NORTON BAY WATERSHED
OCEAN AND COASTAL MANAGEMENT PLAN (NBWOCMP):
PROTECTING THE WATERSHED'S SUBSISTENCE CULTURE & RESOURCES

2021

ACKNOWLEDGEMENTS

Land Acknowledgement

The traditional lands of the **Norton Bay Watershed** (**Watershed**) and of the **Norton Bay Inter-Tribal Watershed Council** (**NBITWC**) membership are those of the Inupiat (Inupiaq) and Yu'pik. For several thousand years, these lands have provided a subsistence lifeway based on hunting, fishing and gathering food. The ***Norton Bay Watershed Ocean and Coastal Management Plan (NBWOCMP): Protecting the Watershed's Subsistence Culture and Resources*** seeks to protect and preserve the Watershed's subsistence resources and culture from the impacts of both climate change (climate stresses) and non-climate stressors through the establishment of this Ocean and Coastal Management Plan and its implementation strategies. The NBWOCMP's strategies draw from over two decades of work done by the Bering Straits Coastal Resource Service Area Board starting in the 1980's.

Individual Acknowledgement

One of the aspects of the NBWOCMP that makes it unique and rising from the grassroots is the inclusion of traditional knowledge communicated through the voices of the project Planning Committee, Tribes and Tribal people who are on the front lines in experiencing and responding to climate change. The narrative contribution and wisdom of the following individuals are sincerely appreciated: Doug Katchatag, Chuck Degnan, Emily Murry, Carol Oliver, Matilda Hardy, John Henry, Frances Degnan and other local community members from the Norton Sound region.

NBWOCMP Primary Authors and Editors

Leigh Takak: Leigh Takak is from the Inupiaq Alaska Native Village of Elim.

Hal Shepherd/Water Policy Consulting (WPC): The Water Policy Consulting is located on the traditional lands of the Athabaskan.

Margaret Hall and Gwen Griffith/Model Forest Policy Program (MFPP): The Model Forest Policy Program's home base, Bonner County, Idaho, is located within the traditional lands of the Kalispel, speakers of a dialect of Interior Salish.

WATER POLICY CONSULTING, LLC

Acknowledgement of Project Support

Through direct contact, webinars, or the provision of reports and other resources, the following agencies and entities also assisted with this project. NBITWC is grateful for people's time, assistance, and willingness to share information and their knowledge.

- ◊ Local Environmental Observer (LEO) Network (ttps://www.leonetwork.org)
- ◊ Aleutian and Bering Sea Islands (ABSI) Landscape Conservation Cooperative (http://www.absipartnership.org/)
- ◊ ArcticToday, providing related news articles, (https://www.arctictoday.com/)
- ◊ Indigenous Sentinels Network: https://www.beringwatch.net/
- ◊ Northern Latitudes Partnerships (http://www.northernlatitudes.org/)
- ◊ Western Alaska Partnership (http://www.westernalaskalcc.org/)

NBITWC reached out to or communicated with the following entities to develop working relationships and research specific issues.

- ◊ NBITWC Membership Tribal Councils worked to increase communications with individual Tribal Councils of participating Tribal entities.
- ◊ U.S. Bureau of Land Management for discussions regarding the Final Decision related to the Bering Sea Western Interior Resource Management Plan in relation to monitoring temperature and instream flows in subsistence rivers and streams.
- ◊ U.S. Geological Survey, Alaska Science Center (https://www.usgs.gov/centers/asc) for assistance with identifying river forecasting information and modeling related to stream flows and temperature.
- ◊ U.S. Fish and Wildlife Service: Corresponded with Scott Ayer regarding the USFS' "Temperature Monitoring Project for Subsistence Rivers" project.
- ◊ NOAA, National Integrated Drought Information System, Pacific Northwest Drought Early Warning System (DEWS) (https://www.drought.gov/dews/pacific-northwest) for discussing effects of drought and warming temperatures on stream habitats.
  - ■ Pacific Northwest Drought Early Warning System (PNW DEWS) Drought & Climate Outlook Webinar Series and presenters, including:
    - ○ Nicholas Bond, Office of the Washington State Climatologist (Webinar: Climate Recap and Current Conditions)
    - ○ Robin Fox, NWS Weather Forecast Office Spokane (Webinar: Seasonal Conditions and Climate Outlook)
    - ○ Oriana Chegwidden, University of Washington (Webinar: A Climate Crystal Ball? Using Forecasts in the Climate Toolbox)
    - ○ Kelly Smith, National Drought Mitigation Center (Webinar: See More Drought (CMOR-Drought) Reporting)
- ◊ Members of the National Science Foundation (NSF) 2019 - 2024 project, "*The Climate Impacts on Alaskan and Yukon Rivers, Fish, and Communities as Told Through Co-Produced Scenarios*" (https://www.arcus.org/nna/projects/1928078) to develop working relationships. NSF project leads include:
  - ■ University of Colorado: Keith Musselman, Mike Gooseff, Cassandra Brooks, Noah Molotch, Sabre Duren
  - ■ Institute for Tribal Environmental Professionals, Northern Arizona University: Karen Cozzetto, Ann Marie Chischilly, Nikki Cooley
  - ■ National Center for Atmospheric Research: Andy Newman, Joe Hammam, Tony Craig
  - ■ University of Saskatchewan: Karl-Erich Lindenschmidt
  - ■ Yukon River Inter-Tribal Watershed Council: Edda Mutter
  - ■ U.S. Geological Survey: Nicole Herman-Mercer, Josh Koch, Ryan Toohey, Mike Carey
  - ■ University of Waterloo: Heidi Swanson

Cover Photo: Norton Bay Alaska at sunrise. *Photo Credit: Leigh Takak (2020)*

Suggested Citation: Takak, Leigh, H. Shepherd, G. Griffith, and M. Hall. 2021. Norton Bay Watershed Ocean and Coastal Management Plan (NBWOCMP): Protecting the Watershed's Subsistence Culture and Resources. A document prepared for the Norton Bay Inter-Tribal Watershed Council.

Project Funder: Bureau of Indian Affairs - Program to Support Tribal Resilience and Ocean and Coastal Management and Planning. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Government. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Government.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS i

TABLE OF CONTENTS iv

THE IMPORTANCE OF TRADITIONAL ECOLOGICAL KNOWLEDGE (TEK) IN THE PLANNING PROCESS 1

EXECUTIVE SUMMARY 2

- Introduction to the Norton Bay Watershed Ocean and Coastal Management Plan (NBWOCMP) 2
- Subsistence Vulnerabilities, Culture, & History 2
- Overview of Marine Protected Area Rapid Vulnerability Assessment (MPARVA) Tool 4
- Summary of Marine Habitat Profiles: Vulnerabilities, Adaptive Capacity, & Adaptation Strategies 4
- Conclusions from MPARVA Tool Assessment Findings 5
- Implementation of Adaptation Strategies 6
- Completed Marine Protected Area Rapid Vulnerability Assessment (MPARVA) Tool 7
- Appendices 7

INTRODUCTION TO THE NORTON BAY WATERSHED OCEAN AND COASTAL MANAGEMENT PLAN (NBWOCMP) 8

- Background 8
- Geographic Area 9

SUBSISTENCE VULNERABILITIES, CULTURE, & HISTORY 10

- Subsistence Culture 12
- More Specific Climate Impacts 13

Bering Straits Coastal Resource Service Area Board (BSCRSAB) 16

- History 16
  - Bering Straits Coastal Resource Service Area Board Volumes (also Bering Straits CRSA) 17
- Relevancy of BSCRSA's Work to NBWOCMP 17

OVERVIEW OF MARINE PROTECTED AREA RAPID VULNERABILITY ASSESSMENT (MPARVA) TOOL 18

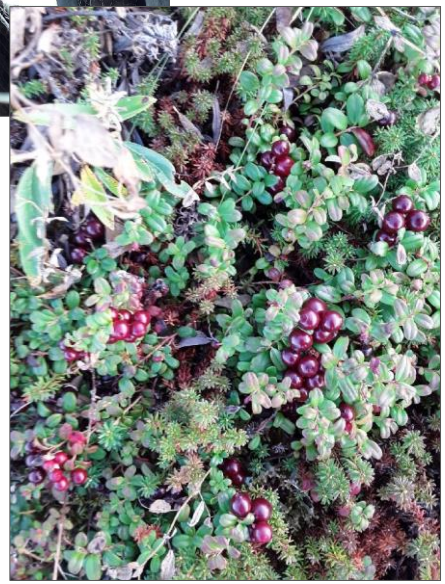
SUMMARY OF MARINE HABITAT PROFILES: VULNERABILITIES, ADAPTIVE CAPACITY, & ADAPTATION STRATEGIES 21
Summary of Marine Protected Area Rapid Vulnerability Assessment (MPARVA) Scope 21
Pelagic Habitat Summary 23
Risks and Vulnerabilities for Pelagic Habitat - TABLES 1 & 2 23
Potential Adaptive Capacity of Pelagic Habitat – TABLE 3 25
Adaptation Strategies for Pelagic Habitat – TABLE 4 26
Ice/Snow Habitat Summary 28
Risks and Vulnerabilities for Ice/Snow Habitat - TABLES 1 & 2 28
Potential Adaptive Capacity for Ice/Snow Habitat – TABLE 3 30
Adaptation Strategies for Ice/Snow Habitat - TABLE 4 31
Rocky/Intertidal Habitat Summary 33
Risks and Vulnerabilities for Rocky / Intertidal Habitat - TABLES 1 & 2 33
Potential Adaptive Capacity for Rocky/Intertidal – TABLE 3 34
Adaptation Strategies for Rocky/Intertidal - TABLE 4 35
Conclusions from MPARVA Tool Assessment Findings 37
IMPLEMENTATION OF ADAPTATION STRATEGIES 39
Introduction 39
Overarching Adaptation Strategies 39
Strategies Based on the Arctic Monitoring and Assessment Programme (AMAP) Recommendations 40
Mitigation Strategies for Salmon Habitat 42
Village-Specific Coastal Subsistence Vulnerabilities: Village Assets and Climate Risks Checklist 43
Coastal Management (Governmental/Policy) Strategies 44
Action Plan / Funding Strategy 47

COMPLETED MARINE PROTECTED AREA RAPID VULNERABILITY ASSESSMENT (MPARVA) TOOL 48
Step 1: Define the Scope of the Vulnerability Assessment. 48
Steps 2 & 3 - Undertake Your Assessment 51
Table 1. Vulnerability Assessment - Pelagic 51
Table 1. Vulnerability Assessment - Ice/Snow 52
Table 1. Vulnerability Assessment - Rocky / Intertidal 54
Step 3 - Undertake Your Assessment 55
Table 2. Consequences - Pelagic 55
Table 2. Consequences - Ice/Snow 57
Table 2. Consequences - Rocky/Intertidal 59
Step 3 - Undertake Your Assessment 60
Table 3. Adaptive Capacity Assessment of Pelagic 60
Table 3. Adaptive Capacity Assessment of Ice/Snow 62
Table 3. Adaptive Capacity Assessment of Rocky/Intertidal 64
Step 4 - Adaptation Strategy Development 66
Table 4: Strategy Development - Pelagic 67
Table 4: Strategy Development - Ice/Snow 70
Table 4: Strategy Development - Rocky/Intertidal 75
Table 5: Strategy Implementation 78
Step 5 - Narrative Vulnerability Assessment 78

APPENDICES 79
A. Summary of Project Research Resources A1
Traditional Ecological Knowledge (TEK) A1
Scientific Research & Data (Climate Data, Modeling, Toolkits) A1
Planning & Permitting, Law & Policy (Public Policy) A4
Education/Outreach and Training Resources A5
Resource Management & Protection (Water, Natural, Subsistence Resources) A6
Monitoring & Evaluation A6
Maps A7
Other A7
B. Village Assets and Climate Risks Checklist - Norton Bay Template B1
C. Strategies for Coastal Management in the Former Bering Straits Coastal Resource Service Area Report, prepared by Dr. Barrett Ristroph, Esq. *Attached*

THE IMPORTANCE OF TRADITIONAL ECOLOGICAL KNOWLEDGE (TEK) IN THE PLANNING PROCESS

The gathering of traditional ecological knowledge (TEK) from tribal board members of the Norton Bay Intertribal Watershed Council (Council), and other community members within the Bering Sea region, was critical to the development of this *Norton Bay Watershed Ocean and Coastal Management Plan (NBWOCMP): Protecting the Watershed's Subsistence Culture and Resources*. TEK can be summed up as qualitative knowledge based on the observations of the peoples who live within and depend upon their local habitats. The Council selected three habitats for this project - rocky intertidal (or coastal), pelagic (or open ocean), and ice and snow as being the most relevant to their subsistent way of life. Their observations, which inform the following risk assessment, provide the basis for future quantitative research and action items to address climate impacts within the Norton Bay Watershed and greater Bering Sea region. While new quantitative research was not within the scope of this project, relevant conventional research and data were referenced in drafting the resulting risk assessment.



Above: An elderly couple smoking salmon at their fish camp near Moses Point. ***Photo Credit: G. Takak. (2021)***

Right: Cranberries at the Tubutulik estuary. ***Photo Credit: Leigh Takak. (September 2021)***

Along the Tubutulik River.
Photo Credit: Gwen Griffith (June 2017)

EXECUTIVE SUMMARY

Introduction to the Norton Bay Watershed Ocean and Coastal Management Plan (NBWOCMP)

The Norton Bay Watershed, on the Bering Sea coast of northwest Alaska, is home to five Alaska Native Villages of the Inupiat and Central Yupik community heritage. They each rely on their ancient traditions of subsistence culture and economy for every aspect of life. In recent years, warmer temperatures, changing precipitation, and extreme weather events are impacting the land and water conditions of the region. Warming air and water temperatures, reduced sea ice, more rain and less snow, and more frequent storms are causing floods, coastal erosion, thawing permafrost, and other impacts to people, infrastructure, wildlife and their marine habitats. This disturbs local ecosystems and seriously disrupts Village access to important subsistence resources on land, rivers, and ocean sites. The Norton Bay Inter-Tribal Watershed Council (NBITWC) recognizes these escalating problems and seeks to assist by understanding current and future risks and vulnerabilities; then developing adaptation strategies that can inform ocean and coastal management decisions for Norton Bay Native Villages and related state, regional, and federal agencies. The NBITWC conducted a vulnerability assessment and developed the Norton Bay Watershed Ocean and Coastal Management Plan to address these issues. The goal of the plan is to increase coastal resilience for the Native Villages and the marine habitat of the Norton Bay Watershed with adaptation strategies that help protect and restore the subsistence culture and resources. The project objectives include active participation by Norton Bay Native Villages, use of the North American Marine Protected Area Rapid Vulnerability Assessment Tool (MPARVAT) to assess risks and develop resilience solutions, draft a plan to guide management decisions to protect subsistence resources, and seek funding to implement identified strategies in Norton Bay.

Subsistence Vulnerabilities, Culture, & History

Increasingly warm conditions in the Norton Bay region are altering the ecosystems of the region. The loss of sea ice cover and related impacts to marine and coastal habitats are disrupting the ecosystem structure and function. Current conditions and future projections point to further temperature increases, altered precipitation patterns, and ocean acidification as key factors impacting the marine environment and related marine subsistence species. Measurable impacts are already affecting the base of the marine food chain, fish, sea mammals, sea birds, and more. The inland fisheries of the Norton Bay rivers are equally at risk from changes in water temperature and streamflow extremes. The rapidly melting glaciers and snowpack cause flooding that degrades river habitat. Then summer heat with reduced snowpack leads to warmer waters and low flow conditions that can be lethal due to low oxygen levels in the water. In early July 2019, stream temperatures in Southcentral Alaska exceeded 81 degrees Fahrenheit, breaking all prior temperature records, warm enough to prevent spawning or even kill salmon and other river species. Salmon are the central species for this subsistence culture, and they are impacted by both ocean and river

Climate Change - Arctic Trends

- Key indicators show rapid and widespread changes in the Arctic.
- Arctic temperature increases are 3 X higher than global increases.
- Projections show a sea-ice-free Arctic in September before 2050.
- Cold Arctic waters absorb more carbon dioxide, increasing ocean acidification.
- Sea level may rise or fall in AK depending on location and topography of the coastline.
- Snow free season increased by 10 days between 1970 to 2000.
- Thawing permafrost is disrupting roads, pipelines, buildings, streambanks, coastal bluffs, and forests.
- Methane, a potent greenhouse gas, is also being released by thawing permafrost.
- Habitat ranges are changing for insects, birds, and other animals.
- White spruce forests are declining in interior AK, while the tundra is converting to shrub species.

deteriorating conditions. Loss of sea ice and land ice makes transportation for hunting dangerous and reduces access to many game species. The location, economic constraints, and reliance on subsistence resources of the Norton Bay Villages leave them particularly vulnerable to these rapidly changing conditions.

Drying salmon at summer camp in the Norton Bay region.
Photo Credit: Deb Kleinman (June 2017)

Non-climate stressors to the system can exacerbate the changing climate impacts and need to be factored into management planning. Examples of factors to manage in addition to changing climate conditions include marine-source pollution, such as waste and spills from shipping, oil and gas drilling, mining, and dredging. Coastal development also increases ocean pollution and habitat destruction along the coastlines. Overfishing and other resource management issues also play a role.

The importance of the subsistence culture to the Native Villagers cannot be over-emphasized. The Inupiat community is one of the last intact, sustainable salmon-based cultures in the world. Salmon are integral to the entire way of life in these cultures as subsistence food and as the foundation for their language, spirituality, and social structure. In Norton Bay the salmon connection has been maintained for at least the past 4,000 years. In Norton Bay, 52% or more of the subsistence harvest comes from salmon. The indigenous identity of the region depends on the respect and importance given to salmon and other wildlife. It also relies on a deep traditional knowledge of the environment and a way of life based on a sustainable, subsistence economy. While this deep connection to subsistence is one of the great strengths of the Native Villages, it also increases the vulnerability to factors that degrade and impact wildlife and their habitat. Mining and development are non-climate stressors that are particularly dangerous threats to the region because of the lasting harm they can cause to the land and waters of the region.

The history of resource and subsistence protection laws for Alaska goes back to the 1970s with the establishment of the Alaska Coastal Management Act adopted in 1977. It was authorized under the federal Coastal Zone Management Act (CZMA), which calls for states to protect, manage, and rehabilitate coastal areas. As a result, the Bering Straits Coastal Resource Service Areas Board (BSCRSA) was formed and spent 11 years developing a comprehensive plan for the coastal fish and wildlife resources and related watersheds of the region. The years-long effort gathered extensive information from a regional public engagement process. The plan included a wide array of existing and new protections for subsistence, habitat, and biological resources. It also identified Important Use Areas in alignment with previously identified Areas of Critical Concern under the Bering Sea-Western Interior Resource Management Plan. Unfortunately, the Governor withdrew Alaska from the CZMA in 2011 and the state authority for proactive coastal management was lost in favor of opening to development opportunities. The in-depth information from the original plan remains as a deep source of information and a model process that this new coastal management initiative can build on and learn from. By keeping this in-depth historical document as a ready reference, this renewed coastal initiative can keep the principles of Native Village sovereignty, local engagement, and prioritization of sustainable, subsistence resources at the forefront of climate adaptation strategies going forward.

Overview of Marine Protected Area Rapid Vulnerability Assessment (MPARVA) Tool

"The North American Marine Protected Area Rapid Vulnerability Assessment Tool was created to help marine protected area managers evaluate the implications of climate change for the habitats of their sites. This tool has three parts (a user guide, a set of blank worksheets, and a booklet containing sample completed worksheets) that are available as downloadable PDFs. The User Guide and sample worksheets provide the narrative explanation of how to use the tool, while the blank worksheets are the hands-on component. Together, they comprise a tool that can help marine protected area managers conduct a rapid vulnerability assessment and adaptation strategy development process." The tool is available online at https://www.cakex.org/documents/north-american-marine-protected-area-rapid-vulnerability-assessment-tool.

Summary of Marine Habitat Profiles: Vulnerabilities, Adaptive Capacity, & Adaptation Strategies

Using the MPARVA Tool as the underlying assessment process, the project developed the coastal management plan based on the findings from the MPARVA five-step process. The plan provides a general review of the assessment findings, and the details of the worksheet findings are available in the final pages of the plan document.

The project selected Pelagic, Ice/Snow, and Rocky/Intertidal as the three habitats for the vulnerability assessment, based on their relevance to marine and coastal subsistence resources. For each habitat, a list of climate stress variables and non-climate stressors were selected for analysis. The most common climate stressors selected for analysis were increased water temperature (all 3); altered precipitation patterns (2); and ocean acidification (2). A longer list of non-climate stressors focused mainly on the impacts of different sources of pollution, resource extraction, and development and population growth. The near-term time frame of 0-10 years was selected for the assessment analysis. Using a series of tables, each habitat and stressor was given consideration for consequences, likelihood, and adaptive capacity; then analyzed for its level of risk (consequences x likelihood) and level of vulnerability (risk x adaptive capacity). Each stressor that ranked medium or high for level of vulnerability was then analyzed for potential adaptation strategy development.

The Norton Bay Inter-Tribal Watershed Council assessed the vulnerability to climate and non-climate stressors of three habitats in the Norton Bay, Bering Sea, and Chukchi Sea regions, including the pelagic, ice/snow, and rocky/intertidal habitats. Multiple climate stressors were considered, including increased water temperatures, altered precipitation patterns, ocean acidification, wave action/coastal erosion, altered currents, sea level rise, harmful algal blooms, and salinity.

Vulnerability for the pelagic zone habitat was greatest for increased water temperature and harmful algal blooms, due to the serious impacts on marine and freshwater habitat from warmer waters and reduced sea ice in both summer and winter conditions. The overall adaptive capacity for the pelagic zone was moderate with strengths in the areas of biodiversity and the organizational capacity of the NBITWC. Adaptation strategies to reduce vulnerabilities include monitoring sea temperatures and ice cover and tightening regulations to reduce non-climate stressors from marine pollution.

Vulnerability for the ice/snow habitat of seasonal frozen precipitation was greatest for increased water temperatures, altered precipitation patterns, and ocean acidification. The climate stressors are causing a shift to more rain and less snow, increased spring floods, and reduced winter sea ice conditions, all of which stress cold water species and aquatic habitat. The overall adaptive capacity for ice/snow habitat was moderate, with strengths in the areas of biodiversity, large habitat ranges, and strong tribal knowledge and commitments to Arctic way of life. Concerns center around the steady loss of winter sea ice and reduced salmon populations. One adaptation strategy for ice/snow habitat is to develop an integrated water resource management plan for the Norton Bay Watershed, including projections of seasonal hydrologic changes from snow to rain and how to manage to reduce ecological impacts.

Native Village of Elim Coastline, Norton Bay.
Credit Photo: Gwen Griffith (2017)

Vulnerability of the rocky/intertidal habitat for shorelines between the low and high tide marks was highest for increased water temperatures, altered precipitation patterns, and ocean acidification. These climate changes can cause severe heat stress during low tide conditions; increase storm surge, coastal flooding, and erosion; and exacerbate the negative effects of ocean acidification on the marine food web. The adaptive capacity of the intertidal zone is assessed as moderate, with strengths in intertidal biodiversity and the importance to tribal subsistence. Weaknesses include negative trends for keystone species, such as salmon, sea birds, and some marine mammals. One adaptation strategy to help protect all three habitats is to re-establish a strong regulatory mandate for coastal management planning and adopt effective protection policies for marine, riverine, and terrestrial subsistence resources.

Conclusions from MPARVA Tool Assessment Findings

All three habitats assessed, pelagic, ice/snow, and rocky/intertidal, are highly vulnerable to climate change impacts from increasing water temperatures, alterations in precipitation patterns, and ocean acidification. The Native Village residents of Norton Bay are equally vulnerable to the impacts to their subsistence resources at the heart of their food, culture, and spirituality for thousands of years. The rapid pace of change toward more extreme weather and degraded conditions for air and water quality, thawing permafrost, increasing floods, coastal erosion, damaged infrastructure, and degraded ecosystem functions is causing significant impacts to subsistence resources from the base of the marine food chain through mussels, crabs, and salmon, and up to the

walrus and seals that sustain the Villagers through the year. It was also clear that there are many non-climate stressors that exacerbate the impacts of climate change. Different sources of water pollution, shipping impacts, threats from oil, gas, and mining extractions, overfishing, and population growth and development all add to the burden upon the regional ecosystems and the subsistence species that live there. Effective adaptation will require strategies that address both climate related and non-climate stressors to the ecosystems and Native Village people and infrastructure.

Implementation of Adaptation Strategies

It is imperative that Native Villages find methods to adapt to these rapid changes in both large and small ways to maintain their subsistence culture and economy and the health and fulfillment of the people who live there. The ancient culture and traditional knowledge of the Native Village residents can combine with science and engineering to help inform adaptive solutions that are in harmony with the culture and biology of the lands and waters. There are several themes for resilience and adaptation that came through in the assessment that universally apply to the habitat adaptive capacity and potential adaptation strategies.

- The NBITWC and local Native Villages could benefit from increased collaboration with organizations, universities, and government agencies to understand the current climate and ecological changes and help project future conditions.
- In return, the appropriate sharing of Traditional Ecological Knowledge (TEK)/Indigenous Knowledge could further this understanding and help project and inform about future conditions.
- Local data collection, monitoring and research are important to understand the ecological and hydrological changes taking place and plan for future ongoing changes.
- There is a critical need to re-establish a coastal management planning and implementation process with strong Native Village participation in decision making, legal enforcement authority, and funding resources to act in a timely manner.
- The in-depth process and information available in the previous Bering Straits Coastal Resource Service Area Board (BSCRSAB) Volumes 1-3 (Resource Inventory, Resource Analysis, and Coastal Management Plan) should be used as an important historical reference and model for both process and use of information.
- Completion of an integrated water resource management (IWRM) plan for the Tubutulik River watershed can identify subsistence protection measures for the Native Village of Elim and serve as a model for replication by other areas of Norton Bay.
- Demonstration projects for on-the-ground habitat restoration and protection are an important next step to inspire additional adaptation measures in the region.
- It is important to develop a funding plan and sustainable revenue sources that support implementation of prioritized Adaptation Strategies.

Finally, several other recommendations, which support the increase of adaptive capacity and implementation of adaptation strategies, were identified in follow-up discussions and further research. These strategies, as a totality, fall under the following groupings: Overarching Adaptation Strategies; Strategies Based on the Arctic Monitoring and Assessment Programme (AMAP) Recommendations; Mitigation Strategies for Salmon Habitat; Village-Specific Coastal Subsistence

Vulnerabilities: Village Assets and Climate Risks Checklist; and Coastal Management (Governmental/Policy) Strategies. The next step in the overall process is to choose the top 10 implementation strategies, prioritizing them into an Action Plan/Funding Strategy.

Completed Marine Protected Area Rapid Vulnerability Assessment (MPARVA) Tool

The MPARVA Tool worksheets provide a series of tables that capture the ideas and analytical details of each step in the process. Those detailed tables are provided at the end of this document. They serve as a useful reference for taking the next steps to seek implementation funding or launch a specific adaptation training, research project, policy initiative, or on-the-ground project. They may also serve as a historical benchmark for long term monitoring of the region.

Appendices

The appendices provide useful references for further information:

A. Summary of Project Research Resources
B. Village Assets and Climate Risks Checklist - Norton Bay Template
C. Strategies for Coastal Management in the Former Bering Straits Coastal Resource Service Area Report, prepared by Dr. Barrett Ristroph, Esq.

Looking south from Unalakleet across the Unalakleet River. ***Photo Credit: Margaret Hall (2019)***

INTRODUCTION TO THE NORTON BAY WATERSHED OCEAN AND COASTAL MANAGEMENT PLAN (NBWOCMP)

Background

The Inupiat and Central Yupik communities located within the Norton Bay Watershed (Watershed) rely on a subsistence economy, as they have since time immemorial. In the last few decades, many changes are impacting these communities related to warming temperatures, including diminishing sea ice in the Bering Straits at a rate no one thought possible a decade ago. Due to extreme weather events and non-weather related stresses, Alaska Native Village communities (Villages) in the Norton Bay Watershed (Watershed) are experiencing many changes including diminishing sea ice, loss of subsistence resources, coastal erosion, village flooding, and increased water and air temperatures. Due to their location, dependency on subsistence resources, and difficult economic conditions, the Norton Bay Villages are disproportionately impacted by changes to their environment in comparison to the rest of the state. The NBITWC recognizes the immediate threat of these changes to the habitats and species they depend on and manage and realizes resources are needed to help managers fully integrate resiliency information and considerations into their management decisions.

As one of the resources, the Norton Bay Inter-Tribal Watershed Council[1] (NBITWC) undertook the development of the Norton Bay Watershed Ocean and Coastal Management Plan (NBWOCMP). The **goal** of the NBWOCMP is to increase coastal resilience for the Native Villages and marine habitat of the Norton Bay Watershed by developing strategies that address the Watershed's greatest coastal ecosystem risks. In developing the NBWOCMP, the NBITWC's **primary objectives** were to: 1) Engage Norton Sound Native Villages in a participatory process for ocean and coastal management planning; 2) Apply the North American Marine Protected Area Rapid Vulnerability Assessment Tool (MPARVAT), created by the Council on Environmental Cooperation's 2015-2016 Marine Protected Areas: Strengthening Management Effectiveness and Supporting Coastal Community Resilience project,[2] [3] to assess risks and develop resilience solutions for oceans and coastal areas of Norton Bay Watershed; 3) Draft a Norton Bay Watershed Ocean and Coastal Management Plan (NBWOCMP); and 4) Continue to seek additional funding to implement identified strategies in Norton Bay. During the process, the NBITWC applied conventional data, Traditional Ecological Knowledge (TEK), and other information to build on the MPARVAT model to create a comprehensive Norton Bay Plan (NBWOCMP) addressing resilience for marine habitat and the health and welfare of local communities.

[1] NBITWC's mission is to conduct legal and scientific research, analysis, and policy advocacy in its efforts to protect and restore tribal interest in water quantity, water quality and tribal water rights for the health of the watershed ecosystem, preservation of cultural identity and the benefit of tribal members.

[2] Commission for Environmental Cooperation. http://www.cec.org/

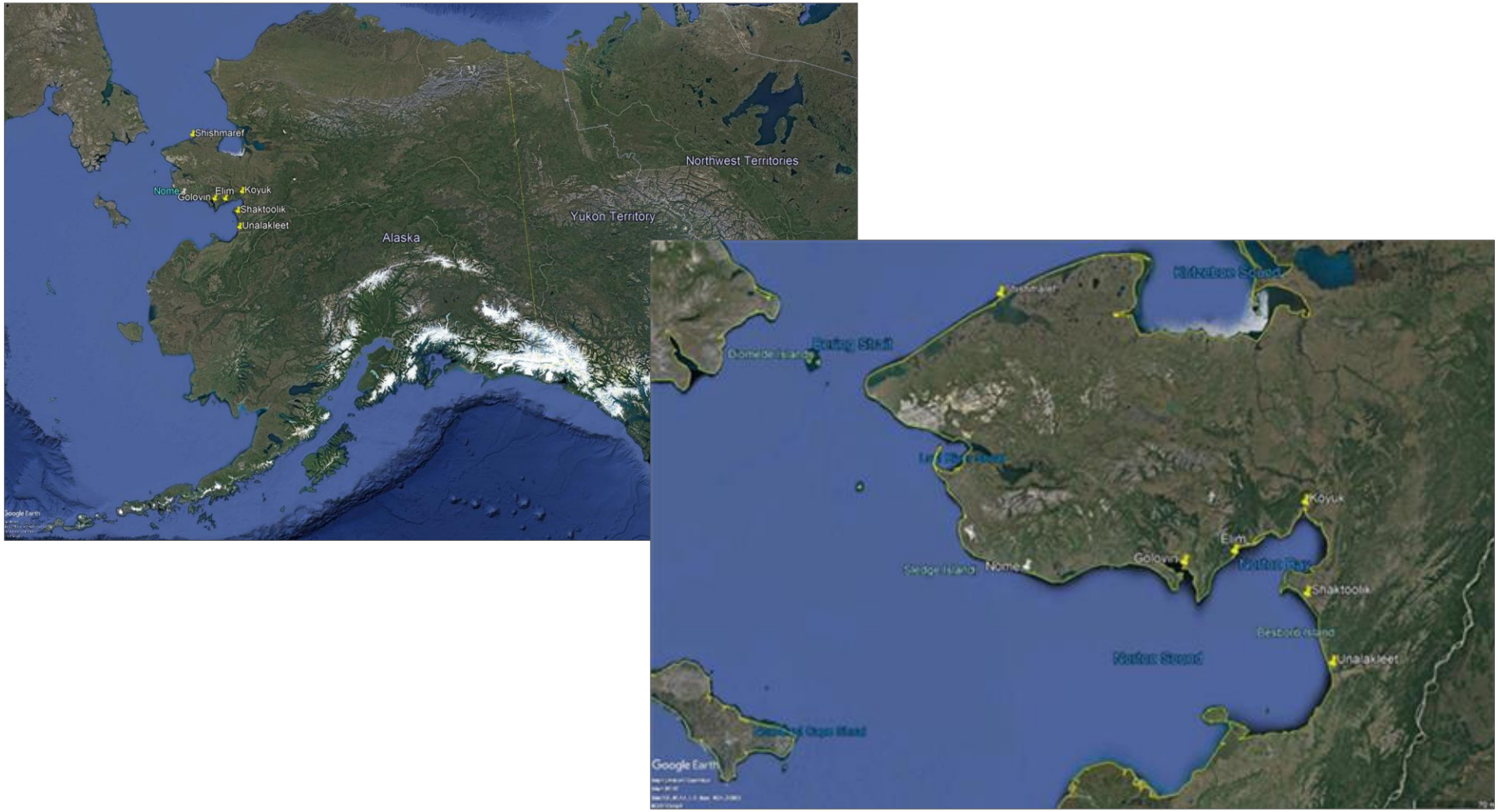
[3] North American Marine Protected Area Rapid Vulnerability Assessment Tool: Created by the Commission for Environmental Cooperation and EcoAdapt in 2017. Found at: https://toolkit.climate.gov/tool/north-american-marine-protected-area-rapid-vulnerability-assessment-tool and http://www3.cec.org/islandora/en/item/11733-north-american-marine-protected-area-rapid-vulnerability-assessment-tool.

Geographic Area

The Norton Bay Watershed (HUC ID #: 19050103) is located in the Bering Sea of Northwestern Alaska. It encompasses approximately 12,000 acres.

The total number of Alaska Native Villagers directly benefiting from the NBWOCMP is 1,818 from 5 Alaska Native Villages, which are Federally recognized tribal entities, including Elim (341), Golovin (161), Koyuk (344), Unalakleet (712), and Shaktoolik (260). The Native Village of Shishmaref (614), as a NBITWC member, will indirectly benefit.

MAP 1 & 2 - Alaska & Norton Sound/Seward Peninsula Native Villages (Geographic Scope)



SUBSISTENCE VULNERABILITIES, CULTURE, & HISTORY

The highly productive northern Bering and Chukchi marine shelf ecosystem has long been dominated by strong seasonality in sea-ice and water temperatures. Extremely warm conditions from 2017 into 2019—including loss of ice cover across portions of the region in all three winters—were a marked change even from other recent warm years. Biological indicators suggest that this change of state could alter ecosystem structure and function.

Melting Sea Ice in Norton Bay. ***Photo Credit: Hal Shepherd. (2018)***

A primary climate risk to the marine and freshwater ecosystems within the Watershed in the near term (from the present to the next 10 Years) include temperature increases, altered precipitation patterns and ocean acidification. Seen as part of climate change, a phenomenon known as "The Blob", in which temperature increases 2 degrees Fahrenheit, has covered major portions of the Pacific Ocean, altered snowpack in mountain ranges, created drought throughout watersheds and more flash storm events, increased glacial melt, and changed water chemistry – including ocean acidification.

The Inupiat Eskimo communities of the Seward Peninsula have resided and relied on a subsistence economy in the vicinity of Norton Bay since time immemorial. In the last few decades, these communities have experienced many changes relating to warming temperatures, including diminishing sea ice in the Bering Strait at a rate that no one would have thought possible a decade ago. This change has opened shipping lanes that never existed here. New research showing many inaccuracies of 10 to 15 percent in charted depths on the old maps are reminders of the rapid transition now taking place. Without planning and accepted rules, every shoal, reef and island is a potential catastrophe waiting to happen.

Due to their location, dependency on subsistence resources and difficult economic conditions, the Norton Bay villages are disproportionately impacted by changes to their environment in comparison to the rest of the state. The NBITWC realizes the immediate threat of these changes to the habitats and species they manage and that are integral to their subsistence culture; resources are not always available to help managers fully integrate climate information and considerations into their management decisions.

In addition, covering approximately 1 percent of the Earth's surface, rivers, lakes, and freshwater wetlands are home to 10 percent of all species and more described fish species than in all the world's oceans. While most people usually associate fish at the restaurant or on the dinner plate with coming from the sea, in reality, over 40 percent of global fish species are found in freshwater ecosystems that provide the major source of protein, water, and economic well-being for

billions of people. According to the U.S. Geological Survey "Inland fisheries provide critical resources to human communities around the world. Almost 20% of global fish production is from inland fish and over 90% of inland fish catch is used for human consumption. Importantly, the vast majority (95%) of inland fish harvests come from developing countries, providing food to oftentimes rural, low income communities."[4] [5]Although freshwater fisheries are a critical source of subsistence and have cultural and economic value to communities throughout the world, they are among the most threatened ecosystems on the planet.

Rivers and streams located within the Norton Bay Watershed are largely fed by snow melt. Due to increasing temperatures in the Bering Sea region, rain instead of snow is becoming more prominent in the fall and winter resulting in increased flood events in such rivers and streams, threatening community infrastructure and scouring stream beds used by fish and wildlife. In addition, after a winter with little snow and an extremely hot summer, many streams containing salmon habitat upon which the local communities rely for subsistence are beginning to run dry or heat up during critical spawning times. In early July 2019, stream temperatures in Southcentral Alaska exceeded 81 degrees Fahrenheit, breaking all prior temperature records. For spawning adult salmon or growing juvenile fish, temperatures above 80 degrees can be lethal to salmon due to the loss of oxygen in the water and heat stress.

At the same time the negative effects of climate change on salmon habitat can be exacerbated by existing non-climate stressors including marine-source pollution; oil and gas spills; energy production and resource extraction; development and population growth; and aquaculture. Marine-source pollution and oil and gas spills can affect the local economy, human health and welfare, smother habitat and, over the long term, stop biological processes. Development and population growth can impact habitat by increased land use activities including toxic effluents, non-point source pollution, including sedimentation, water withdrawals, and oil and gas development. Aquaculture impacts salmon habitat, particularly located in marine waters, from increased competition on food sources.

Climate change may interact with marine-source pollution spills and warmer temperatures to cause reduced resiliency, unsustainable salmon populations, and impacted wetlands. Development and population growth and warmer temperatures can cause low flows to occur when higher flows are needed at key times and pollutants can further stress fishery and other species sensitive to increased water temperature. Adaptation strategies that might reduce this vulnerability of marine and freshwater species to climate change include tighter oil spill contingency planning, cruise ship regulations, and limits to land based and off-shore oil and gas drilling. In order to implement this strategy, the state will need to work with state and federal agency partners and the legislature to develop stricter oil spill contingency planning and cruise ship effluent laws and regulations. This and other strategies can be developed with an Integrated Water Resources Management Plan that accounts for management of the entire watershed and emphasizes ecosystem services in protecting and managing the entire Watershed for multiple users.

---

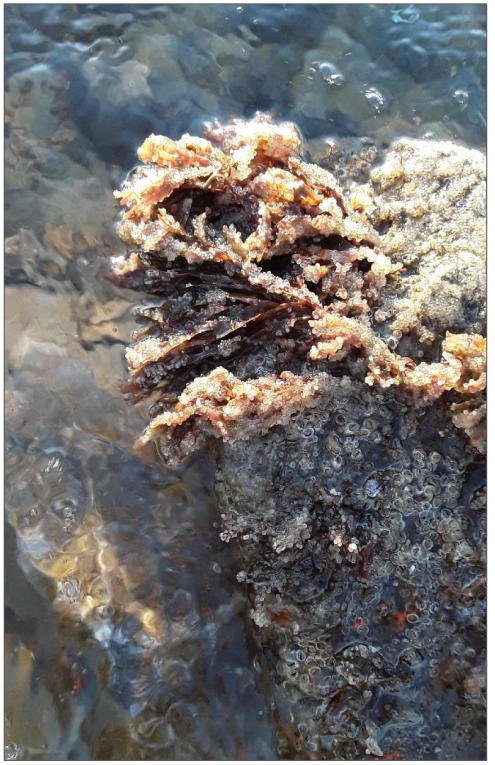
[4] USGS. New Paper Highlights 'InFish,' an International Knowledge-Sharing Network Supporting Global Conservation and Sustainable Use of Inland Fish. July 15, 2020. https://www.usgs.gov/center-news/new-paper-highlights-infish-international-knowledge-sharing-network-supporting-global

[5] Abigail J. Lynch, Steven J. Cooke, Andrew M. Deines, Shannon D. Bower, David B. Bunnell, Ian G. Cowx, Vivian M. Nguyen, Joel Nohner, Kaviphone Phouthavong, Betsy Riley, Mark W. Rogers, William W. Taylor, Whitney Woelmer, So-Jung Youn, and Beard T. Douglas Jr.. The social, economic, and environmental importance of inland fish and fisheries. Environmental Reviews. 24(2): 115-121. https://doi.org/10.1139/er-2015-0064

Subsistence Culture

The importance of Alaska Native Villages subsistence culture is discussed in the *Climate Adaptation and Action Plan for the Norton Bay Watershed, Alaska* completed in 2013,[6]

> *The Alaska Native culture present in the Norton Bay watershed, the Inupiat, is one of the last intact, sustainable salmon-based cultures in the world. In contrast, other Pacific Northwest salmon-based cultures are severely threatened due to development, degraded natural resources, and declining salmon resources. Pacific salmon are no longer found in 40% of their historical breeding ranges in the western United States, and where populations remain, they tend to be significantly reduced or dominated by hatchery fish.*
>
> *Salmon are integral to the entire way of life in these cultures as subsistence food and as the foundation for their language, spirituality, and social structure. The cultures have a strong connection to the landscape and its resources. In the Norton Bay area, this connection has been maintained for at least the past 4,000 years and is in part due to and responsible for the continued pristine condition of the region's landscape and biological resources. The respect and importance given salmon and other wildlife, along with the traditional knowledge of the environment, have produced a sustainable subsistence-based economy and way of life which is a key element of indigenous identity; this respect serves a wide range of economic, social, and cultural functions in Inupiat and Yu'pik societies.*
>
> *The subsistence way of life in many Alaska Native villages is augmented with activities supporting cash economy transactions. Alaska Native villages, in partnership with Alaska Native corporations and other business interests, are considering a variety of economic development opportunities. Most Alaska Native villages have decided for themselves that large-scale hard rock mining is not the direction they would like to go and are, primarily, concerned with the long-term sustainability of their communities.*



Herring roe on kelp along Norton Bay shoreline. *Photo Credit: Leigh Takak (2020)*

> *The NBITWC community is especially vulnerable to mining and development proposed for the Norton Sound area because they are an indigenous population highly dependent on a subsistence economy...In the Norton Bay Watershed, salmon constitute approximately 52% of the subsistence harvest, and for some communities this proportion is substantially higher. The Norton Bay River Watershed produces a variety of important fish species in this region, including Chinook Salmon, Pink Salmon, Chum Salmon, Silver Salmon, as well as whitefish and greyling. However, the fishery is already exhibiting population pressures due to human caused impacts. Parent-year escapements for Chinook salmon, for example, were mostly poor in the 2000s, very poor for returning 5-year old chum salmon, poor to fair for coho salmon in 2003, and were poor to fair for chum in 2004.*

[6] Murray, E., Ryan, J., Shepherd, H. & Thaler, T., Griffith, G., Crossett, T., Rasker, R. (Eds). 2013. *Climate Adaptation and Action Plan for the Norton Bay Watershed, Alaska.* Model Forest Policy Program in association with Norton Bay Inter-Tribal Watershed Council, the Cumberland River Compact and Headwaters Economics; Sagle, ID. Pgs. 70-71. https://www.cakex.org/documents/climate-adaptation-and-action-plan-norton-bay-watershed-alaska-0

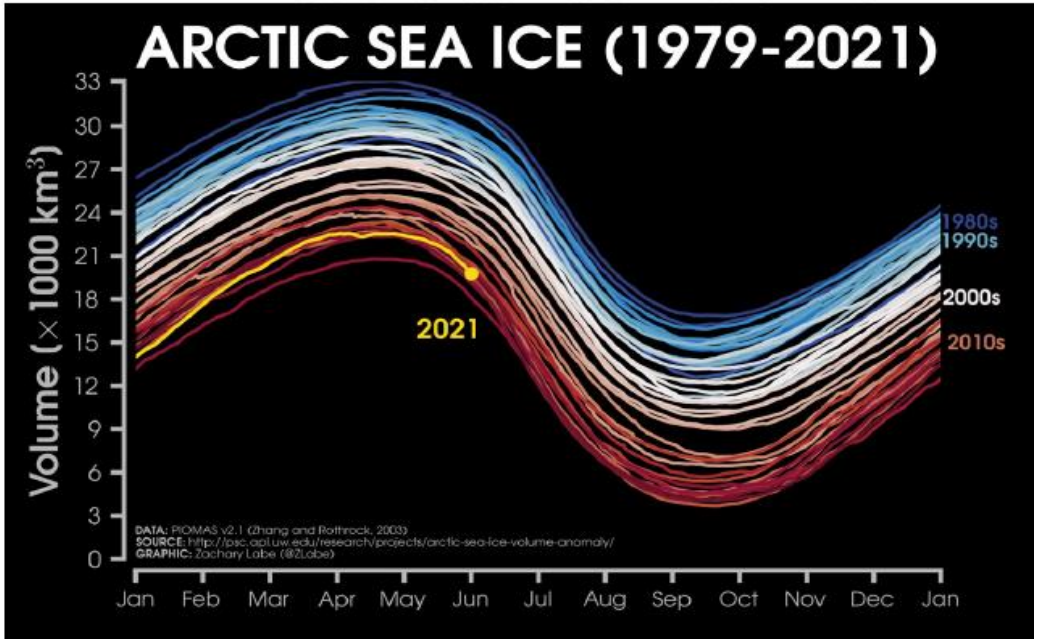
More Specific Climate Impacts

Following are more specific climate trends impacting Alaska that were included in the *Climate Adaptation and Action Plan for the Norton Bay Watershed, Alaska*.[7] Some of the trends (e.g. temperature increase) have seen greater changes than expected over the past several years, hence are updated.

Temperature Increase: The Arctic Monitoring and Assessment Programme (AMAP) May 2021 report stated that,

Key indicators such as temperature, precipitation, snow cover, sea ice thickness and extent, and permafrost thaw show rapid and widespread changes underway in the Arctic. An important update is that the increase in Arctic annual mean surface temperature (land and ocean) between 1971 and 2019 was three times higher than the increase in the global average during the same period... Now according to the AMAP's 2021 report, The newest generation of coupled global climate model projections (CMIP6) show that annual mean surface air temperatures in the Arctic will rise to 3.3–10°C above the 1985–2014 average by 2100, depending on the course of future emissions. Under most emission scenarios, the vast majority of CMIP6 models project the first instance of a largely sea-ice-free Arctic in September occurring before 2050. The probability of an ice-free Arctic summer is 10 times greater under a 2°C global warming scenario compared with a 1.5°C scenario.[8]

Melting Sea Ice: While sea ice doesn't contribute to sea level rise, just as a melting ice cube doesn't increase the volume in a water glass, the loss of ice cover does lead to warmer ocean temperatures. Sea ice, being white, doesn't absorb solar radiation as effectively as the deep blue of the open ocean. This albedo effect, where oceans warm and speed climate change, is happening rapidly in the Earth's Polar Regions. For the first time in at least 100,000 years, since before the last ice age, a channel opened up across the Arctic Ocean during the summer of 2012, and reappeared in 2013. The 900-mile channel may soon be navigable, shortening the route between Europe and ports along the western United States and Japan, and opening the floor of the Arctic to oil exploration.[9]



Included in presentation by Rick Thoman, Alaska Center for Climate Assessment and Policy, University of Alaska Fairbanks. June 18, 2021.
Sources: Data from University of Washington / PIOMAS data.
Graphics by Z. Labe, Colorado State University.

---

[7] *Ibid.* Pgs. 14 - 22.

[8] AMAP, 2021. Arctic Climate Change Update 2021: Key Trends and Impacts. Summary for Policy-makers. Arctic Monitoring and Assessment Programme (AMAP), Tromsø, Norway, pg. 2: https://www.amap.no/documents/doc/arctic-climate-change-update-2021-key-trends-and-impacts.-summary-for-policy-makers/3508.

[9] Environmental News Network: http://www.enn.com, and Nature: http://www.nature.com.

Ocean Acidification: The oceans of the world act as huge carbon dioxide sinks, absorbing approximately 30% of all atmospheric CO2 produced. The cold waters of the arctic and sub-arctic are able to absorb and retain higher concentrations of atmospheric carbon dioxide because CO2 becomes more soluble in colder waters. The down side of this equation is that CO2 in the water column breaks down into carbonic acid, driving up ocean acidification and lowering pH. Even a modest decrease in pH impacts the ability of organisms to form shells- organisms such as crabs, clams, and the tiny shrimp-like creatures that make up the base of the food chain. Fish species depend on these small organisms, and Alaska, in turn, depends on fish for some 78,000 jobs state-wide, or $4 billion in annual sales. Over 50% of the fish eaten in the United States come out of Alaskan waters.[10]

Sea Level Rise: As glaciers recede, sea levels will naturally continue to rise. But sea level won't rise uniformly across the world's oceans, due to tectonic forces that result in subsiding coasts in some regions, and upwelling in other regions. In Alaska some areas that are very recently free of glaciers are rebounding as the land recoils slowly in response to the loss of millions of tons of ice. Early research suggests that these areas are currently outpacing sea level rise. Other regions of the state are not so fortunate and may experience a predicted two to six feet of sea level rise by the end of this century.[11]

In addition, when combined with extreme weather conditions, sea level rise contributes to flooding in Alaskan coastal villages which can result in damage to structures and severe health issues when sewage systems back-up or otherwise become inoperable and drinking water is impacted.

Longer Snow-Free Season: Between 1970 and 2000, the snow-free season increased by about 10 days across much of Alaska, primarily due to earlier snowmelt in the spring.[12]

Permafrost Changes: Warmer winters and longer summers have led to significant hydrological changes in regions underlain by permafrost. Much of the Alaskan interior north of Anchorage and vast swaths of land to the west

Washed up starfish and clams along the Tubutulik River estuary. Photo Credit: Leigh Takak (2021)

[10] Alaska Marine Conservation Council. http://www.akmarine.org/our-work/.

[11] Larsen et. al. 2005. and Alaska Sea Grant Marine Advisory Program. http://seagrant.uaf.edu/map/climate/docs/sea-level.php.

[12] University of Alaska Fairbanks - Scenarios Network for Alaska and Arctic Planning. https://uaf-snap.org/get-data/.

along the Yukon Kuskokwim Delta have discontinuous permafrost – that is, soils just below the surface that remain frozen year-round, usually to great depths. The further north one goes, the more pervasive the permafrost soils are. These soils, provided they remain frozen, are stable and can be depended upon to support roads, pipelines, and buildings in many Alaskan communities, including Fairbanks, which is Alaska's second largest population center. But as soils warm, melting permafrost is creating significant problems with infrastructure, evidenced by homes and businesses sinking into holes opened up where ice has melted away, river banks and coastal bluffs eroding rapidly, and roads buckling as the sun warms their surfaces and melts that ground below. Numerous communities in Interior and coastal Alaska now face near annual flooding and deteriorating infrastructure.[13]

Methane Release: To compound the climate issue, permafrost, which is comprised of a mixture of frozen peat, glacial till, clay, and water, effectively locks up vast quantities of methane. In the ground methane is harmless, but in the atmosphere it is 20 times as effective as CO2 in trapping solar radiation. Even modest releases of methane into the atmosphere will increase the rate of global warming. There is great concern among the scientific community that wide-scale melting of permafrost will release vast stores of methane into the precarious climate change equation.[14]

Habitat Range Extensions: Birds and insects are extending their ranges northward in response to warmer weather and expanded shrublands. Invasive and harmful insects that are not currently found in Alaska, such as mosquitos that carry West Nile virus and ticks, are likely to expand their ranges into Alaska as well.[15]

Spruce Forests Show Declining Growth: White spruce forests in Interior Alaska are experiencing declining growth due to drought stress. At the same time, willows, dwarf birch, and other shrub species are expanding their range as permafrost melts and soils warm across regions that were previously dominated by tundra.[16]

---

13 Environmental Protection Agency: http://www.epa.gov/climatechange.

14 *Ibid.*

15 U.S. Fish & Wildlife Service: https://www.fws.gov.

16 U.S. Global Change Research Program:https://nca2009.globalchange.gov/; and Global Climate Change Impacts in the United States, Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson, (eds.). Cambridge University Press, 2009. https://www.nrc.gov/docs/ML1006/ML100601201.pdf.

Bering Straits Coastal Resource Service Area Board (BSCRSAB)

History

Like many of the Alaska resource and subsistence protection laws that were adopted in the '70s, the legislature adopted the Alaska Coastal Management Act in 1977 under the federal Coastal Zone Management Act (CZMA), which calls for states to protect, manage, and, where possible, rehabilitate coastal areas. Under this directive, and over the course of eleven years, the Bering Straits Coastal Resource Service Area Board (BSCRSAB) (which was comprised mostly of Natives and other representatives from local community programs) developed a comprehensive plan for the coastal fish and wildlife resources and the watersheds that feed into such areas. Among other strategies, the plan reinforced existing protections and developed new protections for subsistence, habitat, and biological resources, water quality standards, environmental protection technology, hazardous materials, toxic substances, siting of facilities, geophysical and coastal hazards, mining and mineral processing, energy facilities, transportation and utility systems, disposal of interest, and state and federal permit review and consistency procedures. The plan also identified Important Use Areas, including the same river drainages that tribes had nominated for protection as Areas of Critical Environmental Concern (ACEC) in the Bering Sea-Western Interior resource management plan (RMP). Additionally, the plan contained information concerning existing ACECs identified by the Kobuk-Seward Resource Management Plan, showing the local importance of sustainably-productive lands.

In the summer of 2011, Governor Frank Murkowski withdrew Alaska from the CZMA. Because a federally approved coastal management program must be administered by a state agency, and because no other entity may develop or implement a federally approved coastal management program, the federal consistency provision no longer applied in Alaska after that point. While Murkowski maintained that he withdrew because it resulted in too much litigation and too many delays in permitting, the local community members who participated on the board maintain that the real reason for the program's demise was development interests, especially those from the mining and oil and gas industries. They believed the act gave too much control over local interests.[17]

Currently, because it cannot be enforced, the Bering Sea Coastal Zone Management plan is simply another layer of information to add to that for management of tribally-nominated Areas of Critical Environmental Concern in the Bering Sea-Western Interior Resource Management Plan.

The loss of the CZMA program represents another phase trending away from the original progressive natural resource protection laws that represented the determination of the public and politicians to prevent the mistakes made by the lower 48 states and to protect Alaska's unique fish and wildlife resources. The loss of the CZMA program and the Bering Sea management plan, however, is particularly discouraging after the substantial amount of work that went into the program.

[17] Also see: Wilson, Ryan M. *Why Did Alaska Eliminate the Alaska Coastal Management Program? A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Natural Resource Management.* School of Natural Resources and Extension, University of Alaska Fairbanks. May 2018. https://scholarworks.alaska.edu/bitstream/handle/11122/8751/Wilson_R_2018.pdf?sequence=1&isAllowed=y

Bering Straits Coastal Resource Service Area Board Volumes (also Bering Straits CRSA)[18]

The people of the 16 communities in the region voted in 1980 to form the Coastal Resource Service Area (CRSA). The resource inventory was developed in 1984 and the resource analysis and other components of the plan were drafted in 1986. The final plan was approved by the Alaska Coastal Policy Council in July 1987 and by the federal Office of Ocean and Coastal Resource Management in December 1989. The documents included in the original coastal management plan include a user guide and three volumes:

- User Guide (1987): The Guide provides an overview of coastal management, identifies the components of the CRSA's plan, and describes implementation procedures.
- Volume 1 - Resource Inventory (October 1984): This volume describes the resources and uses important to the people of the CRSA.
- Volume 2 - Resource Analysis (October 1986)

  Distributed in 1986, the analysis examines the potential impacts of projects proposed by state and federal agencies as well as those proposed by private applicants.
- Volume 3 - Coastal Management Plan (June 1991)

  This document, distributed in 1986 and reprinted in 1991, includes other components of the plan such as the issues, goals and objectives and enforceable policies.
- Final Plan Amendment (June 2010) (Prepared by Glenn Gray and Associates with Assistance from Sandy Harbanuk and Associates)

Relevancy of BSCRSA's Work to NBWOCMP

The NBWOCMP's strategies draw from over two decades of work done by the Bering Straits Coastal Resource Service Area Board (BSCRSAB) starting in the 1980's. The three (3) original volumes (Resource Inventory, Resource Analysis, and Coastal Management Plan) completed by the BSCRSAB are a deep source of information and a model process clearly relevant to this new Norton Bay coastal management initiative; the information and process should not be forgotten. Together the volumes provide fundamental baselines from which to build on and learn from. By keeping these resource and planning documents as critical references, this renewed coastal initiative - starting with this Norton Bay Watershed Ocean and Coastal Management Plan - can keep the principles of Native Village sovereignty, local engagement, and prioritization of sustainable, subsistence resources at the forefront of climate adaptation strategies going forward.

[18] Description of volumes from Bering Straits Coastal Resource Service Area. Coastal Management Plan - Final Plan Amendment. June 2010. Prepared by Glenn Gray and Associates with Assistance from Sandy Harbanuk and Associates. Pg. 3.

OVERVIEW OF MARINE PROTECTED AREA RAPID VULNERABILITY ASSESSMENT (MPARVA) TOOL[19]

The Marine Protected Area Rapid Vulnerability Assessment (MPARVA) Tool was the underlying process used to develop the Norton Bay Watershed Ocean and Coastal Management Plan. It is a product of the Commission for Environmental Cooperation's (CEC's) 2015-2016 project, *Marine Protected Areas: Strengthening Management Effectiveness and Supporting Coastal Community Resilience*. The MPARVA Tool has three parts (a user guide, a set of blank worksheets, and a booklet containing sample completed worksheets) that are available as downloadable PDFs. The blank worksheets are in a dynamic PDF format, which allow them to be filled in, saved and shared.

The MPARVA Tool consists of the following **5 Steps** that define the Assessment's scope, assess the geographic locations climate-related vulnerabilities (both climate stress and non-climate stressors), adaptive capacity, adaptation strategies and their implementation, and narrative:

- **Step 1. Define the Scope of the Vulnerability Assessment.**
  - Box 1: Habitat Type
  - Box 2: Timescale
  - Box 3: Climate Change Variables - Climate Stress
  - Box 4: Climate Change Variables - Non-climate Stressor

- **Step 2 & 3. Undertake Assessment.**
  - Table 1. Vulnerability Assessment (repeat for each habitat type)
  - Table 2. Consequences (Use results of Table 2 to complete Column E on Table 1.)
  - Table 3. Adaptive Capacity Assessment of Habitat

- **Step 4. Adaptation Strategy Development**
  - Table 4: Strategy Development
  - Table 5: Strategy Implementation

- **Step 5. Narrative Vulnerability Assessment**
  - Under Step 5, the MPARVA Tool asked that the results of all completed habitat assessments be used to create a narrative vulnerability assessment for the site, in this case the Norton Bay Watershed. Much of what was written under this step is incorporated into various sections of the NBWOCMP.

[19] *Ibid*. Footnote #3.

As identified above under the different Steps, the MPARVA Tool provides five tables to analyze the details of each climate and non-climate habitat stressor element as follows:

Table 1 - Vulnerability Assessment (overall synthesis of findings)
Table 2 – Consequences
Table 3 – Adaptive Capacity
Table 4 – Strategy Development
Table 5 – Strategy Implementation

The detailed findings of the vulnerability assessment for each habitat are available in the MPARVA Tool Tables 1-5 at the end of this document.
The Tool identifies and addresses each climate stressor and non-climate stressor that impacts each habitat by outlining the following information:

1) Direction or magnitude of the stress for that habitat;
2) Known or potential effects on the habitat;
3) Likelihood of occurrence (probability);
4) Severity of the consequences (impact);
5) Relative risk level of high, moderate, or low - based on likelihood X consequences;
6) Adaptive capacity to resist, respond, or recover; and finally
7) Overall vulnerability level of high, moderate, or low - based on risk level x adaptive capacity.

To assist with completing **Step 2 & 3 Undertake Assessment - Tables 1 - 3,** matrices were provided in the MPARVA Tool - User Guide. The tables serve to help rank the level of risk and vulnerability according to these formulas:

Level of Risk = Likelihood X Consequences
Levels of Vulnerability = Risk X Adaptive Capacity

The Levels of Risk and Vulnerability are reported as Low, Medium (Moderate), High, or Extreme as illustrated in **Figure 2 (Risk)** and **Figure 3 (Vulnerability**) below.

Figure 2. Risk = Likelihood x Consequences[20]

Likelihood	Consequences				
	Negligible	Minor	Moderate	Major	Catastrophic
Rare	Low	Low	Low	Low	Low
Unlikely	Low	Low	Moderate	Moderate	Moderate
Possible	Low	Moderate	Moderate	High	High
Likely	Low	Moderate	High	High	Extreme
Almost Certain	Low	Moderate	High	Extreme	Extreme

Figure 3. Vulnerability = Risk x Adaptive Capacity[21]

Risk	Adaptive Capacity		
	Low	Moderate	High
Low	Low	Low	Low
Moderate	Moderate	Moderate	Low
High	High	Moderate	Moderate
Extreme	High	High	Moderate

[20] CEC 2017. North American Marine Protected Area Rapid Vulnerability Assessment Tool. Montreal, Canada: Commission for Environmental Cooperation. 30 pp, p 12.

[21] Ibid. p 16.

SUMMARY OF MARINE HABITAT PROFILES: VULNERABILITIES, ADAPTIVE CAPACITY, & ADAPTATION STRATEGIES

This section, **Summary of Marine Habitat Profiles: Vulnerabilities, Adaptive Capacity, & Adaptation Strategies**, summarizes the highlights and key facts of the overall vulnerability assessment findings for each habitat and potential adaptation strategies that benefit one or more of three critical habitats. The summary narrative is drawn from the details of the relevant sections of the MPARVA Tool analysis spreadsheets found in the **Completed Marine Protected Area Rapid Vulnerability Assessment (MPARVA) Tool**, located further below in this document.

Summary of Marine Protected Area Rapid Vulnerability Assessment (MPARVA) Scope

The Marine Protected Area Rapid Vulnerability Assessment conducted for the Norton Bay Watershed built upon the Climate Adaptation and Action Plan for the Norton Bay Watershed, Alaska, Assessment of Mining Impacts on Subsistence, Ecosystems of the Tubutulik River Watershed, the Quality Assurance Project Plan for the Native Village of Elim (NVE), and the draft NVE Instream Flow Water Reservation Application. The project team used the Marine Protected Area Rapid Vulnerability Assessment Tool (MPARVA Tool) to guide the assessment process by completing a series of spreadsheet tables with analytical questions to explore and answer. In going through the process, members of the Norton Bay Inter-Tribal Watershed Council, staff and its consultants identified three major habitat types vulnerable to climate change, which is a major risk to salmon – a keystone species in Alaska. The habitats, which are the foci of this vulnerability assessment, are: **Pelagic**, **Ice/Snow**, and **Rocky/Intertidal.** The team researched and recorded relevant information into the MPARVA Tool over a period of several months. Input was gathered from publications, authoritative websites, **NBITWC** board members, and residents of the Norton Bay Native Villages. The **timescale** of the assessment is "**Near term**" defined as **present to 10 years**.

The **"climate stress" variables** that were identified and assessed related to the 3 different habitats are:

- Pelagic:
  - Increased water temperature
  - Altered precipitation patterns
  - Ocean acidification
  - Harmful algal bloom
- Ice/Snow:
  - Increased water temperature
  - Sea-level rise
  - Altered currents
  - Altered precipitation patterns
  - Wave action /Coastal erosion
  - Salinity
- Rocky/Intertidal:
  - Increased water temperature
  - Altered precipitation patterns
  - Ocean acidification

The **"non-climate stressor" variables** that were identified and assessed related to the 3 different habitats are:

- Pelagic:
  - Land-source nutrient pollution
  - Land-source non-nutrient pollution
  - Marine-source pollution and spills
  - Development/population growth
  - Aquaculture
  - Invasive species
  - Transport
  - Extraction (mining, oil and gas)
  - Overwater/underwater structures
  - Dredging
  - Noise
  - Altered sediment transport

- Ice/Snow:
  - Marine-source pollution and spills
  - Development/population growth
  - Aquaculture
  - Transport
  - Extraction (mining, oil and gas)
  - Energy production
  - Overwater/underwater structures

- Rocky/Intertidal:
  - Marine-source pollution and spills
  - Development/population growth
  - Aquaculture

Pelagic Habitat Summary

The Pelagic Zone refers to the habitat of the water column in open ocean waters. It can be further characterized by different depths in the water column. The Norton Bay Plan focuses on the Pelagic Zones of Norton Bay, the Bering Sea, and the Chukchi Sea as the most relevant to the management plan. These open waters are the primary habitat for the growth and maturation period of the salmon life cycle plus many other ocean fish and marine mammal species of importance to native subsistence resources.

Risks and Vulnerabilities for Pelagic Habitat - TABLES 1 & 2

The climate stressors identified for the Pelagic Zone are increased water temperature, altered precipitation patterns, ocean acidification, and harmful algal blooms. **Table 1** assesses the impacts of these climate stresses on the Pelagic habitat. The non-climate stressors for the Pelagic Zone, the focus of **Table 2**, relate mainly to land and marine source pollution, development, and extraction and harvesting activities.

Climate Stressors for Pelagic Habitat

- Increased water temperature - High
- Harmful algal blooms - High
- Altered precipitation - Medium
- Ocean acidification - Medium

Increased water temperature and **harmful algal blooms** were both given a **HIGH Vulnerability Level** for the Pelagic habitat.

- **Increased water temperature**: The warming waters are already observed to be causing significant changes, including loss of sea ice, effects to the ocean cold pool, and changes in the nature of sea ice and currents. Anticipated effects include disruptions to the food chain that lead to unusual mortality events for birds and marine mammals. Observations of ecological shifts, strandings, and habitat loss are already being made. The phenomenon known as "The Blob", with a shifting zone of high temperatures on the ocean, is also causing significant impacts to marine life, freshwater life, and bird populations.
- **Harmful algal blooms (HABs):** Warmer waters combined with excess nutrient pollution also foster harmful algal blooms with potential toxicity to both animals and people. Algal blooms with toxicity are occurring in the Bering Sea region with toxic samples collected all the way to the Chukchi Sea waters north of Utqiagvik. Paralytic shellfish poisoning is one of the HABs that pose risks to people and the ecosystem. For both warmer waters and HABs, the Consequences can be catastrophic and the risks are considered Extreme. The adaptive capacity for warmer waters and HABs is moderate at best, as outlined further below.

Altered precipitation and **ocean acidification** are both assessed to be **Moderate Vulnerability Level** in the near term, though longer term impacts may be more damaging over time, especially for ocean acidification.

- **Altered Precipitation**: The altered precipitation patterns, primarily seen as more rain and less snow, reduce the snowpack and can lead to low instream flows and warmer waters feeding into the ocean at critical times. The risks are considered High**,** while the consequences are listed as Major with Moderate Adaptive Capacity.
- **Ocean Acidification**: As ocean waters absorb excess carbon dioxide from the atmosphere, the pH of the water goes down and leads to ocean acidification. It has the long term potential to be catastrophic to the food chain. Aquatic life is very sensitive to changes in pH. Acidification disrupts the ability of shellfish and other species to build their carbon-based shell. Currently acidification is more prominent in southern Alaska but will become more significant in the Bering Sea and other northern waters in future years. This will reduce the primary food source for salmon and other key ocean fisheries over time.

Non-Climate Stressors for Pelagic Habitat

Table 2 examines the consequences of non-climate stressors for each habitat and whether or not climate change impacts will exacerbate the negative effects. There are numerous non-climate related stressors to open ocean waters that are exacerbated by climate change. The following outlines how these non-climate stressors impact Pelagic habitat and degrade subsistence resources. Each of them is potentially made worse by warmer waters, altered precipitation, ocean acidification, and harmful algal blooms.

- **Land-based Pollution**: Former military sites with toxic soils and existing city and village dumpsites release hazardous land-based toxins that flow downstream and are released into the sea. Warming temperatures and altered precipitation accelerate thawing of permafrost on former military sites and increase toxic runoff from all land sources. Periodic low stream flows during drought can also cause thermal stress and formation of “the blob”, further degrading Pelagic habitat and contributing to the formation of harmful algal blooms. This impacts many sensitive species including salmon, shellfish, clams, and other marine food web species. Ocean acidification and harmful algal blooms also stress sensitive species and further reduce the species as the base of the marine food web. The potential impacts of land-based pollution combined with climate impacts are assessed to range from major to catastrophic to Pelagic habitat.
- **Development:** Population growth and spreading development patterns are serious non-climate stressors to the marine habitat, especially from development along the coastlines. Development disrupts shoreline habitat and interferes with the life cycle of many Pelagic species and/or the food that they eat. Climate change further increases the impacts of development by increasing floods, polluted runoff, and thermal stress to waters.
- **Transportation and Marine Pollution:** The number and size of sea going vessels are increasing significantly, with more than 1,000 vessels going through the Bering Strait daily. These ships release marine pollution, including vessel effluent and noise pollution, just in normal operations. They further pose significant risks of catastrophic pollution in the event of accidents or storms leading to major oil spills or other toxins. The impacts of shipping on Pelagic habitats are intensified by warming waters, acidification, and algal blooms to further degrade the open ocean ecology.

- **Extraction, Dredging, and Mining:** Oil and gas drilling, mining, and dredging all pose serious risks to marine ecosystems of all kinds. Normal operations release significant pollution at the extraction sites, which leads to local impacts plus downstream impacts from runoff of pollutants through rivers and into the ocean. Heavy precipitation can increase the toxic runoff. On the other hand, drought and warm temperatures can lead to low stream flows resulting in concentrated pollution events with even more toxic impact to the ecosystems. The effects can seriously degrade fisheries in both near-shore and open ocean habitats even during normal operations. However, the risk of major oil or gas spills represents the potential for catastrophic impacts to the ecosystems with long term consequences. Climate conditions exacerbate these impacts and increase the chances of serious accidental or storm induced spill events from drilling rigs and mining operations and effluent pond dams. Near-shore dredging can also exacerbate the impacts of thermal stress and harmful algal blooms.
- **Commercial Fishing:** The impacts of commercial fishing to Pelagic habitat and subsistence resources include overfishing, bycatch mortality, and habitat damage from fishing equipment. These impacts can occur at a large scale for Pelagic habitats. Unsustainable commercial fishing combined with the impacts of climate change can increase the impact to sensitive species and results in catastrophic die off under certain conditions, such as recent sea bird die offs due to disruption of food chain species.

Dredging claim for area off of Elim.
Photo Credit: Leigh Takak (2019)

Potential Adaptive Capacity of Pelagic Habitat – TABLE 3

The Adaptive Capacity Assessment is outlined in **Table 3**. This table examines the potential to resist, recover, and respond to climate impacts based on factors in two categories: ecological potential and social potential; the latter is a combination of organization capacity and management potential. The two adaptive capacities are described and rated for a list of relevant indicators on a scale of 5 to 1 as superior, good, fair, poor, or critical for each habitat. Then the overall adaptive capacity is converted to an average capacity rating as: Low = 1 – 2.3; Moderate = 2.4 – 3.6; High = 3.7 – 5.

- **Ecological Potential for Pelagic Habitat:** The ecological potential for Pelagic adaptation was rated poor to fair (2.4). The strongest feature was the biodiversity of food web species in the open ocean, rated as fair. However, other features were all either poor or fair to poor in terms of adaptive capacity. Of most concern is the lack of physical diversity and significant impacts to keystone and indicator species with slow signs of recovery. For example, the food base of zooplankton is being impacted by warmer waters and loss of sea ice, which is an escalating problem. Other signs of poor adaptation potential include decreasing numbers of grey whales and more seabird die-offs from starvation due to forage fish migrating to different, cooler ocean areas.

- **Organization Capacity for Pelagic Habitat:** The organization capacity for adaptation was rated at fair to good based on the factors of the Norton Bay Inter-Tribal Watershed Council (NBITWC). The strong points are the staff capacity, responsiveness, and stability of the organization. The NBITWC has members with expertise and elders with traditional ecological knowledge. The only weak area was the lack of strong stakeholder relationships with state and federal agencies and mining companies.
- **Management Potential for Pelagic Habitat:** The management potential for adaptive capacity was rated as fair, with mixed results for several factors. The strong factors for management are monitoring and evaluation capacity, ability to learn and change, partner relationships, and science and technical support. The weakest areas are the lack of a strong existing mandate for coastal management and a lack of proactive management activities. This coastal management planning project has the potential to help improve those management factors in the future.

The combined average rating of potential ecological and social adaptive capacity was Moderate (2.8) for the Pelagic habitat, based on the conversion "adaptive capacity rating: Low = 1 – 2.3; Moderate = 2.4 – 3.6; High = 3.7 – 5". The areas of focus for improving Pelagic adaptation capacity include research to understand how to improve ecological integrity, building stakeholder relationships and resources for organizational partnerships; and developing adaptation mandates with proactive and well-funded activities.

Adaptation Strategies for Pelagic Habitat – TABLE 4

Table 4 outlines potential adaptation strategies to address each short-term vulnerability of the Pelagic habitat and estimates the relative high, medium, or low cost and efficacy. It also identifies which type of resilience is involved as being **Resistance (RS)**, **Resilience (RL)**, or **Response (RP)** to the stressor. Resistance strategies aim to maintain current conditions by resisting change. Resilience strategies recognize change and allow the system to respond with adjustments that maintain the functions of the site. Response strategies are true adaptations that recognize that historic functions may no longer be possible requiring dramatic change or relocation of a site. One or more of these types of resilience may occur at a given habitat site as a continuum over time.

Increased Water Temperature Strategies for Pelagic Habitat

- Use data and research to monitor sea ice extent and temperatures; Apply NASA ICEsat-2 to track changes in glaciers, sea ice, forests, etc.
- Tighten controls for point source oil spills and other pollution contingency planning.
- Strengthen regulations for cruise ships, harbor, and docks (e.g. tracking devices, dumping of ballast, trash, waste water and sewage).
- Improve use of best management practices.
- Insure protection of marine mammals and shorebirds in deep water port planning.
- Increase tribal representation on the Arctic Council.
- Limit land-based and offshore oil and gas affecting habitats.
- State requires bonds from oil and gas companies for cleanups and establishment of oil and gas spill response teams.
- Re-establish Federal Coastal Zone Management Planning.

Altered Precipitation Strategies for Pelagic Habitat

- Develop a watershed assessment and integrated water resource management plan (IWRMP) to inform policy and land management decisions, such as drought monitoring, temperature forecasting, predictive instream flows and temperatures, summer stream monitoring protocols, critical fish habitat zones, mining mineral sites, and application of data and models.
- Preserve instream flows by limiting water withdrawals and hydro-power development that affects sensitive habitat.
- Engage all levels of stakeholders in risk assessment and scenario planning at the watershed scale for climate impacts.
- Conduct baseline studies and monitoring to understand ecosystem processes and guide decision makers.
- Coordinate collaboration of all government levels for watershed co-management efforts, e.g. Marine Protection Areas.
- Improve stormwater planning and infrastructure to decrease point and nonpoint source discharges.
- Tighten wetland protection and water use regulations.
- Participate in state and federal agency decisions and planning that affects habitat.
- Identify and protect climate change refugia zones.
- Re-establish the Bering Straits Coastal Resource Service Areas Board.

Ocean Acidification Strategies for Pelagic Habitat

- Decrease effects of non-climate stressors on habitats.
- Promote reduction of carbon dioxide emissions.

Harmful Algal Bloom Strategies for Pelagic Habitat

- Tighten regulations on nutrient pollution from both land-based stormwater runoff and marine shipping discharges.
- Monitor water temperatures and algal content and issue local alerts.

Ice/Snow Habitat Summary

Ice and snow habitat refers to seasonal frozen precipitation for ocean, coastal, and inland terrestrial and riverine watershed conditions. The ice and snow conditions vary with seasonal temperature changes that impact ecological cycles and hydrologic functions. There are significant impacts to ice and snow on both water and land from shifting climate patterns of warmer temperatures and changing precipitation patterns. Most notable is the shift to more rain and less snow in winter conditions, plus melting glaciers and thawing permafrost that lead to marked changes in ocean, coastal, river, and land conditions.

Breakup along Norton Bay.
Photo Credit: Leigh Takak (May 2021)

Risks and Vulnerabilities for Ice/Snow Habitat - TABLES 1 & 2

The climate stressors identified for the Ice/Snow habitat are increased water temperature, sea-level rise, altered currents, altered precipitation patterns, wave action/ coastal erosion, and salinity. Table 1 assesses the impacts of these climate stresses on the Ice/Snow Habitat. The non-climate stressors, the focus of Table 2, for the Ice/Snow habitat focused on marine pollution, development, extraction and energy production, aquaculture, and transportation.

<u>Climate Stressors for Ice/Snow Habitat</u>

- Increased water temperature - High
- Sea level rise – no vulnerabilities listed
- Altered currents – Moderate
- Altered precipitation patterns - High
- Wave action/coastal erosion – No vulnerabilities listed
- Salinity – no vulnerabilities listed
- Ocean Acidification – High

Three climate stressors were assessed to be at a **High Vulnerability Level** for Ice/Snow Habitat in **Table 1**:

- **Increased water temperature:** Increased water (and air) temperatures are being experienced already in both marine and freshwater habitats. The Arctic sea ice extent is reduced more with each passing summer. Significant impacts from temperature increases were experienced in 2019 in the Norton Bay region and beyond. The warmth reduced the snowpack, thus reducing the summer stream flows. Overland it also led to thawing permafrost conditions and loss of peatland areas. The warmer water temperatures cause direct thermal stress to the fish and also reduce the level of dissolved oxygen in the waters. It can also reduce instream flow significantly in the warmer summer months. The consequences include higher salmon mortality, reduced biodiversity of macroinvertebrates in the streams, and challenges with fish passages in low flow conditions. Thawing permafrost may also release toxins into the waterways while they also release carbon and methane into the atmosphere, further accelerating the climate change process. These consequences are potentially catastrophic to salmon populations and other village subsistence resources.

- **Altered precipitation:** Changes in precipitation include more rain and less snow, more intense storms and rainfall events, and rapid spring runoff with flood conditions, followed by hotter, drier summers with low instream flow during the hot months. These changes are already taking place with measurable impacts to freshwater aquatic life. In upper elevations glacier melt is also accelerating. This glacier flow may keep downstream flow cool in the near term. However, in the long term, when glaciers are depleted, cold water conditions will rapidly degrade to warm, low flow waters. This poses extreme risk to subsistence resources over time.
- **Ocean acidification**: The changing water chemistry of ocean and river snow/ice conditions poses an extreme risk to aquatic life in both marine and freshwater habitats. The reduced ability for calcification of shells leads to reduced recruitment and disruptions to the base of the aquatic food web. This poses an extreme risk to salmon and other critical subsistence resources.

The climate change impact of altered currents was identified as a **Moderate Vulnerability Level** for Ice/Snow Habitats:

- **Altered Currents:** Changes in water temperatures are already leading to changes in ocean currents. This rising of warmer waters affects currents on the ocean bottom. Coastline currents are also shifting, with more erosion and rapid changes along shorelines. When combined with warmer waters, these altered current patterns impact the sea ice conditions, putting polar bears, walrus, and other marine mammals in jeopardy. Some whales are observed to not be coming as close to shore as in the past, possibly due to current shifts. These shifts may also affect the cold pool flows and ocean mixing.

Non-climate Stressors for Ice/Snow Habitat

The non-climate stressors selected for review in **Table 2** are:

- **Marine-source pollution and spills**: Marine pollution poses potentially catastrophic damages from oil spills or other major pollution events. As sea ice recedes and shipping increases year-round there will be more routine pollution (ballast, waste water, trash) plus increasing risks for major accidents and pollution events. Shoreline habitat is particularly vulnerable to oil spills where the contaminant will kill large swaths of aquatic and bird life for a prolonged period of time. Cleanup services are also very limited in the Arctic region so it's possible cleanup would not be feasible. The loss of sea ice adds to the potential coastline impacts.
- **Energy production / resource extraction**: Production of energy and various types of resource extraction (drilling, mining, logging) often lead to serious ecological impacts, including water withdrawals that impact stream health, release of toxic effluents into waterways or groundwater, loss of peatlands, trees, or gravel. The disruptions can lead to toxic impacts, sediment transport, and damaged fish habitats. Clear cuts can exacerbate flooding and erosion from heavy rains and melting snowpack or glaciers. The combined climate and land use stresses puts additional stress on subsistence species and ecological processes.
- **Development/population growth**: As development spreads across the landscape and along the coastline, increasing impervious cover along with stream crossings, roads, bridges, and other infrastructure lead to habitat loss. The negative consequences include more flooding, erosion, and sediment loading, plus stream degradation, stormwater pollution, and an influx of invasive species. Development also accelerates thawing of permafrost with negative impacts on both ecological processes and human infrastructure.

Potential Adaptive Capacity for Ice/Snow Habitat – TABLE 3

The Adaptive Capacity Assessment is outlined in **Table 3**. This table examines the potential to resist, recover, and respond to climate impacts based on factors in three categories: ecological potential and social potential; the latter is a combination of organization capacity and management potential. The ecological and social adaptive capacities are described and rated as superior, good, fair, poor, or critical on a scale of 5 to 1. Then an average adaptive capacity rating is calculated as Low = 1 – 2.3; Moderate = 2.4 – 3.6; High = 3.7 – 5.

Native Village of Golovin fish processing plant lost to coastal erosion.
Photo Credit: Gwen Griffith (2016)

- **Ecological Potential for Ice/Snow Habitat:** The overall ecological potential for adaptation by the Ice/Snow habitat was rated as fair (2.8). The strongest feature was the high value and importance of the Ice/Snow habitat to the people of the region, especially subsistence species. There was also a Fair value placed on the physical diversity of species, including the large range of salmon species. The rich biodiversity of the food web in freshwater and marine habitat was also rated at fair. However, the distribution and connectivity of species and past evidence of recovery both were rated as poor. The keystone species indicators were assessed as fair to poor, mainly based on salmon species and negative changes being seen to whales, forage fish, and seabirds in recent years.
- **Organization Capacity for Ice/Snow Habitat:** The organization capacity for adaptation was rated as good based on high marks for staff capacity of the Norton Bay Inter-Tribal Watershed Council (NBITWC); the responsiveness and resilience of the Native Villages of Norton Bay; and the stability and longevity of the local villages. The one weak rating was for stakeholder relationships. The Watershed Council has not yet built working relationships with state and federal agencies.
- **Management Potential for Ice/Snow Habitat:** The management potential for adaptive capacity was rated as fair, with a wide range of values. The strongest factors for management are monitoring and evaluation capacity and science and technical support, with both rated as good. The two weakest areas are the lack of a strong existing mandate for management and a lack of proactive management activities. This coastal management planning project has the potential to help improve those management factors in the future. The ability to learn and change was rated fair, a good sign for the chance to make progress under the new administration.

The combined average rating of ecological and social potential adaptive capacity was moderate (2.9) for the Ice/Snow habitat, based on the conversion "adaptive capacity rating: Low = 1 – 2.3; Moderate = 2.4 – 3.6; High = 3.7 – 5".

Adaptation Strategies for Ice/Snow Habitat - TABLE 4

Table 4 outlines potential adaptation strategies for Ice/Snow Habitat.

Increased Water Temperature Strategies for Ice/Snow Habitats

- Collect, assess, and summarize instream flow and water quality data in conjunction with traditional ecological knowledge (TEK) of the watershed.
- Limit water (oil and gas and mining) withdrawals and hydro-power development affecting habitats.
- Improve Connectivity of freshwater habitats including streams, lakes, wetlands, estuaries, and shorelines.
- Preserve instream flows including collection of data and filing of instream flow water right applications for select streams.
- Enhance riparian zones and aquatic habitat to shade streams, e.g. planting willows and other trees close to the banks of streams and rivers; create in-stream habitats made of woody debris; develop matrix of locations and assess in relationship to TEK summary.
- Improve compliance with NEPA, ESA and NHPA statutes.
- Develop an Emergency Recovery Plan to "bend the curve" of freshwater biodiversity including: a) Accelerating implementation of environmental flows, b) Improving water quality, c) Protecting and restoring critical habitats, d) Managing exploitation of freshwater species and riverine aggregates, e) Preventing and controlling non-native species invasions, and f) Safeguarding and restoring river connectivity.
- Apply Northwest Climate Adaptation Science Center datasets on Streamflow Permanence (PROSPER) model at regional scale to see likely impacts to streamflow with annual variations in climate, snow, and rainfall.
- Develop rapid assessment capability and understanding of the Watershed and its response to extreme events including heavy precipitation and drought conditions.
- Coordinate with the NOAA Office of Water Protection and National Weather Service and the USGS Integrated Water Availability Assessments to predict the timing of flooding and drought events.
- Apply USA National Phenology Network application tool to input local seasonal phenological data into, and see the changes as they are happening across Alaska.
- Apply Nature's Notebook application to track seasonal changes and watch changes happen over time near you for certain species of interest.
- Protest BLM RMPs and withdrawal of D1 Lands; contest state dredge mining permits.
- Collaborate with the U.S. Geological Survey re: monitoring water quantity and quality of surface and groundwater.
- Improve non-point source pollution prevention best management practices.
- Participate in Navigating the New Arctic – Arctic Rivers email listserv.
- Incorporate by ref: BSCRSAB (see table for specific section references).
- Develop a long term monitoring and evaluation plan for the watershed.
- Apply the identified Planning Documents and assessments to protect subsistence resources from the impacts of mining activity and extreme weather events by taking measures to mitigate low flows and warming stream temperatures.

- Review USGS Paper Highlighting 'InFish,' an International Knowledge-Sharing Network Supporting Global Conservation and Sustainable Use of Inland Fish and Participate in 'InFish' - a professional network raising awareness of inland fish to inform policy, advance conservation, and promote sustainable fisheries.
- Review Alaska CASC-supported research develops high-resolution, local scale climate and Future Streamflow Projections for Southeast Alaska.

Altered Precipitation Strategies for Ice/Snow Habitat

- Develop a broad watershed assessment process (see tables in **Table 4**).
- Monitor climate outlook projections.
- Project spring breakup flooding potential for Bering Sea region.
- Work with NCASC Drought Early Warning System (www.climatetoolbox.org).
- Apply updatable, searchable database, FiCli (the Fish and Climate Change Database).

Ocean Acidification Strategies for Ice/Snow Habitat

- Decrease effects of non-climate stressors on habitats.
- Incorporate by ref: BSCRSA (see Table 4 for detailed section references).

Teller, Alaska in winter. ***Photo Credit: Hal Shepherd (2018)***

Rocky/Intertidal Habitat Summary

The Rocky/Intertidal Zone is the coastal land that lies between high and low tide lines along the shoreline areas of the Norton Bay region. This zone where the land meets the sea is critical habitat for the food chain and many marine and terrestrial species of importance to the ecosystem and subsistence resources. The plant and animal species range from those that can tolerate being dry twice a day near the high ride mark to those that cannot tolerate dry air near the low tide mark.

Risks and Vulnerabilities for Rocky / Intertidal Habitat - TABLES 1 & 2

The climate stressors identified for the Rocky/ Intertidal zone are increased water temperature, altered precipitation patterns, and ocean acidification. **Table 1** assesses the impacts of these climate stresses on the Rocky / Intertidal Habitat. The non-climate stressors, the focus of **Table 2**, identified for the Rocky/Intertidal Zone were marine pollution, development, and aquaculture.

Climate Stressors for Rocky/Intertidal Habitat

- Increased water temperature - High
- Altered precipitation patterns - High
- Ocean Acidification – High

All three of the **climate stressors** for **Rocky/Intertidal Habitat** (**Table 1**) are assessed to be **High Vulnerability Level**:

- **Increased Water Temperature:** Warming water temperatures can have a significant impact on the intertidal habitat, especially where the tide pools are wide and shallow. Climate change can also impact the shoreline zones with storm surge, coastal erosion, land subsidence or elevation. Warmer waters flowing from rivers into intertidal zones can also disrupt thermal patterns along the coastline. The potential consequences include loss of habitat from erosion, sedimentation, and high temperatures in shallow waters and tide pools. Species can be lost with impacts to subsistence resources. These changes are already taking place in certain locations. The risk is considered extreme with High Vulnerability Level.
- **Altered Precipitation Patterns:** Changes in rain, snowfall, and increased storm patterns all contribute to the impacts along the coastline zones. Coastal erosion and sedimentation can be severe with both ecological and infrastructure damage. Risks of ecological damage are extreme with High Vulnerability Level.
- **Ocean Acidification:** The shift in ocean chemistry to lower pH only adds to the ecological stress that intertidal zones are already going through. Acidification increases the impacts to the food web for both subsistence and commercial harvest species. Risks of ecological damage are extreme with High Vulnerability Level.

The **non-climate stressors** identified for the **Rocky/Intertidal Zone** are marine pollution, development, and aquaculture:

- **Marine-source pollution and spills**: Marine pollution poses potentially catastrophic damages to coastlines and intertidal zones from oil spills or other major pollution events. As sea ice recedes the potential impact to shorelines increases from both storm surge and toxic spills. Shoreline habitat is particularly vulnerable to oil spills where the contaminant may linger and kill large swaths of aquatic and bird life for a prolonged period of time. Cleanup services may be non-existent in the Arctic region too. The loss of sea ice adds to the potential coastline impacts.
- **Development/population growth**: As development spreads across the landscape and along the coastline, increasing impervious cover along with stream crossings, roads, bridges, and other infrastructure lead to habitat loss. The negative consequences include more flooding, erosion, and sediment loading, plus stream degradation, stormwater pollution, and an influx of invasive species. Development also accelerates thawing of permafrost with negative impacts on both ecological processes and human infrastructure.

Dead sea lion, from unknown cause, along beach near Native Village of Unalakleet. *Photo Credit: Margaret Hall (2019)*

- **Aquaculture:** Aquaculture is a form of farming from the sea. It generally takes place along the coastlines and may stress the ecology of the intertidal zone with excess nutrients and chemicals from raising fish or other aquatic species in a confined area. When combined with increased impacts of flooding, erosion, and warmer temperatures, shoreline habitat may be significantly degraded.

Potential Adaptive Capacity for Rocky/Intertidal – TABLE 3

The **Adaptive Capacity Assessment** is outlined in **Table 3**. This table examines the potential for resistance, resilience, and response to climate impacts based on factors in three categories: ecological potential and social potential; the latter is a combination of organization capacity and management potential. The list of ecological and social adaptive capacities are described and rated as superior, good, fair, poor, or critical.

- **Ecological Potential for Rocky/Intertidal Habitat:** The ecological potential for adaptation by the Rocky/Intertidal habitat was rated fair to poor. The strongest feature was the rich biodiversity of this intertidal zone in the Arctic region with a fair rating. Two other elements rated fair to poor. The first is the value and importance of the natural resources to the traditional subsistence lifestyle of the native villages of Norton Bay. The second is the status of the keystone and indicator species, including salmon, forage fish, mussels, crabs, herring, seabirds, and more. There are three weak ratings of poor for

distribution and connectivity of the ecosystem, the evidence of past recovery, and physical diversity. While salmon have a wide ranging habitat, other species such as the seal and walrus, depend upon a limited range of shore ice for their habitat.

- **Organization Capacity for Rocky/Intertidal Habitat:** The organization capacity for adaptation was rated as good based on high marks for staff capacity for Traditional Ecological Knowledge of the Norton Bay Inter-Tribal Watershed Council (NBITWC); the responsiveness of the Native Villages of Norton Bay to alter their practices as circumstances change and find alternative solutions; and the stability and longevity of the local villages. The one weak rating was for stakeholder relationships. It is clear that the Watershed Council could benefit from improved relationships with state and federal agencies.
- **Management Potential for Rocky/Intertidal Habitat:** The management potential for adaptive capacity was rated as fair, with variable ratings from poor to good. The strongest factors for management are monitoring and evaluation capacity and science and technical support, with both rated as good. The two weakest areas are the lack of a strong existing mandate for management and a lack of proactive management activities. The ability to learn and change was rated fair, which bodes well for future innovation and success.

The combined ecological and social adaptive capacity rating of the Rocky/Intertidal habitat was assessed at Moderate (2.8). The strong points include the broad species biodiversity in the intertidal zone and the organizational strengths of the NBITWC. The traditional knowledge and skills of the Native Villagers are also strong factors.

In summary, , the overall adaptive capacity rating of the three habitats of the Norton Bay region is Moderate, based on ecological and social factors at this time. The adaptive capacity assessment helps to understand the strengths, identify the vulnerabilities, and point to areas of improvement where the NBITWC and leaders of the Native Villages can take action to build adaptive capacity and make progress for the region.

Adaptation Strategies for Rocky/Intertidal - TABLE 4

Increased Water Temperature Strategies for Rocky/Intertidal Habitat

- Tighten point source oil spill and other pollution contingency planning.
- Strengthen regulations for cruise ships, harbor, and docks (e.g. tracking devices, dumping of ballast, trash, waste water and sewage).
- Bring back Federal Coastal Zone Management Planning - Worked because it worked on a local level.
- Cleanup hazardous materials from Military dump sites.
- Incorporate by ref: BSCRSA (see **Table 4** for detailed section references).

Altered Precipitation Strategies for Rocky/Intertidal Habitat

- Incorporate by ref: BSCRSA (see **Table 4** for detailed section references).

Ocean Acidification Strategies for Rocky/Intertidal Habitat

- Decrease effects of non-climate stressors on habitats.
- Incorporate by ref: BSCRSA (see **Table 4** for detailed section references).

Harmful Algal Bloom Strategies

- Incorporate by ref: BSCRSA (see **Table 4** for detailed section references).

Willows along Norton Bay.
Photo Credit: Leigh Takak (2020)

Seagull eggs along Norton Bay; laid later in year than usual. Everything in year was later than previous recent years.
Photo Credit: Leigh Takak (May 30, 2021)

Conclusions from MPARVA Tool Assessment Findings

The MPARVA Tool provided a method for a detailed assessment of the levels of vulnerability of three habitat zones to selected impacts of climate change. The Tool helped analyze three selected habitat zones important to the subsistence foods, culture, and economy of the Native Villages of Norton Bay, AK. In those habitats, four climate change impacts were identified to have the most impact: warmer water temperatures, altered precipitation patterns, ocean acidification, and harmful algal blooms.

All three habitats, the Pelagic, Ice/Snow, and Rocky/Intertidal, are Highly Vulnerable to climate change impacts from warmer water temperatures. This is not surprising as aquatic life tends to be sensitive to changes in water temperature and pH. In the open ocean Pelagic zone the warmer waters reduce the winter sea ice and affect the ocean cold pool and sea currents. The Ice/Snow habitat also changes significantly with thinner ice and reduced snowpack. On land warm waters lead to the thawing of permafrost and heat stress in the rivers and streams. The combination of heat and less snow can cause low instream flow conditions, warm waters with low dissolved oxygen levels, and heat stress or mortality to salmon and other migrating fish species. The Rocky/Intertidal zones are also especially vulnerable to warmer air and water temperatures, where heat stress and shallow pools at low tide can kill the intertidal plants and animals. Warmer waters are associated with the phenomenon known as "The Blob" when a large zone of high temperatures moves across ocean areas and impacts the food chain. Forage fish have been known to move to cooler waters and disrupt feeding patterns, in some cases causing starvation and seabird die-offs. Harmful algal blooms (HABs) are also associated with warming waters along with nutrient pollution. The open ocean is highly vulnerable to HABs in some areas, resulting in impacts to habitat and increasing the risk of shellfish poisoning to people under certain conditions.

The Ice/Snow and Rocky/Intertidal habitat were also found to be highly vulnerable to both altered precipitation patterns and ocean acidification. The warming conditions shift the precipitation patterns to more rain and less snow. That shift changes the timing and hydrology of the region, resulting in extremes of spring flood followed by summer drought due to lack of snowpack melt. The loss of seasonal sea ice is also very disruptive to the ocean food chain. At the same time, the absorption of excessive carbon dioxide by ocean waters leads to ocean acidification. The lower pH of the waters interferes with the building of carbon-based shells by the species at the base of the food chain. Over time it can affect the entire food chain, leading to reductions in salmon and other important subsistence fish species.

The Native Village residents of Norton Bay are equally vulnerable to the impacts to their subsistence resources at the heart of their food, culture, and spirituality for thousands of years. The rapid pace of change toward more extreme weather is leading to more degraded conditions for air and water quality, thawing permafrost, increasing floods, coastal erosion, damaged infrastructure, and degraded ecosystem functions. These changes can disrupt the subsistence resources from the base of the marine food chain through mussels, crab, and salmon, and up to the walrus and seals that sustain the Villagers through the year.

It was also clear that there are many non-climate stressors that exacerbate the impacts of climate change. Different sources of water pollution, shipping impacts, threats from oil, gas, and mining extractions, overfishing, and population growth and development all add to the burden upon the regional ecosystems and the subsistence species that live there. Effective adaptation will require strategies that address both climate related impacts and non-climate stressors to the ecosystems and Native Village people and infrastructure.

The analysis of the potential adaptive capacity of the three habitats indicated a Moderate level of adaptability for both ecological and social systems. The major adaptive resilience for the ecology of the region came from the large diversity of species and habitat ranges in the region. The ecological vulnerabilities included negative indicators and lack of recovery from impacts to certain species, especially salmon species. The social adaptive capacity found its strength in the organizational work of the NBITWC and the skills and knowledge of the local Native Village residents. It was noted that the organization could benefit from building more relationships and collaborations with other organizations, and state and federal agencies.

The Summary Table of MPARVA Tool Findings provides an overview of the vulnerability level assessment for the climate impacts and non-climate stressors relevant to the three habitats. Some of the impact and stress factors were not fully assessed but are left in the table for future consideration as further monitoring and research takes place in the future.

The final step in the MPARVA Tool process was to identify potential adaptation strategies for each habitat. From that exercise several themes emerged for further consideration within the coastal management plan or as part of the implementation steps for the plan in future years. These themes (strategies) are discussed below in the **Implementation of Adaptation Strategies** section.

Summary Table of MPARVA Tool Findings - Norton Bay, AK

	Pelagic	Ice/Snow	Rocky/Intertidal
Climate Impacts	**Habitat Level of Vulnerability**		
Warmer water temperatures	High	High	High
Altered precipitation patterns	Medium	High	High
Ocean acidification	Medium	High	High
Harmful algal blooms	High		
Sea level rise			
Wave action / Coastal Erosion			
Altered currents		Medium	
Salinity			
Non-Climate Stressors	**Increased Vulnerability from Non-Climate Stressors**		
Land -source pollution	Yes		
Marine-source pollution	Yes	Yes	Yes
Development & population growth	Yes	Yes	Yes
Transportation	Yes		
Extraction (mining, oil, gas, dredging)	Yes	Yes	
Aquaculture / Commercial Fishing	Yes		Yes
Invasive species			
Noise			
Underwater/overwater structures			
Altered sediment transport			
Energy production		Yes	Yes
Potential Adaptive Capacity	**Capacity to Adapt Low = 1 – 2.3; Moderate = 2.4 – 3.6; High = 3.7 – 5"**		
Ecological	Moderate (2.4)	Moderate (2.8)	Low (2.3)
Social (organizational & management)	Moderate (3.5)	Moderate (3.5)	Moderate (3.5)
Combined	Moderate (2.8)	Moderate (2.9)	Moderate (2.8)

IMPLEMENTATION OF ADAPTATION STRATEGIES

Introduction

It is imperative that Native Villages find methods to adapt to the rapid changes that they face in both large and small ways to maintain their subsistence culture and economy and the health and fulfillment of the people who live there. The ancient culture and traditional knowledge of the Native Village residents can combine with science and engineering to help inform adaptive solutions that are in harmony with the culture and biology of the lands and waters. There are several themes for resilience and adaptation that came through in the assessment, follow-up discussions, and further research that universally support the increase of habitat adaptive capacity and the implementation of potential adaptation strategies. These strategies fall under the following groupings:

- ➢ Overarching Adaptation Strategies
- ➢ Strategies Based on the Arctic Monitoring and Assessment Programme (AMAP) Recommendations
- ➢ Mitigation Strategies for Salmon Habitat
- ➢ Village-Specific Coastal Subsistence Vulnerabilities: Village Assets and Climate Risks Checklist
- ➢ Coastal Management (Governmental/Policy) Strategies

A young Elim Villager picking wild chives along the banks of the Tubutulik and sharing her knowledge of traditional subsistence culture. ***Photo Credit: Leigh Takak (2021)***

Overarching Adaptation Strategies

Please note that several of the following Overarching Adaptation Strategies may also be found in one of the other strategy sections.

- The NBITWC and local Native Villages could benefit from increased collaboration with organizations, universities, and government agencies to understand the current climate and ecological changes and help project future conditions.
- In return, the appropriate sharing of Traditional Ecological Knowledge (TEK)/Indigenous Knowledge could further this understanding and help project and inform about future conditions.
- Local data collection, monitoring and research are important to understand the ecological and hydrological changes taking place and plan for future ongoing changes.
- There is a critical need to re-establish a coastal management planning and implementation process with strong Native Village participation in decision making, legal enforcement authority, and funding resources to act in a timely manner.
- The in-depth process and information available in the previous Bering Straits Coastal Resource Service Area Board (BSCRSAB) Volumes 1-3 (Resource Inventory, Resource Analysis, and Coastal Management Plan) should be used as an important historical reference and model for both process and use of information.

- Completion of an integrated water resource management plan for the Tubutulik River watershed can identify subsistence protection measures for the Native Village of Elim and serve as a model for replication by other areas of Norton Bay.
- Demonstration projects for on-the-ground habitat restoration and protection are important next steps to inspire additional adaptation measures in the region.
- It is important to develop a funding plan and sustainable revenue sources that support implementation of prioritized Adaptation Strategies.

Strategies Based on the Arctic Monitoring and Assessment Programme (AMAP) Recommendations [22]

Steps are already being taken by the NBITWC and individual villages in the Norton Sound/Seward Peninsula region that reflect three of the four recommendations put forth by the Arctic Monitoring and Assessment Programme (AMAP) in their May 2021 report. Monitoring and documentation of changes, addressing the knowledge gaps, and improving the relevancy and availability of scientific information/data for decision making purposes are all critical. These recommendations recognize the need for and importance of community-based monitoring and Traditional Ecological Knowledge (TEK)/Indigenous Knowledge in order to address the rapid changes taking place in the Arctic region. A number of the strategies identified above under **Overarching Adaptation Strategies** dovetail with these AMAP recommendations.

The three most relevant recommendations to the NBWOCMP are:

- **Expand Monitoring and Documentation of Arctic Change** [23]
  *The **rapid pace of change in Arctic ecosystems calls for immediate action to document** what is being lost and what is being created as unique ecosystems are disappearing and the cryosphere is shrinking. Unique ecosystems of the remaining perennial sea ice cover, ice shelves and epishelf lakes, and the Greenland ice sheet are among the priorities for documentation.*

  *AMAP emphasizes the **need for Arctic and international science institutions and governments to address key data gaps**. The use of satellites, autonomous vehicles, and other emerging technologies, along with community-based monitoring to gather data from difficult-to-reach areas of the Arctic, is encouraged.*

  *There is a **need to sustain and enhance the development of pan-Arctic climate indicators, which are co-produced with Indigenous Knowledge holders, along with improvements in data sharing and availability**, to assist researchers and policy-makers at national and regional scales.*

  Documentation of the impacts of extreme events on Arctic ecosystems and people can reveal priorities for further evaluation of changes in extreme events. In particular, there is a need for systematic assessments of socioeconomic impacts from extreme events in the context of environmental change in the Arctic.

  Coordination of climate-ecosystem monitoring in regions of rapid change would benefit from comparable observations in regions less susceptible to change, to help constrain predictive ecosystem and resource management models.

[22] AMAP, 2021. Arctic Climate Change Update 2021: Key Trends and Impacts. Summary for Policy-makers. Arctic Monitoring and Assessment Programme (AMAP), Tromsø, Norway. https://www.amap.no/documents/doc/arctic-climate-change-update-2021-key-trends-and-impacts.-summary-for-policy-makers/3508

[23] *Ibid*, pg. 14.

Changes in coastal ecosystems, intensified by extreme events, affect coastal communities that are increasingly vulnerable to coastal erosion through wave and storm action. ***Adaptation requires sustained and coordinated climate-ecosystem monitoring at key locations in combination with community-driven monitoring that uses Indigenous Knowledge and local knowledge.***

- **Address Information Gaps** [24]

  Large gaps remain in our understanding of the societal implications of climate change in the Arctic. There is a particular need for more integrated modeling and assessment of climate-related impacts on interconnected socioecological systems.

  The impacts of climate change do not occur in isolation and may interact with each other. For example, the combination of rapid springtime warming and heavy precipitation on a deep snowpack triggered nearly 800 avalanches in Greenland in April of 2016. ***Understanding the impacts of these types of cumulative and compound effects is important for risk mitigation, hazard response, climate adaptation, and policy response to changing climatic conditions.***

  A better understanding of the potential links between Arctic change and mid-latitude weather could improve forecasters' ability to predict dangerous extreme weather events in regions far from the Arctic. More research is needed to clarify these linkages.

  The perspectives of Indigenous Peoples are largely absent from assessments of Arctic change. Efforts should be made to include information from those who have been most directly affected by climate change and who have the longest history of observations and knowledge with respect to climate change impacts, including extreme events.

  Large uncertainties remain for projections of Arctic productivity. Predicting the future productivity of the Arctic Ocean requires a better understanding of the changing productivity associated with sea ice and in open waters, the cycling of nutrients and the adaptive capacity of primary producers to changing conditions.

  Thresholds in Arctic ecosystems, such as seawater temperature limits for Arctic phytoplankton species or ocean acidification thresholds beyond which pteropods can no longer form shells, need more rigorous evaluation, especially with regard to potential ecosystem shifts. Few evaluations of extreme high temperatures, rapid sea ice loss events, widespread melt events on the Greenland Ice Sheet, and other extreme events in the Arctic have explored their effect on physical and ecological thresholds or tipping points.

- **Improve Relevance and Availability of Scientific Information for Decision-Making** [25]

  Arctic countries are devoting increasing attention to climate services, which translate climate data into relevant, timely information to support governments, communities, and industries in planning and decision making. Climate services can play a crucial role in the Arctic, enhancing safety and security in the face of climate-related risks as well as informing the activities of industries such as shipping, tourism, and fisheries, and there is a need for

[24] *Ibid*, pg. 15.
[25] *Ibid, pg. 15.*

more data and work in this area. There is an opportunity to improve the flow of data and state-of-the-art climate predictive capacity to climate services organizations, and efforts are needed to develop additional and appropriate climate service products for Arctic communities.

Similarly, ***decision makers could benefit from additional climate information that is directly relevant for planning and decision making, documentation of climate models' ability to capture extreme events, downscaling of model projections to identify community impacts, guidance for selecting models to use in analyses, and quantification of uncertainties in projections. Indigenous Knowledge should be considered as an input to decision making, and the participation and self-determination of Indigenous Peoples in research and decision-making processes is essential.***

There is a ***need to further develop the understanding of future risks to Arctic ecosystems and communities, including economic costs and benefits, to inform effective and ambitious action by Arctic nations and the rest of world to limit Arctic warming and hasten the transformation toward a more resilient state.***

Mitigation Strategies for Salmon Habitat

The following strategies would help to mitigate the effects of climate change on salmon habitat:

- Base management of impacts of climate change on habitat functions on a Watershed Scale.
- Collaborate with other levels of government, such as municipal and Alaska Native Regional and Village Corporations and international land and resource managers, to ensure an ecosystem approach, to identify disproportionately important areas, and to explore forming local and international co-management efforts like Marine Protection Areas.
- Conduct baseline studies and monitoring necessary to understand ecosystem processes and changes that guide community and state decision-making and risk assessment.
- Engage local, regional, federal, and international stakeholders in assessment of risk, scenario planning and integration of leading practices as they apply to climate change impacts.
- Incorporate the effects of climate change on habitats in management decisions and planning documents.
- Improve connectivity of freshwater habitats.
- Tighten wetland protection and water use regulations; participate in state and federal agency decision making and planning that affect habitats including off-site cumulative impacts analysis.
- Limit water withdrawals and diversions for mining, oil and gas development; and preserve instream flows by collecting data and file instream flow water right applications for select streams.
- Tighten management of point source pollution, oil spill contingency planning, and cruise ship, harbor, and docks regulations; improve best non-point source best management practices; limit land-based and off-shore oil and gas affecting habitats.
- Partner with municipalities regarding climate adaptation and stormwater management planning to decrease point and nonpoint source discharges.

Village-Specific Coastal Subsistence Vulnerabilities: Village Assets and Climate Risks Checklist

The primary focus of this coastal management planning is a regional approach to habitat protection for subsistence resources. Such an approach is appropriate since habitat protection is best managed according to ecological conditions on a broad scale. However, creating climate resilience for the habitats of the region also requires integrating local village adaptation and resilience for the people of Norton Bay to complement the resilience of the Pelagic, Ice/Snow, and Rocky/Intertidal habitats.

Completing a local plan for the Native Villages of Norton Bay is beyond the scope of this project. However, the project does recognize the value of local planning and seeks to build the capacity of local villages to take that next step. Creating a local adaptation plan for each village should be encouraged as a key step in the implementation process for the regional coastal management plan. Prior BIA projects have worked to position the Norton Bay Villages to do so starting with the the *Climate Adaptation and Action Plan for the Norton Bay Watershed, Alaska* (2013)[26], followed by the *Norton Sound Tribal Villages Climate Change Adaptation Training (NSCCAT) Series (2015-2017)*[27], and finally, the *Climate Resilience Planning for the Native Alaskan Villages of Norton Sound (2017-2018) Final Report* summarizing barriers/challenges and future actions needed for such planning.

In order to support a local risk assessment process, a Village Assets and Climate Risks Checklist has been prepared as a template for the villages to use. The checklist is designed to be customized according to local village conditions. It can then be used to determine how local village risks relate to the regional risks and to subsistence resource activities. This will help develop a local adaptation action plan that a village can undertake in alignment with the regional plan.

There are three steps to filling out this assets and risks checklist:

- The checklist first provides a list of potential village assets to help identify the important local human resources, buildings, infrastructure, activities, and more. Each village can use the checklist to identify what applies to them and briefly record information for each asset, such as location, age, number, condition, potential risks etc.
- Second, each asset is considered for its role in subsistence resource activities. Does it play an important role in Village health, safety, and welfare related to fishing, hunting, or gathering for the subsistence economy?
- Third, the assets that are important to subsistence activities are further assessed to determine what climate risks are applicable to them.

When completed, this high-level list of assets and risks can help inform action planning at the Native Village level. It is not sufficient information to complete a local plan, but it is a quick way to help prioritize what to focus on for the local plan related to the subsistence resource economy. The Template for the Village Assets and Risks Checklist is available as **Appendix B**.

[26] Climate Adaptation and Action Plan for the Norton Bay Watershed, Alaska (2013). https://www.cakex.org/documents/climate-adaptation-and-action-plan-norton-bay-watershed-alaska-0

[27] Norton Sound Tribal Villages Climate Change Adaptation Training (NSCCAT) Series (2015-2017). https://www.waterpolicyconsulting.com/trainings/

Coastal Management (Governmental/Policy) Strategies

As discussed above in the Bering Straits Coastal Resource Service Area Board (BSCRSAB) section, the Alaska State Legislature adopted the Alaska Coastal Management Act in 1977 under the federal Coastal Zone Management Act, which calls for states to protect, manage, and, where possible, rehabilitate coastal areas. The elimination of the Program, after an intensive effort by local Native Communities and others to develop the BSCRSAB resources and planning documents, is a direct threat to environmental justice and tribal sovereignty in Alaska.

To address these threats, NBITWC will work to create systemic change in the ways tribal interests are represented in policies impacting land and marine management. These changes include the reintroduction of critical permitting requirements and incorporation of Traditional Knowledge from the former BSCRSAB Coastal Management Plan, not only in this Norton Bay Watershed Ocean and Coastal Management Plan - which is already reflected, but also into other coastal and land management processes, thus capturing the efficacy of the CZMA program in regulating the impacts of oil and gas and mining in the area, and creating a culturally relevant management plan(s) for local communities.

NBITWC will assist Arctic Village communities in the Norton Bay Sound Region (NBSR) to assert sovereignty, protect subsistence resources, and advance environmental justice through implementation of the BSCRSAB and NBWOCMP plans by undertaking the following activities:

1) Develop a NBWOCMP Action Plan that incorporates key provisions, as well as Traditional Knowledge and western scientific data, from the BSCRSAB plan;
2) Work with tribal partners to support legislation that implements the permitting and regulatory provisions of the BSCRSAB plan and the NBWOCMP. Request that federal agencies comply with their federal trust responsibility under which they are required to protect the water related interests of the tribes, and to engage in Government-to-Government Consultation between federally recognized tribal entities and the federal agencies;
3) Work with the U.S. Alaskan Legislators to develop legislation introducing standards that federal agencies must meet when addressing subsistence concerns and that would incorporate Traditional Ecological Knowledge;
4) Expand NBITWC's impact in the NBSR and leverage previous grassroots efforts by inviting participants in the original BSCRSAB to join the Watershed Council's board of directors. NBITWC will also invite representatives of other tribal councils in the region to sit on the Watershed Council so that each tribe will have representation.

The following Coastal Management Strategies matrix, from the *Strategies for Coastal Management in the Former Bering Straits Coastal Resource Service Area Report* prepared for the NBITWC by Dr. Barrett Ristroph, Esq., outlines concrete options from which the NBITWC may chose as next steps. The full report is included as **Appendix C**.

SUMMARY OF STRATEGIES[28]

Strategy	Government Level	Difficulty	Cost	What Can Be Gained	Limits
Borough formation	Local/regional (initiated through State)	Not very hard to apply, but may be hard to get approval and not easy to manage	Relatively low cost to start but running borough will be cost-prohibitive (need to hire very large staff) unless there is industrial/ commercial development to tax	More control than any other strategy, but at local/regional level (not tribal)	State and federal law still trump, need to get political agreement among all Bering Strait communities
Co-management under federal statute	Federal	Difficult to gain trust of participants and demonstrate capacity, not easy to manage	Some opportunities for federal funding, but may also need your own funding and staff possibly including Western scientists	Some control or input on harvest levels	Lots of effort for little control, potential that other agencies won't listen to you
Co-management, organic	Federal, state, tribes, and/or tribal organizations	Difficult to gain trust of participants and demonstrate capacity, not easy to manage	You must fund your staff, possibly including Western scientists, travel, and data collection	Some control or input on harvest levels	Limited control and no law to force agencies to listen to you
IMO membership	International	Not very difficult to apply, need time become familiar with IMO	You must fund your staff and international travel	Opportunity to be heard at international level	Not much to be gained beyond attention
IMO routing proposal	Work with US at international level	Requires many years and great technical expertise to submit proposal	You must fund staff, possibly consultants, and travel	Avoid shipping near St. Lawrence and other sensitive areas	Even when international rules are mandatory they can be difficult to enforce
Regulating hunters	Tribal	Simple	May need to spend something on enforcement	Limit tribal members' hunting	No control over non-tribal members and may not be supported by tribal members
Tribal resolutions	Tribal	Simple	Nothing	Gain attention, support	Not much to be gained beyond attention

[28] Ristroph Ph.D., J.D, Barrett. *Strategies for Coastal Management in the Former Bering Straits Coastal Resource Service Area: A Report for Norton Bay Inter-Tribal Watershed Council*. October 2020. Pgs. 4-6.

Land into trust	Tribal through BIA	Not an option under Trump administration, difficulty unclear for future admin. Hard to get land. Management could be complex	Not expensive to apply, could be expensive to maintain (like Borough) depending on size.	Power to control land management and hunting on whatever land is in trust	Still must work through BIA for approvals, which can be slow; may generate opposition from state
Native corporation agreements	Tribal-Native Corporation	Relatively simple, but may take some time/good lawyers to negotiate	Small start-up costs, may be some maintenance costs depending on what control this gives tribes	Strengthen relationship with Native corporations and assure protection for important areas on corporation land	Native corporations may not agree
Industry agreements	Tribal-private	Relatively simple, but may take some time/good lawyers to negotiate	Small start-up costs, may be some maintenance costs depending on what control this gives tribes	Industry may voluntarily avoid certain areas or actions	Difficult to get industry to agree
Claiming aboriginal rights	Federal	No clear path for doing this, will likely require litigation	Litigation likely to be expensive	Shared jurisdiction over offshore resources	Much money and effort could be spent with no result,
Federal land conservation areas	Federal	Time-consuming to participate in designation processes, potential political backlash	Must pay for staff/consultant to participate in designation process	Substantial protection from industrial development	Can be changed with future administration/ Congress, current admin/Congress may not allow
Traditional cultural properties	Federal, state	Difficult to gather proof needed to satisfy state	Need to pay for anthropologist/ consultant	Possible restrictions on development, consultation	Does not prohibit development, land owner may not cooperate
Lobbying for ACMP	State	Restrictions on lobbying for non-profit, difficult to build political will	Need to pay staff, lobbyists, public political campaign	Potential to regain power as an ACMP coastal district	Much money and effort could be spent with no result, or program could end again under future legislature or be restricted by state agency

Action Plan / Funding Strategy

The prioritization of the Implementation of Adaptation Strategies will drive the development of the Action Plan /Funding Strategy.

NBITWC's next step is to identify the top 10 implementation strategies and then prioritize them using a modified **Table 5: Strategy Implementation,** which would include two additional columns, Funding Sources and Ability to Implement.

Strategy	Leader & Potential Partners	Funding/ Costs	Funding Sources	Ability to Implement 0 (Easy) - 10 (Extremely Difficult)	Timeline	Existing/Needed Management Mechanisms	Monitoring & Evaluation Criteria

COMPLETED MARINE PROTECTED AREA RAPID VULNERABILITY ASSESSMENT (MPARVA) TOOL

Step 1: Define the Scope of the Vulnerability Assessment.

Box 1: What habitat types are you considering for this assessment? *(Select 3 that are your priorities)*

During an in-person workshop held on June 25, 2019 in the Native Village of Unalakleet, members of the Norton Bay Inter-Tribal Watershed Council determined that the 3 most vulnerable habitat types that should be the focus of this MPARVAT are: **Pelagic, Ice/Snow and Rocky/Intertidal**. The **Summary of Marine Habitat Profiles: Vulnerabilities, Adaptive Capacity, & Adaptation Strategies** is found above**.**

Select	Habitat Type
	Beach and dunes
	Cliffs and rocky shore
X	Rocky intertidal
	Soft bottom intertidal and mudflats
	Estuary/wetland
X	Pelagic
	Kelp forest
	Seagrass
	Coral reef
	Mangrove/Coastal Forest
	Deep seafloor, canyon
X	Ice/Snow
	Other:

Box 2: What timescale are you interested in assessing?

Select Timescale	
X	Near term (present to 10 years)
	Medium term (next 50 years)
	Long term (next 100 years)
	Very long term (> next 100 years)

Box 3: What climate change variables are likely to affect these habitats?

(Select 3 that are your priorities)

Habitat			
Pelagic	Ice/ Snow	Rocky / Intertidal	Climate Stress
X	X	X	Increased water temperature
	X		Sea-level rise
			Diminish dissolved oxygen
	X		Altered currents
			Altered upwelling/mixing
X	X	X	Altered precipitation patterns
X		X	Ocean acidification
			Turbidity
	X		Wave action/coastal erosion
	X		Salinity
			Storm severity/frequency
X			Harmful algal blooms
			ENSO/PDO
			Other:

Box 4: What climate change variables are likely to affect these habitats?

(Select 3 that are your priorities)

Habitat			
Pelagic	Ice/Snow	Rocky / Intertidal	Non-climate Stressor
X			Land-source nutrient pollution
X			Land-source non-nutrient pollution
X	X	X	Marine-source pollution and spills
X	X	X	Development/population growth
			Harvest
X	X	X	Aquaculture
X			Invasive species
			Disease
			Tourism/Recreation
X	X		Transport
X	X		Extraction (mining, oil & gas)
	X		Energy production
X	X		Overwater/underwater structures
			Roads/armoring
X			Dredging
			Boat groundings
X			Noise
			Researcher disturbance
X			Altered sediment transport
			Other:

Steps 2 & 3 - Undertake Your Assessment

Table 1. Vulnerability Assessment - Pelagic

Location: Norton Sound		**Habitat Type: Pelagic**				**Timescale: Near Term**	
A. Climate Stress.	B. Indicate the observed or projected direction and magnitude of this stress, as well as any specific relevant details.	C. Anticipated effects on this habitat type (Highlight any important features that might be affected).	D. Likelihood (Rare, Unlikely, Possible, Likely, Almost certain)	E. Consequence (Table 2) Negligible, Minor, Moderate, Major, Catastrophic)	F. Risk **(Figure A (aka Fig. 2 of 11733 pdf)**	G. Adaptive Capacity (Table 3)	H. Vulnerability Level **(Figure B) (aks Fig. 3 of 11733 pdf)** and Key Drivers
Increased Water Temperature	Water column under ice heating up. Oceans warming; loss of sea ice; affecting cold pool. Currents getting stronger; reversing direction; absorbing more sunlight; melting permafrost. Fresh water – Doesn't freeze as quickly, has different gravity – more brittle. Has more flexibility - rubbery. Causes forage species to disperse: https://www.usgs.gov/center-news/a-quintessential-forage-fish-understanding-crucial-role-sand-lance.	Surface area for sunlight. Absorption affecting species. Cold Pool - no longer barrier - affecting species type. Die-off of marine mammals and birds due to starvation, ice seal UME (unusual mortality event); Avian Cholera, Saxitoxin, etc.. Walrus/Seals - using dryland for haul out, following ice north. Ecological shifts, strandings, habitat loss. Commercial fish and predator ecological shifts. Change in Bowhead Whale movements - away from shoreline. “Beaver-driven engineering” is moving north, altering Arctic ecosystems — and probably accelerating climate change: https://www.arctictoday.com/beavers-are-booming-in-some-parts-of-the-arctic-and-speeding-up-changes-to-the-tundra/. Forage fish dispersal results in less accessibility and disruption of food chain - can result in starvation and die-offs.	**Likely**	**Catastrophic**	**Extreme**	**Moderate**	**HIGH**
Altered Precip	Affects snow pack and instream flows causing low flows and temperature increases at critical time.	Depending on timing of low flows, potentially increases ocean temperatures, therefore, further stressing species sensitive to pollutants that are dependent on habitat.	**Likely**	**Major**	**High**	**Moderate**	**MODERATE**

Ocean Acidification	More Prevalent in Southern Alaska.	Decreases shell thickness.	**Probable**	**Catastrophic**	**High**	**Moderate**	**MODERATE**
Harmful Algal Bloom	Throughout Bering Sea; different colors (orange, red, green, and brown), stringy and furry. Samples have been collected 70 miles north of St. Lawrence Island and 50 miles north of Cape Lisburne. Alexandrium, the algae that produces the toxin found all the way to Chukchi Sea waters north of Utqiagvik.	Causes paralytic shellfish poisoning - can be deadly.	**Likely**	**Catastrophic**	**Extreme**	**Moderate**	**HIGH**

Table 1. Vulnerability Assessment - Ice/Snow

Location: Norton Sound		**Habitat Type: Ice/Snow**				**Timescale: Near Term**	
A. Climate Stress.	B. Indicate the observed or projected direction and magnitude of this stress, as well as any specific relevant details.	C. Anticipated effects on this habitat type (Highlight any important features that might be affected).	D. Likelihood (Rare, Unlikely, Possible, Likely, Almost certain)	E. Consequence (Table 2) Negligible, Minor, Moderate, Major, Catastrophic)	F. Risk **(Figure A (aka Fig. 2 of 11733 pdf)**	G. Adaptive Capacity (Table 3)	H. Vulnerability Level **(Figure B) (Actually Fig. 3 of 11733 pdf)** and Key Drivers
Increased Water & Air Temperatures	Increased fresh and marine water temperatures throughout watershed and region (especially in summer 2019) due to high air temps, reduced snowpack and shallow water. Loss of peatlands and permafrost.	High temperature and low DO and dried up stream beds are lethal for salmon and other fish species. Reduced diversity in stream invertebrate populations. Inhibit fish passage/use. Impacts riparian vegetation – potentially rapid alder growth and increased stream shading; Large areas of perennially frozen (permafrost) peatlands are thawing, causing them to rapidly release the freeze-locked carbon back into the atmosphere as carbon dioxide and methane: https://www.pnas.org/content/early/2020/08/04/1916387117.	**Almost certain:** Already taking place & likely to become new normal & increase.	**Catastrophic**	**Extreme**	**Moderate**	**HIGH**
Altered Precipitation Patterns	Altered snowpack in the Mountain Ranges – more rain than snow at low to mid-elevations. More flash storm events. Increased glacial melt.	Low flows or dried up streams at key times for Salmon and other fish species; Scouring & erosion – increased water coming at one time.	**Almost certain:** Already taking place & likely to become new normal & increase.	**Major**	**Extreme**	**Moderate**	**HIGH**

Altered Currents	Currents have been changing because of increased/decreased water temperatures. (Chuck Degnan: strong currents from the raising of the water; water getting higher affects currents on ocean bottom; strong current, the more erosion along all of the coastlines. Coastline is changing rapidly; temperature is undermining where used to be permafrost; if have rocky points and cliffs, they are more stable. In 2006 Carol Oliver's mother noticed that high tide and low tides were being affected - tides were higher and winds stronger; winds from southeast pushed into Norton Sound - storm surge raises water even higher; see those impacts when living in the area. (Came from NBITWC Call March 2020.)	Higher mortality rates. Changes impact sea ice and therefore walrus, polar bears and other mammals and marine habitats. (Are whale migrations being affected by altered currents? Chuck Degnan: Whales not coming as close to the shore as in the past; could that be because of the currents; whales would be following whatever they are feeding on; follow forage fish; chuck heard that small fish not showing up as before - resulted in die offs in sea birds from starvation; chain reaction up the food chain.) Came from NBITWC Call March 2020.)	**Likely:** Already taking place. (Need to determine if there is a likelihood of it becoming new normal & increasing.) Carol Oliver: Unfortunately, it is going to become more likely. Seeing changes in creeks, lagoon and bay. They hope the summer will be better. Hal Shepherd: Arctic News, sea ice lower than normal. Receding very quickly.	**Major** (Revisit w/Planning Committee.)	**High**	**Moderate**	**MODERATE**
Ocean Acidification	Changing water chemistry – including acidification; pH study underway. (Alaska Ocean Acidification Network, Ocean Acidification: An annual update on the state of ocean acidification science in Alaska, November 2018 - http://aoos.org/wp-content/uploads/2018/11/2018_State_of_OA_in_AK_medres-2.pdf; and 2019 Update - https://aoos.org/wp-content/uploads/2019/12/2019_OA_Science_Update_medres.pdf.) Naturally more acidic than ocean already. Destruction of some shelled organisms. Recruitment will be problem, especially for smaller, younger organisms. Also see, *Surface ocean pH and buffer capacity: past, present and future*, https://doi.org/10.1038/s41598-019-55039-4.	Destruction of some shelled organisms. Recruitment will be problem, especially for smaller, younger organisms.	**Almost Certain**	**Catastrophic:** Impact entire ocean food web; Ultimately, species could disappear.	**Extreme**	**Moderate**	**HIGH**
Sea-Level Rise							
Wave Action/ Coastal Erosion							
Salinity							

Table 1. Vulnerability Assessment - Rocky / Intertidal

Location: Norton Sound		**Habitat Type: Rocky / Intertidal**				**Timescale: Near Term**	
A. Climate Stress.	B. Indicate the observed or projected direction and magnitude of this stress, as well as any specific relevant details.	C. Anticipated effects on this habitat type (Highlight any important features that might be affected).	D. Likelihood (Rare, Unlikely, Possible, Likely, Almost certain)	E. Consequence (Table 2) Negligible, Minor, Moderate, Major, Catastrophic)	F. Risk **(Figure A (aka Fig. 2 of 11733 pdf**	G. Adaptive Capacity (Table 3)	H. Vulnerability Level **(Figure B) (Actually Fig. 3 of 11733 pdf)** and Key Drivers
Increased Water Temperature	Oceans Warming; loss of shoreline ice; currents getting stronger and reversing direction. Absorbing more sunlight. Melting permafrost. Fresh water streams temperatures increasing. Increased glacial melt.	Habitat loss/damage from shoreline ice, coastal erosion, increasing sedimentation and high temperatures in shallow waters.	**Almost certain:** Already taking place & likely to become new normal & increase.	**Catastrophic:** Freshwater and marine species die - offs; reduction of species populations, loss of key salmon runs, impacts to subsistence and commercial harvest; impact to entire ocean food web.	**Extreme**	**Moderate**	**HIGH**
Altered Precipitation Patterns	Altered snowpack causing increased flash flooding in winter and low flows in summer.	Habitat impacts from coastal erosion and increased sedimentation, scouring and erosion. Increased fresh water temperatures.	**Almost certain:** Already taking place and likely to become new normal and increase.	**Major (Revisit w/Planning Committee.)** Freshwater and marine species die - offs. Reduction of species populations, loss of key salmon runs, impacts to subsistence and commercial harvest.	**Extreme**	**Moderate**	**HIGH**
Ocean Acidification	Changing water chemistry – including acidification. Naturally more acidic than ocean already.	Destruction of some shelled organisms. Recruitment will be problem, especially for smaller, younger organisms.	**Almost Certain**	**Catastrophic:** Impact entire ocean food web. Ultimately, species could disappear. Impacts to subsistence and commercial harvest.	**Extreme**	**Moderate**	**HIGH**

Step 3 - Undertake Your Assessment

Table 2. Consequences - Pelagic

Location:	Habitat Type:	Timescale:				
Norton Sound	Pelagic	Near Term (Present to 10 years).				
A. Non-climate Stressor.	B. How does this stressor affect this habitat type?	C. Will climate change make this better or worse? (+)(-)	D. What is the combined impact of this non-climate stressor and… identified climate stresses below.			
			Increased Water Temperature	Altered Precipitation	Ocean Acidification	Algal Bloom
Hazardous Materials - from old military sites	Toxins in permafrost - exposed as permafrost melts - carried downstream & out to sea; • Close to Rivers – Potential seepage into river.	Worse	Further stresses species sensitive to increased temperature that are dependent on habitat.	Depending on timing of low flows, "The Blob" temperatures potentially increase, therefore, further stressing species sensitive to pollutants that are dependent on habitat.	Further stresses food web of or species sensitive to acidification that are dependent on habitat.	High levels of toxins have, in the past, closed shellfish harvests; affects clams, exposure to marine mammals - seals, walrus, sea birds, etc. and ultimately people.
Dumpsites	Unalakleet's new dump site up the hill, concerned about drilling for water wells for new housing below dump site.	Worse	Further stresses species sensitive to increased temperature that are dependent on habitat.	Depending on timing of low flows, "The Blob" temperatures potentially increase, therefore, further stressing species sensitive to pollutants that are dependent on habitat.	Further stresses food web of or species sensitive to acidification that are dependent on habitat.	Potential hazardous materials from dumpsites combined with the effects of algal blooms negatively impacts shellfish, clams, and other marine life and ecosystems.
Development	Mouth of River - current follows steel sheeting - scoured down to bedrock. New developments built downstream getting contaminated.	Worse	Decreased flows needed at key times combined with pollutants can further stress fishery and other species and pollutants can further stresses species sensitive to increased temperature that are dependent on habitat.	Affects snow pack and instream flows causing low flows and temperature increases at critical times.	Further stresses species sensitive to acidification that are dependent on habitat.	Potential stormwater runoff and/or flood events could increase contaminated water flowing into river and ocean that could exacerbate algal blooms.

Transportation	More than 1,000 vessels now going through Bering Strait daily. Vessels are bigger.	**Worse**	Further stresses species sensitive to increased temperature that are dependent on habitat.	The combined impact of altered precipitation and river transportation could impact species and their habitat.	Increased pollution from increased transportation combined with increased ocean acidification could detrimentally impact marine species and their habitat. **Does increased transportation lead to increase in ocean acidification? From Leigh Takak's research: Research is still trying to decipher what kind of pollution is contributing to acidification (e.g CO2 or atmospheric) or where and how the ocean is being polluted.** "The researchers are currently looking into daily, seasonal, interannual, and decadal variability to better distinguish between natural and human caused changes." (From Ocean Acidification: An annual update on the state of ocean acidification science in Alaska.)	1) Potential oil spills from shipping incidents combined with the effects of algal blooms would negatively impacts shellfish, clams, and other marine life and ecosystems; and 2) Release of marine vessel effluent (e.g. cruise ships) combined with the effects algal blooms negatively impact marine ecosystems.
Extraction (Mining, oil and gas)	Increasing oil and gas extraction; increasing oil and gas spill potential - persists in environment long term (See Exxon Valdez). Mining containment pond failures tailings get washed down stream. Persist in environment for decades (See e.g, Exxon Valdez). In 2020, the U.S. Bureau of Land Management is expected to open almost 3 million acres of land, much of it within critical fish habitat, including the Tubutulik River, to mining activity under the Kobuk- Seward Resource Management Plan (RMP).	**Worse**	Decreased flows needed at key times combined with pollutants can further stress fishery and other species and pollutants can further stresses species sensitive to increased temperature that are dependent on habitat. Have to be careful about how the extraction of oil and gas is valued.	Affects snow pack and instream flows causing low flows and temperature increases at critical time.	Further stresses species sensitive to acidification that are dependent on habitat.	Extraction (Mining, oil and gas) activities including seismic, potential oil or gas rig blowouts, and/or breaching of mining pond dams combined with the effects of algal blooms would negatively impacts shellfish, clams, and other marine life and ecosystems.

Dredging / Mining	Dredging – Wipes out your underwater ecosystem and potentially stirs up pollution or hazardous materials that were laid dormant.	**Worse**	Pollutants can further stresses species sensitive to increased temperature that are dependent on habitat.	Affects snow pack and instream flows causing low flows and temperature increases further exacerbating impacts of pollution.	Further stresses species sensitive to acidification that are dependent on habitat.	Nearshore dredging/mining activities combined with the effects of algal blooms could negatively impacts shellfish, clams, and other marine life and ecosystems.
Commercial fishing	Bycatch mortality - Taking of sensitive species and throwing back into waters. Overfishing of species.	**Worse**	Overfishing and bycatch would further stress species sensitive to increased temperature that are dependent on habitat.	Overfishing and bycatch would further stress species sensitive to increased temperature, resulting from altered precipitation.	Overfishing and bycatch would further stress species sensitive to increased ocean acidification.	Overfishing and bycatch would further stress species sensitive to increased algal blooms.
Consequence: Assess the consequence of the direct effect of the climate stress in tandem with existing non-climate stressors on this habitat type. (Negligible, Minor, Moderate, Major, Catastrophic)			**Catastrophic**	**Major**	**Catastrophic**	**Catastrophic**

Table 2. Consequences - Ice/Snow

Location:	**Habitat Type:**	**Timescale:**				
Norton Sound	**Ice/Snow**	**Near Term (Present to 10 years).**				
A. Non-climate Stressor.	B. How does this stressor affect this habitat type?	C. Will climate change make this better or worse? (+)(-)	D. What is the combined impact of this non-climate stressor and… identified climate stresses below.			
			Increased Water Temperature	Altered Precipitation	Altered Currents	Ocean Acidification
Marine-source pollution and spills	Catastrophic Oil Spill Economic – Human health and welfare. Smothering of habitat. Chronic – Boats, cruise ships harbors, docs, nonpoint pollution. Long term: Biophysical – stops biological processes. See, BSCRSA Vol. 2, Chapter 3, Sections 3.1 & 3.2 ((3.2.1-2.3 & 3.2.5-2.7)	**Worse**	Reduces Resiliency. Un-sustainable populations. Warmer Water – Oil spreads out more and may not cause as much damage. Pollution eventually impacts wetlands. Accelerated isostatic rebound (a positive).	Further stresses species sensitive to pollutants that are dependent on habitat. More rain, less snow, faster glacial melt.	Could further exacerbate species migration patterns that are already impacted by altered ocean currents. Also, if coastal areas are less protected because of loss of sea ice, then coastal areas could be more greatly affected by pollution.	Habitat loss can further stresses species sensitive to acidification - reduced populations.

Energy production and resource extraction	Toxic effluents and water withdrawals from oil and gas development. Potential for catastrophic oil spill. Logging, gravel and peat extraction increase sediment transport, destroy stream fish habitats. See, BSCRSA Vol. 2, Chapter 3, Sections 3.1 & 3.2 ((3.2.1-2.3 & 3.2.5-2.7)	**Worse**	Low flows needed at key times and pollutants can further stress fishery and other species sensitive to increased water temperature. Offshore drilling can exacerbate impacts from high water temperatures and sea-ice loss by harassment of marine mammals and oil spills can damage habitat and effect forage species.	Affects snow pack and instream flows causing low flows and temperature increases at critical times. Increased bank erosion.	If species are already impacted by altered currents, then energy production and resource extraction could further stress species by habitat loss and harassment.	Habitat loss and harassment can further stresses species sensitive to acidification - reduced populations.
Development/ population growth	More hard surfaces = more flooding, more stream crossings interfere with fish passage. Mouth of Beluga Slough moved every ~10 years. See, BSCRSA Vol. 2, Chapter 3, Sections 3.1 & 3.2 ((3.2.1-2.3 & 3.2.5-2.7)	**Worse**	Snow drought and more hard surface leads to more flash flooding, erosion and stream sediment loading.	Stronger fall storms and hard surfaces will lead to more flash flooding, erosion and stream sediment loading.	Could further exacerbate species migration patterns that are already impacted by altered ocean currents. Also, if coastal areas are less protected because of loss of sea ice, then coastal areas could be more greatly affected by pollution.	Habitat loss can further stresses species sensitive to acidification - reduced populations.
Consequence: Assess the consequence of the direct effect of the climate stress in tandem with existing non-climate stressors on this habitat type. (Negligible, Minor, Moderate, Major, Catastrophic)			**Catastrophic**	**Major**	**Major** (Revisit w/Planning Committee.)	**Catastrophic**

Table 2. Consequences - Rocky/Intertidal

Location:	Habitat Type:	Timescale:			
Norton Sound	**Rocky/ Intertidal**	**Near Term (Present to 10 years).**			
A. Non-climate Stressor.	B. How does this stressor affect this habitat type?	C. Will climate change make this better or worse? (+)(-)	D. What is the combined impact of this non-climate stressor and… [Insert your three climate stresses here]		
			Increased Water Temperature	Altered Precipitation	Ocean Acidification
Marine-source pollution and spills	Catastrophic Oil Spill Economic – Human health and welfare. Smothering of habitat. Chronic – Boats, cruise ships harbors, docs, nonpoint pollution. Long term: Biophysical – stops biological processes. See, BSCRSA Vol. 2, Chapter 3, Sections 3.1 & 3.2 ((3.2.1-2.3 & 3.2.5-2.7)	**Worse**	Reduces resiliency. Results in un-sustainable populations. Warmer Water – Oil spreads out more and may not cause as much damage. Pollution eventually impacts wetlands.	Further stresses species sensitive to low flows that are dependent on habitat.	Further stresses species sensitive to acidification that are dependent on habitat
Development/population growth: (Energy production user groups, etc.)	Potential impacts on habitat by increased land use activities including toxic effluents, water withdrawals, logging, oil and gas development, etc. See, BSCRSA Vol. 2, Chapter 3, Sections 3.1 & 3.2 (3.2.1-2.3 & 3.2.5-2.7)	**Worse**	Low flows occur when higher flows are needed at key times and pollutants can further stress fishery and other species sensitive to increased water temperature.	Affects snow pack and instream flows causing low flows and temperature increases at critical times.	Further stresses species sensitive to acidification that are dependent on habitat.
Aquaculture	Potential impacts on habitat, particularly located in marine waters from increased competition on food sources between primarily Pink and Chum salmon.	**Worse**	Further stresses species sensitive to increased temperature that are dependent on habitat – including salmon species located in freshwater.	Further stresses species sensitive to increased temperature that are dependent on habitat – particularly salmon species located in freshwater.	Further stresses species sensitive to acidification that are dependent on habitat.
Consequence: Assess the consequence of the direct effect of the climate stress in tandem with existing non-climate stressors on this habitat type. (Negligible, Minor, Moderate, Major, Catastrophic)			**Catastrophic**	**Major** (Revisit w/Planning Committee.)	**Catastrophic**

Step 3 - Undertake Your Assessment

Table 3. Adaptive Capacity Assessment of Pelagic

Pelagic	C. Assess status and condition of each factor of Adaptive Capacity for this habitat. **Rate on a scale from 1-5 (5=Superior, 4=Good, 3=Fair, 2=Poor, 1=Critical)** [If your answers vary by stressor, consider evaluating the habitat for each stressor separately.]	
A. Ecological Potential	**Pelagic (and stressor if applicable):**	**Rationale:**
Extent, Distribution & Connectivity	2: Poor	Already greatly impacted by climate change. Is connected to other systems but also very isolated.
Past Evidence of Recovery	*Varying levels and dependent on stressor and species w/in the habitat.*	Non-Climate Stressor (oil spills); recovery of pelagic habitat indicated by recovery of various species.
Value/Importance	2.5 (3: Fair to 2: Poor)	Valuation comes from competing interests and political environment. Exploitation of natural resources competes against subsistence way of life and rights.
Physical Diversity	2: Poor (Planning Committee question.)	The cold pool exists because of cold and salt water. Cold pool directly impacted by warm air and water temperatures. Directly related to sea ice.
Biodiversity	3: Fair (Species dependent)	There is rich biodiversity (e.g. microorganisms to whales) of the pelagic habitat in the Norton Sound area allowing it to potentially adapt more quickly. Different species live in different locations. Species being impacted by warming temperatures.
Keystone & Indicators Species	2.5 (3: Fair to 2: Poor) (Species dependent)	Zooplankton currently being impacted by heating of water and loss of sea ice. Decreasing population impacting grey whales. Forge fish moving to different areas resulting in die-offs of seabirds.
Other:		
Ecological Potential Average	**2.4 (12/5)**	
B. Social Potential	**Pelagic (and stressor if applicable):**	**Rationale:**
Organization Capacity	NBITWC (Organization)	
Staff Capacity (training, time)	4	TEK - Local knowledge is critical. Have all kinds of resources that can access through government agencies and academic institutions.
Responsiveness	4	Pertains to the resilience of the Villages and how they are impacted by climate change. Altered practices based on circumstances (e.g. change routes if ice patterns shift, or hunting practices depending on movement.) Find alternative solutions and ability to adapt shifting patterns.

Stakeholder Relationships	2	Unfortunately depends on political party in power. Stakeholders are federal, state and mining. These relationships are now very adversarial. Depends on who you are involved with.
Stability/Longevity	4	Depends on whether talking about the Watershed Council or Villages. Villages have been through this before and still will be around, whether they may have to relocate or not. In terms of the Watershed Council, depends on the commitment of the Council to long-term and the way that the "torch" is passed on and outreach done.
Other:	N/A	N/A
Management Potential		
Existing Mandate	1.5	Two mandates: The Marine Mammal Protection Act and Endangered Species Act.
Monitoring & Evaluation Capacity	4	With climate change taking place, quite a bit of Monitoring & Evaluation (M&E) is taking place. Actually has gone up with the concern of climate change.
Ability to Learn and Change	3	Culturally adaptive capacity through TEK/resilience - very strong. Adaptive management strong in the scientific community. Political environment for learning and changing very weak.
Proactive Management	1	Not taking place, but should be. Tied to politics, which is completely unsupportive at this time.
Partner Relationships	3	On one hand, good partnership relationships between federal government/academia and Tribes, and among Tribes and Tribal entities; not great between state and Tribes.
Science/Technical Support	4	Good relationships with federal and university experts when comes to climate support.
Other:	N/A	N/A
Social Potential Average	**30.5 (30.5/10 = 3.5)**	
Combined Potential Average	**42.5 (42.5) / 15 = 2.83)**	
Adaptive Capacity for Pelagic	**Moderate**	

Convert average to adaptive capacity rating: Low = 1 – 2.3; Moderate = 2.4 – 3.6; High = 3.7 – 5

Table 3. Adaptive Capacity Assessment of Ice/Snow

Ice/Snow	C. Assess status and condition of each factor of Adaptive Capacity for this habitat. **Rate on a scale from 1-5 (5=Superior, 4=Good, 3=Fair, 2=Poor, 1=Critical)** [If your answers vary by stressor, consider evaluating the habitat for each stressor separately.]	
A. Ecological Potential	**Ice/Snow (and stressor if applicable):**	**Rationale:**
Extent, Distribution & Connectivity	2: Poor	Already greatly impacted by climate change. Is connected to other systems but also very isolated.
Past Evidence of Recovery	2: Poor	Non-Climate Stressor (minings); recovery of ice/snow habitat indicated by recovery of various species.
Value/Importance	4.5	High societal valuation - salmon is highly valued throughout the area.
Physical Diversity	3: Fair (Species dependent)	Salmon - extremely large range, hence high diversity. Walrus - Limited range, dependent on shore ice for habitat, which is more limited.
Biodiversity	3: Fair	There is rich biodiversity for freshwater and marine habitat. Different species live in different locations. Species being impacted by warming temperatures.
Keystone & Indicators Species	2.5 (3: Fair to 2: Poor) (Species dependent)	Salmon definite indicator species of habitat health. For marine habitat, zooplankton is currently being impacted by heating of water and loss of sea ice. Decreasing population impacting grey whales. Forge fish moving to different areas resulting in die-offs of seabirds.
Other:	N/A	N/A
Ecological Potential Average	**17.0/6 = 2.83**	
B. Social Potential	**Ice/Snow (and stressor if applicable):**	**Rationale:**
Organization Capacity	NBITWC (Organization)	
Staff Capacity (training, time)	4	TEK - Local knowledge is critical. Have all kinds of resources that can access through government agencies and academic institutions.
Responsiveness	4	Pertains to the resilience of the Villages and how they are impacted by climate change. Altered practices based on circumstances (e.g. change routes if ice patterns shift, or hunting practices depending on movement.) Find alternative solutions and ability to adapt shifting patterns.
Stakeholder Relationships	2	Unfortunately depends on political party in power. Stakeholders are federal, state and mining. These relationships are now very adversarial. Depends on with whom you are involved.

Stability/Longevity	4	Depends on whether talking about the Watershed Council or Villages. Villages have been through this before and still will be around, whether they may have to relocate or not. In terms of the Watershed Council, depends on the commitment of the Council to long-term and the way that the "torch" is passed on and outreach done.
Other:	N/A	N/A
Management Potential		
Existing Mandate	1.5	Positive Mandates: The Marine Mammal Protection Act; Endangered Species Act; Clean Water Act; Federal Land Management Practices Act; and NEPA. Negative Mandate: 1872 Mining Claims Act.
Monitoring & Evaluation Capacity	4	With climate change taking place, quite a bit of M&E is taking place. Actually has gone up with the concern of climate change.
Ability to Learn and Change	3	Culturally adaptive capacity through TEK/resilience - very strong. Adaptive management strong in the scientific community. Political environment for learning and changing very weak.
Proactive Management	1	Not taking place, but should be. Tied to politics, which is completely unsupportive at this time.
Partner Relationships	3	On one hand, good partnership relationships between federal government/academia and Tribes, and among Tribes and Tribal entities; not great between state and Tribes.
Science/Technical Support	4	Good relationships with federal and university experts when comes to climate support.
Other:	N/A	N/A
Social Potential Average	**30.5 (30.5/10=3.5)**	
Combined Potential Average	**47.5 (47.5 /16 = 2.97)**	
Adaptive Capacity for Ice/Snow	**Moderate**	

Convert average to adaptive capacity rating: Low = 1 – 2.3; Moderate = 2.4 – 3.6; High = 3.7 – 5

Table 3. Adaptive Capacity Assessment of Rocky/Intertidal

Rocky/Intertidal	C. Assess status and condition of each factor of Adaptive Capacity for this habitat. **Rate on a scale from 1-5 (5=Superior, 4=Good, 3=Fair, 2=Poor, 1=Critical)** [If your answers vary by stressor, consider evaluating the habitat for each stressor separately.]	
A. Ecological Potential	**Rocky/Intertidal (and stressor if applicable):**	**Rationale:**
Extent, Distribution & Connectivity	2: Poor	Already greatly impacted by climate change. Is connected to other systems but also very isolated.
Past Evidence of Recovery	2:Poor	Non-climate Stressor (oil spills/mining); recovery of rocky/intertidal habitat indicated by recovery of various species.
Value/Importance	2.5 (3: Fair to 2: Poor)	Valuation comes from competing interests and political environment. Exploitation of natural resources competes against subsistence way of life and rights.
Physical Diversity	2: Poor	Walrus and seal - Limited range, dependent on shore ice for habitat, which is more limited.
Biodiversity	3: Fair (Species dependent)	There is rich biodiversity for in this habitat. Different species live in different locations. Species being impacted by warming temperatures.
Keystone & Indicators Species	2.5 (3: Fair to 2: Poor) (Species dependent)	Forge fish, mussels, crabs, herrings are indicator species, which are being impacted by warming temperatures. Puffins, cormorants, other migratory birds - are also indicators species.
Other:		
Ecological Potential Average	**14/6 = 2.33**	
B. Social Potential	**Rocky/Intertidal (and stressor if applicable):**	**Rationale:**
Organization Capacity	NBITWC (Organization)	
Staff Capacity (training, time)	4	TEK - Local knowledge is critical. Have all kinds of resources that can access through government agencies and academic institutions.
Responsiveness	4	Pertains to the resilience of the Villages and how they are impacted by climate change. Altered practices based on circumstances (e.g. change routes if ice patterns shift, or hunting practices depending on movement.) Find alternative solutions and ability to adapt shifting patterns.

Stakeholder Relationships	2	Unfortunately depends on political party in power. Stakeholders are federal, state and mining. These relationships are now very adversarial. Depends on who you are involved with.
Stability/Longevity	4	Depends on whether talking about the Watershed Council or Villages. Villages have been through this before and still will be around, whether they may have to relocate or not. In terms of the Watershed Council, depends on the commitment of the Council to long-term and the way that the "torch" is passed on and outreach done.
Other:	N/A	N/A
Management Potential		
Existing Mandate	1.5	Positive Mandates: The Marine Mammal Protection Act; Endangered Species Act; Clean Water Act; and NEPA. Negative Mandate: 1872 Mining Claims Act.
Monitoring & Evaluation Capacity	4	With climate change taking place, quite a bit of Monitoring & Evaluation (M&E) is taking place. Actually has gone up with the concern of climate change.
Ability to Learn and Change	3	Culturally adaptive capacity through TEK/resilience - very strong. Adaptive management strong in the scientific community. Political environment for learning and changing very weak.
Proactive Management	1	Not taking place, but should be. Tied to politics, which is completely unsupportive at this time.
Partner Relationships	3	On one hand, good partnership relationships between federal government/academia and Tribes, and among Tribes and Tribal entities; not great between state and Tribes.
Science/Technical Support	4	Good relationships with federal and university experts when comes to climate support.
Other:	N/A	N/A
Social Potential Average	**30.5 (30.5/10=3.5)**	
Combined Potential Average	**44.5 (44.5 / 16 = 2.78)**	
Adaptive Capacity for Rocky/Intertidal	**Moderate**	

Convert average to adaptive capacity rating: Low = 1 – 2.3; Moderate = 2.4 – 3.6; High = 3.7 – 5

Step 4 - Adaptation Strategy Development

From North American Marine Protected Area Rapid Vulnerability Assessment Tool - User Guide

Step 4 (pgs. 17-18):

For each stress with a high or moderate vulnerability score, develop a list of adaptation strategies that could reduce that vulnerability. Where possible, consider strategies that address multiple vulnerabilities.

Once the issues relating to High and Moderate vulnerability are identified, it is time to begin considering what, as MPA managers, you can do to reduce those vulnerabilities. By considering the climate stresses of concern and the factors of the habitat that are the key drivers of the vulnerability (likelihood, consequence and adaptive capacity), adaptation strategies can be developed.

Begin by transferring the climate stress and the key driver(s) of that vulnerability description from Table 1 to Table 4, Column A. With your knowledge of the system and the management opportunities, consider what could be done to reduce these vulnerabilities. At least one strategy should be developed for each vulnerability and recorded in Column B. After creating a suite of strategies, proceed to Columns C and D to evaluate their relative cost and expected efficacy.

The approach used to develop the adaptation strategies was "The 3 Rs" (Resistance. Resilience, Response).

The 3 Rs:

An alternative approach is to consider the different types of response to adaptation, categorized as resistance, resilience and response. Resistance strategies are those that maintain current conditions by holding back change. Resilience strategies recognize that there is change happening and provide opportunity for the system to adjust in response, so that function is maintained at the site being managed. Response strategies recognize that historic functions may no longer be possible at a given site without dramatic change or movement to a new location. Often these strategies can be thought of as a continuum wherein early actions are often aligned with resistance, followed by resilience and response as time progresses. Additionally, this suite of options may be adopted across a site in response to variable local conditions and goals.

While these are similar to the outcomes from the Vulnerability Assessment Model approach, often this framing is easier for practitioners to envision and apply. Examples from Reynier and Hansen (2015) are presented in Figure 5 [below].

Figure 5. Sample Adaptation Strategies for the 3 Rs[29]

Stress/Vulnerability	Sea Level Rise
Resistance	Use "soft-engineering" techniques and/or natural infrastructure to replenish or mimic natural buffers (e.g. restore tidal marsh for coastal protection).
Resilience	Require setbacks and buffers from the shoreline for all future development.
Response	Maintain and/or increase habitat connectivity to facilitate species migrations (e.g. update marine zoning to ensure reef connectivity)

[29] CEC 2017. North American Marine Protected Area Rapid Vulnerability Assessment Tool. Montreal, Canada: Commission for Environmental Cooperation. 30 pp, p 18.

Table 4: Strategy Development - Pelagic

Table 4: Strategy Development				**Resistance/RS** (How to maintain status quo.); **Resilience/RL** (In between); **Response/RP** (True adaptation - make use of the new condition.)	E.g. Title, Author/Researcher, Year, Link, etc. - if applicable and/or known.
Habitat: Pelagic					
A. Vulnerability/ Stress	**B. Strategies: Increased Water Temperature Strategies for Pelagic Habitat**	**C. Cost (H/M/L)**	**D. Efficacy (H/M/L)**	**Key 3Rs: RS, RL, RP**	**References**
Short-term	Use of existing data and research from IARC, ACCAP, etc. to monitor sea ice extent & temperatures.	L	M	RL	IARC, ACCAP, etc.
	Apply NASA's ICESat-2 to gather data that can track changes of terrain including glaciers, sea ice, forests, etc.	L	M	RL	Adrian Borsa - geodesist at the Scripps Institution of Oceanography.
Marine-source pollution and spills/Development - Oil & Gas; Mining; Dredging;	Tighter point source oil spill contingency planning, cruise ship, harbor, & docks regulations; Improve best management practices; limit land based and offshore oil and gas affecting habitats.	M	H	RL	State/Fed resource agencies; Re-establish Bering Straits Coastal Resource Service Area Board.
Marine-source pollution and spills/Development - Oil & Gas; Mining; Dredging;	State requires bonding from oil and gas for cleanup; Don't have great contingency plans for spills; Establish local oil & gas spill response teams.	M	H	RL	State/Fed resource agencies; Re-establish Bering Straits Coastal Resource Service Area Board.
Marine-source pollution and spills/Development - Oil & Gas; Mining; Dredging;	Bring back Federal Coastal Zone Management Planning - Worked because it worked on local level; Travel - Strengthen cruise ship, harbor, & docks regulations; Require tracking devices on bigger vessels, strengthen requirements for dumping of ballast, trash, waste water, sewage; Insure that protection of marine mammals and shore birds are included in deep water port planning; Approach Arctic Council for help - Asked them to place tribal reps on Council.	M	H	RL	State/Fed resource agencies; Trbally led Watershed Councils, Boroughs, collaboratives, non-profits, etc.
Medium-term					
Long-term					

A. Vulnerability/ Stress	B. Strategies: Altered Precipitation Strategies for Pelagic Habitat	C. Cost (H/M/L)	D. Efficacy (H/M/L)	Key 3Rs: RS, RL, RP	References
Short-term	Develop a watershed assessment that includes: 1) Application of drought and temperature forecasting for the Peninsula that will be applied to models for predicting instream flows and temperature; 2) Protocols for collection of instream flow, temperature and DO data during the summer season; 3) Identify lands within the Watershed that include critical fish habitat and potentially locatable minerals that have been opened for mining under the RMP; and 4) Identify a process for applying the modeling and data collected to assist policy makers and land managers and a process for applying for instream flow water rights under Alaska state law to mitigate land uses that potentially exacerbate climate related impacts in critical salmon habitat.	M	M	RL-RP	USFWS, Arctic Rivers Project, Native Village of Elim, etc
	Limit water withdrawals & preserve instream flows including: Collect Data and file instream flow water right applications for select streams, limit water withdrawals and hydro-power development affecting sensitive habitat. Engage local, regional, federal, and international stakeholders in assessment of risk, scenario planning and integrate leading practices as they apply to climate change impacts. Base management of impacts of climate change on habitats on a Watershed Scale. Conduct baseline studies and monitoring necessary to understand ecosystem process and changes that guide community and state decision-making and risk assessment. Collaborate with other levels of government, such as municipal and Alaska Native Regional and Village Corporations and international land and resource managers, to ensure an ecosystem approach, to identify disproportionately important areas, and to explore forming local and international co-management efforts like Marine Protection Areas.	M	M	RL	State/Fed resource agencies; Re-establish BeringStraits Coastal Resource Service Area Board
	Population Growth - Partner with municipalities re: climate adaption, stormwater planning to decrease point & nonpoint source discharges; Tighten wetland protection & water use regulations; Participate in state & federal agency decision making & planning that affect habitats including off-site cumulative impacts analysis.	M	M	RL	State/Fed resource agencies; Re-establish Bering Straits Coastal Resource Service Area Board
	Establish climate change refugia -- areas relatively buffered from climate change over time -- can protect species from the negative effects of climate change in the short-term as well as provide longer-term protection for biodiversity and ecosystem function.	M	H	RL	Frontiers in Ecology & the Environment, Volume 18, Issue 5, Special Issue:Climate-Change Refugia, Pages: 225-308, June 2020
Medium-term					
Long-term					

A. Vulnerability/ Stress	B. Strategies: Ocean Acidification Strategies for Pelagic Habitat	C. Cost (H/M/L)	D. Efficacy (H/M/L)	Key 3Rs: RS, RL, RP	References
Short-term	Decrease effects of non-climate stressors on habitats.				
Medium-term					
Long-term					
A. Vulnerability/ Stress	**B. Strategies: Harmful Algal Bloom Strategies for Pelagic Habitat**	**C. Cost (H/M/L)**	**D. Efficacy (H/M/L)**	**Key 3Rs: RS, RL, RP**	**References**
Short-term	Tighten regulations on nutrient pollution from both land-based stormwater runoff and marine shipping discharges. Monitor water temperatures and algal content and issue local alerts.				
Medium-term					
Long-term					

Table 4: Strategy Development - Ice/Snow

Table 4: Strategy Development				**Resistance/RS** (How to maintain status quo.); **Resilience/RL** (In between); **Response/RP** (True adaptation - make use of the new condition.)	E.g. Title, Author/Researcher, Year, Link, etc. - if applicable and/or known.
Habitat: Ice/Snow					
A. Vulnerability/ Stress	**B. Strategies: Increased Water Temperature Strategies for Ice/Snow Habitat**	**C. Cost (H/M/L)**	**D. Efficacy (H/M/L)**	**Key 3Rs: RS, RL, RP**	**References**
Short-term	Collect, assess, and summarize instream flow and water quality data in conjunction with traditional ecological knowledge (TEK) of the Watershed	M	M	RL-RP	USFWS, Arctic Rivers Project, Native Village of Elim, etc
	Limit water oil & gas & mining withdrawals & hydro-power development affecting habitats; Improve Connectivity of freshwater habitats including: Preserve instream flows including: Collect Data and file instream flow water right applications for select streams, limit water withdrawals.	M	H	RL	
	Plant willows and other trees close to the banks of streams and rivers; provide shade over the water and create in-stream habitats made of woody debris; develop matrix of locations and assess in relationship to TEK summary, compliance with NEPA, ESA and NHPA statutes, cost and potential funding sources; and choose Demonstration project location.	H	M	RS-RL	
	Develop an Emergency Recovery Plan to "bend the curve" of freshwater biodiversity including: a) Accelerating implementation of environmental flows, b) Improving water quality, c) Protecting and restoring critical habitats, d) Managing exploitation of freshwater species and riverine aggregates, e) Preventing and controlling non-native species invasions, and f) Safeguarding and restoring river connectivity.	M	M	RL	

	Determine how land use or climate change has or is likely to impact streamflow by applying Northwest Climate Adaptation Science Center datasets on Streamflow Permanence at regional scale that account for year-to-year variations in climatic conditions: Streams are classified based on whether they are perennial which receive special regulatory protections for providing critical fish and wildlife habitat, and intermittent and ephemeral. As part of this strategy, refer to NW CASC PRObability of Streamflow PERmanence (PROSPER) model (publicly available through the USGS StreamStats platform) that provides streamflow permanence information for the Northwest including publicly available regional datasets, models and maps of where perennial streams are located across the Pacific Northwest and how they respond to year-to-year variation in climate conditions such as annual snow and rainfall.	M	M	RL	See, recently published paper introduces the PROSPER model and demonstrates its use by analyzing streamflow permanence in three Northwest river basins.
	In cooperation with federal, state city and/or tribal governments, conservation organizations and other stakeholder located within the Watershed. Develop rapid assessment capability and understanding the Watershed and its response to extreme events including heavy precipitation and drought conditions including; a) Conduct research and modeling of: b) Discharge, temperature and dissolved oxygen data; c) Establishing a contiguous corridor of protected and resilient streams within Watershed; and d) Coordinate with the NOAA Office of Water Protection and National Weather Service and the USGS Integrated Water Availability Assessments to predict the timing of flooding and drought events.	M	H	RL	NWCAC, AKCAC
	Apply USA National Phenology Network application tool to input local seasonal phenological data into, and see the changes as they are happening across Alaska.	L	L	RL-RP	USFWS, Arctic Rivers Project, Native Village of Elim, USGS, etc.
	Apply Nature's Notebook application is the easy way to track seasonal changes and watch changes happen over time near you for certain species of interest.	L	L	RL-RP	
	Protest BLM RMPs and withdrawal of D1 Lands; contest state dredge mining permits;	M	H	RL	BLM, Tribes, Conservationists, AK Delegation, litigation
	Collaborate with the U.S. Geological Survey re: monitoring water quantity and quality of surface and groundwater, and their hydro-connectivity and conducting water analysis and recent focus on impacts of climate change to Arctic freshwater resources including quantifying related hydrological and biogeochemical changes.	L	M	RL	https://www.usgs.gov/centers/asc/science/arctic-boreal-catchment-studies?qt-science_center_objects=0#qt-science_center_objects
	Improve non-point source pollution prevention best management practices.	M	H	RL	BLM, DNR, DEC, Tribes, Conservationists, Litigation, legislature

	Participate in Navigating the New Arctic – Arctic Rivers email listserv - Addressing climate impacts on Alaskan and Yukon rivers, fish, and communities as told through co-produced scenarios; Integrates Indigenous knowledges, community and needs with climate, river ice, and fish modeling to better understand how Arctic rivers, fish, and Indigenous communities might be impacted by, and adapt to, climate change.	L	M	RL	Nicole Herman-Mercer, Research Social Scientist, Decision Support Branch - Integrated Information Dissemination Division, Water Resources Mission Area, US Geological Survey / Denver Federal Center, MS 410 /Denver, CO 80225 303-236-5031 [http://orcid.org/0000-0001-5933-4978] Link to fact sheet: https://drive.google.com/file/d/14HA3gty8gRSsvQKBb_fP4X3OttRUzSmm/view?usp=sharing Link to table: https://drive.google.com/file/d/1Gtv9y-iP9-TvqIEUctngq3BdeKL4snDk/view?usp=sharing Link to proposed project description: http://www7.nau.edu/itep/main/docs/arcticRivers_NSF_NNA_project_description.pdf
	Incorporate by ref: BSCRSAB Chapter 5, Sections 5.3, Subsection A. (Subsistence); Subsection B. (Habitat & Biological Resource Protection), Subsections B-1 - 2, B-4 - 5, B-9 - 16, B-18 & B-21 and Subsection C. (Air, Land & Water Quality), Subsections C-2 (Water Quality Standards) Sub-Subsection C-2.2, Subsections C-3 (Environmental Protection Technology), Subsections C-4 (Hazardous Materials and Toxic Substances) Sub-Subsection C-4.1 & 4.3, Subsections C-5 (Siting of Facilities), Subsections C-7 (Refuse Disposal) Sub-Subsections C-7.1 - 7.5, Subsections C-8 (Sewage Disposal), Subsections C-9 (Storage of Petroleum and Products), Subsections C-10 (Oil Spill Contingency Plans), Subsections C-11 (Siltation & Sedimentation), Subsections C-12 (Discharge of Drilling, Muds, Cuttings & Production Waters), Subsections C-13 (Oil & Gas Operations), Subsections C-9 (Storage of Petroleum and Products) & Subsections C-14 (Nuclear Testing), Subsections E. (Geophysical Hazards), F. Coastal Hazards, G. Mining & Mineral Processing, H. Energy Facilities, I. Transportation and Utility Systems, K. Disposal of Interest, & L. Timber; Chapter 6, Sections 6.2 (Permits & Activities Subject to Consistency Determination) & 6.3 (State & Federal Permit Review & Consistency Procedures)	L	H	RL	BSCRSAB
Medium-term	Develop long-term monitoring and evaluation (M&E) plan for Watershed	L	M	RL	Model Forest Policy Program
	Apply the identified Planning Documents and assessments to protect subsistence resources from the impacts of mining activity and extreme weather events by taking measures to mitigate low flows and warming stream temperatures;	M	H	RL	Native Village of Elim Tubutulik River Watershed Temperature, Dissolved Oxygen and Stream Flow Monitoring Risk Assessment
	Review USGS Paper Highlighting 'InFish,' an International Knowledge-Sharing Network Supporting Global Conservation and Sustainable Use of Inland Fish and	L	L	RL	National CASC Research Fish Biologist Abby Lynch and Chief Doug Beard, First published: 14 April

	Participate in 'InFish' - a professional network raising awareness of inland fish to inform policy, advance conservation, and promote sustainable fisheries.				2020
	Review Alaska CASC-supported research develops high-resolution, local scale climate and Future Streamflow Projections for Southeast Alaska.	L	M	RL	https://www.usgs.gov/center-news/future-streamflow-projections-southeast-alaska
	Review USGS - Inland Fish, and More Accurate Valuations of Global Inland Fisheries	L	M	RL	https://www.usgs.gov/center-news/scientist-spotlight-abby-lynch-inland-fish-and-more-accurate-valuations-global-inland
Long-term					
A. Vulnerability/ Stress	**B. Strategies: Altered Precipitation Strategies for Ice/Snow Habitat**	**C. Cost (H/M/L)**	**D. Efficacy (H/M/L)**	**Key 3Rs: RS, RL, RP**	**References**
Short-term	Develop: A Watershed Assessment that includes: 1) Application of drought and temperature forecasting that will be applied to models for predicting instream flows and temperature; 2) Protocols for collection of instream flow, temperature and DO data during the summer season; 3) Identify lands within the Watershed that include critical fish habitat and potentially locatable minerals that have been opened for mining under the RMP; and 4) Identify a process for applying the modeling and data collected to assist policy makers and land managers and a process for applying for instream flow water rights under Alaska state law to mitigate land uses that potentially exacerbate climate related impacts in critical salmon habitat. Once the Assessment is completed, it may serve as an ecosystem wide vulnerability assessment for natural resource(s) that can be used by multiple tribes in developing their own stream flow and temperature modeling risk assessment. **In 2019 rivers and streams throughout the Peninsula reported record water temperatures resulting in the deaths of thousands of salmon as they migrated to spawning grounds.**	M	H	RL	Native Village of Elim, NBITWC Also Dan Joling, AP article, published in Anchorage Daily News, August 23, 2019. https://www.adn.com/alaska-news/wildlife/2019/08/23/alaska-salmon-deaths-blamed-on-record-high-temperatures/
Higher Fresh Water Temps/Stream Bank Erosion	Monitor climate outlook projections, CHANGING LENGTHS OF SUMMERS AND WINTERS IN ALASKA & CLIMATE AND WEATHER SUMMARY:	L	L	RL-RP	Rick Thoman Alaska Center for Climate Assessment and Policy, UAF; Brian Brettschneider, National Weather Service Alaska Region/International Arctic Research Center (IARC), UAF; ACCP - Alaska Climate Dispatch
	Projecting spring breakup flooding potential for Bering Sea Region	L	L	RL-RP	Daniel Fisher is the Alaska Data Collection Officer for the NRCS; Jessica Cherry, AK Pacific River Forecast Center, National Weather Service; "The Water Column,`" ACCP - Alaska Climate Dispatch
	Work with NCASC - Drought Early Warning System - PNW - climatetoolbox.org is a free, online website for inspecting climate and water and inland fish data;	L	M	RL-RP	(Contact: Oriana Chegwidden - orianac@uw.edu; @scientistoriana)
	Apply updatable, searchable database, FiCli (the Fish and Climate Change Database) contains a breadth of peer-reviewed literature spanning geographic regions on a global scale) to assist in modeling climate related impacts on freshwater species. FiCli - can be used to query fish families, species, response	L	M	RL-RP	(www.usgs.gov/center-news/new-fish-and-climate-change-database-ficli-informs-freshwater-fisheries-management)

	types, or geographic locations to obtain summary information on fish responses to climate change and recommended management actions.				
	Incorporate by ref: BSCRSA Chapter 5, Sections 5.3, Subsection A. (Subsistence); Subsection B. (Habitat & Biological Resource Protection), Subsections B-1 - 2, B-4 - 5, B-9 - 16, B-18 & B-21.	L	M	RL-RP	NBITWC
Medium-term	Apply updatable, searchable database, FiCli (the Fish and Climate Change Database) contains a breadth of peer-reviewed literature spanning geographic regions on a global scale) to assist in modeling climate related impacts on freshwater species. .				
Long-term					
A. Vulnerability/ Stress	**B. Strategies: Altered Currents Strategies for Ice/Snow Habitat**	**C. Cost (H/M/L)**	**D. Efficacy (H/M/L)**	**Key 3Rs: RS, RL, RP**	**References**
Short-term					
Medium-term					
Long-term					
A. Vulnerability/ Stress	**B. Strategies: Ocean Acidification Strategies for Ice/Snow Habitat**	**C. Cost (H/M/L)**	**D. Efficacy (H/M/L)**	**Key 3Rs: RS, RL, RP**	**References**
Short-term	Decrease effects of non-climate stressors on habitats.				
	Incorporate by ref: BSCRSA Chapter 5, Sections 5.3, Subsection A. (Subsistence); Subsection B. (Habitat & Biological Resource Protection), Subsections B-1 - 2, B-4 - 5, B-9 - 16, B-18 & B-21 and Subsection C. (Air, Land & Water Quality), Subsections C-2 (Water Quality Standards) Sub-Subsection C-2.2, Subsections C-3 (Environmental Protection Technology), Subsections C-4 (Hazardous Materials and Toxic Substances) Sub-Subsection C-4.1 & 4.3, Subsections C-5 (Siting of Facilities), Subsections C-7 (Refuse Disposal) Sub-Subsections C-7.1 - 7.5, Subsections C-8 (Sewage Disposal), Subsections C-9 (Storage of Petroleum and Products), Subsections C-10 (Oil Spill Contingency Plans), Subsections C-11 (Siltation & Sedimentation), Subsections C-12 (Discharge of Drilling, Muds, Cuttings & Production Waters), Subsections C-13 (Oil & Gas Operations), Subsections C-9 (Storage of Petroleum and Products) & Subsections C-14 (Nuclear Testing)	L	M	RL	NBITWC, Pew Charitable Trust, Kawerak, Inc.
Medium-term					
Long-term					
A. Vulnerability/ Stress	**Sea-Level Rise (Not Complete)**				
A. Vulnerability/ Stress	**Wave Action/ Coastal Erosion (Not Complete)**				
A. Vulnerability/ Stress	**Salinity (Not Complete)**				

Table 4: Strategy Development - Rocky/Intertidal

Table 4: Strategy Development				**Resistance/RS** (How to maintain status quo.); **Resilience/RL** (In between); **Response/RP** (True adaptation - make use of the new condition.)	E.g. Title, Author/Researcher, Year, Link, etc. - if applicable and/or known.
Habitat: Rocky/Intertidal					
A. Vulnerability/ Stress	**B. Strategies: Increased Water Temperature Strategies for Rocky/ Intertidal Habitat**	**C. Cost (H/M/L)**	**D. Efficacy (H/M/L)**	**Key 3Rs: RS, RL, RP**	**References**
Short-term	Incorporate by ref: BSCRSAB Chapter 5, Sections 5.3, Subsection A. (Subsistence); Subsection B. (Habitat & Biological Resource Protection), Subsections B-1 - 2, B-4 - 5, B-9 - 16, B-18 & B-21.	M	H	RL	DEC, Tribes, Conservationists, Litigation, legislature
	State requires bonding from oil and gas for cleanup; Update and make stronger contingency plans for spills; Establish local oil & gas spill response teams	M	H	RL	DEC, Tribes, Conservationists, Litigation, legislature
	Bring back Federal Coastal Zone Management Planning - Worked because it worked on local level.	M	H	RL	Tribes, Conservationists, AK Delegation, NBITWC, Trust Duty, BSCRSA, BIA, NOAA, USFWS
	Travel - Strengthen cruise ship, harbor, & docks regulations; Require tracking devices on bigger vessels, strengthen requirements for dumping of ballast, trash, waste water, sewage; Insure that protection of marine mammals and shore birds are included in deep water port planning; Approach Arctic Council for help - Asked them to place tribal reps on Council.	M	H	RL	NOAA, Corps, ADF&G, DEC, Tribes, Conservationists, litigation, legislature
	Clean-up Hazardous materials from military/dump sites	H	H	RL	Dalee Sambo Dorough - Background – Has doctorate; knows issues, players and laws. Her roots are from Unalakleet.

	Incorporate by ref: BSCRSA Chapter 5, Sections 5.3, Subsection A. (Subsistence); Subsection B. (Habitat & Biological Resource Protection), Subsections B-1 - 2, B-4 - 5, B-9 - 16, B-18 & B-21 and Subsection C. (Air, Land & Water Quality), Subsections C-2 (Water Quality Standards) Sub-Subsection C-2.2, Subsections C-3 (Environmental Protection Technology), Subsections C-4 (Hazardous Materials and Toxic Substances) Sub-Subsection C-4.1 & 4.3, Subsections C-5 (Siting of Facilities), Subsections C-7 (Refuse Disposal) Sub-Subsections C-7.1 - 7.5, Subsections C-8 (Sewage Disposal), Subsections C-9 (Storage of Petroleum and Products), Subsections C-10 (Oil Spill Contingency Plans), Subsections C-11 (Siltation & Sedimentation), Subsections C-12 (Discharge of Drilling, Muds, Cuttings & Production Waters), Subsections C-13 (Oil & Gas Operations), Subsections C-9 (Storage of Petroleum and Products) & Subsections C-14 (Nuclear Testing)	L	M	RL	NBITWC
Medium-term					
Long-term					
A. Vulnerability/ Stress	**B. Strategies: Altered Precipitation Strategies for Rocky/ Intertidal Habitat**	**C. Cost (H/M/L)**	**D. Efficacy (H/M/L)**	**Key 3Rs: RS, RL, RP**	**References**
Short-term	Incorporate by ref: BSCRSA Chapter 5, Sections 5.3, Subsection A. (Subsistence); Subsection B. (Habitat & Biological Resource Protection), Subsections B-1 - 2, B-4 - 5, B-9 - 16, B-18 & B-21 and Subsection C. (Air, Land & Water Quality), Subsections C-2 (Water Quality Standards) Sub-Subsection C-2.2, Subsections C-3 (Environmental Protection Technology), Subsections C-4 (Hazardous Materials and Toxic Substances) Sub-Subsection C-4.1 & 4.3, Subsections C-5 (Siting of Facilities), Subsections C-7 (Refuse Disposal) Sub-Subsections C-7.1 - 7.5, Subsections C-8 (Sewage Disposal), Subsections C-9 (Storage of Petroleum and Products), Subsections C-10 (Oil Spill Contingency Plans), Subsections C-11 (Siltation & Sedimentation), Subsections C-12 (Discharge of Drilling, Muds, Cuttings & Production Waters), Subsections C-13 (Oil & Gas Operations), Subsections C-9 (Storage of Petroleum and Products) & Subsections C-14 (Nuclear Testing)	L	M		NBITWC
Medium-term					
Long-term					
A. Vulnerability/ Stress	**B. Strategies: Ocean Acidification Strategies for Rocky/ Intertidal Habitat**	**C. Cost (H/M/L)**	**D. Efficacy (H/M/L)**	**Key 3Rs: RS, RL, RP**	**References**
Short-term	Decrease effects of non-climate stressors on habitats.				

	Incorporate by ref: BSCRSA Chapter 5, Sections 5.3, Subsection A. (Subsistence); Subsection B. (Habitat & Biological Resource Protection), Subsections B-1 - 2, B-4 - 5, B-9 - 16, B-18 & B-21 and Subsection C. (Air, Land & Water Quality), Subsections C-2 (Water Quality Standards) Sub-Subsection C-2.2, Subsections C-3 (Environmental Protection Technology), Subsections C-4 (Hazardous Materials and Toxic Substances) Sub-Subsection C-4.1 & 4.3, Subsections C-5 (Siting of Facilities), Subsections C-7 (Refuse Disposal) Sub-Subsections C-7.1 - 7.5, Subsections C-8 (Sewage Disposal), Subsections C-9 (Storage of Petroleum and Products), Subsections C-10 (Oil Spill Contingency Plans), Subsections C-11 (Siltation & Sedimentation), Subsections C-12 (Discharge of Drilling, Muds, Cuttings & Production Waters), Subsections C-13 (Oil & Gas Operations), Subsections C-9 (Storage of Petroleum and Products) & Subsections C-14 (Nuclear Testing)	L	M	RL	NBITWC
Medium-term					
Long-term					
A. Vulnerability/ Stress	**B. Strategies: Harmful Algal Bloom Strategies for Rocky/ Intertidal Habitat**	**C. Cost (H/M/L)**	**D. Efficacy (H/M/L)**	**Key 3Rs: RS, RL, RP**	**References**
Short-term	Incorporate by ref: BSCRSA Chapter 5, Sections 5.3, Subsection A. (Subsistence); Subsection B. (Habitat & Biological Resource Protection), Subsections B-1 - 2, B-4 - 5, B-9 - 16, B-18 & B-21 and Subsection C. (Air, Land & Water Quality), Subsections C-2 (Water Quality Standards) Sub-Subsection C-2.2, Subsections C-3 (Environmental Protection Technology), Subsections C-4 (Hazardous Materials and Toxic Substances) Sub-Subsection C-4.1 & 4.3, Subsections C-5 (Siting of Facilities), Subsections C-7 (Refuse Disposal) Sub-Subsections C-7.1 - 7.5, Subsections C-8 (Sewage Disposal), Subsections C-9 (Storage of Petroleum and Products), Subsections C-10 (Oil Spill Contingency Plans), Subsections C-11 (Siltation & Sedimentation), Subsections C-12 (Discharge of Drilling, Muds, Cuttings & Production Waters), Subsections C-13 (Oil & Gas Operations), Subsections C-9 (Storage of Petroleum and Products) & Subsections C-14 (Nuclear Testing)	L	M	RL	NBITWC
Medium-term					
Long-term					

Table 5: Strategy Implementation

Once the Strategies, identified in the **Implementation of Adaptation Strategies** section, have been prioritized, then the following matrix, or a modified version of it as found in the **Implementation of Adaptation Strategies: Action Plan/Funding Strategy**, should be used. The recommendation would be to focus on the top 10 Strategies, at the most, as a starting point for more in-depth research and analysis.

A. Strategy	B. Leader and potential partners	C. Monitoring and evaluation criteria	D. Funding/Costs	E. Existing or needed management mechanisms	F. Timeline

Step 5 - Narrative Vulnerability Assessment

Step 5 - Narrative Vulnerability Assessment has been incorporated into the Summary of Marine Habitat Profiles: Vulnerabilities, Adaptive Capacity, and Adaptation Strategies section above.

APPENDICES

A. Summary of Project Research Resources

B. Village Assets and Climate Risks Checklist - Norton Bay Template

C. Strategies for Coastal Management in the Former Bering Straits Coastal Resource Service Area Report, prepared by Dr. Barrett Ristroph, Esq.

A. Summary of Project Research Resources

The following regional and national programs and resources offer potential guidance and technical assistance in support of Ocean, Coastal, and Freshwater Ecosystems.

Traditional Ecological Knowledge (TEK)

- AK Arctic Observatory and Knowledge Hub (AAOKH), https://arctic-aok.org/ - Community-Based Observations of Alaskan Arctic Change.
- Local Environmental Observer (LEO) Network, https://www.leonetwork.org - The LEO Network is a group of local observers and topic experts who share knowledge about unusual animal, environment, and weather events.
- Government of Canada - Indigenous Knowledge under the Impact Assessment Act: Procedures for Working with Indigenous Communities. https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/practitioners-guide-impact-assessment-act/indigenous-knowledge-under-the-impact-assessment-act.htm
- Government of Canada - Indigenous Knowledge under the Impact Assessment Act: Procedures for Working with Indigenous Communities. Protecting Confidential Indigenous Knowledge under the Impact Assessment Act, https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/practitioners-guide-impact-assessment-act/protecting-confidential-indigenous-knowledge-under-the-impact-assessment-act.html; and https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/practitioners-guide-impact-assessment-act/indigenous-knowledge-under-the-impact-assessment-act.html.
- Rosen, Yereth; "*Alaska's first shellfish toxin death in 10 years comes amid signs of spreading harmful algal blooms*"; July 21, 2020; ArcticToday. https://www.arctictoday.com/alaskas-first-shellfish-toxin-death-in-10-years-comes-amid-signs-of-spreading-harmful-algal-blooms/

Scientific Research & Data (Climate Data, Modeling, Toolkits)

- Alaska Climate Adaptation Science Center (AKCASC)/ U.S. Geological Service's (USGS) Alaska Environmental Modelling and Software Report Streamflow Models in Southeast Alaska project; https://akcasc.org/projects-overview/. Also see: https://akcasc.org/project/streamflow-models-in-southeast-alaska/; https://www.sciencebase.gov/catalog/item/5b48b1dce4b060350a18b229; and https://pubs.usgs.gov/fs/2019/3024/fs20193024.pdf.
- Climate Adaptation Knowledge Exchange (CAKE): Climate Adaptation Toolkit for Marine and Coastal Areas. https://www.cakex.org/MPAToolkit
- International Arctic Research Center, University of Fairbanks – Documenting Alaska's physical and biological changes through observation. https://uafiarc.org/our-work/alaskas-changing-environment/
- Hugelius, Gustaf; "We mapped the world's frozen peatlands – what we found was very worrying;" August 12, 2020; The Conversation. https://theconversation.com/we-mapped-the-worlds-frozen-peatlands-what-we-found-was-very-worrying-144235
- Leslie A. Jones, Erik. R. Schoen, and Rebecca Shaftel, et. al. Watershed-scale climate influences productivity of Chinook salmon populations across southcentral Alaska. Global Change Biology. 06 July 2020. https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.15155

- Littell, J., and Mcafee, S.A., 2018, Collection: Historical and Projected Estimates of Snow Fraction and and the Amount of Precipitation that Likely Falls as Snow Across Alaska: U.S. Geological Survey data release. https://doi.org/10.5066/P9G6F51
- Kirkland, John; Flitcroft, Rebecca; Grant, Gordon. 2021. Let the fish do the talking: How fish behavior is linked to patterns of temperature and stream discharge. Science Findings 240. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 5 p. https://www.srs.fs.usda.gov/pubs/62644
- McAfee, et al., 2013, Statistically downscaled projections of snow/rain partitioning for Alaska. https://onlinelibrary.wiley.com/doi/epdf/10.1002/hyp.9934
- MsSweeney, Robert; "'Atlantification' of Arctic sea tipping it towards new climate change;" 25 June 2018; CarbonBrief (Oceans). https://www.carbonbrief.org/atlantification-arctic-sea-tipping-towards-new-climate-regime
- National Council for Science & the Environment Report: "*Climate Science Research in the United States and U.S. Territories: Survey of Scientific Publications From Selected Public Universities (2014-2018).*" (November 2019). https://www.gcseglobal.org/climate-science-research-united-states-and-us-territories
- National Integrated Drought Information System - Assistance with Temperature and precipitation datasets and predicting extreme weather events. https://www.drought.gov/
- National Snow and Ice Data Center website, "Quickly retreating sea ice off Alaska is driving another dramatic Arctic melt season." https://nsidc.org/
- Northwest Boreal Science and Management Research Tool - Thousands of curated scholarly articles, state and federal resource reports, land management plans, and more from across Alaska and Northwest Canada. https://nwblcc.github.io/geosearch/
- NOAA, Alaska River Forecast Center – Flood forecasting and data collection in Alaska. https://www.weather.gov/aprfc/
- Northwest Climate Adaptation Science Center (NWCASC). https://nwcasc.uw.edu/
- Northwest Climate Adaptation Science Center (NWCASC), datasets on Streamflow Permanence in Northwest: Streams for perennial, intermittent and ephemeral streams. https://nwcasc.uw.edu/2019/10/04/nw-casc-research-provides-new-datasets-on-streamflow-permanence-in-northwest/
- NW Climate Adaptation Science Center (NWCASC) NWCASC resources regarding developing streamflow permanence information at regional scales. https://nwcasc.uw.edu/2019/02/12/nw-casc-funded-research-explores-streamflow-permanence-in-northwest-rivers-and-streams/
- Polyakov Igor V., et al; "Borealization of the Arctic Ocean in Response to Anomalous Advection From Sub-Arctic Seas;" Frontiers in Marine Science, Vol. 7; 2020; Pg 491. https://www.frontiersin.org/article/10.3389/fmars.2020.00491
- Rosen, Yereth; "Most polar bear populations will collapse by century's end without emissions cuts, study says;" July 20, 2020; ArcticToday. https://www.arctictoday.com/most-polar-bear-populations-will-collapse-by-centurys-end-without-emissions-cuts-study-says/
- Rosen, Yereth; "Quickly retreating sea ice off Alaska is driving another dramatic Arctic melt season;" June 12, 2019; ArcticToday. https://www.arctictoday.com/quickly-retreating-sea-ice-off-alaska-is-driving-another-dramatic-arctic-melt-season/

- Scenarios Network for Alaska and Arctic Planning (SNAP) Data, Historical and Projected Decadal Average Monthly Snowfall Equivalent and the Ratio of Snowfall Equivalent to Precipitation 771m CMIP5/AR5/CRU TS3.1. http://ckan.snap.uaf.edu/dataset/historical-and-projected-decadal-average-monthly-snowfall-equivalent-and-the-ratio-of-snowfall-
- SNOTEL Alaska - Snowpack data for snotel sites on Seward Peninsula. https://www.nrcs.usda.gov/wps/portal/nrcs/ak/snow/
- University of Alaska Fairbanks (UAF) Research Centers (Research for existing data to monitor sea ice, diminishing thermal barrier, algae and food chain, Ice Seal Unusual Mortality Event (UME), Avian Cholera, Saxitoxin, starvation, ecological shifts, strandings, sea-bird die-offs, and habitat loss):
  - Alaska Center for Climate Assessment and Policy (ACCAP). https://uaf-accap.org/
  - Alaska Sea Grant. https://alaskaseagrant.org/
  - International Arctic Research Center (IARC). https://uaf-iarc.org/
  - UAF College of Fisheries and Ocean Sciences (UAF-CFOS) https://www.uaf.edu/cfos/
- University of Alaska Fairbanks, Alaska Center for Climate Assessment and Policy, Alaska Climate Dispatch - The Dispatch features seasonal weather and climate summaries as well as Alaska weather, wildfire, and sea ice outlooks. https://uaf-accap.org/about-accap/alaska-climate-dispatch/
- University of Montana, Montana Climate Office – Modeling used in Pacific Northwest drought and stream flow predictions. http://climate.umt.edu/
- University of Washington Hydro/Computational Hydrology Program – Information on how modeling affects hydraulic climate impacts studies in the Pacific Northwest drought and stream flow predictions. http://www.uw-hydro.github.io/
- U.S. Geological Survey article, A “Quintessential” Forage Fish: Understanding the Crucial Role of the Sand Lance, July 31, 2020. https://www.usgs.gov/center-news/a-quintessential-forage-fish-understanding-crucial-role-sand-lance?qt-news_science_products=3#qt-news_science_products
- U.S. Geological Survey article, “New Fish and Climate Change Database, FiCli, Informs Freshwater Fisheries Management;” April 27, 2020. https://www.usgs.gov/center-news/new-fish-and-climate-change-database-ficli-informs-freshwater-fisheries-management
- U.S. Geological Survey, Climate Change Effects on Biodiversity, Ecosystems, Ecosystem Services, and Natural Resource Management in the United States, April 10, 2020. https://www.usgs.gov/center-news/climate-change-effects-biodiversity-ecosystems-ecosystem-services-and-natural-resource
- U.S. Geological Survey, Alaska Science Center – Snowpack, drought, stream temperature, flooding data and information for Alaska. https://www.usgs.gov/centers/as
- U.S. Geological Survey - Inland Fish, and More Accurate Valuations of Global Inland Fisheries (8/31/2020). When most people think of fish as a food source they probably think of the ocean. However, many important fisheries are also found in freshwater rivers, lakes, and streams. Abby Lynch, a Research Fish Biologist with the U.S. Geological Survey, is working to illustrate the significance to global as a food source and other resources of inland fisheries and how climate change is affecting them. https://www.usgs.gov/center-news/scientist-spotlight-abby-lynch-inland-fish-and-more-accurate-valuations-global-inland

- U.S. Geological Survey, National Center for Atmospheric Research, USFS - Five year study focused on indigenous knowledge informing the science around climate change, fisheries, and the subsistence way of life focusing on climate sensitivity in Alaskan & Yukon Rivers, Fish, and Communities.
- U.S. Geological Survey. Data Spotlight: New Statistically Downscaled Climate Data Available for the Conterminous U.S. (July 20, 2016). https://www.usgs.gov/center-news/new-statistically-downscaled-climate-data-available-conterminous-us
- U.S. Department of Agriculture (USDA), Forest Service - Linking temperature and discharge to expressed behavior of fishes: Implications for climate change.
- Walsh, John E., et al., 2018, Downscaling of climate model output for Alaskan stakeholders. http://ffden-2.phys.uaf.edu/usbhatt/publications/Walsh_etal_2018.pdf

Planning & Permitting, Law & Policy (Public Policy)

- Bering Straits Coastal Resource Service Area Board Documents: The documents identified below are very hard to find online and/or in any electronic format. Kawerak (www.kawerak.org), the Bering Straits regional tribal non-profit corporation, does have some of the documents electronically. Individual members of the former BSCRSAB may also have hard copies of certain volumes and/or a DVD, created in 2019, of the scanned Volumes 1 - 3.
    - User Guide (1987): The Guide provides an overview of coastal management, identifies the components of the CRSA's plan and describes implementation procedures.
    - Volume 1 - Resource Inventory (October 1984): Describes the resources and uses important to the people of the CRSA.
    - Volume 2 - Resource Analysis (October 1986): The analysis examines the potential impacts of projects proposed by state and federal agencies as well as those proposed by private applicants.
    - Volume 3 - Coastal Management Plan (June 1991): Distributed in 1986 and reprinted in 1991, Volume 3 includes other components of the plan such as the issues, goals and objectives and enforceable policies.
    - Final Plan Amendment (June 2010) (Prepared by Glenn Gray and Associates with Assistance from Sandy Harbanuk and Associates)
- Commission on Environmental Cooperation (CEC) North American Marine Protected Area Rapid Vulnerability Assessment Tool (MPARVAT). https://www.cakex.org/documents/north-american-marine-protected-area-rapid-vulnerability-assessment-tool?utm_source=Summer+Rewind+Part+1+Webinar+Announcement&utm_campaign=CFP+7-25&utm_medium=email
- Kliskeya, Andrew, et al, "Planning for Idaho's waterscapes: A review of historical drivers and outlook for the next 50 years," Environmental Science & Policy, Volume 94, 2019, Pages 191-201, ISSN 1462-9011. https://doi.org/10.1016/j.envsci.2019.01.009
- Norton Sound Villages Plans:
    - Climate Adaptation and Action Plan for the Norton Bay Watershed, Alaska. (2013). https://www.cakex.org/documents/climate-adaptation-and-action-plan-norton-bay-watershed-alaska-0
    - Climate Resilience Planning for the Native Alaskan Villages of Norton Sound (2017-2018) Final Report

- Northern Bering Sea Region Villages Local Economic Development Plans (LEDPs)
- Hazard Mitigation Plans - Climate Risk Assessment Update (CRAU) (Teller/Golovin)
- Native Village of Shaktoolik Plans

- Ocean Tipping Points. http://oceantippingpoints.org/
  - The Ocean Tipping Points Guide Science to Improve Management in a Changing Ocean. http://oceantippingpoints.org/sites/default/files/uploads/OTP_GUIDE_Final.pdf
    - Citation: Martone, Rebecca, Carrie Kappel, Courtney Scarborough, Ashley Erickson, and Kristen Weiss. 2017. Ocean Tipping Points Guide: Science for Managing a Changing Ocean. Stanford, California: The Woods Institute for the Environment, Stanford University, and the University of California Santa Barbara.
  - Aligning with Law and Policy. http://oceantippingpoints.org/portal/aligning-law-policy
    - Alignment of Ocean Tipping Points Science with the Water QualityBased Approach to Pollution Control under the Clean Water Act. http://oceantippingpoints.org/sites/default/files/uploads/Water%20Quality%20Tipping%20Points%20Alignment_0.pdf
    - Alignment of Ocean Tipping Points Science with Environmental and Cumulative Impact Analyses under the National Environmental Policy Act. http://oceantippingpoints.org/sites/default/files/uploads/NEPA%20Tipping%20Points%20Alignment_2.pdf
    - Alignment of Ocean Tipping Points Science with Stock- and EcosystemBased Fisheries Management under the Magnuson-Stevens Act. http://oceantippingpoints.org/sites/default/files/uploads/Fisheries%20Tipping%20Points%20Alignment_Updated%20Sept2017.pdf
- USDA - Pacific Northwest Research Station, 2017, Climate Change Vulnerability Assessment for the Chugach National Forest and the Kenai Peninsula. https://www.fs.fed.us/pnw/pubs/pnw_gtr950.pdf

Education/Outreach and Training Resources

- Alaska Center for Climate Assessment and Policy (ACCAP) Webinar recording, "VAWS: Future changes in Alaska snow conditions from statistically downscaled climate projections." https://uaf-accap.org/event/future-changes-in-alaska-snow-conditions-from-statistically-downscaled-climate-projections/
- Alaska Center for Climate Assessment and Policy (ACCAP) past event webinars by Crane Johnson, National Weather Service (NWS)/ Rick Thoman, ACCAP. https://uaf-accap.org/events/list/?tribe_event_display=past
- Aleutian Islands Waterways Safety Committee - The mission of the Aleutian Islands Waterways Safety Committee is to enhance safe, efficient and environmentally sound maritime operations in the Aleutian Islands region by fostering a productive exchange of information among mariners and other stakeholders and establishing and promoting best practices and standards of care. https://www.aleutianislandswsc.org/
- ArcticToday's April 27, 2020 article, "New climate models predict ice-free Arctic summers by 2050 on new climate models that predict ice-free Arctic summers by 2050," by Melody Schreiber. https://www.arctictoday.com/new-sea-ice-models-predict-ice-free-arctic-summers-by-2050/

- National Environmental Education Foundation: Sea Level Rise. https://www.neefusa.org/nature/water/sea-level-rise
- Norton Sound Tribal Villages Climate Change Adaptation Training (NSCCAT) Series (2015-2017). https://www.waterpolicyconsulting.com/trainings/
- U.S.G.S.New Paper Highlights 'InFish,' an International Knowledge-Sharing Network Supporting Global Conservation and Sustainable Use of Inland Fish, July 15, 2020. The paper is co-authored by National CASC Research Fish Biologist Abby Lynch and Chief Doug Beard. https://www.usgs.gov/center-news/new-paper-highlights-infish-international-knowledge-sharing-network-supporting-global

Resource Management & Protection (Water, Natural, Subsistence Resources)

- Alaska Harmful Algal Bloom Network. https://aoos.org/alaska-hab-network/
- BEACONs Project - The BEACONs Project, founded at the University of Alberta, recognizes the need for a new approach to conservation planning in North America's boreal region; the scientific framework guiding its research is the Conservation Matrix Model. http://beaconsproject.ca/
- Bering Strait Coastal Resource Service Board, Volume 3– Coastal Management Plan (1991), and Volume 1 – Resource Inventory (1984) and Volume 2-Resource Analysis (1986).
- National Estuarine Research Reserve Science Collaborative publications:
    - *A Manual for Re-Engineering Living Shorelines to Halt Erosion and Restore Coastal Habitat in High-Energy Environments,* http://www.nerrssciencecollaborative.org/resource/manual-re-engineering-living-shorelines-halt-erosion-and-restore-coastal-habitat-high?utm_source=NERRS+Science+Collaborative&utm_campaign=2fff12a1ac-EMAIL_CAMPAIGN_2019_12_19_02_32&utm_medium=email&utm_term=0_34d696be7b-2fff12a1ac-99732585; **and**
    - *Management Brief: Accelerating Collective Learning and Action for Enhanced Climate Resilience,* http://www.nerrssciencecollaborative.org/resource/management-brief-climate-resilience?utm_source=NERRS+Science+Collaborative&utm_campaign=2fff12a1ac-EMAIL_CAMPAIGN_2019_12_19_02_32&utm_medium=email&utm_term=0_34d696be7b-2fff12a1ac-99732585.
- Northwest Climate Adaptation Science Center (NWCASC) - Resources regarding developing streamflow permanence information at regional scales. https://nwcasc.uw.edu/2019/02/12/nw-casc-funded-research-explores-streamflow-permanence-in-northwest-rivers-and-streams
- U.S. Climate Resilience Toolkit (Alaskan Tribes). https://toolkit.climate.gov/case-studies/alaskan-tribes-join-together-assess-harmful-algal-blooms
- U.S. Environmental Protection Agency, "*Adaptive Management Strategies for Ridge to Reef Conservation*" Webinar, December 17, 2019. https://www.epa.gov/watershedacademy/adaptive-management-strategies-ridge-reef-conservation-webinar

Monitoring & Evaluation

- National Estuarine Research Reserve System Science Collaborative, System-Wide Monitoring Program (SWMP) Time Series Data Analysis Code. https://nerrssciencecollaborative.org/resource/swmp-time-series-data-analysis-code
- World Tailing Failure website. https://worldminetailingsfailures.org/

Maps

- Alaska State Geological Mapping Office – Mapping potential mining activity. https://geoportal.dggs.dnr.alaska.gov/portal/apps/opsdashboard/index.html#/73f54ddda31b4188aaee51e3ff0e8275
- Environmental Protection Agency (EPA)'s EnviroAtlas Interactive Map. www.epa.gov/enviroatlas/enviroatlas-interactive-map
- US Geological Survey, Alaska - CASC supported research develops high-resolution, local scale climate projections for Southeast Alaska (August 31, 2020). https://www.usgs.gov/center-news/climate-projections-southeast-alaska

Other

- Arctic Council, Protection of the Arctic Marine Environment (PAME), https://www.pame.is/; and Pan-Arctic Marine Protected Area (PAME) Network, https://www.pame.is/projects/marine-protected-areas
- Atkisson, A., Arnbom, T., Tesar, C., Christensen, A. (2018). Getting it right in a new ocean: Bringing Sustainable Blue Economy Principles to the Arctic. https://arcticwwf.org/site/assets/files/2050/report_arctic_blue_economy_web.pdf
- Bureau of Indian Affairs (BIA) Tribal Resilience Program - Tribal Resilience resources. https://www.bia.gov/bia/ots/tribal-resilience-program/guide
- Institute for Tribal Environmental Professionals, http://www7.nau.edu/itep/main/Home/; and ITEP 2019 Norton Bay Inter-Tribal Watershed Council Profile, http://www7.nau.edu/itep/main/tcc/Tribes/ak_nortonBay
- Model Forest Policy Program (MFPP). www.mfpp.org
- Norton Bay Inter-Tribal Watershed Council (NBITWC). https://www.nortonbaywatershed.org/
- U.S.G.S.New Paper Highlights 'InFish,' an International Knowledge-Sharing Network Supporting Global Conservation and Sustainable Use of Inland Fish, July 15, 2020. The paper is co-authored by National CASC Research Fish Biologist Abby Lynch and Chief Doug Beard. https://www.usgs.gov/center-news/new-paper-highlights-infish-international-knowledge-sharing-network-supporting-global
- Water Policy Consulting, LLC (WPC). https://www.waterpolicyconsulting.com/

B. Village Assets and Climate Risks Checklist - Norton Bay Template

Village Assets and Climate Risks Checklist - Norton Bay, Alaska (TEMPLATE)				
The purpose of this checklist is a quick assessment of existing village assets and the potential climate and non-climate risks. The assets-at-risk and potential impacts identified will help inform local village adaptation planning and implementation. Asset Types and Potential Impacts may be customized to align with each Village, as needed.				**Role in Subsistence Resources**
Instructions: *Hide this row when not needed.*	*Does the village have this type of asset? Add line items as needed.*	*Is this an asset in the village?*	*If yes, briefly indicate what the asset is at risk, the name, location, how many, and proximity / exposure to particular hazard(s).*	*If this asset is valued or used in some way for subsistence resource purposes, please rate the importance of the asset to subsistence resource activities.*
Asset Type	**Sample Assets**	**Yes/No?**	**Describe / Name / Location / Number / Risk Exposure**	**High/Med/Low**
Government	Community Hall			
	Tribal office			
	City office			
Medical	Health Clinic			
Community	Store			
	Heavy Equipment Shop			
	Gravel pit			
	Outdoor gathering large pavilion			
	Rental units			
	Lodge			
	School			
	Harbor / Marina			
	Other buildings			
Transportation	Airport			
	Community Roads			
	Bridges			
	State Highway			
	Boats			
	Vehicles (auto, snowmobile)			
Utilities	Maintenance Shop			
	Power Plant			
	Cell phone tower			
	Water building			
	Other			
Activity Areas	Hunting			
	Fishing			
	Trapping			
	Gathering			
	Recreation			
	Habitat			
	Historic/Cultural			
Houses	Tribal-owned			
	Individually owned			
	Government owned			
Village Residents	Village Elders			
	Village Children			
	Village Adults			
Add as Needed				

Village Name: **Last Update:**

Identify Potential Impacts and Risks to Village Assets from Climate Hazards
(Regional and Local climate risks for Norton Bay Villages)

Potential risks from warming air temperatures? Yes/No?	*Potential risks from warming waters? Yes/No?*	*Potential risks from ocean warming and pH changes? Yes/No?*	*Potential risks from heavy precipitation? Yes/No?*	*Potential risks from severe weather? Yes/No?*	*Potential risks from floods? Yes/No?*	*Potential risks from erosion? Yes/No?*	*Potential risks from wildland fire: Yes/No?*	*Potential risks from forest die-off and invasive species. Yes/No?*	*Potential risks from thawing permafrost? Yes/No?*	*Potential risks from rapid melt of snowpack/ glaciers? Yes/No?*	*Potential risk from other climate stressors? Yes/No? What?*
Warming Air Temperatures	**Warming Water Temperatures**	**Ocean Warming & Acidification**	**Heavy Precipitation**	**Severe Weather**	**Floods**	**Erosion**	**Wildland Fires**	**Forest Decline / Species Shifts**	**Thawing Permafrost**	**Melting Snowpack/ Glaciers**	**Other?**

Describe Risk to Assets from Non-Climate Stressors					
Potential risk from earthquake? Yes/No?	*Potential risk from aging infrastructure? Yes/No?*	*Potential risk from volcanic ash exposure? Yes/No?*	*Potential risk from tourism and recreational impacts? Yes/No?*	*Potential risk from unsustainable development practices? Yes/No?*	*Potential risk from other non-climate stressors? Yes/No? What?*
Earthquake	**Aging Infrastructure**	**Volcanic Ash**	**Tourism**	**Development**	**Other?**

C. Strategies for Coastal Management in the Former Bering Straits Coastal Resource Service Area Report, prepared by Dr. Barrett Ristroph, Esq.

Strategies for Coastal Management in the Former Bering Straits Coastal Resource Service Area

A Report for Norton Bay Inter-Tribal Watershed Council

By Barrett Ristroph, Ph.D., J.D.
Model Forest Policy Program
October 2020

Photo Credit: Alaska Division of Community and Regional Affairs' Community Photo Library

Contents

Introduction and Summary 4
Summary of Strategies 4
Background on AMCP and Jurisdiction 6
ACMP Rise and Fall 6
Jurisdiction 7
Strategies 8
Borough Formation 9
Co-management 12
Federal statutes providing for co-management 12
Organic Co-management Agreements 15
Evaluation of Co-Management Agreements 16
International Maritime Organization 17
Exerting Tribal Jurisdiction 18
Regulating Hunters 18
Resolutions 19
Land into Trust 19
Working with Native Corporations on land management 20
Agreements with Industry 21
Conflict Avoidance Agreement 21
Oil Spill Contingency Mitigation Agreement 21
Claiming Aboriginal Rights 22
Seeking Federal Designations for Important Areas 23
National Conservation Area 24
Monuments 24
ACECs 25
Traditional Cultural Properties 25
Joint Hazard Mitigation Plan 27
Lobbying to bring back ACMP 28
Additional Funding Sources 28
Planning and Government Capacity Building 28

BIA Resilience 28
Wetland Program Development Grants 29
Alaska Conservation Fund 29
Implementing Land and Wildlife Protections 29
Bureau of Reclamation Cooperative Watershed Management Program 29
Tribal Wildlife Grants 30
National Fish and Wildlife Foundation 30

1. Introduction and Summary

The Norton Bay Inter-Tribal Watershed Council (NBITWC) is a 501(c)(3) non-profit representing a number of the villages in the Bering Straits region. NBITWC would like to reestablish the policies that the Bering Straits Coastal Resource Service Area Board had through the Alaska Coastal Management Program (ACMP), which ended in 2012. This report describes and evaluates strategies that could achieve the effect of these policies and discusses how these strategies could be funded. Carrying out all of these strategies would be impossible. **I recommend that NBITWC pick around five of these strategies and hold meetings with NBITWC tribes and possibly others in the Bering Straits region to decide which of the five strategies to pursue.**

Summary of Strategies

Strategy	Government Level	Difficulty	Cost	What Can Be Gained	Limits
Borough formation	Local/regional (initiated through State)	Not very hard to apply, but may be hard to get approval and not easy to manage	Relatively low cost to start but running borough will be cost-prohibitive (need to hire very large staff) unless there is industrial/ commercial development to tax	More control than any other strategy, but at local/regional level (not tribal)	State and federal law still trump, need to get political agreement among all Bering Strait communities
Co-management under federal statute	Federal	Difficult to gain trust of participants and demonstrate capacity, not easy to manage	Some opportunities for federal funding, but may also need your own funding and staff possibly including Western scientists	Some control or input on harvest levels	Lots of effort for little control, potential that other agencies won't listen to you
Co-management, organic	Federal, state, tribes, and/or tribal organizations	Difficult to gain trust of participants and demonstrate capacity, not easy to manage	You must fund your staff, possibly including Western scientists, travel, and data collection	Some control or input on harvest levels	Limited control and no law to force agencies to listen to you
IMO membership	International	Not very difficult to apply, need time become familiar with IMO	You must fund your staff and international travel	Opportunity to be heard at international level	Not much to be gained beyond attention
IMO routing proposal	Work with US at international	Requires many years and great technical	You must fund staff, possibly consultants, and	Avoid shipping near St. Lawrence and	Even when international rules are

Strategy	Government Level	Difficulty	Cost	What Can Be Gained	Limits
	level	expertise to submit proposal	travel	other sensitive areas	mandatory they can be difficult to enforce
Regulating hunters	Tribal	Simple	May need to spend something on enforcement	Limit tribal members' hunting	No control over non-tribal members and may not be supported by tribal members
Tribal resolutions	Tribal	Simple	Nothing	Gain attention, support	Not much to be gained beyond attention
Land into trust	Tribal through BIA	Not an option under Trump administration, difficulty unclear for future admin. Hard to get land. Management could be complex	Not expensive to apply, could be expensive to maintain (like Borough) depending on size.	Power to control land management and hunting on whatever land is in trust	Still must work through BIA for approvals, which can be slow; may generate opposition from state
Native corporation agreements	Tribal-Native Corporation	Relatively simple, but may take some time/good lawyers to negotiate	Small start-up costs, may be some maintenance costs depending on what control this gives tribes	Strengthen relationship with Native corporations and assure protection for important areas on corporation land	Native corporations may not agree
Industry agreements	Tribal-private	Relatively simple, but may take some time/good lawyers to negotiate	Small start-up costs, may be some maintenance costs depending on what control this gives tribes	Industry may voluntarily avoid certain areas or actions	Difficult to get industry to agree
Claiming aboriginal rights	Federal	No clear path for doing this, will likely require litigation	Litigation likely to be expensive	Shared jurisdiction over offshore resources	Much money and effort could be spent with no result,
Federal land conservation areas	Federal	Time-consuming to participate in designation processes, potential political backlash	Must pay for staff/consultant to participate in designation process	Substantial protection from industrial development	Can be changed with future administration/ Congress, current admin/Congress may not allow

Strategy	Government Level	Difficulty	Cost	What Can Be Gained	Limits
Traditional cultural properties	Federal, state	Difficult to gather proof needed to satisfy state	Need to pay for anthropologist/ consultant	Possible restrictions on development, consultation	Does not prohibit development, land owner may not cooperate
Lobbying for ACMP	State	Restrictions on lobbying for non-profit, difficult to build political will	Need to pay staff, lobbyists, public political campaign	Potential to regain power as an ACMP coastal district	Much money and effort could be spent with no result, or program could end again under future legislature or be restricted by state agency

2. Background on AMCP and Jurisdiction

2.1. ACMP Rise and Fall

In 1972, Congress passed the Coastal Zone Management Act to better involve states in decisions regarding coastal management.[1] The Alaska Legislature implemented the Alaska Coastal Management Program (ACMP) in 1977.[2] Each coastal district (either a borough or coastal resource area in the case of Bering Straits, since there is no borough there), had the opportunity to prepare management plans with a resource inventory and enforceable policies to guide reviews of coastal projects. **The enforceable policies were important because, once approved by the state and federal government, they had the effect of state and federal law.** They would apply to development activities across the coastal district, even if these activities took place beyond state waters. Every time that a state or federal agency was involved in a permitting decision in a coastal district, it had to coordinate with the district to make sure that the decision or permit would be consistent with the district's enforceable policies.

In the 1980s, communities in the Bering Strait region, including those that are part of NBITWC, formed a coastal district and developed a three-volume program: the Resource Inventory (Vol. 1, 1984), an analysis of potential impacts to resources (Vol. 2, 1986), and a Coastal Management Plan (Vol. 3, 1986) identifying the coastal area boundary and enforceable policies. The Alaska Coastal Policy Council approved the Plan on behalf of the state in 1986, while the federal Office of Ocean and Coastal Resource Management approved in on 1989. **Presumably, NBITWC is**

[1] 16 U.S.C. § 1451, et seq.

[2] See the former Alaska Statute (AS) 46.40.

seeking to revive the enforceable policies of its 1986 Plan and perhaps gain protection for Areas Meriting Special Attention. Other parts of the program, such as the resource inventory, may have significantly changed.

ACMP functioned well, promoting responsible development as a partnership between the State of Alaska, Alaska's coastal districts, and the federal government, until 2003. Then, the Alaska State Legislature altered ACMP in various ways,[3] including restricting the kinds of enforceable policies that districts could make.[4] State regulations in 2004 further narrowed the scope of enforceable policies. Over the next few years, the state continued to change its interpretation of the regulations, impeding districts' ability to get meaningful ACMP plans approved.

When the state legislation authorizing ACMP was expiring in 2010, rural legislators pushed to have the earlier version of the program reestablished. The governor and the House of Representatives developed a compromise bill in 2011, but the bill did not pass the senate and ACMP ended. Juneau's mayor, Bruce Botelho, organized a voter initiative to revise the program and raised $200,000 to support the campaign.[5] But ACMP opponents to heavily outspent proponents, raising about $1.5 million to defeat the measure. This leaves Alaska as the only jurisdiction in the entire USA (including Pacific Islands like American Samoa) with no coastal management program.

2.2. Jurisdiction

Now that ACMP no longer exists, a former coastal district has no jurisdiction over the lands and waters associated with the district (unless the former district is a borough). It is important to understand how jurisdiction works in Alaska. By "jurisdiction," I mean the power to make laws regarding land or people. Jurisdiction is different from ownership. The Bering Straits Regional Native Corporation owns a lot of land, and has the power to say who can come on the land to fish and who must stay off. But this Corporation does not have the jurisdiction to say how many fish a person can catch, unless it is prohibiting fishing or limiting fishing to a level below what the Alaska Department of Fish and Game (ADFG) has set. ADFG has jurisdiction over fishing on Corporation land.[6]

[3] HB 191 (Chapter 24 SLA 03)

[4] AS 46.40.070(a)

[5] Mark Thiessen, Coastal management initiative fails by a heavy margin, Alaska Journal of Commerce (Sep. 2012), https://www.alaskajournal.com/business-and-finance/2012-08-31/coastal-management-initiative-fails-heavy-margin

[6] ANILCA applies to most federal public lands and all waters that flow in or adjacent to most federal wildlife refuges, parks and preserves, conservation areas, recreation areas, and national forests. See ANILCA §§ 102(1), (2), and (3) (16 U.S.C. §§ 3102(1), (2), and (3)); 36 C.F.R. §§ 242.1-242.28 and 50 C.F.R. §§ 100.1-100.28. State law governs subsistence on state and private lands, including those owned by Native Corporations. State v. Morry, 836 P.2d 358, 367 (Alaska 1992). State law also applies to waters on general public domain lands managed by the Bureau of Land Management as well as waters on or adjacent to Native allotments. John v. U.S., 720 F.3d 1214 (9th Cir. 2013), cert. denied Alaska v. Jewell, 134 S. Ct. 1759 (2014).

The federal and state governments do not recognize Alaska tribes as having any jurisdiction over land, except over land that is held in trust by the Bureau of Indian Affairs on behalf of tribes (including allotments).[7] Alaska tribes do still have jurisdiction over their members, meaning that they can regulate the actions of members on matters such as child custody and banishment.[8] A tribe would have the jurisdiction to limit members' hunting and fishing, but would not have the jurisdiction over the land where hunting and fishing takes place, unless the land is held in trust for the tribe.

When considering the strategies in this report, it is important to consider how much jurisdiction each one would or would not allow. Forming a borough would create a jurisdiction that is most similar to the former coastal district, though a borough wouldn't have jurisdiction past three nautical miles into the ocean.[9] A borough is a political subdivision of the state, and does not increase or decrease the jurisdiction of a tribe.

3. Strategies

Which strategy to choose depends on NBITWC's goals and what aspects of the original program are most important to NBITWC in the context of today's threats and opportunities. **In the 1980s, the primary goal of the BSCRMA Plan was to avoid conflict between development and subsistence resources and habitats, commercial fishing, reindeer herding, and cultural resources.** Much of the concern was the prospect for offshore oil development.[10] At that time, various offshore lease sales were held, and there was concern regarding potential oil and mining development, new settlements, and land exchanges. There have been many environmental and social changes since the 1980s.

- Now that sea ice is melting and more ships are traversing the Bering Strait, there may be concern about spills from tankers and traffic disturbing wildlife.
- There may also be concern about declining village populations (some of the villages described in the original plan are no longer inhabited) and there may be a desire for more economic development.
- There may be greater concern about the hazard areas identified in the original plan as well as new hazard areas, given the amount of permafrost melt and erosion.
- The potential for oil and mining development continues, though hydraulic fracturing and the crash of Alaska's oil economy have decreased the likelihood of oil development in the near future.

[7] The Alaska Native Claims Settlement Act (ANCSA), 43 U.S.C. §§ 1601-1629 (2012), passed in 1971, purported to extinguish all Alaska Native land claims and aboriginal title-based hunting and fishing rights. 43 U.S.C. § 1603. Alaska v. Native Village of Venetie, 522 U.S. 520, 523 (1998).

[8] John v. Baker, 982 P.2d 738 (Alaska 1999).

[9] 43 U.S.C. 1312.

[10] See BSCRMA Program Vol. 2 Ch. 2-3.

Once the present-day goals are established, NBITWC can consider what aspects of the former BSCRMA Plan would be helpful in fulfilling these goals. Consider these examples:

- Development conflict avoidance: If it is most important that potential offshore development and shipping avoid interfering with NBITWC's hunting and fishing areas, then NBITWC may want to form agreements with industry and seek representation in IMO.
- Agency coordination: If it is most important for state or federal agencies to consider NBITWC's policies when these agencies are crafting and enforcing agency policies, then co-management with agencies may be a better option.
- Harvest levels: If there is concern about properly allocated harvest levels among the villages in the region, then an inter-tribal co-management agreement may be needed.
- Entire program: If there is a desire to have Norton Bay's policies resurrected just the way they were, then lobbying to revive ACMP may be most effective, followed by planning to form a borough.
- Consultation: If "recognition of concerns associated with development activities in the Bering Straits CRSA Region"[11] is the priority, then strengthening government-to-government consultation[12] and establishing consultation agreements with industry may be sufficient.

It is also important to consider whether NBITWC is interested in an entity or agreement that only covers NBITWC villages, or if it wants to include all of the villages and lands of the former coastal district. In the latter case, NBITWC may want to carry out larger scale planning efforts with the help of Kawerak or the Bering Straits Regional Corporation. In short, figuring out which strategy or strategies to pick should be part of a larger planning process involving all stakeholders.

3.1. Borough Formation

I put this strategy first because it could provide the most jurisdiction, but at a cost. Article X, Section 3 of Alaska's constitution provides for the state to be divided into organized boroughs (similar to counties in other states). Unincorporated areas form "the unorganized borough"[13] governed directly by the state legislature.[14] The Bering Straits Region is part of the unorganized borough, meaning that typically thought of as "local," such as planning and zoning, are handled hundreds of miles away in Anchorage and Juneau.

[11] BSCRMA Program Vol, 2 p. 1-1.

[12] Executive Order 13,175 (2000) is the most commonly cited law providing for government to government consultation. Tribes can make their own policies regarding how they would like federal agencies to consult with them. There is no equivalent law that applies to the State of Alaska.

[13] AS 29.03.010.

[14] Alaska Constitution, Article X, Section 6.

Boroughs have different levels of power. A "general law" borough can exercise only those powers designated by state law.[15] A "home rule" borough can exercise any power not prohibited by state or federal law or its home rule charter.[16] This provides substantial opportunities to regulate land use and development, but not subsistence or pollution. [17] Regardless of whether a borough is general law or home rule, it generally has land use planning authority over federal, state, and Native Corporation land within their boundaries.[18] For coastal boroughs, jurisdiction extends to three nautical miles offshore.[19]

Unincorporated regions of the state that meet certain requirements[20] may incorporate directly as a home rule borough by adopting a charter with voter approval and filing a petition with the

[15] Alaska Constitution, Article X, Sections 9-11; AS 29.04.010-020.

[16] *See* Alaska Const. art. X, § 1 (providing for maximum local self-government and liberal construction of powers of local government); Alaska Const. art. X, § 11 (home rule borough may exercise all legislative powers not prohibited by law or by charter); A.S. 29.04.010 ("A home rule municipality has all legislative powers not prohibited by law or charter.").

[17] A.S. 29.35.180(b) provides that "A home rule borough shall provide for planning, platting, and land use regulation." Regulation of land use under AS 29.35.180 (b) is distinct from a state or federal agency's regulation of the environment. *See California Coastal Com'n v. Granite Rock Co*., 480 U.S. 572, 587 (1987) ("Land use planning in essence chooses particular uses for the land; environmental regulation, at its core, does not mandate particular uses of the land but requires only that, however the land is used, damage to the environment is kept within prescribed limits."). Generally, the State regulates resources in their natural state, *see* Article VIII, Section 3 of the Alaska Constitution, while the borough regulates resources are appropriated for private use by project applicants, *see Constantine v. Alaska*, 739 P.2d 188, 194 (Alaska App. 1987) ("Game fish, wildlife, fisheries, and water are recognized as belonging to the state so long as in a natural state . . . once an animal is taken in compliance with law, it becomes the property of the taker, subject to use or disposition within the law.").

[18] *See Native Village of Eklutna v. Alaska R.R. Corp*., 87 P.3d 41 (Alaska 2004) (requiring a governmental entity seeking an exemption from local zoning laws to prove that a balance of several factors weighs in favor of immunity); *State v. Prince*, 53 P.3d 157, 162 (Alaska App. 2002) (generally speaking, a municipality's authority to enforce its ordinances on land within its boundaries does not depend on the identity of the landowner).

[19] This parallels state jurisdiction set by the 1953 Submerged Lands Act 43 USC 1301, 1312.

[20] See AS 29.05.031(a):

"An area that meets the following standards may incorporate as a home rule, first class, or second class borough, or as a unified municipality:

(1) the population of the area is interrelated and integrated as to its social, cultural, and economic activities, and is large and stable enough to support borough government;

(2) the boundaries of the proposed borough or unified municipality conform generally to natural geography and include all areas necessary for full development of municipal services;

(3) the economy of the area includes the human and financial resources capable of providing municipal services; evaluation of an area's economy includes land use, property values, total economic base, total personal income, resource and commercial development, anticipated functions, expenses, and income of the proposed borough or unified municipality;

(4) land, water, and air transportation facilities allow the communication and exchange necessary for the development of integrated borough government."

See also 3 AAC 110.045, 3 AAC 110.050 (requiring 1000 residents). The commissioner of the Department of Commerce, Community, and Economic Development will decide whether incorporation meets the best interests of the state 3 AAC 110.065.

Alaska Local Boundary Commission.[21] In addition to providing a great deal of tax revenue, incorporation allows boroughs to apply for and obtain municipal grants. Incorporation also allows a borough to obtain ownership of up to 10% of the total vacant unappropriated and unreserved state land within borough boundaries.[22]

On the North Slope, incorporation as a borough in 1972 and adoption of a home rule charter in 1974[23] was a means of ensuring a voice in oil and gas development and taking advantage of a lucrative tax base. For North Slope Natives, incorporation has been a valuable tool in maintaining control over land use. The North Slope Borough became a coastal district and incorporated their original (1988) enforceable policies into Title 19 of their municipal land use code.[24] After the Borough was unsuccessful in getting its 2007 enforceable policies approved by the State, an effort began to revise Title 19 to incorporate the 2007 policies, but this was never completed.

The Northwest Arctic Borough, which incorporated as a First Class Borough in 1986 and became a Home Rule Borough in 1987[25], has also been able to take advantage of the tax base generated by Red Dog Mine. Like the North Slope Borough, the population of Northwest Arctic Borough communities continues to be majority Native, with the vast majority of assembly members consisting of tribal members. Also like the North Slope Borough, the Northwest Arctic Borough incorporated its original enforceable policies into its land use code (Title 9).[26] Also like the North Slope Borough and the former BSCRMA Plan, the Northwest Arctic Borough makes subsistence the highest priority.[27]

Unlike the North Slope Borough, the Northwest Arctic Borough did incorporate its revised 2007 enforceable policies into its current code. [28] Private, state, and federal entities with projects in the Northwest Arctic Borough generally must follow Title 9. **But Title 9 is not as strong as the original enforceable policies during the time of ACMP, since they are only borough-level laws and not used in consistency reviews, and because agencies will not follow Title 9 if they believe it directly conflicts with a federal or state policy.**

The large size of the North Slope and Northwest Arctic Boroughs (nearly that of Michigan and Maine, respectively) and the resource development across these lands has made borough incorporation a viable option for these areas. In the absence of a major development project or

[21] AS 29.05.060; 3 AAC 110.045-.060; Department of Commerce, Community, and Economic Development, Community and Regional Affairs, Borough Incorporation, https://www.commerce.state.ak.us/dnn/dcra/LocalGovernmentOnline/MunicipalGovernment/BoroughIncorporation.aspx

[22] AS 29.65.030.

[23] North Slope Borough, A Historical Perspective, https://www.municode.com/library/ak/north_slope_borough/codes/code_of_ordinances?nodeId=NOSLBOHIPE

[24] 19.70.050

[25] Northwest Arctic Borough, http://www.nwabor.org/about.html

[26] 9.04.050

[27] 9.25.020(B)(1)

[28] 9.25.020

other source of revenue, borough incorporation could be less desirable, because it means taxing residents and adding another layer of government.[29] **I would not advise NBITWC to incorporate as a borough unless and until it appears that large scale development or commercial activity in the area is imminent—such development would be needed to fund the borough, and the power of a borough would be needed to control the development.** It could be the commercial fishing would be the source of this development, or a large-scale oil or mining development.

Once a borough is incorporated, the borough could create a zoning code based on the old enforceable policies. Important use areas or "areas meriting special attention" from the former Plan could be zoned as such (for example, "subsistence use" zone) and there could be limits or conditions on the development that can occur there.[30] Some moderation would be needed to avoid conflict with state and federal law. For example, the Federal Aviation Administration might oppose the altitude restrictions in Policy B-19. Also, the oil and gas policies (and others) would need to be updated to reflect advances in technology.

Borough incorporation does not directly affect tribal council jurisdiction. Tribes could influence borough government through their members' votes and participation on the borough assembly. Tribes could also negotiate with a borough for zoning ordinances that require consultation with the tribal council in decision-making processes such as the review of applications for permits and rezoning.

3.2. Co-management

Co-management can take place under particular statutes that authorize it. Or co-management can be "organic," meaning that state or federal agencies voluntarily work with a tribe. Thus far, co-management is Alaska has been limited to working with agencies and other tribes on monitoring or limiting subsistence harvest. **It has not come close to the jurisdiction that former coastal districts had under ACMP.**

3.2.1. Federal statutes providing for co-management

This subsection gives examples of federal statutes that could be (and have been) used to form co-management entities in Alaska. The federal government may provide funding for meetings, but except for TSGA agreements, the Alaska Native participant groups may have to fund data collection on their own. NBITWC could approach a federal agency about forming a co-management group directly with NBITWC under Alaska National Interest Lands Conservation

[29] AS 29.35.170 requires boroughs to assess property taxes.

[30] The North Slope Borough has regulated oil and gas development through Title 19 of its code as well as through permits and zoning ordinances that provide for resource development. The Matanuska-Susitna Borough has adopted land use ordinances to address coal bed methane production, which requires significant amounts of water to be pumped out of the ground and re-injected. *See* MSB Chapter 17.62 (Conditional Permit for Coal Bed Methane Exploration and Development).

Act (ANILCA) or the Marine Mammal Protection Act (MMPA), or directly with tribes under TSGA.

3.2.1.1. Alaska National Interest Lands Conservation Act Section 809

Section 809 of ANILCA allows the Interior Secretary to "enter into cooperative agreements or otherwise cooperate with other Federal agencies, the State. Native Corporations, other appropriate persons and organizations, and acting through the Secretary of State, other nations to effectuate the purposes and policies of this title." Agreements with Native entities have primarily related to harvest monitoring activities, but have also attempted to minimize conflicts among different users.[31] One example is the 1991 agreement signed between the U.S. Fish and Wildlife Service (FWS) and the Tanana Chiefs Conference (the non-profit tribal services entity for Interior Alaska) to document subsistence uses in four villages and report subsistence harvests of caribou in three villages.[32] Perhaps more commonly, Section 809 authority is used to fund Alaska Department of Fish and Game studies.[33]

3.2.1.2. Tribal Self-Governance Act

The 1994 Tribal Self-Governance Act (TSGA) allows federal agencies to transfer authority over aspects of federal programs, including land management, to Indian tribes or consortia of tribes.[34] TSGA permits tribes to petition DOI agencies to manage federal programs that are of "special geographical, historical, or cultural significance"[35] to the tribe.[36] A number of Lower 48 tribes have used this authority to enter into co-management agreements, such as those between NPS

[31] Eric Smith, *Some Thoughts on Comanagement*, 14 HASTINGS W.-N.W. J. ENV. L. & POL'Y 763, 769n28 (2008).

[32] James A. Schwarber, Conditions leading to grassroots initiatives for the co-management of subsistence uses of wildlife in Alaska, Thesis, University of British Columbia (1992), available at https://open.library.ubc.ca/cIRcle/collections/ubctheses/831/items/1.0086163.

[33] E.g., Caroline L. Brown, Robert Walker, and Susan B. Vanek, The 2002-2003 Harvest of Moose, Caribou, and Bear in Middle Yukon and Koyukuk River Communities, ADFG Technical Paper No. 280 (Apr. 2004).

[34] TSGA is Title IV of the Indian Self-Determination Act. 25 U.S.C. §§ 458aa-hh (2006). TSGA addresses non-Bureau of Indian Affairs ("BIA") programs within the Department of the Interior. One limit of the law is that an agency cannot "enter into any agreement … with respect to functions that are inherently Federal or where the statute establishing the existing program does not authorize the type of participation sought by the tribe." 25 USCS § 458cc(k). It is my opinion that NBITWC would not qualify as a consortia of tribes under this act, though Kawerak might, since NBITWC is not directly controlled by tribes. " In the case of a consortium of tribes, the governing body of each participating tribe must authorize participation by an official action by the tribal governing body." 25 CFR 1001.2(b).

[35] 25 U.S.C. § 458cc(c).

[36] 25 USCS § 458bb describes the criteria for participating tribes. The Interior Secretary may select up to 50 new tribes per year from those who apply. To apply, the tribe needs to pass a resolution requesting participation, demonstrate that it has been financially stable for the past three years (i.e., no significant problems with audits), and complete a planning phase that includes legal and budgetary research. See also 25 CFR 1001.2 (Applicant eligibility).

and the Navajo Nation to manage Canyon de Chelly.[37] Canyon de Chelly is a national monument that was established by Congress within the boundaries of the Navajo reservation, but primarily owned by the federal government.[38]

Alaska tribes have used TSGA to enter into agreements with BIA and the Indian Health Service,[39] but most of the natural resource co-management agreements in Alaska have not been signed under TSGA authority. The first (and perhaps one of the only) TSGA agreements in Alaska was signed in 2004 by the Council of Athabascan Tribal Governments and FWS for the Yukon Flats Wildlife Refuge.[40] The agreement was the product of almost two years of negotiations.[41] It allowed the Council to perform activities including locating easements, environmental education and outreach, and monitoring the moose population and hunt in cooperation with ADFG.[42]

3.2.1.3. Marine Mammal Protection Act

The Marine Mammal Protection Act[43] gives the National Marine Fisheries Service (NMFS) and FWS authority to enter into cooperative agreements with Alaska Native organizations.[44] An example is the agreement between the Eskimo Walrus Commission (EWC), which represents 19 villages, and FWS to monitor the walrus harvest.[45] There has been some friction in this

[37] Mary Ann King, *Co-Management or Contracting? Agreements between Native American Tribes and the U.S. National Park Service Pursuant to the 1994 Tribal Self-Governance Act*, 31 HARV. ENVTL. L. REV. 475 (2007).

[38] Pub. L. No. 71-667, 46 Stat. 1161 (Feb. 14, 1931), 16 U.S.C. § 445

[39] Case and Voluck, Alaska Natives and American Laws: Third Edition, 235

[40] See Fish and Wildlife Service and Council of Athabascan Tribal Governments Sign Annual Funding Agreement, 69 Fed. Reg. 41838-41845 (July 12, 2004).

[41] U.S. Fish and Wildlife Service, News Release, Council of Athabascan Tribal Governments, Reach Agreement (Feb. 13, 2004), available at http://www.fws.gov/news/ShowNews.cfm?ID=4AF518E3-AC1B-46BF-82CB8826E9BB0720.

[42] *Id.*

[43] Public Law 103-238, Section 119, 16 U.S.C. 1388

[44] The term "Alaska Native organization" means a group designated by law or formally chartered which represents or consists of Indians, Aleuts, or Eskimos residing in Alaska. 16 U.S.C. 1362(23) I assume NBITWC could be considered an Alaska Native organization since its Bylaws Art. III(2) provide that "Directors will be representative of the board of individuals with expertise and/or background working with or for federal recognized Indian Tribes and will share the mission and goals of the corporation."

[45] *See* Eskimo Walrus Commission, http://www.kawerak.org/ewc.html. In 1987, prior to the 1994 amendment to the Marine Mammal Protection authorizing co-management agreements, EWC entered into a Memorandum of Agreement with FWS and the Alaska Department of Fish and Game. EWC entered into another agreement with FWS in 1997, and in 2004 EWC and FWS issued guidelines to prevent waste. Eskimo Walrus Commission and U.S. Fish and Wildlife Service, Walrus Harvest Guidelines (2004) (cooperatively developed guidelines to address waste), cited in Martin Robards and Julie Lurman Joly, *Interpretation of "Wasteful Manner" Within the Marine Mammal Protection Act and Its Role in Management of the Pacific Walrus*, 13 OCEAN & COASTAL L.J. 171, 189 (2008).

arrangement regarding the goals of management, what constitutes waste, and the lack of enforcement authority on the part of both EWC and FWS.[46]

Perhaps a more successful and well known example is the agreement between the Alaska Eskimo Whaling Commission (AEWC) and the National Oceanic and Atmospheric Administration (NOAA) to manage the bowhead whale hunt, which has been renewed every few years since 1981. AEWC is responsible for ensuring that local hunters follow the International Whaling Commission's quota limits and other regulatory measures, and NOAA must consult with AEWC "on any action undertaken or any action proposed to be undertaken by any agency or department of the Federal Government that may affect the bowhead whale and/or subsistence whaling."[47]

3.2.2. Organic Co-management Agreements

Some co-management agreements are formed "organically" because the members decide they want to work together to manage something, even though there is no law specifically providing for this management. The lack of law means this subsection gives examples of voluntary collaborations to regulate harvests.

3.2.2.1. Kuskokwim River Salmon Management Working Group

One example of a state co-management regime is the Kuskokwim River Salmon Management Working Group, formed in 1988 by the Alaska Board of Fisheries in response to requests from local fishermen.[48]

The Group is made up of 13 member seats representing elders, subsistence fishermen, processors, commercial fishermen, sport fishermen, members at large, federal subsistence regional advisory committees, and the Alaska Department of Fish and Game (ADFG).[49] There is no formal nomination process. Members meet 10 to 20 times a year, with facilitation is provided by the USFWS Office of Subsistence Management and the Alaska Department of Fish and Game.[50] During the meetings, members review reports on subsistence and commercial catch, fishing methods, and other information, and make recommendations on salmon management to ADFG.[51] According to the Group's bylaws, the goal is for all parties to reach consensus

[46] See generally Martin Robards and Julie Lurman Joly, *Interpretation of "Wasteful Manner" Within the Marine Mammal Protection Act and Its Role in Management of the Pacific Walrus*, 13 OCEAN & COASTAL L.J. 171 (2008); Jessica Cardinal, *Master's Thesis, Pacific walrus management in a world of changing climate : experiences and observations from King Island walrus hunters* (2004) p. 21 *available at* http://ir.library.oregonstate.edu/jspui/handle/1957/4255. The lack of enforcement authority relates to the fact that the walrus is not categorized as "depleted" under MMPA 16 U.S.C. § 1371, limiting FWS's authority.

[47] NAT'L OCEANIC AND ATMOSPHERIC ADMIN. & ALASKA ESKIMO WHALING COMM'N, COOPERATIVE AGREEMENT (2013), available at http://www.nmfs.noaa.gov/ia/species/marine_mammals/inter_whaling/aewc_cooperative.pdf.

[48] ADFG, Commercial Salmon Fisheries, Kuskokwim Management Area, http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareakuskokwim.kswg

[49] *Id.*

[50] *Id.*

[51] Kuskokwim River Salmon Management Working Group Bylaws, III(2) (June 22, 2010) available at http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareakuskokwim.kswg.

regarding fishery management.[52] Motions are passed by consensus. Final authority rests with ADFG.

3.2.2.2. Western Alaska Brown Bear Management Area Working Group

Another example is the Western Alaska Brown Bear Management Area Working Group, which was established to give local input on brown bear regulations for Game Management Unit 18 that were inconsistent with Yup'ik customs.[53] This led to the formation of a Western Alaska Brown Bear Management Area, where permits are available for subsistence hunters who pursue bears primarily for meat.

3.2.2.3. Yukon River Intertribal Watershed Council

YRITWC has a purpose and origin much like NBITWC. It is not technically a tribal entity or a co-management group—it was incorporated as a 501(c)(3) in Alaska and Canada in 1999 by Alaska tribal and Canadian First Nations leaders.[54] It is carrying out data collection and building village capacity in various aspects related to scientific management. It does not have any actual co-management agreements that I am aware of with state and federal agencies, though it has received a great deal of funding (usually in the form of grants) from federal and state agencies including the National Science Foundation, the US Department of Agriculture, and the Environmental Protection Agency. It also has funding from private foundations. **The YRITWC's webpage regarding funders[55] is a good source of potential funders for NBITWC.**

YRITWC is the largest watershed council in Alaska but there are others, including Takshanuk Watershed Council (active, non-tribal), Taiya Inlet Watershed Council (not clearly active, tribal), and Kuskokwim River Watershed Council (not clearly active, tribal).

3.2.3. Evaluation of Co-Management Agreements

Several factors affect the success of co-management agreements. One is trust: co-management cannot function without a willingness by all parties to build trusting relationships.[56] Lack of trust between tribes and the State of Alaska has been a particular challenge.[57] Another factor is the

[52] *Id.*

[53] Healy, Carole, ADFG, Brown Bear Management Report (Dec. 2001), available at https://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/mgt_rpts/mbr01_nw.pdf.

[54] There is also apparently a 1997 Inter-Tribal Accord governing the Watershed Council signed by many of the tribes and First Nations along the Yukon River, but this is not mentioned on the YITWC website or publicly available.

[55] YITWC, Our Funders and Donors, https://www.yritwc.org/our-funders-donors (last visited Sep. 8, 2020).

[56] Marine Mammal Commission, Review of Co-management, Efforts in Alaska, iv, 6–8 February 2008, Anchorage, Alaska, http://alaskafisheries.noaa.gov/protectedresources/agreements/mmc_comgmtrev2008.pdf

[57] *Id.*

need for tribal capacity-building to carry out the agreements and the lack of funding (except for limited funding for groups formed under federal laws).[58] The success of AEWC as a co-management entity relates to its ample funding (including support from industry and the North Slope Borough (NSB)), scientific expertise (provided by NSB Wildlife Management),[59] and the feasibility of regulating a limited harvest (less than a hundred individuals of a single species). Favorable agreements like that between NOAA and AEWC can give a tribe a good amount of control over management, above and beyond what can be gained by consultation with federal and state agencies. **In many cases, "co-management" amounts to no more than consultation.**

3.3. International Maritime Organization

As climate change opens up Arctic waters to increased shipping activities, marine subsistence may be affected by noise, pollution, and even ship strikes. Bering Straits tribes, Kawerak, and/or NBWITC may want to seek representation before the United Nations' International Maritime Organization (IMO), which has the power to establish ship traffic directives, pollution control, and areas to be avoided.[60]

Non-governmental international organizations that can demonstrate their capability to contribute to IMO's work may be granted consultative status.[61] An organization must also show that it has no means of access through other organizations already in consultative status and that it has international membership.[62] Thus far, none of Alaska's indigenous organizations have sought this status. NBITWC could consider seeking this status to be part of conversations related to shipping,[63] but this may or may not be worth the expense of participating (including attending meetings in London).

Alternatively, NBITWC could work with the United States on proposals relevant to the Bering Strait Region. In late 2018, IMO adopted voluntary ship routing measures proposed by the United States and Russia, including recommended routes, precautionary areas, and areas to be

[58] *Id.* In 2008, the Marine Mammal Commission estimated that "Under the best circumstances, capacity-building will take decades." *Id.*

[59] See NOAA, Final Environmental Impact Statement for Issuing Annual Quotas to the Alaska Eskimo Whaling Commission for a Subsistence Hunt on Bowhead Whales for the Years 2013 through 2018, 10 (Jan. 2013) ("the role of cooperative management in this case is highly distinctive in the degree to which the AEWC and the North Slope Borough (NSB) committed to a major peer-reviewed program of scientific research to improve understanding of the bowhead population status and dynamics in order to persuade the IWC to increase the subsistence catch limits").

[60] See generally E.B. Ristroph, "Loosening Lips to Avoid Sinking Ships: Designing a Ship Communications System for the Bering Strait Region." INDIANA INTERNATIONAL & COMPARATIVE LAW REVIEW 24(3):581-664.

[61] IMO, Member States, IGOs, and NGOs (2020), http://www.imo.org/en/About/Membership/Pages/Default.aspx.

[62] *Id.*

[63] IMO, Q & A Briefing, Incorporating Arctic Indigenous Peoples Perspectives in International Maritime Law Arctic Indigenous Representation at the International Maritime Organization (2018), https://1bps6437gg8c169i0y1drtgz-wpengine.netdna-ssl.com/wp-content/uploads/2018/10/Indigenous-Participation-at-IMO-Briefing-QA.pdf.

avoided in the region.[64] The United States had considered, but not proposed, an area to be avoided in the middle of the Bering Strait itself.[65] The United States proposed a larger area to be avoided around St. Lawrence Island, but this was not implemented.[66] NBITWC could work to strengthen future proposals, perhaps calling for mandatory areas to be avoided.

3.4. Exerting Tribal Jurisdiction

As mentioned above, despite ANCSA, Alaska tribes still have jurisdiction over their members, the ability to work with the Bureau of Indian Affairs to issue permits for land held in trust, [67][68] the power to write persuasive resolutions regarding the activities of non-members, and innovative opportunities to expand jurisdiction as Native law evolves. But the land over which tribes in the Bering Strait region would have control is extremely small. Also, NBITWC is not a tribe and would not have the powers of a tribe unless tribes ceded power to the organization. Tribes in the region could choose to designate certain powers to NBITWC, similar to what tribes did for the Alaska Eskimo Whaling Commission in 1978 to regulate whaling.[69]

3.4.1. Regulating Hunters

An example of a tribe's effort to assert jurisdiction over hunting is that of Point Lay. Point Lay's traditional beluga hunt is regulated by National Marine Fisheries Service and the Alaska Beluga Whale Committee, a co-management body endorsed by the Point Lay Village through an authorizing resolution in 1996.[70] In 2008, the Tribal Council of Point Lay adopted its own

---

[64] International Maritime Organization (IMO). 2019. Ships' Routeing, 2019 Edition. London, U.K. IMO Publication.

[65] U.S. Coast Guard (USCG, Port Access Route Study: In the Chukchi Sea, Bering Strait, and Bering Sea. Preliminary Findings. [Docket Number USCG-2014-0941 and USCG-2010- 0833]. 17th Coast Guard District. December 23, 2016.

[66] USCG, Routeing Measures and Mandatory Ship Reporting Systems: Establishment of Three New Areas to Be Avoided in the Bering Sea. Submitted by the United States to the IMO Subcommittee on Navigation, Communications, Search, and Rescue. November 16, 2017.

[67] These are allotments established under the Alaska Native Allotment Act, Act of May 17, 1906, 43 USC Sec.270-1 to 270-3, repealed with savings clause, 43 USC 1617(a) and townsites established under the Alaska Native Townsite Act, 43 U.S.C. Sec 733,735, repealed under Federal Land Policy Management Act, section 701, with savings clause. *See Aleknagik Natives Ltd v. U.S*., 886 F.2d 237 (9th Cir. 1989).

[68] *See* 25 CFR 1.4(a) (prohibiting state or local regulation of "zoning or otherwise governing, regulating, or controlling the use of any real or personal property … that is held in trust or is subject to a restriction against alienation imposed by the United States"); 25 CFR 1.4(b) (giving the Interior Secretary authority to agree on zoning regulations, in consultation with the affected tribe); *Santa Rosa Band of Indians v. Kings County*, 532 F. 2d. 655 (9th Cir. 1975), cert. den. 429 US 1038 (upholding 25 CFR 1.4); *People of South Naknek v. Bristol Bay Borough*, 466 F.Supp. 870 (D. Alaska 1979) (Taxation by local government prohibited).

[69] An example is the Concurrent Resolution of the Native Villages of Gambell, Kivalina, Savoonga, Wales, and the Inupiat Community of the Arctic Slope (Mar. 26, 1978) to give the Alaska Eskimo Whaling Commission to authority to regulate whaling on behalf of the tribes.

National Marine Fisheries Service and Alaska Beluga Whale Committee (1999) Agreement between the National Marine Fisheries Service and the Alaska Beluga Whale Committee for Co-Management of the Western Alaska Beluga Whale Population, November 1, 1999, 8 pages, http://alaskafisheries.noaa.gov/protectedresources/whales/beluga/abwcagrefinal.pdf.

bylaws to protect and manage the traditional community beluga hunts.[71] The bylaws aim to regulate resident hunters, visitors (including visiting hunters, journalists, photographers, and scientists), and aircraft flying near Point Lay during the hunt period. It is not likely that the Council could the Guidelines against visitors and scientists.[72] But the Council would clearly have jurisdiction over the conduct of its own hunters, and the Guidelines may encourage voluntary compliance by others.

3.4.2. Resolutions

Even though a tribe cannot issue a binding resolution regarding activities on its traditional land and resources (outside of restricted property), it can craft a resolution that expresses its intent for how management should take place or to oppose an action. Examples are the resolutions enacted by many tribes opposing offshore drilling and opposing Alaska House Bill 77.[73] NBITWC can (and likely has) helped tribes in the Bering Strait region craft this kind of resolution, and could prepare additional resolutions aimed at protecting important areas.

While these resolutions cannot force government agencies to act, they are persuasive and may catch the attention of higher level officials. It is noteworthy that more than 30 tribes provided the state administration with resolutions opposing H.B. 77,[74] and the bill did not pass in 2014 (despite changed proposed by the administration).[75]

3.4.3. Land into Trust

After a lengthy court battle in *Akiachak v. Salazar,* Alaska tribes gained the right to have the Interior Secretary put land in trust on their behalf.[76] But the Trump Administration halted all fee-to-trust applications in Alaska in 2018.[77] It is not clear what would happen with a future administration, and if all Alaska tribes would be eligible or only IRAs.[78]

---

[71] Robert J. Wolfe, Sensitive Tribal Areas on the Arctic Slope, An Update of Areas, Issues, and Actions in Four Communities, 8 (Sep. 2013), citing Bylaws for the Traditional Beluga Hunt by the Tribal Village of Point Lay, June 27, 2008, 4 pages. (Point Lay Native Village, 2008)

[72] The Federal Aviation Administration (FAA) has jurisdiction over aircraft, so the Tribal Council may not be able to enforce a 1500 altitude if this is inconsistent with FAA regulations. Also, the Tribal Council may not be able to control what people do with photographs taken in a public place on public land.

[73] Hal Shepherd, Democracy is not dead in Alaska, but HB 77 is -- for now (April 16, 2014) https://www.adn.com/commentary/article/democracy-not-dead-alaska-hb-77-now/2014/04/17/; Alexandra Gutierrez, Tribal Councils Express Opposition To Permitting Bill, APRN (Jan. 16, 2014), http://www.alaskapublic.org/2014/01/16/tribal-councils-express-opposition-to-permitting-bill/.

[75]Presentation by Wyn Menefee, Division Operations Manager, ADNR Div. Mines Land and Water (Jan. 17, 2014); H.B. 77, Bill History/Action for 28th Legislature http://www.legis.state.ak.us/basis/get_bill.asp?bill=HB%20%2077.

[76] Akiachak v. Jewell, 995 F.Supp.2d 7 (D.D.C. 2014), Akiachak v. Jewell, 2016 WL 3568092 (D.D.C. July 1, 2016); 25 C.F.R. § 151.1.

[77] Interior Solicitor's Opinion M-37053, Withdrawal of Solicitor Opinion M-37043, "Authority to Acquire Land into Trust in Alaska" Pending Review (June 29 2018).

[78] See Interior Solicitor's Opinion M-37055, Withdrawal of Solicitor's Opinion M-37029. "The Meaning of 'Under Federal Jurisdiction' for Purposes of the Indian Reorganization Act" (Mar. 9, 2020).

If Alaska tribes regain the ability to put land into trust, pros and cons must be considered before moving forward. If a tribe could acquire a large amount of land that covers area where tribe members conduct subsistence, trust status could be beneficial, as it would limit the state's control over land use and wildlife management and increase tribal control over the regulation of alcohol, domestic violence, and other health, safety, and welfare issues. But few tribes (aside from Elim) own significant amounts of land that be put into trust, and Native Corporations would not necessarily be willing to sell their land. Also, there would be additional oversight by the federal government, restrictions on alienation, and limitations on leasing without Secretarial approval. A tribe would need to have enough resources to acquire and manage the land.

NBITWC is not a tribe but could be in a good position to help Bering Straits Region tribes manage any land that they might put into trust.

3.5. Working with Native Corporations on land management

The Bering Strait Regional Corporation owns a large amount of land that was subject to the BSCRSAB Policies, though the Corporation has no jurisdiction over the land. **NBITWC could consider entering an agreement with this Corporation and with village corporations so that the corporations; land management would adhere to the BSCRAB Policies**. **Corporations might not agree if they are planning to allow industrial development on the land, or they may only agree to certain aspects of the Policies.**

An example of a management agreement between a tribe and a corporation is the Aug. 29, 2008 Memorandum of Agreement Between Ukpeagvik Inupiat Corporation And Native Village Of Barrow. The agreement limited access to UIC-owned land for hunting to UIC shareholders and NVB tribal members. UIC authorized NVB to help implement/enforce the agreement on UIC lands.

Another type of corporation-tribe agreement is a Tribal Conservation District, which is a partnership with the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) to provide for conservation of tribal lands in Alaska). Since most Alaska tribes do not own much land, the agreement needs to involve an Alaska Native Corporation. Once an agreement is reached, the District is then incorporated as a non-profit and eligible for funding from USDA and participation in a range of USDA programs beyond just land conservation.[79] For example, the Tyonek Tribal Conservation District was able to obtain $1.3 million in funding for a project to replace narrow culverts that blocked salmon passage under roads. The District does not have regulatory powers, as it is based on voluntary cooperation between stakeholders.

NBITWC could facilitate agreements between tribes and corporations and possibly with USDA to form a conservation district to garner funding.

[79] Peter, Angela and Kristine Harper, PowerPoint, Tribal Conservation Districts (on file with the author); see also Alaska Village Initiatives, Traditional Conservation Districts, http://aktca.org/how-to-form-a-tcd/

3.6. Agreements with Industry

This section describes how North Slope tribal organizations have been able to broker agreements with industry representatives to mitigate and avoid subsistence impacts. These agreements are not directly required by federal, state, or borough law. They might serve as models for NBITWC and Bering Strait tribes in other areas dealing with large-scale natural resource development.

3.6.1. Conflict Avoidance Agreement

In 1978, Northwest Alaska tribes with whaling traditions designated authority to AEWC to regulate whaling in coordination with the federal government.[80] AEWC started working with the oil and gas industry in the 1980s to address the immediate threats to human life posed by the industry's large vessels passing through waters occupied by small whaling boats.[81] AEWC's voluntary annual agreements with industry representatives have evolved significantly over time to cover issues such as pollution control.[82]

3.6.2. Oil Spill Contingency Mitigation Agreement

In the early 2000s, the North Slope Borough (NSB), AEWC, and ICAS developed a template for an Oil Spill Contingency Mitigation Agreement designed to provide emergency funding in the event that an oil spill reached the ocean and destroyed subsistence resources. The agreement requires the developer to put up a bond equivalent to the estimated costs of relocating subsistence hunters, transporting subsistence foods, and other likely expenses in the event of a catastrophic oil spill.[83] Some NSB authorizations have required development applicants to enter such agreements as a condition of approval,[84] though NSB has not consistently required these agreements in connection with the rezoning process. In some cases developers voluntarily signed agreements.

---

[80] These tribes include Gambell, Kivalina, Savoonga, Whales, and the Inupiat Community of the Arctic Slope, which has been delegated authority by the North Slope villages. See Concurrent Resolution of the Native Villages of Gambell, Kivalina, Savoonga, Wales, and the Inupiat Community of the Arctic Slope, March 26, 1978.

[81] Jessica S. Lefevre, A Pioneering Effort in the Design of Process and Law Supporting Integrated Arctic Ocean Management 43 ELR 10893 (2013), citing Cooperative Programs for The Beaufort Sea, Oil/Whalers Working Group (July 9, 1986). Signatories include Pete Woodson, Shell Western E&P Inc., Wayne Smith, Amoco Production Company, Frank Locascio, Geophysical Services, Inc., L.E. Bratos, Western Geophysical, Arnold Brower Jr., Chairman, Alaska Eskimo Whaling Commission, Darrel Kava, Secretary, Alaska Eskimo Whaling Commission, Nolan Solomon, Treasurer, Alaska Eskimo Whaling Commission, Thomas Napageak, Alaska Eskimo Whaling Commission.

[82] See 2012 Open Water Season Programmatic Conflict Avoidance Agreement (Mar. 1, 2012), available at http://www.nmfs.noaa.gov/pr/pdfs/permits/bp_openwater_caa2012.pdf, at § 108 (providing for meetings with subsistence hunters to discuss the timing and location of industrial activities); § 402(b) (notice of geophysical equipment testing); § 403 (monitoring plan for impacts on whales); § 503(a) (prohibiting waste discharge in some areas); § 203(b)(1) (providing for funding).

[83] *See, e.g.*, ExxonMobil Point Thomson Project, Oil Spill Contingency Mitigation Agreement, Part E (Nov. 17, 2009).

[84] *E.g.*, Planning Commission Resolution 2009-05 concerning the rezone for Beechy Point.

Following these models, a tribe or NBITWC could consider negotiating an agreement with industry or researchers operating in a defined area regarding issues such as the timing of operations, avoiding subsistence disturbance, and altitude restrictions for aircraft. Nothing obliges industry to enter into such an agreement, but once signed, the agreement would be binding.

3.7. Claiming Aboriginal Rights

Aboriginal subsistence hunting and fishing rights are part of "aboriginal title," the possessory rights that tribes retain by virtue of their use and occupancy for centuries or even millennia. There have been several court cases on the issue of whether an Alaska tribe can claim aboriginal title to parts of the ocean that have traditionally been used for hunting and fishing. In *Iñupiat Community of the Arctic Slope v. United States*,[85] the Ninth Circuit extended the effect of ANCSA to the use of sea ice many miles from shore. This suggests that it would be difficult for a tribe to claim exclusive sovereign rights to the outer continental shelf of the Arctic Ocean.[86] Still, a tribe may be able to claim non-exclusive rights over offshore subsistence resources.[87] Non-exclusive rights would probably mean that NOAA would have some rights to control fisheries and marine mammals and allocate resources in the claimed area among users.[88]

Native Village of Eyak v. Blank[89] provides guidance on what a tribe or group would have to prove to demonstrate non-exclusive rights. No Alaska tribe has tried this so far. Gambell and Savoonga, with their continuous occupation of St. Lawrence Island and the sea around it, could be in a good position to make pursue a claim. The tribes (perhaps through NBITWC) would need to be prepared to invest in anthropological research that could show a court that the *Native*

[85] 548 F.Supp. 182 (D. Alaska 1982), *aff'd on other grounds*, 746 F.2d 570 (9th Cir. 1984), *cert. denied*, 474 U.S. 820 (1985).

[86] *See also Eyak Native Village v. Daley*, 364 F.3d 1057 (9th Cir. 2004), upheld by *Native Village of Eyak v. Blank*, 688 F.3d 619 (9th Cir. 2012), *cert. denied* 134 S. Ct. 51(October 7, 2013) (holding that "the federal paramountcy doctrine" barred the Native Villages' aboriginal title claims to the OCS, including exclusive hunting and fishing rights); *North Slope Borough v. Andrus*, 642 F.2d at 611-12; *United States v. Rayonier, Inc.*, 627 F.2d 996, 1003 (9th Cir. 1980)

[87] In *Village of Gambell v. Hodel*, 869 F.2d 1273, 1278-80 (9th Cir. 1989), the Ninth Circuit held that ANCSA did not extinguish aboriginal claims to the OCS and left open the question of whether a tribe could assert "non-exclusive" subsistence rights in the OCS area.

[88] In *United States v. Washington* and other cases, the courts have interpreted treaty-reserved rights to be non-exclusive, and have therefore apportioned resource rights between tribal and non-tribal users. *See, e.g., United States v. Washington*, 384 F.Supp. 312 (W.D. Wash. 1974), *aff'd*, 520 F.2d 676 (9th Cir. 1975), *aff'd sub. nom., Washington v. Washington State Commercial Passenger Fishing Vessel Ass'n*, 443 U.S. 658 (1979). Such rights are also subject to regulation of seasons, manner of fishing, and size of take for purposes of conservation. *See, e.g., Puyallup Tribe v. Dep't of Game*, 391 U.S. 392 (1968).

[89] 688 F.3d 619 (9th Cir. 2012), certiorari denied by Native Vill. of Eyak v. Pritzker, 134 S. Ct. 51; 187 L. Ed. 2d 23 (2013).

Village of Eyak v. Blank criteria are met. The tribes could then draft a resolution asserting aboriginal title, shaped by what the research can support. The resolution could call on the federal government to enter into an agreement recognizing aboriginal rights and outlining a management scheme. The tribes could share the resolution with the federal government, including the State Department, NOAA, and FWS. The tribes could also work with the media and international organizations like the Arctic Circle participants to bring international attention to the issue.

It is likely that the Alaska Congressional delegation would oppose the move, similar to their opposition to the Executive Order on the Bering Sea Elders. That order was issued by President Obama[90] to limit offshore drilling and provide special consideration for Bering Straits traditional knowledge. Alaska's Congressional delegation opposed the order,[91] and the Trump administration overturned it. [92] Also, the case may not be successful in the courts, which may eliminate aboriginal title altogether.

In a best-case scenario, the federal government would recognize the authority and work with the tribe on some type of management agreement. If the federal government ignores the resolution, the tribe could consider other strategies for offshore co-management or file suit. This strategy is a long shot, and would only work for tribes, not NBITWC (though NBITWC could take the lead in making the claim).

3.8. Seeking Federal Designations for Important Areas

Since there is so much federal land in the former coastal district, NSWITC may consider working with federal agencies to provide federal protection to Areas Meriting Special Attention under the former BSCRMA Plan. This section gives some examples of federal protection. **The upside of such protections is that they are likely to last longer than those at lower levels of government, and federal money (rather than local or state money) will be used to maintain them. The downside is that such designations can be political, and generate opposition** from Republican leaders or possibly Native Corporations concerned about how designations may impede development, similar to what was done with the Bering Sea Elders executive order.

[90] 81 Fed. Reg. 90669

Executive Order 13754 of December 9, 2016

Northern Bering Sea Climate Resilience

[91] Bering Sea Elders condemn executive order

May 4th, 2017 | Shady Grove Oliver, Arctic Sounder
http://www.thearcticsounder.com/article/1718bering_sea_elders_condemn_executive_order

[92] 82 Fed. Reg. 20815

Executive Order 13795 of April 28, 2017

3.8.1. National Conservation Area

A National Conservation Area (NCA) is a permanent public land designation established by Congress to conserve land.[93] There is no federal act specifically providing for management of these areas-- the degree of protection depends on particular law that establishes the NCA. NCAs are typically established on BLM- managed land, although some have been proposed on lands managed by other agencies.[94] Unless prohibited by law, roads, logging, grazing, and motorized vehicles may occur within NCAs.

It is unlikely that the Alaska Congressional delegation would support a NCA, based on their belief that ANILCA prevents any more land from being withdrawn from the public domain into a protected status.[95] Of course, Congress has the power to change ANILCA whenever it wants, though it is unlikely that change would take place over the opposition of the Alaska Congressional delegation..

3.8.2. Monuments

A National Monument is a permanent public land designation established by the President under the Antiquities Act[96] or by the President with Congressional approval. Once the President has designated a monument, only Congress may "undesignate" it. The cases in which Congress has undesignated Monuments are relatively rare; and many of the acts undesignating Monuments have established some type of conservation unit (such as a National Park) in the same area.[97] The

---

[93] *See* Bureau of Land Management, U.S. Dep't of the Interior, National Conservation Areas and Similarly Designated Lands, http://www.blm.gov/wo/st/en/prog/blm_special_areas/NLCS/National_Conservation_Areas.html (last visited Sept. 27, 2014).

[94] *See, e.g.*, Craig Miller, *Another Try for California's Second National Conservation Area*, KQED SCIENCE (Apr. 26, 2013), *available at* http://science.kqed.org/quest/audio/another-try-for-californias-second-national-conservation-area/. Discussing the Berryessa Snow Mountain Conservation Area in California, consisting of lands managed by the Forest Service, the Bureau of Land Management, and the Bureau of Reclamation.

[95] The "no more" rule in ANILCA is based on ANILCA Section 101(d), which says "This Act provides sufficient protection for the national interest in the scenic, natural, cultural and environmental values on the public lands in Alaska … thus Congress believes that the need for future legislation designating new conservation system units, new national conservation areas, or new national recreation areas, has been obviated thereby."

Opponents of withdrawing more land also look to ANILCA Section 1326(a), which puts a specific limit on withdrawals of more than five thousand acres in Alaska. It requires the President or the Secretary to make such a withdrawal only by providing notice in the Federal Register and to both Houses of Congress. The withdrawal terminates "unless Congress passes a joint resolution of approval within one year after the notice of such withdrawal has been submitted to Congress."[95]

[96] 16 U.S.C. §§431-433 (2012).

[97] *See, e.g.*, Act of Aug. 3, 1950, Pub. L. No. 81-652, 64 Stat. 405 (1950) (abolishing Wheeler National Monument in Colorado and converting the area to a national forest); *see also* National Park Service, About "Abolished" National Monuments, http://www.nps.gov/archeology/sites/antiquities/abolished.htm (last updated Sept. 27, 2014).

Although ANILCA abolished the Alaska monuments designated by President Carter in 1978, it established each monument area as a National Park, Wildlife Refuge, and/or Wilderness, and it re-established two of the monuments. *See* 16 U.S.C. § 3209(a) (2012) (rescission of prior reservations and withdrawals); ANILCA §§ 201-203, 302, 503, 702.

degree of protection depends on the language in the designating act or presidential proclamation, as well as the laws governing the managing agency. Unless prohibited by the authorizing agency or the proclamation, roads, logging, grazing, and motorized vehicles may occur within Monuments. Again, Alaska's Congressional delegation is likely to argue that ANILCA prohibits withdrawal of more land, and withdrawal is unlikely to occur under the Trump administration. A future administration could interpret ANILCA to allow a Monument on land that is already "withdrawn" as part of the Alaska Maritime National Wildlife Refuges.[98]

3.8.3. ACECs

For the last five years, the Bureau of Land Management (BLM) has been developing a land use plan for an area in western Alaska that encompasses approximately 62.3 million acres of land, including 13.4 million acres managed by the BLM. The Bering Sea-Western Interior planning area includes all lands south of the Central Yukon watershed to the southern boundary of the Kuskokwim River watershed, and all lands west of Denali National Park and Preserve to the Bering Sea. Through the process, BLM can designate "Areas of Critical Environmental Concern" (ACECs) under the Federal Land Policy and Management Act [99] and limit development in these areas. ACECs have become politically charged, and it is unlikely that a plan issued by the Trump administration would designate ACECs. If a different administration comes in prior to (or even after) plan completion, it may restart the planning process and allow for ACECs. NBITWC could be helpful in providing comments to BLM or in supporting tribes who serve as cooperating agencies with BLM in a future planning process.

3.8.4. Traditional Cultural Properties

Section D of the enforceable policies for the former BSCRMA Plan provided protection for many cultural resource areas that are now without much protection. NBITWC could consider working with tribes to designate some or all of these areas as Traditional Cultural Properties (TCPs) to highlight their cultural and historic significance. A TCP found eligible for listing on the National Register of Historic Places ("the Register") is entitled to consideration under the National Historic Preservation Act of 1966 (NHPA) [100] in federal decisions that may impact historic or cultural aspects of the place.

---

[98] Case law suggests that layering one form of public land protection (i.e., a reservation) over another form (i.e., a withdrawal) does not effectuate a "second withdrawal" of previously withdrawn land unless this intent is stated in the proclamation. See *Tulare County v. Bush* (306 F.3d 1138 (D.C. Cir. 2002)) (the Giant Sequoia National Monument did not unlawfully withdraw national forest land in violation of the National Forest Management Act, since the proclamation specifically stated that it did not revoke any existing withdrawal, reservation, or appropriation); *Cameron v. U.S.* (252 U.S. 450 (1920)) (the Grand Canyon National Monument could be established in a forest reserve).

[99] 43 U.S.C. § 1711(a).

[100] PL 89-665, 80 Stat. 915 (1966), 54 U.S.C. 100101, et seq.

A TCP designation does not prohibit development, but it requires federal agencies to communicate with tribes and consider mitigation measures when planning activities that could affect cultural resources.[101] A property may be designated as a TCP by a tribe or any other entity. TCPs can be designated anywhere—on federal or non-federal land.

A TCP designation can provide some measure of protection for what are traditionally thought of as a cultural resource (like a sod house) or something much bigger, like an entire landscape[102] or perhaps even the range of an animal. [103] A tribe can designate a collection of TCPs as a Traditional Cultural District. [104]

NPS, the agency responsible for listing TCPs on the Register, determines the eligibility for listing.[105] It is important to remember that a TCP may be eligible for listing in the Register—and get many of the benefits of listing—without ever being formally nominated or listed on the Register and revealing the exact location to the public.[106]

I have been working with Allakaket and Alatna Tribes for the past two years to get recognition of their TCPs to avoid road development or mining through these areas. The process has been challenging because of the need for concurrence by the State Historic Preservation Officer (housed in the Alaska Department of Natural Resources), which has impeded recognition. Also, the Native Corporations did not cooperate as they feared that no development would be allowed on their land (though this is not accurate).Still, BLM has recognized the TCPs as part of the Central Yukon plan (which will serve a similar purpose as the Bering Sea Western Interior plan), so there will be some stipulations in the plan to avoid development on the TCPs.

---

[101] *See* 54 U.S.C. 306108, 302706.

[102] *See* 54 U.S.C. 302101

[103] *See* Dugong v. Rumsfeld, No. C 03-4350, 2005 WL 522106 (N.D. Cal. Mar. 1, 2005) (observing that the presence of culturally significant animals had been the basis for several determinations of eligibility, including several animal habitats important in Native American tribal histories, and that the U.S. National Register included three wildlife refuges culturally associated with certain species).

[104] Patricia L. Parker and Thomas F. King, Guidelines for Evaluating and Documenting Traditional Cultural Properties, 11, U.S. Department of the Interior (1998), *available at* https://www.nps.gov/subjects/nationalregister/upload/NRB38-Completeweb.pdf.

[105] NPS's eligibility criteria are at 36 C.F.R. § 60.4. In 2012, NPS launched a process to update its guidelines on identifying, evaluating, and documenting Traditional Cultural Properties and Native American Landscape ("Bulletin No. 38). Comments regarding the existing guidelines and the need for new guidelines can be viewed at National Register of Historic Places Program: Traditional Cultural Properties Request for Comments http://www.nps.gov/nr/publications/guidance/TCP_comments.htm#extension. The project appears to have stalled, with no revision released as of this writing.

[106] 54 U.S.C. 302706; 36 C.F.R. § 800.2(c)(2). *See* NHPA § 101(e)(3).Subsection A explains that the Secretary (through the National Park Service) shall administer a program of direct grants for the preservation of properties included on the National Register. Subsection B states that the Secretary may also make grants or loans to Indian tribes and cultural organizations "for the preservation of their cultural heritage"—for this subsection there is no requirement that property be listed on the Register.

NBITWC could work with tribes either through an agency planning process or on its own to get recognition for Bering Straits TCPs. The process would require anthropological research as well as traditional knowledge from local elders and hunters to justify the particular locations and boundaries.

3.9. Joint Hazard Mitigation Plan

The geophysical hazards in Section E of the Enforceable Policies of the former BSCRMA Plan demonstrates that permafrost melt, erosion, flooding, and other hazards related to climate change were an issue as far back as the 1980s. Now they are even more of a problem. If NBWITC wants to address this aspect of the former BSCRMA Plan, **the Bering Straits tribes could join together to make a joint HMP. A HMP does not have the force of law that the enforceable policies did, but it would provide guidance and could allow for funding for projects to mitigate the hazards.** Many of the communities in the region already have HMPs, though they may be affiliated with the cities rather than the tribes. These plans expire after five years, and the State of Alaska typically provides a contractor to work with the cities for free to update the plans.

NBWITC could get a grant from Federal Emergency Management Agency (FEMA) to coordinate all of the tribes and cities in the region (with the help of a consultant plan drafter) to consider adopting a joint plan. All of the tribes and cities who participated in the plan would then be eligible to apply for FEMA funding to carry out projects in the plan.

The Federal Emergency Management Agency (FEMA) has two Hazard Mitigation programs that provide project funding: the post-disaster Hazard Mitigation Grant Program (HMGP) and the Building Resilient Infrastructure and Communities Program (BRIC), which replaced the former Pre-Disaster Mitigation Program (PDM). These programs can fund measures designed to prevent future disasters, such as building elevations, relocations, and buyouts. Federally recognized tribes can apply for funding either directly as applicants or indirectly as subapplicants through states.[107] When applying directly to FEMA, there is potential for greater funding, but there is also a match requirement.[108] HMGP funding is typically much greater than PDM funding, since it is based on a percentage of funds spent on a recent federal disaster declaration within the state.[109] BRIC funding will be a little bigger than PDM funding (up to 6% of all US funds spent on the previous year's disasters)[110] but smaller than HMGP.

[107] 42 U.S.C. 5170(b); 44 C.F.R. 201.7. A tribe can only apply directly to FEMA for HMGP if the tribe itself has had a presidential disaster declaration. 42 U.S.C. § 5170c. As of this writing, no ANV has succeeded in getting a presidential disaster declaration.

[108] Both HMGP and PDM require a 25% match, or 10% for small and impoverished communities (for which the Bering Sea villages would qualify). 42 U.S.C. 5170c(a); 44 C.F.R. 206.432. 42 U.S. Code § 5133(h)

[109] 42 U.S.C. 5170c(a); 44 C.F.R. 206.432.

[110] 42 U.S.C. § 5133(i)(1).

3.10. Lobbying to bring back ACMP

Alongside of all of the above strategies, NBITWC could consider hiring a lobbyist or having its own members educate state legislators about the benefits of ACMP. There are limits to the amount of direct lobbying a 501(c)(3) member can do.[111] Direct lobbying means any communications between members and legislators, legislative staff or other government officials that express a view on the merits of a specific legislative proposal. Unless and until there is a specific bill to bring back ACMP, conversations with legislators would not fall in the category of direct lobbying. Once there is bill, NBITWC could still provide factual information on ACMP without this being considered "lobbying."

There is no legal limit on the amount of lobbying that tribes can do, though, as for NBITWC, lobbying can be very expensive and there is no guaranteed success. It is not clear where funding for lobbying would come from, since most grants indicate that they may not be used to fund lobbying. Regardless, **members of tribes and NBITWC flying to Anchorage and Juneau for conferences and other purposes can always plan for meetings with legislators to provide factual information on ACMP.**

4. Additional Funding Sources

Funding issues related to each strategy are discussed above. This section provides information on additional sources of funding, namely grants that NBITWC could apply for to do more planning or carry out strategies. Most, including those offered by EPA and BIA, are for planning rather than actually carrying out strategies. FEMA and FWS are among the few that offer grants for implementation. I have left out programs that are only for states (not tribes or non-profits). I also left out the Denali Commission (since this is mostly infrastructure related) and The Rasmuson Foundation (which is currently only focusing on COVID-19).

4.1. Planning and Government Capacity Building

4.1.1. BIA Resilience

NBITWC already received funding from the Bureau of Indian Affairs (BIA) Program to Support Tribal Resilience and Ocean and Coastal Management and Planning Grants Program[112] FY 2018,

[111] Under 26 U.S.C. 4911(c)(2), the maximum amount that can be spent on annual lobbying is the lesser of $100,000 or the sum of 20% of the first $500,000 plus 15% of the second $500,000 plus 10% of the third $500,000 plus 5% of the remainder of such expenditures, with a cap of $1 million in annual lobbying expenses. On top of this cap, there is a further restriction that an organization may not spend more than 25% of its permitted lobbying total on grassroots lobbying (lobbying where you ask the public to call their legislators to take action on a bill).

It is important to note that lobbying expenditures include, among other things, the value of the allocable portion of staff time attributable to lobbying; such salary allocations must be substantiated through the use of time records (see below).

[112] BIA, Tribal Resilience Program (2020) https://www.bia.gov/bia/ots/tribal-resilience-program

Category 4, Ocean and Coastal Management Planning. These grants are offered annually and generally provide funding of no more than $100,000. No match is required. This funding paid for this report, a planning process, and a vulnerability assessment. A future grant could pay for meetings among Bering Strait stakeholders to pick which strategies to pursue. It could also pay for planning efforts to carry out a particular strategy (i.e., planning for co-management), but would not pay for implementing a strategy (i.e., data collection for co-management).

4.1.2. Wetland Program Development Grants

The Environmental Protection Agency (EPA) offers annual Wetland Program Development Grants[113] to assist tribal and intertribal entities in developing or refining programs to protect, manage, and restore wetlands. Grants are usually $100,000 or less and require a 25% match from the applicant. Mapping and monitoring are allowed, but other tasks related to carrying out management are not. Ninilchik Village previously got one of these grants for mapping or bird habitat on the Kenai.

This grant could be used to develop a protection program for Areas Meriting Special Attention to the extent these areas are considered wetlands. It could also be used to make sure that a joint HMP provides for wetland management. It is not clear that NBITWC would be classified as an intertribal organization, in which case Kawerak or a tribe might need to apply.

4.1.3. Alaska Conservation Fund

The Discovery Grants program[114] provides very small grant awards ($500 to $2,000) to Alaska-based non-profits in order to build a conservation movement. This funding might be used to build support for ACMP. Applications are accepted on an ongoing basis and reviewed every two months.

4.2. Implementing Land and Wildlife Protections

4.2.1. Bureau of Reclamation Cooperative Watershed Management Program

The Bureau of Reclamation Cooperative Watershed Management Program[115] provides grants to tribes and nonprofits for planning and carrying out watershed protection projects. Phase I grants

[113] EPA, Wetland Program Development Grants and EPA Wetlands Grant Coordinators (2020) https://www.epa.gov/wetlands/wetland-program-development-grants-and-epa-wetlands-grant-coordinators

[114] Alaska Conservation Foundation, Grant Opportunities (2020) https://alaskaconservation.org/community-resources/grant-opportunities/

[115] Bureau of Reclamation, Water and Energy Efficiency Grants (2020) https://www.usbr.gov/watersmart/cwmp/#:~:text=The%20Cooperative%20Watershed%20Management%20Program,address%20their%20water%20management%20needs.

for planning may be up to $100,000 per year for up to two years with no cost share. In 2020, the Cook Inletkeeper group in Kenai got a grant to develop a watershed restoration plan.

Phase II grants for implementation of watershed management projects are for up to $300,000 per project but require 50% match.

4.2.2. Tribal Wildlife Grants

FWS offers annual Tribal Wildlife Grants[116] of up to $200,000 to support the development and implementation of programs for the benefit of wildlife and their habitats and species of Tribal cultural or traditional importance, including species that are not hunted or fished. A match is not required but projects that propose matches score higher. Funding can be used for planning conservation projects (including mapping and studies) or for carrying them out (including restoring habitat and building fish passages).

4.2.3. National Fish and Wildlife Foundation

National Fish and Wildlife Foundation (NFWF) provides funding on a competitive basis to projects that sustain, restore and enhance fish, wildlife and plants, and their habitats.

- The Alaska Fish and Wildlife Fund supports projects in focus areas (which included the Bering Sea in 2020), including those to reducing the risk of vessel disturbance, oil spill contamination, and/or lethal strikes for marine mammals and seabirds from shipping; protecting key species; and collecting data to support instream flows.[117] Grants may be between $50,000 and $150,000.
- The Resilient Communities program provides for grants from $100,000 to $500,000 to help communities build resilience through a range of programs, including conservation of wetlands.[118]
- The National Coastal Resilience Fund provides grants averaging $125,000 for conservation projects that restore or expand natural features such as coastal marshes and wetlands, and for developing coastal resilience plans.[119]

Tribes and non-profits are eligible to apply. The downside to this grant is that it requires a non-federal match of at least 100%, so if you want $50,000, you have to find at least $50,000 from someone else. The upside is that the match can include staff and volunteer time.

[116] FWS, Tribal Wildlife Grant Program - Overview (2018) https://www.fws.gov/wsfrprograms/Subpages/GrantPrograms/TWG/TWG.htm

[117] NFWF, Alaska Fish and Wildlife Fund (2020) https://www.nfwf.org/programs/alaska-fish-and-wildlife-fund

[118] NFWF, Resilient Communities Program (2020) https://www.nfwf.org/programs/resilient-communities-program

[119] NFWF, Coastal Resilience Program (2020) https://www.nfwf.org/programs/national-coastal-resilience-fund

In 2019, Shaktoolik got $1 million from the foundation to build a coastal berm to protect the spit of land where the village is located. Shaktoolik provided a $5 million from other sources.

4.2.4. North American Wetlands Conservation Act (NAWCA) grants

The North American Wetlands Conservation Act (NAWCA) grants are supposed to increase bird populations and wetland habitat, while supporting local economies and American traditions such as hunting and fishing. There a two grant options, the standard one (generally up to $1 million) and the Small Grants Program application process (up to $100,000). It is not clear who exactly is eligible to apply for this grant (tribes or non-profits). The good part of this grant is that it can be used to buy land you are trying to conserve/restore, or to carry out restoration projects.

The downside of this grant is, as the website says, "Grant applications take a great deal of time and effort to prepare"[120] and, like the NFWF grant, this would require a match of at least 100%.

5. Conclusion

I recommend that NBITWC pick around five of these strategies and hold meetings with NBITWC tribes and others in the Bering Straits region to decide which of the five strategies to pursue. Another BIA Resilience grant or a similar grant could fund this planning process.

The political climate (i.e., the state and federal administrations and the Alaska Congressional delegation), relationships between tribes and corporations in the region, likelihood of major industrial development in the near future, and willingness to invest money in grantwriters or otherwise pursue funding will be the greatest determinants of which strategy to pick. If major development or ships stopping in the region is imminent, or there is substantial commercial fishing by non-locals that can be taxed, and there is agreement among tribes in the region, then borough formation may be valuable. A home rule borough could enact strong zoning codes and easily fund a team of grant-writers and lobbyists to pursue other strategies (including lobbying). Land into trust could provide similar control, but it would be difficult to purchase all of the land needed to make this a reality.

If there is relatively little funding and agreement throughout the region, then NBITWC may want to start small, working on resolutions and small agreements between tribes, with Native Corporations, and with potential developers about how to protect land

There are many grants available to plan for strategies and few to carry them out. It could be helpful to pursue some of the same funders as YRITWC. Thus, borough formation and

[120] FWS (2020), How to Apply for a NAWCA Grant

agreements where agencies, corporations, and industry agree to provide regular funding over time can be more sustainable than organic co-management.

Regardless of which strategies are selected, it could be helpful to start working on a joint hazard mitigation plan to address climate change issues that now threaten coastal management. It is easy to get funding to pay for the initial plan-writing. Grants from FEMA to carry out projects are expensive to apply for and must relate to natural hazards, but offer the potential for much more funding than other strategies.