immunoassays were validated for use in humpback whales for progesterone, testosterone, cortisol, corticosterone, aldosterone and DHEA-S, an algorithm termed "Morphometer" was developed to automate the process of measuring and analyzing morphometric measurements, and hormones and body condition metrics were paired to determine whether pregnancy status can be detected from aerial photographs. This project seeks to lay the groundwork for long term monitoring of humpback whales that can provide critical information to managers. By using baseline physiological indices and tools to rapidly analyze these metrics that I developed here, managers and researchers will be able to analyze current and future samples within a longitudinal context and make management decisions based on more accurate biological information for these populations.

Effect Of Macroalgae Diet On Growth Rate And Nutrition Of The Pinto Abalone, Haliotis Kamtschatkana

James Crimp
Summer 2024

Sharp increases in the price of distillate fuel have led to wider economic opportunities for local renewable energy resources in the over 180 rural Alaskan communities that are served by electrical microgrids isolated from larger population centers. Between 2002 and 2007 the median price of diesel fuel for utility power generation in rural Alaska increased by 72% to $0.71/l ($2.70/gal). During this period the median unsubsidized residential cost of power increased by 20% to $0.468/kWh. The Alaska Rural Energy Plan, based on 2002 fuel costs, indicated widespread opportunities for cost-saving measures from end use efficiency, diesel generation efficiency, diesel combined heat and power, and wind energy. This paper assesses economics of small hydroelectric, wind-diesel, and biomass-fired combined heat and power under a range of future oil price assumptions.

Investigating Mariculture-Associated Ecosystem Services In The Northern Gulf Of Alaska

Josie Haag
Fall 2025

The rapid expansion of mariculture in Alaska can drive physical and chemical alterations to the marine environment by introducing non-native organisms or artificially increasing the biomass of a native species. Currently, the main mariculture products grown in Alaska include the Pacific oyster (Crassostrea gigas), the Pacific blue mussel (Mytilus trosuslus), and three macroalgae species: ribbon kelp (Alaria marginata), sugar kelp (Saccharina latissima), and bull kelp (Nereocystis luetkeana). This dissertation examines how these species can impact their surrounding environment to better inform management practices for this growing industry. This research characterized the resource use of C. gigas and M. trossulus seasonally and regionally across the Gulf of Alaska, revealing that the non-native C. gigas may occupy a new dietary niche within the marine environment and create a new predatory pressure on the zooplankton community. This finding could position C. gigas as a successful colonizer if temperatures rise and these shellfish acquire the ability to reproduce in Alaska's cold waters, necessitating consideration for carrying capacities in smaller bays. However, C. gigas and M. trossulus also consumed detrital macroalgae, supporting co-culturing shellfish with macroalgae. Additionally, I investigated the ability of macroalgae farms to drawdown atmospheric carbon dioxide (CO_2) and whether fluxes varied across the three sites in the Gulf of Alaska. The site-specific CO_2 drawdown rates demonstrated that macroalgae farms may act as both a source and sink of CO_2 to the atmosphere. Despite the observed transition from heterotrophy to autotrophy in spring across all three sites, the atmospheric CO_2 flux varied from positive to negative within the span of hours due to variable wind forcing and disequilibrium between the ocean and the air. These results suggest that selling carbon credits from kelp farms in Alaska would require site-specific analyses and a greater understanding of the other sinks of macroalgae (such as the dissolved and particulate fraction). Combined, these findings indicate that aquatic farms can affect marine ecosystems, highlighting the need to constrain the potential impacts of both native and non-native mariculture products on the environment.

Ocean And Stream Ecology Of Adult Hatchery And Wild Pink Salmon

Julia McMahon
Summer 2021

In this thesis I investigate potential interactions of hatchery and wild pink salmon (Oncorhynchus gorbuscha) at sea and on the spawning grounds, in the context of the ecological and economic importance of modern Alaskan hatcheries. Although hatchery and wild salmon are known to interact, the nature and outcome of those interactions remain unclear. Here, I identify potential mechanisms of competition and hatchery salmon fitness with two datasets from Prince William Sound, Alaska, home to the largest pink salmon hatchery program in the world. First, I compared fitness-related traits such as body length, return timing, instream lifespan, and egg retention between straying hatchery and homing wild pink salmon to identify potential barriers or bridges to gene flow with over 120,000 individuals sampled over six years (2013-2018). Predicted lengths of hatchery and wild fish depended on the even or odd year lineage, return timing, and sex. Odd year pink salmon were smaller on average than even year pink salmon, odd year hatchery fish were smaller than wild fish, odd year length decreased over the season, and odd year males tended to be larger than females. In even years, hatchery pink salmon were larger on average than wild pink salmon, length increased over the season, and hatchery females were larger on average than any other group. I found no statistically significant differences in instream lifespan (2017: t-test ($_{20.54}$), P = 0.41; 2018: t-test($_{6.26}$), P = 0.556) or egg retention ($x^2_{(2)}$= 4.5, p = 0.11; 2017 and 2018 combined) between hatchery and wild fish. In contrast, I detected significant differences in stream life of the wild fish between two different sized streams in a manner consistent with observed black bear (Ursus americanus) predation; specifically stream life was shorter in the smaller stream with markedly higher predation. Second, I used stable carbon and nitrogen isotope analysis to test the hypothesis that hatchery and wild pink salmon have distinct foraging niches during their last months at sea, which could underpin observed differences in length between hatchery and wild pink salmon. Using data from 2015, I fit linear models and detected no difference in broad-scale foraging locations (delta^{13}C values) of hatchery and wild pink salmon. However, trophic positions (delta^{15}N values) for hatchery and wild pink salmon were inversely related to size where large wild salmon and small hatchery salmon tended to have the highest delta^{15}N values. Because delta^{13}C values and delta^{15}N values of wild fish were positively associated with body size, it is likely that hatchery and wild pink salmon have size-dependent, yet still overlapping foraging niches. Overall, these results are consistent with the potential for hatchery and wild pink salmon to compete for resources on the spawning grounds and at sea to the extent that resources are limiting.

Evaluating The Viability Of The Use Of Two Tag Types On Prespawn Arctic Lamprey

Mary Spanos
Summer 2022

Arctic Lamprey Lethenteron camtschaticum are harvested by subsistence and commercial fisheries in the Yukon-Kuskokwim region of Alaska; however, there is little to no baseline population data available for this species. For mark-recapture and telemetry studies to be effectively utilized to collect information on Arctic Lamprey abundance, migratory and dispersal patterns, and spawning locations, the tags and transmitters used must not impact fish survival, physiology, or behavior. For this laboratory evaluation, survival, incision healing, tag retention, changes in body size, and short- (24 hours) and long-term (43 days) swim endurance were examined for prespawn Arctic Lamprey (N = 216) collected from the lower Yukon River. A total of six treatment groups were evaluated: control, sham surgery, external t-bar anchor tag, and small (0.30 g; 0.1-0.4% tag burden [the ratio of transmitter weight to Arctic Lamprey body weight]), medium (0.57 g; 0.2-0.8% tag burden), and large (1.50 g; 0.6-1.9% tag burden) internal radio transmitters. While all Arctic Lamprey survived tagging and surgical procedures, the mortality hazard of Arctic Lamprey was significantly greater for the large transmitter treatment group compared to the control, t-bar, and sham surgery treatments. Internal scar tissue production, displacement of eggs, and breaks in male testes were found in individuals in all internal transmitter treatment groups. Over the 14-week experimental period, only one t-bar anchor tag and one small transmitter were shed by tagging-evaluation Arctic Lamprey. While no significant differences in healing were found among surgical treatment groups, persistent inflammation was observed at surgical incision sites as well as erosion of the skin at antenna protrusion locations. Most Arctic Lamprey declined in total length (mean relative change = -5.02%) and wet weight (mean relative change = -9.65%) over the experimental period, with no differences among treatments. While treatment group was not a significant predictor of swim endurance, higher tag burden resulted in reductions in swim duration at 24-hours, but not 43-days post-treatment. My results indicate that t-bar anchor tags and internal radio transmitters (maximum tag burden = 1.3%) do not impact survival, changes in body size, or swimming endurance of prespawn Arctic Lamprey and can be used to monitor spawner abundance and migratory patterns in the Yukon River.

Where are they now?

(employment after graduation)

Marina Washburn-Alcantar	Department of Defense Environment Specialist
Kelly Cates	NOAA, Fisheries Management Specialist
James Crimp	SeaGrant MAP Agent - Juneau
Josie Haag	Engaging in a year of travel and exploration
Julia McMahon	UAF, Technician
Mary Spanos	Pacific States Marine Fisheries

Cover: Austin Flanigan - Ph.D. Fisheries (RFRC Recipient 2019-2022)
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