



Informing Fishery Management and Understanding Marine Ecosystems

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Dr. Matthew Baker, Science Director

North Pacific Fishery Management Council Meeting – Anchorage, Alaska

NPRB update

- Mission
- Partnership and coordination with the Council
- Research Priorities
- Recently funded research
- Northern Bering Sea Integrated Ecosystem Research Program



Mission

To develop a comprehensive science program... that provides a better understanding of the North Pacific ecosystems and their fisheries.... conducted through science planning, prioritization of pressing fishery management and ecosystem information needs, coordination and cooperation among research programs, competitive selection of research projects, enhanced information availability, and public involvement.

Pressing Fishery Management Issues

NPRB-NPFMC have developed a coordinated approach to identify and track joint research interests:

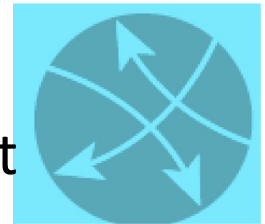


1) identify priorities for research to inform management



1) monitor investments in research and related results:

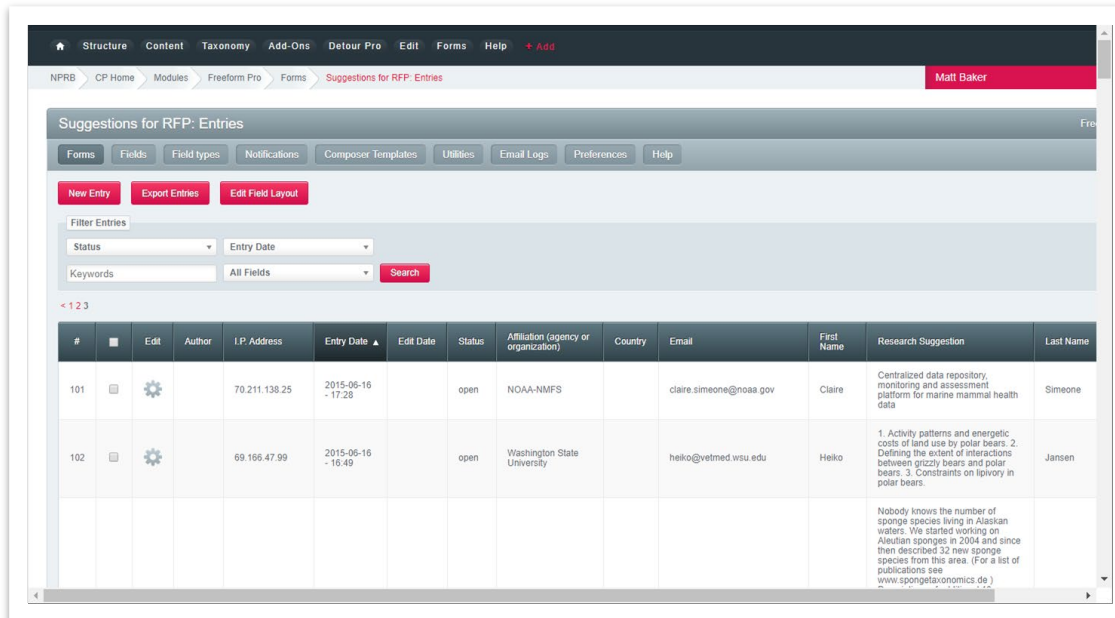
- what priorities are addressed
- what information is developed through research
- how information is applied to inform management



NPRB Research Priorities

Research Priorities identified through:

- review of NPFMC priorities
- solicitation of priorities:
 - management agencies
 - research community and public
- input from Board and Panel members



The screenshot shows a web interface for 'Suggestions for RFP: Entries'. It includes a navigation menu, a search bar, and a table of entries. The table has columns for #, Edit, Author, I.P. Address, Entry Date, Edit Date, Status, Affiliation, Country, Email, First Name, Research Suggestion, and Last Name.

#	Edit	Author	I.P. Address	Entry Date	Edit Date	Status	Affiliation (agency or organization)	Country	Email	First Name	Research Suggestion	Last Name
101			70.211.138.25	2015-06-16 - 17:28		open	NOAA-NMFS		claire.simeone@noaa.gov	Claire	Centralized data repository, monitoring and assessment platform for marine mammal health data	Simeone
102			69.166.47.99	2015-06-16 - 15:49		open	Washington State University		heiko@vetmed.wsu.edu	Heiko	1. Activity patterns and energetic costs of land use by polar bears. 2. Defining the extent of interactions between grizzly bears and polar bears. 3. Constraints on lipivory in polar bears.	Jansen
											Nobody knows the number of sponge species living in Alaskan waters. We started working on Aleutian sponges in 2004 and since then described 32 new sponge species from this area. (For a list of publications see www.spongefaconomics.de)	



North Pacific Research Board

"Building a clear understanding of the North Pacific, Bering Sea, and Arctic ecosystems that enables effective management and sustainable use of marine resources."

visit us at www.nprb.org



Submit Your Research Ideas

Open Period Ends June 30th

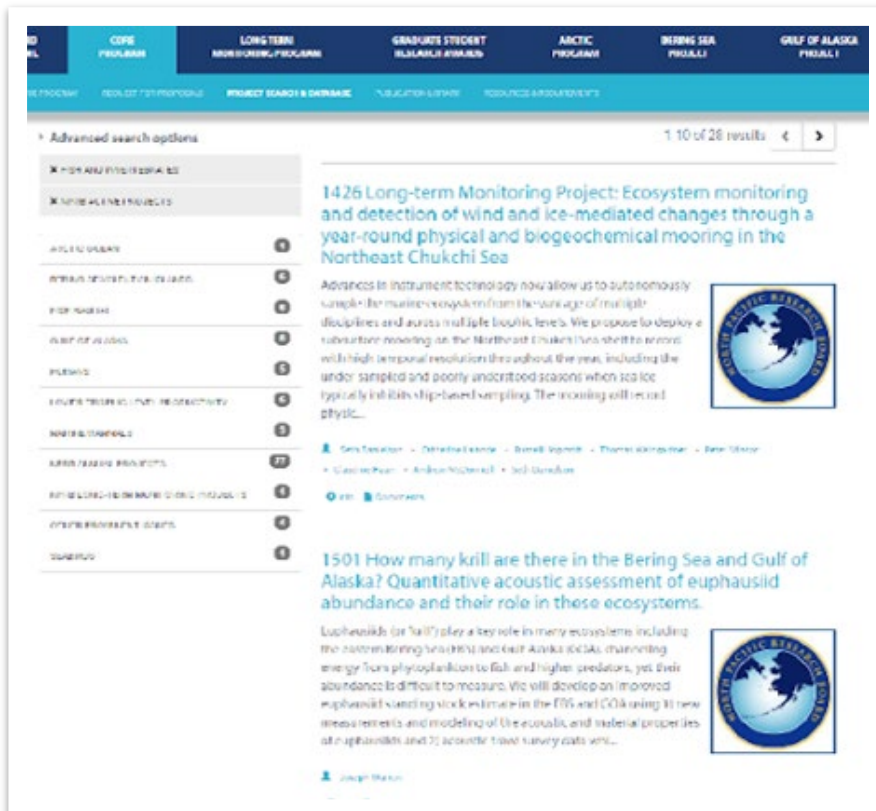
The North Pacific Research Board (NPRB) will release the 2022 Core Program Request for Proposals (RFP) in October 2022. Input from the research community is considered by the NPRB Science Panel, Advisory Panel, and Board to highlight areas of particular interest. Public input is welcome throughout the year through the website link below. **To have your recommendations considered for the 2022 RFP, please submit recommendations by Thursday, June 30th.** Please keep suggestions brief and easily converted to a bullet format. More information on the program is available [here](#).

Submit Your Ideas

NPRB Research Priorities

Development of searchable database to determine:

- what priorities have been funded
- what priorities have not been funded
- where investments have been made
- what has been developed and implemented as a result of that information



The screenshot displays the NPRB Project Search & Database interface. The top navigation bar includes categories like COPE PROGRAM, LONG TERM MONITORING PROGRAM, GRADUATE STUDENT RESEARCH AWARDS, ARCTIC PROGRAM, BERING SEA PROJECTS, and GULF OF ALASKA PROJECTS. Below the navigation, there are tabs for PROJECT SEARCH & DATABASE, EDUCATION LINKS, and RESOURCE DEVELOPMENT. The main content area shows search results for 110 of 26 results. The first result is titled "1426 Long-term Monitoring Project: Ecosystem monitoring and detection of wind and ice-mediated changes through a year-round physical and biogeochemical mooring in the Northeast Chukchi Sea". The abstract describes advances in instrument technology for autonomous sampling in the marine ecosystem. The second result is titled "1501 How many krill are there in the Bering Sea and Gulf of Alaska? Quantitative acoustic assessment of euphausiid abundance and their role in these ecosystems." The abstract discusses the role of euphausiids in marine ecosystems and the challenges of measuring their abundance. Both results include the NPRB logo and author information.

red king crab

Bering Sea

Project title: Assessment of Bristol Bay Red King Crab Resource for Future Management Action--A New Approach
 Year: 2006
 Research Priorities: Life history, ecology and fluctuations in BSAI crab stocksOther fish and invertebrate research
 Award: \$250000

Project title: Developing biological reference points for crustacean fisheries: Reproductive potential of Bristol Bay red king crab and eastern Bering Sea snow crab
 Year: 2007
 Research Priorities: Life history, ecology and fluctuations in BSAI crab stocks
 Award: \$248206

Project title: Assessment of Bristol Bay Red King Crab Resource for Future Management Action - Implementing a Cooperative Approach
 Year: 2008
 Research Priorities: Ecosystem Monitoring and Research: Fishing: Cooperative Research with Industry
 Award: \$209900

Project title: Red king crab movement, growth, and size composition within eastern Norton Sound.
 Year: 2011
 Research Priorities: Fish and Shellfish movement
 Award: \$293522

Project title: Impacts of climate change on red king crab larval advection in Bristol Bay: implications for recruitment variability
 Year: 2014
 Research Priorities: Impacts of climate change on fish and crab stocks
 Award: \$284860

Project title: Assessment of Bristol Bay Red King Crab Resource for Future Management Action--A New Approach
 Year: 2006
 Research Priorities: Life history, ecology and fluctuations in BSAI crab stocksOther fish and invertebrate research
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 Year: 2007
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sablefish

Bering Sea

Project title: Testing two countermeasures to reduce sablefish depredation by sperm and killer whales in the Gulf of Alaska and Bering Sea
 Year: 2012
 Research Priorities: Ecosystem observations and research
 Award: \$172733

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Other

Gulf of Alaska

Project title: Seasonal patterns of energy allocation and implications for overwinter survival of post-settlement juvenile sablefish
 Year: 2017
 Research Priorities: Estimation of life history parameters that impact stock assessmentsFishes and Invertebrates
 Award: \$224333

Project title: Environmental factors contributing to starvation resiliency in first feeding Sablefish (Anoplopoma fimbria)
 Year: 2020
 Research Priorities: Fishes and Invertebrates
 Award: \$143901

Project title: Testing two countermeasures to reduce sablefish depredation by sperm and killer whales in the Gulf of Alaska and Bering Sea
 Year: 2012
 Research Priorities: Ecosystem observations and research
 Award: \$172733



Update on current research and recent funding decisions

- **Pacific Cod**
- **Crab**
- **Salmon**



Pacific Cod

Thermal effects on cod in the Gulf of Alaska*
2018-2022

NOAA-AFSC

IBM validation and enhancement

NOAA-AFSC 2018-2022

Population structure in the Aleutians

NOAA-AFSC 2019-2022

Spawning habitat in a changing Bering Sea
2020-2023

NOAA-AFSC

Passive acoustic monitoring in the Arctic
2022-2025

U Victoria

Evaluating response to warming (otoliths)*
2023-2025

Oregon State

* Partnership with BSFRF, PCCRC

Age validation

U Florida 2023-2026



North Pacific Crab

North Pacific crab growth

UW 2016-2019

Pribilof Islands blue king crab recruitment
2016-2019

UAF

Qualitative approaches to blue king crab management
Tanner crab response to temperature change

UW

2016-2019

NOAA-AFSC

2017-2020

Snow crab body condition

NOAA-AFSC 2020-2024

Pathology of black eye syndrome

Bigelow Lab 2021-2025

Fatty acid sampling in snow crab*

* Partnership with BSERF, PCCRO
Bigelow Lab 2022-2025

Bristol Bay red king crab movement*

NOAA-AFSC 2023-2026

Bristol Bay red king crab settlement potential*

ADFG



Pacific Salmon

Recruitment in PWS pink salmon
2016-2018

ADFG

Data and information in stock-recruitment
2017-2020

UAF

Model for Coho survival and abundance
2017-2019

UAF

Sex ID assay for Chinook

UW 2017-2019

Size and abundance of sockeye

PWSSC 2019-2022

Salmon winter ecology

NOAA-AFSC 2020-2023

Automation of scale age estimation*

PWSSC 2022-2025

* Engaging Yukon fishers in Chinook and Chum research* Yukon (YRDFA) 2023-2026

Climate Drivers of Yukon River Chinook Productivity ADFG 2023-2026



INTEGRATED ECOSYSTEM RESEARCH PROGRAM

NPRB aims to improve understanding of how changing environmental conditions influence physical, chemical, and biological processes in marine ecosystems.



INTEGRATED ECOSYSTEM RESEARCH

To support innovative multi-disciplinary research to improve understanding of the complex mechanistic processes that influence the structure and function of marine ecosystems.

[Learn More](#)

Intent

- understand mechanistic processes that influence the structure and function of marine ecosystems
- characterize processes, interactions and ecosystem attributes, to improve forecasts and response to change

Design

- promote collaboration across disciplines (e.g., oceanography, fisheries, social science)
- promote integration across ecosystem components (e.g., physics, plankton, fishes)
- advance partnership and exchange





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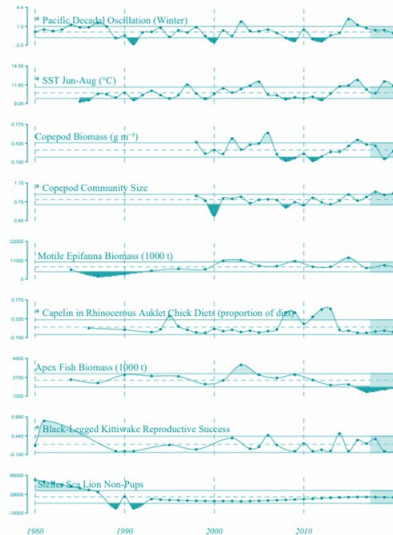
Gulf of Alaska IERP (2011-2017)

Ecosystem Status Report 2022 GULF OF ALASKA

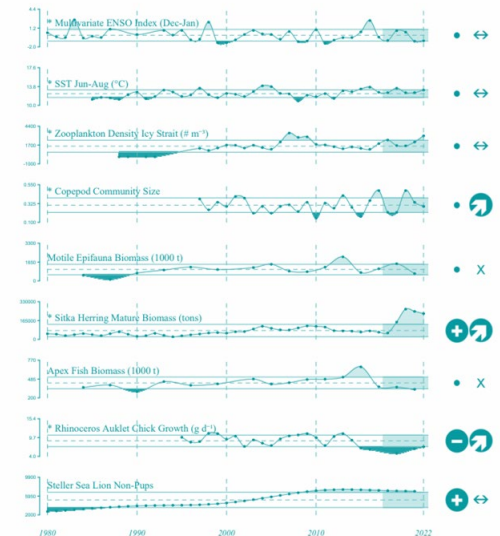


Western Gulf of Alaska 
Eastern Gulf of Alaska 

Western Gulf of Alaska 2022 Report Card



Eastern Gulf of Alaska 2022 Report Card





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Gulf of Alaska IERP (2011-2017)

Ecosystem Status Report 2022 GULF OF ALASKA



Eastern Gulf of Alaska 2022 Report Card

- **Multivariate ENSO Index** was negative. La Niña conditions, in the winter of 2021/2022 (Dec./Jan., 1980-2022). A third consecutive winter of La Niña conditions are predicted for winter 2022/2023.
- **Sea-surface temperatures (°C)** in the summer of 2022 (Jun.-Aug.), were above average (1985-2022) in the eastern GOA, and close to 1SD above the long-term mean.
- **Total zooplankton density (# m⁻³)** in southeastern Alaska inside waters (May-Aug., 1988-2022) increased to above 1SD of the long-term mean, driven by large and small calanoid copepods. This suggests above-average foraging conditions for planktivorous fish, seabirds, and mammals.
- **Copepod community size** (ratio of large calanoid copepods to total calanoid copepods) remained approximately average in 2022 (May-Aug., 1997-2022). The copepod community is sampled in Icy Strait (southeast Alaska Inside waters).
- **Motile epifauna biomass (1,000 t)**, observed during 2021 NOAA Fisheries bottom trawl survey (May-Aug., 1984-2021), decreased from 2019 to 2021 but remains within 1SD of the long-term mean. Hermit crabs, brittle stars, and other echinoderms are all below their long-term means. Eelpouts have also decreased from 2019 to 2021 but remain above their long term mean.
- **Estimated total mature herring biomass (age 3+) of Sitka herring** in spring 2022 remains 1 SD above average (1980-2022) continuing a 4 year trend of the largest value in the time series (since 1980). The two populations with ocean influence (Sitka Sound and Craig) were elevated while populations in southeastern AK inner waters and Prince William Sound increased but remained low.
- **Fish apex predator biomass (1,000 t)**, observed during 2021 NOAA Fisheries bottom trawl survey (May-Aug., 1984-2021), trended downward from a high in 2015 to their second lowest value over the time series in 2021, but remaining just within 1SD of the long-term mean. The decrease over this time period has largely been driven by arrowtooth flounder which are at their lowest value over the time series, more than one standard deviation below their long term mean. Pacific halibut, sablefish, and Pacific cod, have all increased from 2019 and are above their long term means.
- **Growth rates of piscivorous rhinoceros auklet chicks (g d⁻¹)** remain 1SD below the long-term mean in 2022 (Jun.-Jul., 1995-2022), but continue a multi-year increasing trend.
- **Eastern Gulf of Alaska Steller sea lion non-pups** model predicted counts continue a decreasing trend, but remain above 1SD of the long-term mean (1980-2021) through 2021. However, counts suggest that non-pup have been lower than predicted in 2019 and 2017. These data have not been updated since 2021.

Western Gulf of Alaska 2022 Report Card

For more information on individual Report Card indicators, please see "Report Card Indicator Description and Methods" in the Appendix of this Report (p.218).

- **Winter average PDO index** (Dec.-Feb., 1980-2022) continued its negative trend in 2022, reflecting cooling sea surface temperatures in the GOA.
- **Sea-surface temperatures in the summer (°C)** (Jun.-Aug., 1985-2022) 2022 in the western GOA were warmer than average, but remained within 1SD of the long-term mean.
- **Copepod biomass (g m⁻³)** was approximately average (1998-2022) in 2022, indicating potentially average foraging conditions for planktivorous predators. Total (large and small) calanoid copepods are surveyed south of Seward in May of each year.
- **Copepod community size** (ratio of large calanoid copepods to total calanoid copepods) remained elevated in 2022, approximately 1SD above average (1998-2022), indicating increased large copepods in the community, relative to small copepods. Total (large and small) calanoid copepods are surveyed south of Seward in May of each year.
- **Motile epifauna biomass (1,000 t)**, observed during 2021 NOAA Fisheries bottom trawl survey (May-Aug., 1984-2021), decreased from 2019 to 2021 but remains within 1SD of the long-term mean. The biomass of this guild is dominated by octopuses, hermit crabs, and brittle stars. Hermit crabs, brittle stars, and octopus are below their long-term means while other echinoderms are above their long term mean.
- **Capelin abundance (proportion of diet by weight)**, as sampled by rhinoceros auklets at Midleton Island (Apr.-Aug., 1985-2022), continue to be minimal in seabird chick diets in recent years, but still remain within 1SD of the long-term mean.
- **Fish apex predator biomass (1,000 t)**, observed during 2021 NOAA Fisheries bottom trawl survey (May-Aug., 1984-2021), increased from 2019 to 2021 to within just above 1SD below the long-term mean. The primary species driving these trends include Pacific cod biomass, continuing to stay above their low in 2017, but remain below their long term mean. Arrowtooth flounder, which has trended upward since their low in 2017 but also remain below their long-term mean, and sablefish which are well above their long-term mean.
- **Black-legged Kittiwakes reproductive success** in 2022 (Jun.-Jul., 1980-2022) increased to 1SD above the long-term mean at the Semidi Islands, potentially, indicating above-average prey availability for these surface-feeding, piscivorous seabirds.
- **Western Gulf of Alaska Steller sea lion non-pup** model predicted counts continued a slightly decreasing trend from previous years, remaining within 1SD of the long-term mean (1980-2021). These data have not been updated since 2021.



INTEGRATED ECOSYSTEM RESEARCH PROGRAM

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Arctic IERP (2016-2022)



ARCTIC PROGRAM DATA & RESULTS

Principal investigators who have completed NPRB-funded research are required to provide datasets and metadata records for all data collected under NPRB grants as per the NPRB Metadata and Data Policy. Final reports are also required at the conclusion of the program. Peer-reviewed publications will be posted here as they become available.





INTEGRATED ECOSYSTEM RESEARCH PROGRAM

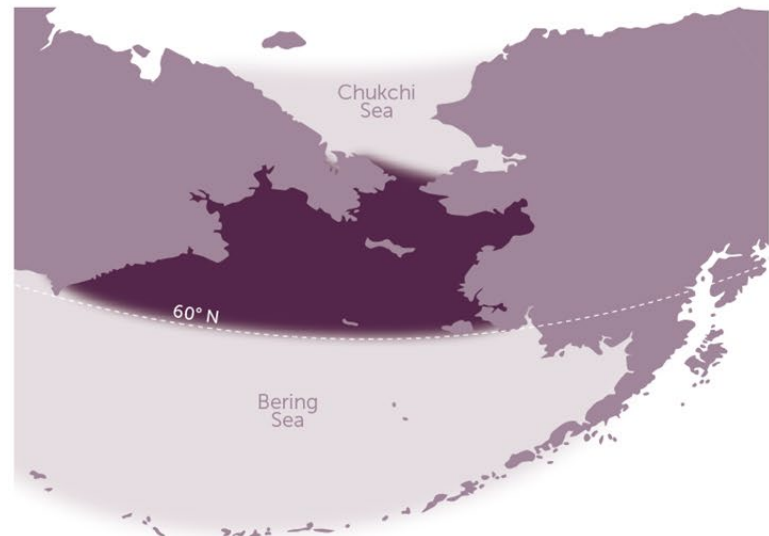
NPRB aims to improve understanding of how changing environmental conditions influence physical, chemical, and biological processes in marine ecosystems.

Northern Bering Sea IERP (2024-2030)

Arctic IERP documented significant changes in the environment and community responses. NBS IERP will further investigate changing ecosystem in this region.

NORTHERN BERING SEA DEFINED

The northern Bering Sea is defined as the area of the Bering Sea shelf north of 60°N (area shaded in dark). This ecosystem typically has continuous winter sea ice cover and strong northern water flow through the narrow Bering Strait. The two largest rivers in Alaska (Yukon and Kuskokwim) also exit in this area and represent an important source of freshwater and nutrients.





INTEGRATED ECOSYSTEM RESEARCH PROGRAM

NPRB aims to improve understanding of how changing environmental conditions influence physical, chemical, and biological processes in marine ecosystems.

Areas of scientific interest:

- *Influence of shifts in environment on species of commercial, ecological, and subsistence importance*
- *implications for fisheries management, and communities that depend on these resources*



IMPORTANCE
TO COASTAL
COMMUNITIES



IMPORTANCE
TO INDUSTRY
STAKEHOLDERS



INTEGRATED ECOSYSTEM RESEARCH PROGRAM

NPRB aims to improve understanding of how changing environmental conditions influence physical, chemical, and biological processes in marine ecosystems.

ANTICIPATED TIMELINE OF ACTIVITIES

Approximately \$6.5 million have been made available by NPRB for this program. NPRB anticipates additional resources from funding partners.



**OCTOBER
2023**

NPRB solicits pre-proposals.



**OCTOBER
2024**

NPRB invites full proposals with additional awards to support Indigenous partnerships.



**SUMMER
2025**

NPRB coordination with funding partners.



**OCTOBER
2025**

NPRB announces funding decisions and scope of funded research program.



**2026-
2031**

Coordinated research, fieldwork, analysis, and outreach.

