TESTIMONY
OF
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NORTH PACIFIC RESEARCH BOARD

BEFORE THE COMMERCE COMMITTEE SUBCOMMITTEE ON OCEANS, ATMOSPHERE, FISHERIES, AND COAST GUARD
UNITED STATES SENATE

HEARING ON
THE STATE OF OUR SALMON: A REVIEW OF THE SCIENCE AND DATA INFORMING THE MANAGEMENT OF ALASKA'S SALMON FISHERIES

OCTOBER 20, 2018
ANCHORAGE, ALASKA

Mr. Chairman, and Members of the Subcommittee joining the hearing remotely, thank you for the opportunity to testify before you today.

My name is Matthew Baker. I am the Science Director of the North Pacific Research Board (NPRB), a Congressionally created marine science funding organization based in Anchorage, Alaska. My formal education is in marine ecology, statistics, and quantitative fisheries science through training at Columbia University and the University of Washington, where I contributed to the research developed in the Fisheries Research Institute and Alaska Salmon Program, programs active in Alaska since the 1940s. My graduate research focused on stock assessment and optimal management of salmon resources in Alaska. I also have experience working as crew in the Red and King salmon fisheries in Bristol Bay. Subsequent and current areas of research include groundfish distribution, survey design, multispecies fishery management, forage fish demographics and forage fish-salmon interactions. My primary role at NPRB is to direct the development of our scientific program to inform marine ecosystem understanding and sustainable fishery management and to reflect the interests and priorities of the institutions represented on our Board and to serve the needs of stakeholders in Alaska.

I am joined today by Dr. Betsy Baker, NPRB Executive Director and Danielle Dickson, NPRB Senior Program Manager and Chief Officer for Collaboration and Synthesis.

I. NPRB: Funding Alaska Fishery and Ecosystem Science since 2002

In 1997 Congress established the North Pacific Research Board (NPRB) to recommend marine research to the U.S. Secretary of Commerce (Secretary) relating to the waters off of Alaska.[1] Research projects approved by the Secretary are funded through a competitive grant program using a portion of the interest earned on the Environmental Improvement and Restoration Fund (EIRF), which Congress created in the same enabling legislation. These funds must be used to conduct research activities on, or relating to, fisheries and marine ecosystems in the North Pacific Ocean, Gulf of Alaska, Bering Sea, Aleutian Islands, and Arctic. NPRB prioritizes collaborative research that improves understanding of marine ecosystems and enhances effective fishery management and sustainable use of marine resources. The enabling legislation directs the Board to address pressing fishery management and marine ecosystem information needs. The Board is composed of twenty members, representing federal, state, Alaska Native, commercial fishing, oil and gas, academic, and conservation interests (Appendix A). The Board is supported by a Science Panel, an Advisory Panel, and NPRB staff.

[1] Department of the Interior and Related Agencies Appropriations Act, 1998, PL 105-83, Title IV, Sec. 401, codified at 43 USC 1474d.

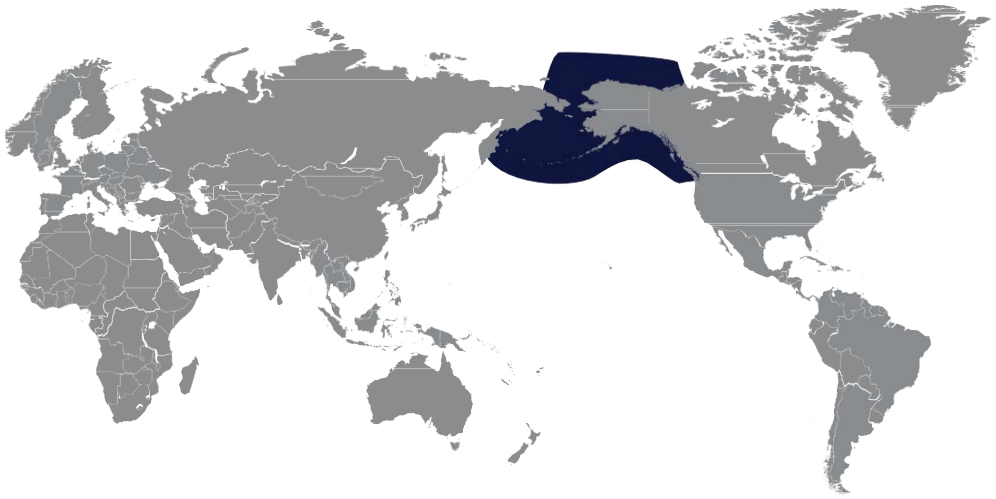


Figure 1: NPRB supports research in the marine systems of the North Pacific, including the Gulf of Alaska (Strait of Juan de Fuca to Unimak Pass), Bering Sea (Alaska Peninsula to the Kamchatka Peninsula and north to the Bering Strait), Aleutian Islands (Unimak Pass to the Commander Islands), Chukchi Sea (Point Barrow to Cape Billings), Beaufort Sea (Point Barrow to Victoria Island), and processes in the North Pacific and Arctic Ocean basins relevant to these regions.

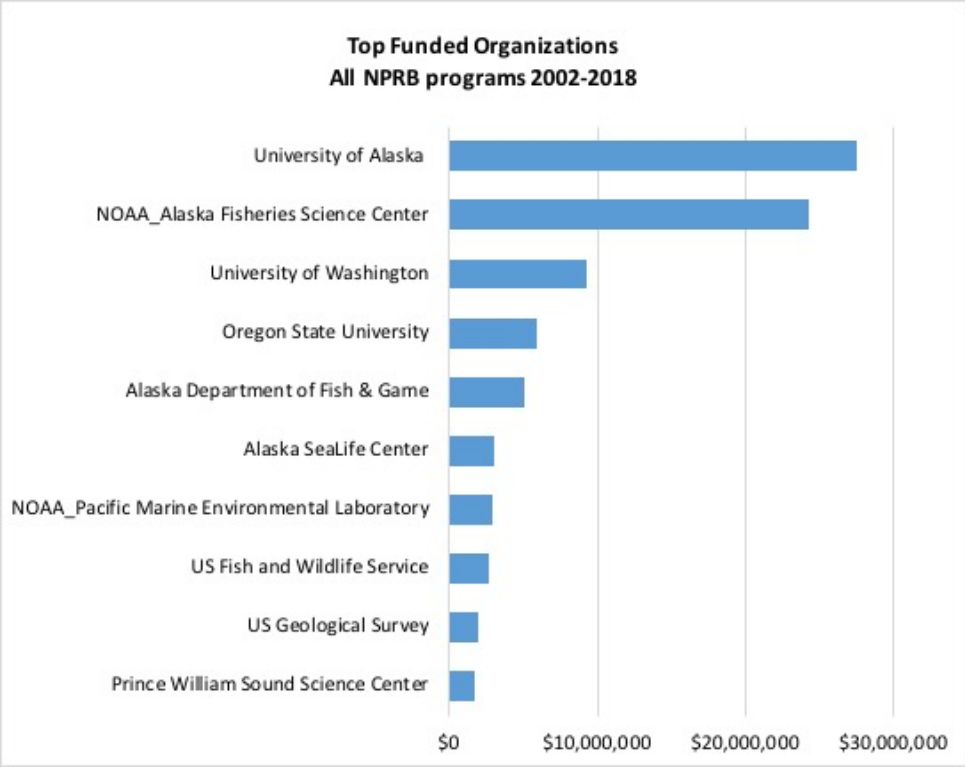
NPRB supports three marine science research programs, as well as graduate student research awards:

- IERP – Integrated ecosystem research programs in which dozens of scientists integrate their disciplinary expertise over five to seven years and multiple research cruises in specific geographic regions (to date the Gulf of Alaska, Bering Sea, and Arctic Ocean);
- CORE – Discipline-specific research by individual or small groups of scientists. The Core program was formerly known as the Annual program; and
- LTM – Long-term monitoring of oceanographic conditions in three locations, two in the Gulf of Alaska and one on the Northeast Chukchi shelf off the state's northwest coast.

Integrated Ecosystem Research Programs provide information about mechanistic processes that structure marine ecosystems and drive change. The Core Program provides funds for research projects focused by discipline, including socioeconomic studies as well as natural science research. NPRB's Long-Term Monitoring Program is designed to provide stable funding in five-year increments, potentially over decades, for collecting data that provide useful indices of ecosystem conditions and variability. All three research programs, detailed below, have yielded results relevant to informing the management of Alaska's salmon fisheries.

In addition to research results, NPRB funding has also created a substantial data repository for data generated by NPRB research. It is intended as a public repository for completed projects that includes data and metadata published through the NPRB Research Workspace, accessible through a public data portal http://projects.nprb.org/ and via our data partner Axiom Data Systems and DataOne, an international data platform.

Since NPRB began funding research in 2002 it has provided over $114 million in research sub-awards to 492 projects, based at 162 academic, community, and other research institutions:



II. Salmon relevant research funded by the North Pacific Research Board 2002-2018

Salmon-specific studies have been funded in 20 of the 22 years that NPRB has awarded Annual (now Core) Program research funds. The call for proposals published in October 2018 for projects that will be reviewed in 2019 requests research proposals to address "anomalous changes in abundance of sockeye salmon within a system or across a broad geographic range." In addition to research specifically targeting salmon, much of the research NPRB funds is relevant to understanding issues related to critical habitat, oceanographic conditions, species interactions relevant to marine competition and carrying capacity, environmental metrics informative to forecasting recruitment, run strength and timing, tools and approaches to improve stock assessment modeling, and social and economic considerations that can help inform management of Alaska's salmon fisheries.

Three salmon-specific projects were among the funded by NPRB in our first year of operation alone, which was 2002:

- *Application of new sonar technology to reducing salmon bycatch in pollock fisheries* – Alaska Fisheries Science Center (AFSC) ($121,918).
- *North Pacific anadromous fish commission salmon tagging* – North Pacific Anadromous Fish Commission ($190,800).
- *Genetic stock identification of western Alaska sockeye salmon* – NMFS, ADF&G, Auke Bay Laboratory, AFSC ($216,515).

A non-salmon specific study that first year that was also relevant to salmon fisheries was *Detecting change in the Bering Sea*, a joint project of the Alaska Fisheries Science Center and NOAA Pacific Marine Environmental Laboratory ($124,084).

Of the 453 Core projects NPRB funded between 2002 and 2018, 51 – or 11% – include salmon in their project descriptions have some implications for salmon management. Thirty-two of those projects targeted salmon as the primary species studied in the Gulf of Alaska (GOA) and the Bering Sea/Aleutian Islands (BSAI) Large Marine Ecosystems (LMEs). Those studies were evenly split between Bristol Bay, the Copper River, and the Yukon River. All three NPRB Integrated Ecosystem Research Programs – in the Bering, the Gulf and the Arctic – have included salmon either as a species studied, or as one affected by other factors examined by these programs.

A. NPRB Integrated Ecosystem Research relevant to Alaska Salmon Fisheries

NPRB's Integrated Ecosystem Research Programs (IERPs) use a multi-disciplinary approach to examine ecological processes in detail and provide a wealth of information that is relevant to addressing a wide variety of resource management questions. Here we highlight some examples of how these programs provide data and products that inform the management of Alaska's salmon fisheries.

Gulf of Alaska and Bering Sea IERPs

The Gulf of Alaska IERP (2010-2018), although focused on drivers of groundfish recruitment, provided data on salmon distribution and diet that were relevant to examining the role of salmon as competitors and predators of groundfish. The year 2011 was an anomalously low production year in the Gulf of Alaska and in 2011 salmon were in relatively poor body condition and stomach content analysis indicated lower feeding rates. The Gulf of Alaska IERP did not collect data during 2014-16 when anomalously warm conditions persisted in the Gulf of Alaska, however, data collected by NOAA scientists and others who participated in our GOA synthesis project provide evidence that poor prey quality in those years likely affected all salmon species in Gulf of Alaska waters. Scientists suggest that the Gulf of Alaska has demonstrated resilience to anomalous conditions that occur in any given year, but the *persistence* of anomalous conditions may have lasting effects on fish production and ecosystem dynamics.

The Bering Sea IERP (2007-2016) reached similar conclusions with respect to pollock. When warm water conditions persisted over several years 2001-2005, pollock recruitment was negatively affected because zooplankton prey were limited (Hunt et al. 2011). The persistence of warm or cold conditions over consecutive years, termed a "stanza", can affect ecosystem dynamics more profoundly than interannual variability that oscillates year to year.

The Gulf of Alaska IERP did not collect data 2014-2016 during persistent anomalous warm water conditions because the program was designed several years in advance to conduct research cruises mid-way through the funding period. However, the program developed oceanographic models that incorporate biological processes and those models could be used to examine questions specific to salmon ecology and the production of their prey. The current models run from 2000 to 2013 and could be run into subsequent years to examine the conditions that salmon experience when they are in the offshore marine environment.

The Gulf of Alaska IERP also provided insights into ecosystem dynamics in the Gulf of Alaska and contributed to identifying indices for the Ecosystem Considerations chapter of the North Pacific Fishery Management Council Stock Assessment and Fishery Evaluation report. As a result of this research and recognition of distinct dynamics in eastern and western sections of this

ecosystem, the indices used to hindcast conditions in this ecosystem are now separated into eastern and western sections. This development is relevant to the management of all fish species in the Gulf of Alaska. The program also developed oceanographic models that incorporate biological processes, which might be used to examine questions specific to salmon ecology and production of prey resources. The current models run from 2000 to 2013 and could be run into subsequent years to examine conditions salmon experience in the offshore marine environment.

The Gulf of Alaska IERP synthesis included genetic analyses of salmon captured in southeast Alaska in July 2011-2015 and found that juvenile salmon in the Gulf of Alaska in mid-summer are predominantly from the Columbia River, comprising nearly 80% of the samples. The study provides valuable information about the timing and speed of Chinook migrations. The results indicate that collaboration to combine data from surveys along the North American coastal migration pathway can provide information relevant to understanding stock-specific and inter-annual variation in the survival of juvenile salmon. Furthermore, sampling in the Gulf of Alaska may allow assessment of the marine survival of juvenile Columbia River Chinook salmon two years prior to their return to the river as adults (Van Doornik et al. in prep.).

Research associated with the Bering Sea IERP on "calorie-sheds" supports the notion that collection of data across vast geographic regions is warranted to understand the factors influencing the health and survival of species throughout their range. Subsistence communities are especially concerned about cumulative impacts on migratory species.

Arctic IERP

The Arctic IERP currently underway (2016-2021) will provide information relevant to addressing concerns about food security for Arctic residents and will collect data related to salmon, specifically. The focus of the program is on how reductions in Arctic sea ice and associated changes in the physical environment will influence the flow of energy through the ecosystem in the Chukchi Sea. The program includes examining the environmental factors that influence the distribution and abundance of fish in the U.S. Arctic, including pink and chum salmon. The program includes social science research that examines the relative influences of environmental and socioeconomic factors in determining food security for Arctic residents. The research includes consideration of local and traditional knowledge and members of Arctic communities participate in annual science meetings.

NPRB is providing $7 million in base funding for the Arctic Program and leveraging partner funding from the Bureau of Ocean Energy Management, the Collaborative Alaskan Arctic Studies Program (formerly the North Slope Borough/Shell Baseline Studies Program), the Office of Naval Research Marine Mammals and Biology Program and in-kind contributions from NOAA (Alaska Fisheries Science Center and Pacific Marine Environmental Laboratory), the University of Alaska Fairbanks, the U.S. Fish & Wildlife Service, and the National Science Foundation. The combined support for the program totals >$18 million.

B. NPRB discipline-specific research relevant to Alaska Salmon Fisheries

Of the 65 Core (formerly Annual) projects that named salmon in their abstracts, we identify 32 as having management application to salmon. Those 32 projects are highlighted in Appendix C, which includes all 65 projects naming salmon. In addition, we summarize below six Core projects of particular relevance to salmon management:

- NPRB project 0202 – *Application of new sonar technology to reducing salmon bycatch in pollock fisheries* – applied advanced sonar technology to a cooperative industry/government effort to modify pelagic trawls to reduce salmon bycatch in Alaska pollock fisheries. Dual-frequency Identification SONar (DIDSON) provided detailed observations of the behavior of these two species within pelagic trawls and observations informed the development and testing of salmon excluder designs. Excluder development has progressed through repeating this sequence of behavior observations, expert feedback, concept development, design, model testing, full-scale observations and performance experiments. Performance experiments indicate that more than 12% of the salmon escape, with a pollock loss less than 3%.

- NPRB project 0327 – *Early marine ecology of juvenile chum salmon in Kuskokwim Bay, Alaska* – investigated estuarine residence of juvenile chum salmon, a stage of high mortality that may ultimately determine year class strength. Results included spatial and temporal patterns of estuarine distribution, diet, and condition of chum salmon juveniles in Kuskokwim Bay and a spatially-explicit foraging/bioenergetic modeling that assessed growth potential of Kuskokwim Bay habitats for outmigrating juvenile chum salmon. Results indicated that timing of outmigration is highly important to condition, growth, and subsequent survival probability.

- NPRB project 1111 – *Over-winter Survival of Bristol Bay Sockeye Salmon at Sea* – addressed variability in adult sockeye salmon returns and related uncertainty in harvest forecasts and economic returns. This project used historical measures of scale growth (1960s-2010) and juvenile sockeye salmon in the Bering Sea (2000-2010) to investigate whether productivity shifts of sockeye salmon since the 1960s are related to shifts in ocean productivity that affect early marine salmon growth and overwinter survival and whether salmon growth and survival are lower during "cold" water years when prey availability and growth are reduced.

- NPRB project 1423 – *Defining critical periods for Yukon and Kuskokwim river Chinook salmon* – found that Chinook in the Yukon-Kuskokwim region grow more slowly under warm water conditions, likely because their prey are less available. This annual project finding was complemented by the Bering Sea Integrated Ecosystem Research Program (2007-2016), which described mechanisms that limited pollock growth and survival in the Bering Sea when warm water conditions persisted over multiple years. A similar mechanism may affect Chinook.

- NPRB project 1619 – *Relative rate of survival (RRS) of pink salmon in PWS* – Returns from hatchery releases of pink and chum salmon provide 51-97 million adult salmon to harvests, contributing up to 25% of the exvessel value of the statewide harvest. The Alaska Hatchery Research Program (AHRP) sought to reduce uncertainty about straying and genetic interactions between hatchery and wild stocks and used genetic parentage analysis to estimate the relative reproductive success of hatchery-origin pink salmon in natural streams to investigate the potential for a reduction in fitness due to hatchery straying and to inform resource management decisions regarding hatchery production.

- NPRB project 1702 – *Data and information in salmon stock-recruitment analysis* – is an ongoing review that emphasizes the diverse types of primary data (e.g., counts, indices, model-derived reconstructions), auxiliary data (habitat quantity and characteristics, environmental covariates), and considerations of model structure, to determine their effects on the quality of estimates of the stock-recruitment relationship. Best practices will be emphasized to provide guidance to stock-recruitment analysts.

C. NPRB Long-Term Monitoring work relevant to Alaska Salmon Fisheries

NPRB currently funds three Long-Term Monitoring projects[2]:

- The North Pacific Continuous Plankton Recorder Project is a ship of opportunity monitoring program that has operated since 2000 using commercial ships to collect samples of phytoplankton and zooplankton, and selected aspects of the physical environment, along their regular routes of passage on a seasonal basis. Project scientists recently found that pink salmon predation induces a trophic cascade in plankton populations in the southern Bering Sea and around the Aleutian Islands (Batten et al. 2018). The results support the idea that abundant pink salmon may affect the growth and survival of the other four species of salmon that occur in this region.

- The Seward Line Project has operated in the Gulf of Alaska for over 20 years and provides oceanographic data and other indices of ecosystem health and variability. The project has expanded over the years as new funding partners are added to the consortium and was recently established as a National Science Foundation Long-Term Ecological Research Site. NPRB recently committed to providing funding for another five years (FY20-24).

- The Chukchi Ecosystem Observatory consists of an array of moored instruments that collect data on the Chukchi Sea shelf near Hanna Shoal year-round. A wide range of data are collected to address physical, chemical, and biological oceanography, sediment flux, timing and magnitude of plankton blooms, and fish and marine mammal migratory patterns. A similar moored array will be added in the Gulf of Alaska soon that is associated with the Seward Line project. Such instrumentation provides valuable information about the ecosystem that should prove useful to addressing questions relevant to salmon.

D. NPRB data relevant to informing Alaska's Salmon Fisheries

All projects funded by NPRB are required to submit the data they generate to NPRB, which works with Axiom Data Science locally and with DataOne, an international data platform, to make it available to the NPRB science community and, after the required two-year embargo period passes, to the public. NPRB implemented comprehensive data publication processes in 2016 to improve overall access to the data. NPRB has started with the most recent projects (2014-2018) and is working to fully vet, process and release data from past projects. Archived data from legacy projects (pre-2014 awards) will be available through the NPRB web portal in the future.

III. Future research: Promising directions, and Research needs

A. Promising directions – Research and data coordination

NPRB is interested in maximizing the use of NPRB-funded products and is actively working to create synergies with other organizations. NPRB's Chief Officer for Collaboration and Synthesis, Danielle Dickson, is working to foster collaboration with other organizations and demonstrating that

[2] The Gulf of Alaska Seward Line https://www.gulfwatchalaska.org/monitoring/environmental-drivers/the-seward-line-marine-ecosystem-monitoring-in-the-northern-gulf-of-alaska/;
The North Pacific Continuous Plankton Recorder Survey https://www.pices.int/projects/tcprsotnp/default.aspx/; and
The Chukchi Ecosystem Observatory https://www.uaf.edu/cfos/research/projects/ne-chukchi-sea-moored-eco/.

NPRB can serve to coordinate Alaska marine research whether that research is funded directly by NPRB or not.

Salmon run timing – supporting coordination between state and federal salmon managers. One relevant example is an ecological forecasting project coordinated by NPRB staff and supported by NOAA that involves collaboration among NOAA and ADF&G staff to develop a salmon run timing model for Cook Inlet. The run timing model will examine the relative influence of offshore and nearshore marine environmental conditions and will make use of data derived from various NPRB-funded projects, including indices of zooplankton prey derived from the Gulf of Alaska IERP model, zooplankton measurements collected by the Seward Line Long-Term Monitoring project over the past two decades, and runoff modeled by NPRB Core Program project 904. The model will use decades worth of salmon time series data collected by ADF&G and environmental data provided by NOAA Fisheries, National Weather Service, National Ocean Service, U.S. Geological Survey, and the Alaska Ocean Observing System. A separate salmon run timing model for Yukon River Chinook salmon supported by AOOS, NOAA, and ADF&G typically uses sea ice as an important predictor of run timing but the virtually ice-free conditions experienced in 2018 complicated the forecast and illustrated the importance of identifying other relevant environmental indices (Postseason Analysis of the 2018 Yukon River Chinook Run Timing Forecast). Projects such as these illustrate the power of coordinating research across various organizations to forecast biological and ecological events and this approach could be applied to other species or geographic areas.

NPRB is uniquely positioned to facilitate conversation about opportunities to coordinate marine research across a variety of organizations and sectors. The broad representation of the Board, including federal, state, industry, conservation, and Alaska Native interest seats, ensures that a wide variety of stakeholder voices are included in these discussions. The Board presents an opportunity for those stakeholder groups to leverage one another's resources, expertise, and perspectives to advance marine science in Alaska. NPRB staff have unique experience in developing research programs that address stakeholder concerns, building partnerships to fund such research, and implementing programs that achieve remarkable coordination and collaboration across disciplines and institutions.

In some respects, despite Alaska's vast geographic area, coordinating research in Alaska is tenable because the community is tightly-knit. In both the scientific research community and the stakeholder community, the same individuals are often engaged in conversation in a variety of forums.

Just two examples of NPRB staff involved in research and data coordination with other research organizations suggest promising research coordination directions:

Salmon Data: coordination and data gaps. NPRB Science Director Matthew Baker's participation in two activities sponsored by the National Center for Analysis and Synthesis (NCEAS): Coupling Climate and Salmon (June 2018); and the State of Alaska Salmon and People knowledge synthesis project (November 2018). These multi-institutional discussions are directly relevant to identifying data streams useful to support salmon research and have important insights relevant to informing future directions in salmon management.

Cross-organizational collaboration. The federal Interagency Arctic Research Policy Committee (IARPC) Collaborations model works well to coordinate Arctic research within and beyond federal agencies. The Collaborations model actively solicits non-federal participants, bringing together scientists from Federal, State, academic, NGO, industry, indigenous and international organizations to share their work. The Collaborations model could be applied more broadly to improve coordination for other areas of Alaska and nationwide. NPRB staff member Danielle Dickson

serves as Co-Lead of the IARPC Marine Ecosystems Collaboration Team. In that forum she works to coordinate Arctic research with other organizations. The success of such a model relies on strong participation; agency staff from Alaska field offices and headquarters of each federal agency, and non-federal researchers from other public and private entities should be encouraged to participate in IARPC.

B. Research and funding needs

Research needs

NPRB focuses exclusively on the marine environment. Given that perspective applied to a set of anadromous species, research needs relevant to the management of Alaska's salmon fisheries might include:

- Further analyses on marine carrying capacity, thresholds, and density dependent constraints
- Further understanding and modeling of life cycle and stage-specific mortality
- Further research on inter-species interactions among salmon and spatial and diet overlap of salmon species and stocks in the marine environment
- Further genetic sampling and categorization of various stocks and substocks
- Improved methods for run timing and stock-size forecasts
- Integrated regional oceanographic models that provide insight into stock distribution, growth and survival
- Understanding of oceanographic processes that determine plankton production and first year ocean survival for smolts
- Increased research on forage species and relative availability to salmon stocks

Leveraging existing initiatives to share data and management practices

As part of the North Pacific Anadromous Fish Commission International Year of the Salmon 2019 (IYS - with projects from 2018-22) and recent National Center for Ecological Analysis and Synthesis salmon projects, multiple research-oriented sessions have been convened to address issues related to effective salmon use, management and conservation. NPRB has provided conference support for a January 2019 IYS workshop on Salmon Status and Trends. There is an opportunity to leverage these findings and conclusions to further inform state and federal salmon management.

Funding Needs

NPRB relies almost entirely on competitive annual grants from NOAA to fund the research described in this testimony but, as described in the next paragraph, those grant funds have diminished over time due to market influences. NPRB is grateful for the additional funds available through funding partnerships, which comprise a small percentage of our overall funding: For the Core (formerly Annual) program, NPRB has developed funding partnerships with the Oil Spill Recovery Institute and is in discussion with other potential partners; for the Integrated Ecosystem Research Programs (IERPs) with the National Science Foundation, Bureau of Ocean Energy Management, the Collaborative Alaskan Arctic Studies Program (formerly the North Slope Borough/Shell Baseline Studies Program), the Office of Naval Research Marine Mammal and Biology Program and in-kind contributions from NOAA from NOAA (Alaska Fisheries Science Center and Pacific Marine Environmental Laboratory), the University of Alaska Fairbanks, the U.S.

Fish & Wildlife Service, and the National Science Foundation. NPRB is actively working to develop additional funding partnerships.

By law, NPRB receives 20% of interest earned on the Environmental Improvement and Restoration Fund established in the same law that created NPRB. However, EIRF investments are limited by law to interest bearing obligations of the United States. NPRB is feeling very acutely the negative Impact of sustained low yield on 10-year Treasury Notes on monies made available to NPRB for science funding. In recent years grants based on those yields have dropped from almost $9 million in 2011 to $6.9 million in FY2019, severely restricting our ability to fund our research programs at levels that provide scientists with the support they need. For example, in 2019 funding for the discipline-specific Core Program will drop from $4.5 to $4 million; the program used to be known as the "Annual Program" but was recently renamed the Core program to reflect the fact that annual funding of the program could not necessarily be guaranteed. Although the Board recently committed $1 million for the synthesis phase of the Artic IERP, set-asides for future integrated ecosystem research programs are pending clarity on NPRB's near-term funding.

CONCLUDING REMARKS

Thanks to the foresight of Senator Ted Stevens and his congressional colleagues in establishing the North Pacific Research Board in 1997, NPRB has been able to contribute valuable research relevant to the management of Alaska's salmon fisheries in the sixteen years we have awarded research funds. As each of the organizations and witnesses testifying today at this hearing make clear, the value of our research is multiplied when we work together. We appreciate the opportunity to highlight NPRB research and to demonstrate and learn from all of these witnesses new ways we can combine our collective research and expertise to help improve management of Alaska's salmon fisheries.

Thank you for your consideration of our testimony. We look forward to answering your questions.

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APPENDICES

APPENDIX A
NPRB Board Composition

As codified in 43 U.S.C. §1474d, the Board is composed of 20 members:

• Ten seats are ex-officio representatives or their designees, with no official term length:

Secretary of Commerce,
Secretary of State, Secretary of the Interior,
Commandant of the Coast Guard,
Director of the Office of Naval Research,
the Alaska Commissioner of Fish and Game,
Chairman of the North Pacific Fishery Management Council,
Chairman of the Arctic Research Commission,
Director of the Oil Spill Recovery Institute, and
Director of the Alaska SeaLife Center.

• Nine seats are held by members appointed by the Secretary of Commerce from nominations provided by the governors of

Alaska (five seats),
Washington (three seats), and
Oregon (one seat).

These board members serve for three-year terms and may be reappointed. The five Alaska seats must represent fishing interests, Alaska Natives, conservation interests, academia, and oil and gas interests.

• One seat is appointed by the Secretary of Commerce from a Board nomination to represent fishing interests. This is also a three-year term appointment but is not renewable.

APPENDIX B
Abbreviations

ADF&G	Alaska Department of Fish and Game
AFSC	Alaska Fisheries Science Center
BOEM	Bureau of Ocean and Energy Management
BSAI	Bering Sea/Aleutian Islands
DIDSON	Dual-frequency Identification SONar
DFO	Department of Fisheries and Oceans Canada
EIRF	Environmental Improvement and Restoration Fund
GOA	Gulf of Alaska
IARPC	Interagency Arctic Research Policy Committee (Federal)
IERP	Integrated Ecosystem Research Program
IYS	International Year of the Salmon (NPAFC)
LME	Large Marine Ecosystems
LTER	Long-Term Ecological Research Site (NSF)
LTM	Long-term Monitoring
NCEAS	National Center for Ecological Analysis and Synthesis
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPAFC	North Pacific Anadromous Fish Commission
NPRB	North Pacific Research Board
NSF	National Science Foundation
PMEL	Pacific Marine Environmental Laboratory
PWSSC	Prince William Sounds Science Center
UA	University of Alaska
UAF	University of Alaska Fairbanks
UAS	University of Alaska Southeast
USFS	US Forest Service

APPENDIX C
NPRB Core/Annual Projects including salmon in the described research

Please see next page

APPENDIX C

PROJECT	YEAR	NPRB Project Title	AWARDED	STATUS	THEME	LME	LEAD INSTITUTION
0202	2002	Application of new sonar technology to reducing salmon bycatch in pollock fisheries	$121,918	closed	Fishes & Invertebrates	GOA	AFSC
0204	2002	North Pacific Anadromous Fish Commission Salmon Tagging	$190,800	closed	Fishes & Invertebrates	BSAI	North Pacific Anadromous Fish Commission
0205	2002	Genetic stock identification of western Alaska sockeye salmon	$216,515	closed	Fishes & Invertebrates	GOA	ADF&G, AFSC
0303	2003	North Pacific Anadromous Fish Commission Cooperative Research: genetic stock identification	$499,080	closed	Fishes & Invertebrates	BSAI	ADF&G, AFSC
0310	2003	Estuaries as essential fish habitat for salmonids: assessing residence time and habitat use	$400,022	closed	Fishes & Invertebrates	GOA	PWSSC, USFS, Pacific Northwest Research Station
0311	2003	Establishing a statewide data warehouse of salmon size, age and growth records	$43,066	closed	Fishes & Invertebrates	GOA	ADF&G
0317	2003	Pre-season forecast of Bristol Bay sockeye salmon migration timing based on oceanographic and biological variable	$24,930	closed	Fishes & Invertebrates	BSAI	Natural Resource Consultants Inc.
0321	2003	Alternative hypotheses for the collapse of the Kvichak sockeye salmon	$192,850	closed	Fishes & Invertebrates	BSAI	Bristol Bay Science & Research Institute, Natural Resource Consultants
0327	2003	Early marine ecology of juvenile chum salmon in Kuskokwim Bay, Alaska	$624,025	closed	Fishes & Invertebrates	BSAI	UAF, USGS Alaska Science Center
0504	2005	Analysis of ongoing salmon programs	$99,850	closed	Fishes & Invertebrates	GOA	Consulting Fisheries Scientist
0520	2005	Gulf of Alaska Long-Term Observations	$420,000	closed	Lower Trophic Level Productivity	GOA	UAF
0521	2005	A profiling echosounder for North Pacific monitoring	$100,000	closed	Fishes & Invertebrates	GOA	Institute of Ocean Sciences, DFO
0535	2005	Dietary specialization of Killer Whales	$183,140	closed	Marine Mammals	GOA	AFSC, Northwest Fisheries Science Center, UAF
0536	2005	A continuous plankton recorder survey of the North Pacific and southern Bering Sea	$100,000	closed	Lower Trophic Level Productivity	GOA	DFO, Kintama Research, Sir Alister Hardy Foundation for Ocean Science
0603	2006	Gulf of Alaska Long-Term Observations	$415,925	closed	Lower Trophic Level Productivity	GOA	UAF
0630	2006	Food web linkages: Forage Fish in the Aleutian Archipelago	$163,845	closed	Fishes & Invertebrates	GOA	USF&WS, USGS Alaska Science Center
0642	2006	Forage Fish Prince William Sound Nearshore	$150,000	closed	Fish Habitat	GOA	AFSC
0708	2007	Gulf of Alaska Longterm Observation Program (LTOP)	$249,996	closed	Lower Trophic Level Productivity	GOA	UAF
0731	2007	Temperature data collections on BS groundfish vessels	$147,816	closed	Fishes & Invertebrates	BSAI	AFSC, Marine Conservation Alliance Foundation, PMEL
0805	2008	On-shelf transport of mesozooplankton in subarctic seas	$169,050	closed	Lower Trophic Level Productivity	GOA	UAF
0823	2008	Cultural Models of Copper River Salmon Biology	$99,535	closed	Human Dimensions	GOA	Ahtna Inc., ADF&G, Ecotrust, North Cape Fisheries Consulting, UA
0915	2009	Disease severity in Chinook salmon during marine migration	$99,998	closed	Fishes & Invertebrates	BSAI	Purdue University, UAF
0922	2009	Eyak Lake community monitoring project	$98,949	closed	Lower Trophic Level Productivity	GOA	Prince William Soundkeeper, PWSSC
1008	2010	Salmon bycatch in the BSAI pollock fisheries	$393,449	closed	Fishes & Invertebrates	BSAI	UAF
1009	2010	Chinook Survival	$302,262	closed	Fishes & Invertebrates	BSAI	University of Washington
1019	2010	Assessment of Health Conditions of Subsistence Fish and Shellfish	$49,947	closed	Other Prominent Issues	GOA	Chugach Regional Resources Commission, NOAA
1110	2011	Pink salmon response to climate change	$157,350	closed	Fishes & Invertebrates	GOA	UAS
1111	2011	Over-winter Survival of Bristol Bay Sockeye Salmon at Sea	$219,006	closed	Fishes & Invertebrates	GOA	ADF&G, Natural Resources Consultants, Inc., AFSC
1114	2011	Steller sea lion diet and population trend in the Aleutians	$392,500	closed	Marine Mammals	BSAI	AFSC, SMRU Ltd.
1122	2011	Development of a fish health and composition analyzer	$39,816	closed	Fishes & Invertebrates	GOA	AFSC
1308	2013	Early Marine Ecology of Juvenile Chinook Salmon (Oncorhynchus tshawytscha) on the Yukon Delta, Alaska	$172,903	closed	Fishes & Invertebrates	BSAI	AFSC
1315	2013	Bioeffects Assessment in Bristol Bay	$91,164	closed	Other Prominent Issues	BSAI	NOAA
1319	2013	Benthic impacts of raised groundgear for the Bering Sea pollock fishery	$286,068	closed	Fish Habitat	BSAI	Alaska Pacific University, AFSC
1412	2014	Yukon River Patterns and Trends	$199,949	ended	Human Dimensions	BSAI	ADF&G, Alaska Pacific University
1413	2014	Value of Salmon	$92,695	closed	Human Dimensions	BSAI	Yukon River Drainage Fisheries Association
1414	2014	Copper River Salmon Blitz	$152,753	closed	Fish Habitat	GOA	Copper River Watershed Project
1422	2014	Arctic-Yukon-Kuskokwim (AYK) Chinook salmon egg thiamine exploration	$70,006	closed	Fishes & Invertebrates	BSAI	ADF&G, NOAA, Spearfish Research
1423	2014	Defining critical periods for YK Chinook	$244,350	closed	Fishes & Invertebrates	BSAI	ADF&G, AFSC, University of Washington
1424	2014	Fitness-based habitat models for Chinook salmon	$495,282	closed	Fishes & Invertebrates	BSAI	University of Georgia
1519	2015	Social and ecological resilience in a Gulf of Alaska community	$153,453	closed	Human Dimensions	GOA	ADF&G
1524	2015	Investigating causes of decline of the Klawock Lake sockeye salmon population	$98,622	closed	Community Involvement	GOA	The Nature Conservancy of Alaska
1529	2015	Tracking marine fish with a payload-controlled autonomous underwater vehicle	$194,556	active	Technology Development	GOA	AFSC
1531	2015	Construction of a fish health and body composition analyzer	$49,566	closed	Technology Development	BSAI	Seafood Analytics
1613	2016	Local and traditional knowledge of Alaska coastal ecosystems	$105,713	active	Human Dimensions	GOA	UAF
1619	2016	Relative reproductive success of pink salmon in Prince William Sound	$289,435	active	Cooperative Research with Industr	GOA	ADF&G
1622	2016	ADF&G Data Rescue and Dissemination	$299,128	active	Data Rescue	BSAI	ADF&G
1702	2017	Data and information in salmon stock-recruitment analysis	$96,041	active	Fishes & Invertebrates	GOA	UAF
1710	2017	State-space model of factors affecting coho survival and abundance	$82,195	active	Fishes & Invertebrates	GOA	UAS
1712	2017	Oil spills and Pacific herring population recruitment	$208,346	active	Fishes & Invertebrates	GOA	NOAA Northwest Fisheries Science Center
1719	2017	Policy Choices and Permit Migration in a Limited Entry Permit (LEP) Fishery	$99,355	active	Human Dimensions	GOA	UAF
1724	2017	A sex identification assay for Chinook salmon	$167,335	active	Technology Development	GOA	University of Washington

See Appendix B for abbreviations