Joint Session Materials

JOINT FEDERAL SUBSISTENCE REGIONAL ADVISORY COUNCILS

Egan Center
Anchorage, Alaska
March 7, 8:30 a.m. – 5:30 p.m.
March 8, 8:30 a.m. – 12:30 p.m.

TELECONFERENCE: call the toll free number: 1-888-455-5897, then when prompted enter the passcode: 3344290

PUBLIC COMMENTS: As this is not an action meeting, there will not be a public comment period for any agenda items during the joint session. Please join the Councils at their individual meetings scheduled for March 9-11, as noted on the overall meeting schedule, to provide public comments on their agenda items.

PLEASE NOTE: These are estimated times and the agenda is subject to change. Contact staff for the current schedule. Evening sessions are at the call of the chair.

AGENDA

The Co-Chairs of this session will be Molly Chythlook, Chair, Bristol Bay Subsistence Regional Advisory Council and Jack Reakoff, Chair, Western Interior Alaska Subsistence Regional Advisory Council

1. Welcome and Invocation (*Lee Stephan, Eklutna Village*)

2. Opening Remarks

3. Call to Order

4. Regional Reports

A delegate from each of the regions will provide an update on subsistence uses and issues for that region. Each region is limited to ten minutes.

5. Discussion

a. Salmon and Halibut Bycatch Report (*North Pacific Fisheries Management Council*)

b. Current Trends in Impacts to Subsistence

c. Youth Engagement in Subsistence Management

d. Status of Secretarial Review (*Amee Howard & Theo Matuskowitz, OSM*)

6. Agency Reports

b. Office of Subsistence Management (*Gene Peltola, Jr., Assistant Regional Director*)

c. Federal Subsistence Board (*Tim Towarak, Chair*)

7. Awards and Recognition

8. Closing Comments

9. Adjorn

To teleconference into the meeting, call the toll free number: 1-888-455-5897, then when prompted enter the passcode: 3344290

Reasonable Accommodations
The Federal Subsistence Board is committed to providing access to this meeting for all participants. Please direct all requests for sign language interpreting services, closed captioning, or other accommodation needs to Carl Johnson, 907-786-3676, carl_johnson@fws.gov, or 800-877-8339 (TTY), by close of business on February 25, 2016.

Climate Change and Subsistence

What It Means to Alaskans and How We Can Adapt

How does climate change affect subsistence?

Rural Alaskans harvest more of their food from the sea and land than other Americans. Subsistence activities provide important cultural connections to nature and community, as well as nourishment. The warming climate is causing a host of environmental changes that affect Alaska's subsistence culture.

What are Alaskans observing?

- Ice covers less area and is thinner on seas, rivers, and lakes.
- Ice cellars (underground freezers in permafrost) are thawing.
- More wildfires are changing wild game forage and habitat.
- Animal abundance, distribution, and behavior are changing.
- Permafrost is thawing.
- The health of some subsistence fish, birds, and mammals appears compromised.
- Shrubs and trees are expanding northward.

What are scientists telling us?

- The average temperature in the Arctic has increased by 3 degrees F in the last century, and in some parts of Alaska by as much as 5 degrees F.
- A warmer climate is altering the distribution and abundance of fish, birds, mammals, and plants that subsistence users need.

U.S. FISH AND WILDLIFE SERVICE

Subsistence fish camp on the Koyukuk River, Alaska.

How is climate change affecting us now, and what can we expect in the future?

- Decreased ice cover makes winter subsistence activities more difficult, expensive, and dangerous. Ice fishing opportunities are fewer.
- Traditional subsistence resources have become harder to find and often require longer travel and greater expense.
- In some cases new subsistence resources are becoming available. In other cases nuisance animals or predators that compete with people have hampered the success of subsistence activities.
- Thawing permafrost reduces tundra access, and makes summer travel harder and more destructive to the environment.

What is causing climate change?

Atmospheric scientists say that the worldwide use of fossil fuels (coal, oil, natural gas) releases gases into the air that trap heat, which would otherwise escape into space. Some scientists also point to the earth's natural climate cycle as a factor in increasing atmospheric temperatures. Though there remains some debate about the causes, scientists agree that the earth is warming.

What can subsistence users do to halt or reverse these changes?

Individuals can't do much to reverse global trends on their own, but they can join a worldwide effort to reduce use of fossil fuels. Even if this happens it will be decades before results are apparent.

How can subsistence users adapt?

- Be flexible with subsistence harvest time and effort.
- Hold local discussions on how changing temperatures and ice affect the family and community. Encourage elders to offer suggestions on how to adapt.
- Take advantage of new subsistence opportunities as they present themselves.
- Be open to utilizing new species coming to the area that usually have not been part of the traditional diet.
- Meet with subsistence hunters, fishermen, and gatherers from other parts of the state to learn how they use the biological resources that are becoming more abundant and how they have dealt with scarcity.
- Engage elders to teach children and youth the values of adaptability, and to temper expectation with appreciation of the resources that are available.
- Expand use of traditional ecological knowledge and community-based monitoring to track changes and develop adaptation strategies.
- Increase use of co-management bodies, including federal, state, local, and regional rural representation, that can respond rapidly to setting seasons and bag limits on fish and wildlife.
- Make full use of available federal, state, and local agency assistance to help locate and fully utilize subsistence foods, and push for resource management plans that increase subsistence access to the available resources.

For more information or assistance

Climate Change Adaptation, Alaska Sea Grant Marine Advisory Program
http://www.marineadvisory.org/climate

Alaska Center for Climate Assessment and Policy (ACCAP)
http://ine.uaf.edu/accap/alaska_arctic.html

Alaska Department of Fish and Game, Division of Subsistence
http://www.subsistence.adfg.state.ak.us

Federal Subsistence Board
http://alaska.fws.gov/asm/board.cfml

Community temperature charts, Scenarios Network for Alaska Planning
http://www.snap.uaf.edu/community-charts

U.S. Fish and Wildlife Service, Office of Subsistence Management
http://alaska.fws.gov/asm/osm.cfml

This Alaska Sea Grant Marine Advisory Program (MAP) project is supported by the Alaska Center for Climate Assessment and Policy (ACCAP). MAP is a statewide outreach and technical assistance program that helps Alaskans sustain economic development, traditional cultural uses, and conservation of marine and coastal resources. ACCAP's mission is to assess the socioeconomic and biophysical impacts of climate variability in Alaska, make this information available to local and regional decision-makers, and improve the ability of Alaskans to adapt to a changing climate.

Sea Grant Alaska

ACCAP Alaska Center for Climate Assessment & Policy

UAF University of Alaska Fairbanks School of Fisheries and Ocean Sciences
America's Arctic University

Fisheries Effects

What They Are Now, and May Be in the Future

As the earth's atmospheric climate changes, so does that of the oceans. The average temperature in Alaska has increased about 3°F since 1949, and the temperature of the sea is rising about a tenth of a degree per decade. Thermal changes in the atmosphere alter wind patterns that influence oceanic current patterns. Effects on fish and shellfish could be as dramatic as anything experienced on land. Changes will include fish and shellfish **distribution** and **abundance**; some changes will benefit humans who depend on those resources, and others will be detrimental. Changes already have begun and effects already are well documented.

How does climate change affect fish and shellfish?

Each species has its own optimal temperature range and will do poorly if temperatures exceed or fall below that range, due to:

- Elevated water temperature in the ocean, and in rearing streams (salmon).
- Faster egg incubation and earlier hatch timing for the young of many fish and shellfish.
- Changes in circulation patterns of ocean currents that distribute larvae and food.
- Changes in abundance of zooplankton, forage fish stocks, and other food sources.
- Disease and other environmental stressors.
- Increases or decreases in abundance of competing species and of predators.


TERRY JOHNSON

Fish stocks are advancing northward, possibly creating opportunities for commercial fisheries.

- Increasing "acidification" of the seas. (Not caused by temperature change but by elevated dissolved carbon dioxide.)

Fish stocks in a warming ocean may adjust by extending their range to the north, and several species of commercially valuable fish and shellfish in Alaska waters already have done so. Other responses are to abandon surface or nearshore waters in favor of deeper, colder regions.

However, there are upper limits to an organism's ability to tolerate higher temperatures. Salmon, for example, appear unable to survive if stream temperatures exceed 20°C (68°F) for extended periods, and in recent years key Kenai Peninsula streams have exceeded this maximum. Stream temperature appears to be the factor that prevents the existence of viable sockeye spawning stocks south of the Columbia River, and has caused pre-spawning mortality of sockeye adults returning to the Fraser River in British Columbia.

Changing currents may take eggs or young fish into regions of better or poorer rearing conditions. Likewise, planktonic (drifting) or small free-swimming prey may be swept to, or from, the reach of rearing fish. Many kinds of prey, from microscopic zooplankton to large forage fish, also are affected by changes in temperature and circulation. For example, in the Bering Sea, an early ice retreat means a later phytoplankton bloom in temperature-stratified water that tends to favor production of organisms that live up in the water column rather than on the bottom. However, if water is too warm and the bloom is too late it produces smaller zooplankton than are preferred by pollock.

Many disease organisms prosper as temperatures rise. A few years ago king salmon in the Yukon River suffered an epidemic of *Ichthyophonus* infections when river temperatures increased 7°F above normal.

Warming sea temperatures are associated with increased competition for food and with increased predation from species that normally do not flourish in the area. For example, Pacific and jack mackerel, which are both competitors with and predators on juvenile salmon, have extended their range north from California to southeast Alaska in recent warm years.

Short-term climate variability

The atmosphere and oceans are known for short-term dramatic weather, and an individual warm year is not global warming. A slow, steady increase in temperatures with large variability is true climate change. The ocean is affected by alternating cooler and warmer periods in a 3 to 7

year pattern known as El Niño-Southern Oscillation (ENSO). A similar alternating pattern, but on a frequency of 10 to 30 years, is the Pacific Decadal Oscillation. The PDO is correlated with dramatic changes in the marine ecosystem, but a "regime shift" to a warmer PDO phase is not the same as a long-term increase in ocean temperatures associated with global warming. However, changes to the ocean food web that occur during warm PDO phases provide indications of what to expect in a future of long-term warmer seas.

What Alaskans are observing

- Non-native species are appearing in Alaska waters with increasing frequency, including Pacific white-sided dolphins, albacore tuna, ocean sunfish, and subtropical sharks.
- Algal blooms have caused sickness in people and have triggered massive die-offs of seabirds.
- Polar ice cap thickness has dramatically decreased.
- After the last major PDO regime shift to a warmer phase, cod and pollock stocks surged while shrimp and many crab stocks crashed. Cod are major predators on crabs and shrimp. Alaska salmon boomed. But in exceptionally warm years pollock recruitment to the fishery has decreased.
- Biomasses of yellowfin sole and predatory arrowtooth flounder have increased and are advancing northward in the Bering Sea.

What to expect for Alaska's fisheries in a warmer ocean future

- Fish and shellfish stocks will continue to advance northward, possibly creating opportunities for commercial fisheries in Alaska's Arctic.
- While salmon may advance to the north, some stocks such as on the Kenai Peninsula may decline due to thermal stress in streams.
- During exceptionally warm years pollock recruitment to the fishery in the Bering Sea may decrease.
- Invasive species may decimate some stocks of commercially important shellfish and farmed shellfish. Harmful algal blooms, parasites, and diseases will occur more frequently.
- Local stocks may suffer more vigorous predation by invasive fish from temperate waters, while valuable temperate species such as albacore may become reliably available.

How can Alaskans adapt?

The only way to reverse climate change is to implement measures to decrease use of fossil fuels and this approach will take a long time. Meanwhile, people and communities dependent on fisheries resources can adapt by:

- Supporting adaptive resource management measures, and demanding that climate-related changes to the environment be considered in drafting management plans.
- Assessing their own business vulnerabilities to climate-related shifts in resource abundance and distribution and building overall resilience to changing environmental, economic, and regulatory conditions.

For more information or assistance

Climate Change Adaptation, Alaska Sea Grant Marine Advisory Program
http://www.marineadvisory.org/climate

Alaska Center for Climate Assessment and Policy (ACCAP)
http://ine.uaf.edu/accap/alaska_arctic.html

Alaska Climate Change Impact Mitigation Program, Division of Community and Regional Affairs (DCRA)
http://www.commerce.state.ak.us/dcra/ACCIMP.htm

Bering Sea yields fatter plankton, changes in pollock diet
http://www.sfos.uaf.edu/news/story/?ni=352

Changing Climate – Changing Alaska's Fisheries?
http://seagrant.uaf.edu/bookstore/pubs/M-90.html

Alaska Department of Fish and Game Climate Change Strategy
www.adfg.alaska.gov/static/lands/ecosystems/pdfs/climatechangestrategy.pdf

What Does Climate Change Mean for Alaska's Fisheries?
http://www.sfos.uaf.edu/news/2007/KruseScienceforAlaska.pdf

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Species Shifts

What They Mean for Alaskans, and How We Can Adapt

Alaska's environment is changing, in part due to global climate forces, and the mix of species that inhabit our seas and lands is changing along with it. Some changes are advantageous to people who live here, and others are detrimental. A few species shifts already are occurring and have been noted by scientists and by the rural people who live and work closest to nature.

What species shifts are anticipated?

Endemic (naturally occurring) species can change in **abundance** or **distribution**. That means there may be more or fewer of them, and they can extend their range into areas where they were not previously common or were entirely absent.

A warming climate may allow a species to becomes more abundant because of **greater food availability**, **less winterkill**, or other biological factors. Examples are salmon and the bears that feed on them, both of which have increased in abundance with an oceanic warming trend that began in the mid-1970s. However, there can be too much of a good thing, and sometimes a population explosion can have detrimental results, such as when toxic algae **bloom** or jellyfish numbers increase to the point that they clog fishermen's nets and decimate larvae of commercially valuable species.

A stock that is at the southern fringe of the species' preferred habitat, or is sensitive to consequences of temperature changes, can become less abundant. While a warming sea has boosted cod and pollock numbers, for example, it has had disastrous consequences for crab and shrimp, in part due to **predation** by cod and pollock.

A major consequence of changing temperature regimes is the arrival of non-native or **invasive species**, which can arrive in at least three ways. They can:

- **spread naturally** through the environment by walking, flying on their own wings, or drifting with the currents;
- **"hitchhike"** in ballast water, on boat hulls, on the soles of wading boots, in vehicles, or as seeds clinging to hiking boots and outdoor clothing; or
- be **intentionally introduced** (transported) by people who want them for sport fishing or hunting, natural pest control, or aesthetic addition to the landscape.

The climate link is not in how invasives arrive, it's whether they survive and flourish. If an invasive encounters a hostile environment it will soon perish, but if conditions are good it can soon breed an invasive population. Some invasives, like certain songbirds, seem benign, but even so the newly arrived species likely is competing with and possibly displacing a previously existing one. Others, like the European green crab, could be disastrous for Alaska's shellfish industries if they become established.

What are Alaskans observing?

Increasing abundance: salmon, cod, pollock, yellowfin sole, arrowtooth flounder, and many other fishes became more abundant following an oceanic "regime shift" in the late 1970s that warmed the ocean by about one degree. Many terrestrial animals, including bears, beavers, caribou, and moose likewise experienced

NOAA ALASKA FISHERIES SCIENCE CENTER

A warming sea has boosted pollock numbers in Alaska.

population increases due to more food, less winterkill, or other factors.

Decreasing abundance: shrimp, crabs, and several species of pelagic forage fish and the seabirds that depended on them went into decline, as did the Steller sea lion in western Alaska waters.

Note: the oceanic regime shift of the late 1970s was not global warming, but it was the warm phase of a multi-decadal cycle, called the Pacific Decadal Oscillation. However, the slightly elevated sea temperatures it brought are indicative of the effects of a warming climate. A long-term trend of increasing air and sea temperatures is masked by regime shifts.

Range extension: Many fish species appear to be extending their range northward during warm years, including salmon, pollock, and some crabs. Tuna and other subtropical fish species show up more frequently in Alaska waters. Beavers are moving north, causing public health concerns and depriving residents of access to traditional skiff travel routes due to their dams. Moose are moving north, becoming a new food resource in some remote western and northern Alaska communities where they had been unavailable. Woody shrubs are advancing to the north and higher up mountain slopes, providing food for moose but displacing vegetation required by caribou. Various songbirds are showing up in Alaska where they previously were rare or entirely unknown.

Other changes in range or abundance: walrus, several kinds of seals, and polar bears have shown changes in location, and in some cases abundance, related to climate-induced decreases in sea ice.

Invasive species: Several species of invasive tunicates (marine invertebrates known as sea squirts) have been identified in southeast Alaska and Prince William Sound. If they spread they could foul aquaculture gear. More than 160 species of invasive plants have taken root in the state, including purple loosestrife, yellow toadflax, and orange hawkweed. If they add color to the Alaska landscape, they also displace native plants, and some are toxic to native wildlife. Atlantic salmon, escaped from net-pens in Washington or British Columbia, are caught in Alaska. Northern pike, which decimate trout and salmon populations, have taken hold in several southcentral Alaska water systems, probably purposefully and illegally introduced by anglers. While none of these are a direct result of climate change itself, a more agreeable marine and aquatic environment allows some Alaska waters to support introduced populations.

For more information or assistance

Climate Change Adaptation, Alaska Sea Grant Marine Advisory Program
http://www.marineadvisory.org/climate

Alaska Center for Climate Assessment and Policy (ACCAP)
http://ine.uaf.edu/accap/alaska_arctic.html

Ecological Impacts of Climate Change – National Academies Press
www.nap.edu/catalog/12491.html

Protecting Alaska's Valuable Natural Resources from Marine Invaders
www.alaskasealife.org/New/research/mis_documents/Brochures/AK_Marine_Invaders.pdf

Invasive Species in Alaska – Defenders of Wildlife
www.defenders.org/resources/publications/invasives/alaska.pdf

Smithsonian scientists to help identify and eradicate invasive species in Alaska waters
http://smithsonianscience.org/2010/12/smithsonian-scientists-help-identify-and-eradicate-marine-invasive-species-in-Alaska

Invasive Species: state resources – Alaska
www.invasivespeciesinfo.gov/unitedstates/ak.shtml

How can Alaskans adapt to species shifts?

- Fishermen (commercial, sport, subsistence, and personal use) may have to adjust their harvesting expectations to account for decreased (or increased) availability. Hunters may find they have more moose and fewer caribou to harvest. Harvesters of all kinds may have to travel farther or shift their focus on different target species. Each species is a different story and the key is to be adaptive.
- Support research on species shifts and invasive species. Never release a non-native species into the wild. Participate in local monitoring programs. Support adaptive management policies.

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The Aleutian-Bering Climate Vulnerability Assessment

Final Report

January, 2016

edited by Aaron Poe, Thomas Van Pelt, and Jeremy Littell

Funding provided by:

Aleutian and Bering Sea Islands Landscape Conservation Cooperative

DOI Alaska Climate Science Center

Alaska Ocean Observing System

Suggested citation:

Poe, A., Van Pelt, T.I., and J. Littell, 2015. The Aleutian-Bering Climate Vulnerability Assessment. Final report. ABSILCC, Anchorage, Alaska. 151 pp.

EXECUTIVE SUMMARY

Recent efforts to develop downscaled climate projections for the Bering Sea and Aleutians created an opportunity to better assess regional vulnerability to climate change. The Aleutian Bering Climate Vulnerability Assessment (ABCVA) was launched in 2014 to bring together regional science expertise and stakeholder interests in a rapid evaluation of the implications of future climate projections. This effort followed an internationally accepted but flexible pathway to develop practical, priority research topics that address ecosystem and community vulnerabilities. The ABCVA was completed as a partnership between the Aleutian and Bering Sea Islands Landscape Conservation Cooperative (ABSI LCC), the Alaska Climate Science Center and the Alaska Ocean Observing System (AOOS), and ultimately brought together three linked objectives:

1. identify and assess selected climate vulnerabilities of key resources and ecosystem services in the Aleutian Islands and Bering Sea region
2. broadly engage managers and stakeholders about the implications of climate vulnerabilities in the region
3. help ABSI LCC and the Alaska Climate Science Center and AOOS prioritize future research investments and focus

The ABCVA convened a group of 30 researchers with expertise ranging from anthropology to zooplankton to review climate projections and their implications for the Aleutians and Bering Sea. These experts worked in five topic-based teams to assess vulnerabilities of species and ecosystem services relative. Each team identified initial vulnerabilities and made recommendations for further research that would help managers and communities better understand the implications of the changing climate in this region.

In a subsequent rapid synthesis effort, members from the expert team ranked species that may be most vulnerable to climate change and also ranked the key drivers of change affecting those species. Finally, they used a Structured Decision Making process to collectively prioritize 35 research topics for potential future action by ABSI LCC, the Alaska Climate Science Center, AOOS and ideally other management and science organizations working in the region.

Results from this work were shared during a focused, public session held within the regional hub community of Unalaska/Dutch Harbor where structured insights about climate change were collected from local residents. The results of this project have also been shared at several other local, regional, and national conferences to broaden awareness about climate change issues for this region. Further investments in communication have included developing a downloadable 'interactive' that tells the story of this project from motivation and methodology to process and results. An additional lasting legacy of the ABCVA is a catalog of online content hosted on the AOOS Arctic Portal where spatially explicit projections for climate and ecosystem variables are available to visualize and download.

This work brought together novel collaborations between residents, stakeholders, scientists, and natural resource managers in the region. We hope this project might serve to launch new and diverse partnerships to further address challenges related to climate change in Bering Sea and Aleutians.

Chapter 4: Vulnerability of Subsistence Cultures, Harvests, and Community Sustainability

Liliana Naves, Debra Corbett, Liza Mack, Henry Huntington, Julie Raymond-Yakobian, Nicole Misarti, Diane Hanson, Sean Mack, and Karen Pletnikoff

Introduction

The objective of this assessment of vulnerability of subsistence communities is to identify factors and processes local to the ABSI region. This assessment downscales from previous large-scale climate change vulnerability assessments (Weller and Lange 1999, ACIA 2004), while furthering advancements made by previous efforts dedicated to the Bering Strait region (BESIS 1997, Callaway 1999, Gadamus 2013). This document is intended to provide a basis for further involvement of stakeholders, and to identify information gaps, research questions, and policy directions. We recognize the need for further development of some topics here included, and the likelihood that relevant topics and studies have been overlooked. Within these limits we hope to have advanced, even a modest amount, the understanding of the complex factors and processes through which climate-related changes interact with other changes affecting the well-being and sustainability of subsistence cultures in the ABSI region.

Human Communities in the Bering Sea and Aleutian Islands

Alaska rural communities are complex socio-ecological systems. Efforts to assess vulnerability of these communities to climate change require an understanding of how environmental variables interact with a range of ongoing socio-economic and cultural drivers of change. In assessing community vulnerability, it is also relevant to try to identify divergences between actual effects of climate change and local perceptions of changes associated with climate, which may be mediated by other drivers of change (Moerlein and Carothers 2012).

Alaska's rural communities are vibrant societies, with a rich cultural heritage, and strong traditions of self-reliance and adaption. These communities have access to diverse biological resources and rely on knowledge accumulated through generations to use these resources. Alaska Native cultures emphasize relationships among people and the natural world, and have a strong sense of place and identity. These values and knowledge make the sustainability of indigenous cultures and the maintenance of cultural diversity important, as consumerism and other distractions progressively compromise the well-being of modern societies. Alaska rural communities face many challenges in their efforts to co-exist with western societies. This assessment refers to some of these challenges in an effort to identify interactions with climate change vulnerabilities. This exercise, however, should not be perceived as emphasizing the challenges, but rather as a pragmatic search for directions to promote the sustainability of these communities.

There are large uncertainties in forecasting effects of climate change on biological resources and on environmental and ecological systems. Therefore, it is difficult to forecast impacts of climate-related changes on rural communities and how they may react to such impacts. Furthermore, climate change is not the only, nor the most pressing, challenge that rural communities are facing. While Arctic Native peoples are experienced in dealing with environmental variability, social changes have represented serious challenges to the persistence of subsistence communities. Changing lifestyles, decreasing participation in subsistence activities, and economic and social changes are understood to be primary drivers reshaping subsistence patterns and practices in the Arctic (Moerlein 2012, Moerlein and Carothers 2012, Raymond-Yakoubian 2013). Regulatory actions and competition for resources with other uses also affect harvest patterns, e.g. salmon bycatch. Understanding and forecasting consequences of climate changes on Alaska rural communities requires considerations of how these changes interact with ongoing changes on their social, economic, and cultural settings.

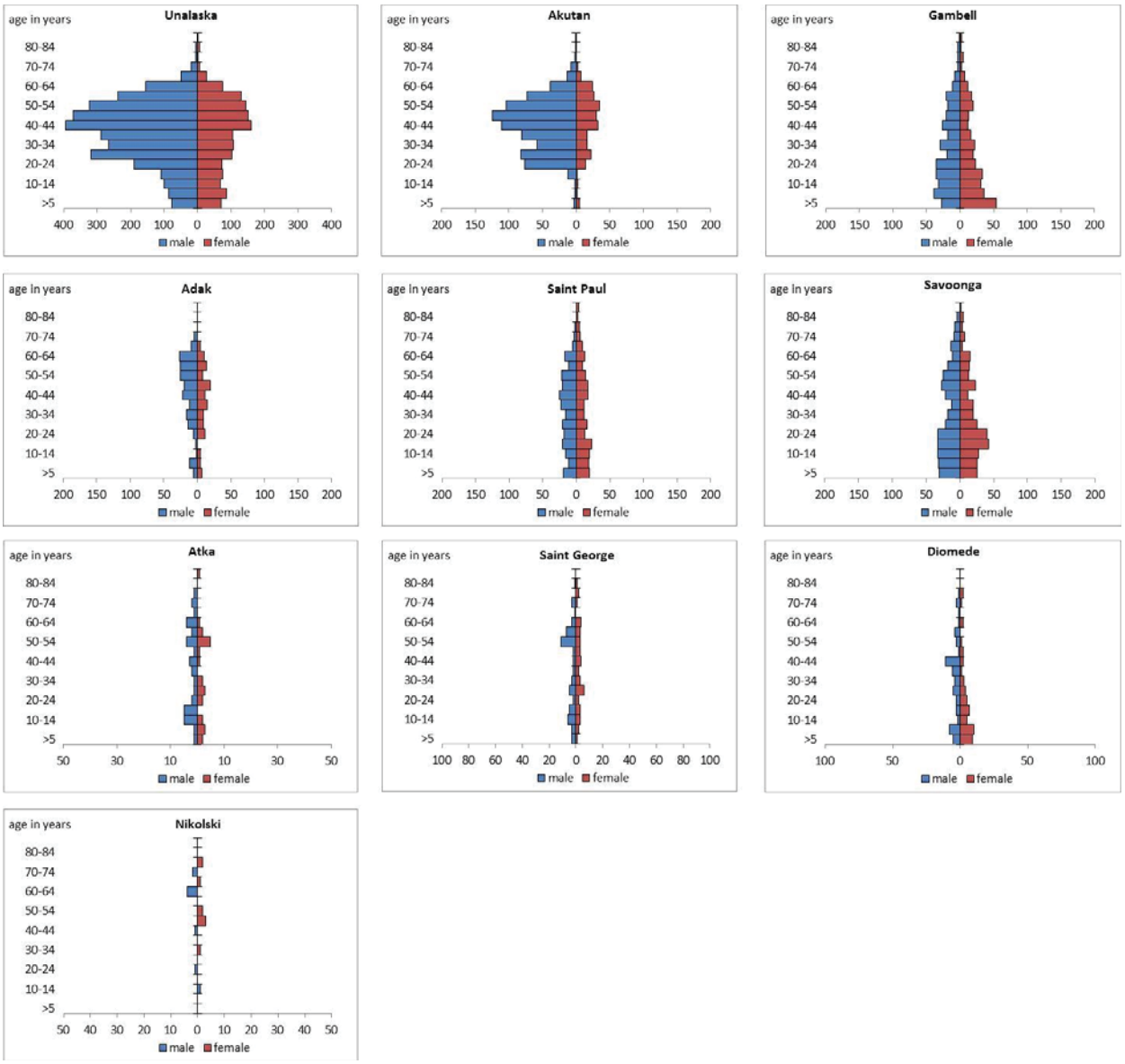
Several communities, most of which are primarily Alaska Native, are located in the Aleutian and Bering Sea Islands Landscape Conservation Cooperative (ABSI-LCC) region. Gambell, Savoonga, St. Paul, St. George, Akutan, Unalaska, Nikolski, Atka, and Adak are in the core of the ABSI region. Diomede, False Pass, Cold Bay, King Cove, Sand Point, and Nelson Lagoon are in the larger Aleutian-Bering Sea ecoregion. Gambell and Savoonga, on Saint Lawrence Island, are Siberian Yupik in heritage, Diomede, on Little Diomede Island, is of Inupiaq heritage, and the other communities in the region are of Unangax Aleut heritage. They differ in their historic, cultural, socio-economic, demographic, and ecological backgrounds, and these factors may affect their vulnerability and adaptability to climate change (Figure 1). Drivers and perceptions of change may also be affected by specific local factors and processes.

The sustainability and resilience of northern communities are largely based on social networks for the production and distribution of resources within and among communities (Magdanz *et al.* 2011, Reedy-Maschner and Maschner 2012). Sharing likely evolved as a social adaptive strategy developed by communities living in extreme environments subject to variability in resource abundance (Berkes and Jolly 2001). Sharing has been traditionally recognized by communities as an important cultural value (Kawerak 2013a, Raymond-Yakoubian 2013). Key people and places (or network nodes) play a vital role in the maintenance of the subsistence infrastructure (Wolfe *et al.* 2010). Disruption of network nodes may disrupt economic and social systems.

Outmigration is a concern in much of rural Alaska and is a threat to smaller communities. Out-migration is more prominent for women and children, leading to closure of local schools, and eventually the demise of small villages (Martin 2009, Lowe 2010). Age pyramids constricted at the base and deflated female ratios depict this process (Figure 1). Population additions due to immigration of commercial fisherman and processing workers are composed mostly by males and are usually seasonal. These additions are more common in the commercial fishing centers of the southern part of the ABSI-LCC. However, because of their unbalanced demographic structure (Figure 1), their potential to contribute to demographic sustainability of communities is low. As a resident of Nelson Lagoon explained: "*Cannery helps, but it doesn't bring in families, only single men who bring in problems of their own*" (Reedy-Maschner and Maschner 2012: 197).

Unalaska (including Dutch Harbor) is the largest community in the core ABSI-LCC area, with 2,273 people in households and a transient population of 2,103 people housed in group quarters supporting commercial fishing and processing. The Alaska Native population (355 people) represents 8% of the total Unalaska population (2010 population, U.S. Census Bureau 2011). The community of Akutan has a large seafood processing plant, which in 2010, housed 937 seasonal employees in group quarters. In Akutan, the 90 permanent residents include 76 Alaska Native people, representing 84% of the population (2010 population, U.S. Census Bureau 2011). Adak is a former Navy base, decommissioned in the mid-1990s, and acquired by The Aleut Corporation for redevelopment as a civilian community. The 2010 census showed a population of 326, with 217 of these being transients housed in group quarters. Of the 109 permanent residents 46, or 13%, are Alaska Natives. Except for Unalaska and Adak, Alaska Native people represent 83%–96% of the population in communities in the ABSI region.

Figure 1: Age and sex demographics for towns and villages within the study area.



Alaska rural communities, especially their Alaska Native residents, are primarily engaged in customary and traditional subsistence activities and rely on harvests of wild resources for nutrition, cultural identity, and social well-being. These communities have a subsistence-cash mixed economy, blending harvest, use of traditional foods, wage employment, and transfer payments as they adapt to a rapidly changing and interconnected world (Fall *et al.* 2013). Income generated by wage employment is necessary to procure fishing and hunting gear and supplies.

The economies of Unalaska, Akutan, Adak, and St. Paul are based on commercial fishing. Commercial fishing also plays a primary role in many subsistence-cash economies, and is an

important factor in defining socio-economic contexts. Commercial fishing is a culturally sustainable path for Alaska Native communities to integrate into the wage economy, because fishing is compatible with traditional lifestyles (Wolfe 1984, Brakel, 2001). In rural communities, involvement in commercial fishing often increases local household harvest of fish and wildlife for subsistence (Wolfe *et al.* 2010). Such households own or have access to equipment, skills, knowledge, and cash needed to harvest wild foods. Local commercial fisheries also contribute a direct source of food because diverse products from commercial catches (both targeted species and incidental catches) are used for household consumption, especially halibut, salmon, crab, and octopus (up to 44 pounds per person per year) [Community Subsistence Information System (CSIS), http://www.adfg.alaska.gov/sb/CSIS/index.cfm?ADFG=main.home]. On the other hand, commercial fishing may reduce the abundance of subsistence resources and affect local and ecological processes.

In the ABSI region, Gambell, Savoonga, Nikolski, Atka, and St. George do not have important participation in commercial fisheries and rely on local services, government jobs, and transfer payments. In Gambell and Savoonga, walrus ivory carving is an important source of income.

Bering Strait islands communities of Gambell, Savoonga, and Diomede, largely rely on harvests of marine mammals. In 2009, subsistence harvests at Savoonga were estimated at 948 edible lb/person and were composed of 45% walrus, 28% ice seals, 14% bowhead whale, 6% fish, 2% birds, 2% birds eggs, and 3% other resources (Tahbone and Trigg 2011). On the Pribilof Islands, the communities of St. Paul and St. George largely rely on harvests of halibut (about 40% of annual harvests), fur seal (about 30%), and Steller sea lion (5%–21%) [harvest survey conducted in 1994, http://www.adfg.alaska.gov/sb/CSIS/index.cfm?ADFG=main.home]. In the Aleutian communities, salmon (21%–45%), and halibut (10%–30%) are the main subsistence resources, while crabs (up to 11%), octopus (up to 10%), Steller sea lion (up to 23%), harbor seal (up to 11%), reindeer (up to 21%), and feral cattle (up to 23%) are important for some communities. Birds and eggs accounted for a small proportion of harvests (up to 4%) (http://www.adfg.alaska.gov/sb/CSIS/index.cfm?ADFG=main.home, Reedy-Maschner and Maschner 2012).

Interactions Among Ecological, Cultural, and Socio-Economic Factors

Socio-economic and cultural changes experienced by Alaska Native communities have affected their lifestyle and harvest patterns and may directly or indirectly interfere with perceptions of environmental change. Below we refer to some of these changes.

- Disruption of Native societies and economies by foreign Nation-states beginning with the Russian fur trade in 1741 and continuing to the present.
- Demographic collapse caused by introduced diseases and resulting famines, warfare, and population relocations forcing abandonment of traditional territories, affecting traditional harvest patterns and social structures.
- Imposed social and economic changes such as missions, schools, trading posts, and integration into worldwide market economies, resulted in the consolidation of small settlements into larger villages, affecting traditional harvest patterns and social structures.

- Commercial whaling depleted stocks important for subsistence harvests.
- During World War II, Aleut villages west of Unimak Island were evacuated to remove civilians from the war zone. During the 3 years of the evacuation, many people died of diseases and malnourishment, including many elders, who were depositories of culture and knowledge. When people were allowed to return to the Aleutians at the end of the war, they found their villages in disarray from the U.S. military occupation. Several formerly viable communities were never reoccupied and are referred to by the descendants as "Lost Villages". Although monetary reparations were made in 1988, cultural and social consequences were not mendable.
- At many locations in the Bering Sea and Aleutian Islands, remains of military operations are significant sources of contamination and have actual and perceived associations with diseases such as cancer. Perceptions about the efficacy of past and on-going clean-up efforts are mixed. Contaminated locations may be close to communities (e.g., Gambell, Unalaska, Cold Bay, Adak) or on currently unoccupied islands used for subsistence activities or considered important cultural sites.
- Beginning in the 1950s, welfare programs and food stamps allowed survival independent of subsistence resources and contributed to changing food preferences.
- Transition from dog teams to snow machines in the 1960s–1970s caused major changes in harvest patterns on St. Lawrence Island and elsewhere in Alaska because large amounts of fish or meat were no longer necessary to feed dog teams. Use of snow machines, and boat motors beginning in the 1920's, also defined dependency on cash income to acquire industrialized goods and fuel.
- Alaska National Interest Lands Conservation Act (ANILCA) and establishment of regional corporations promoted the cash economy. Participation in wage economy limits time available for subsistence pursuits.
- Modern infrastructure, industrialized goods, telecommunication systems, changing food preferences are resulting in indoor, sedentary lifestyles and increased material expectations.
- Modern education focuses on technical training and wage employment resulting in fewer avenues and opportunities to train youth for a subsistence-cash mixed economy. General shift in social norms means youth are not necessarily expected to engage in subsistence activities. Language loss disconnects youth from Elders and less traditional knowledge is passed on.
- Many technologies are viewed as basic, yet expensive, necessities for subsistence activities. Buying gas, and acquiring and maintaining fishing and hunting gear is expensive and limits harvesting trips. Food stamps allow access to frozen, packaged food of low nutritional value while harvest pursuits of local resources become progressively more expensive.
- Rising costs of fuel and other necessities limit the number and length of harvest trips.
- Resource management systems are progressively more complex. There is growing polarization between rural and urban, commercial and subsistence interests.

Environmental Changes Reported by Alaska Arctic Communities

Projected climate changes in the Arctic include increased precipitation, shorter and warmer winters, decreased snow and ice cover, and increased storminess (Corell 2006). Environmental changes observed in recent decades include melting sea ice, rising sea levels, coastal erosion, permafrost thaw, and northward range extension of some sub-Arctic fish species (Hinzman *et al.* 2005).

In the spring walrus hunt on Saint Lawrence Island, three environmental variables (ice concentration, wind direction, and wind speed) accounted for 25%–32% of the daily variability in hunting effort and 18%–24% of the daily variability in harvest. High ice concentration and wind speeds were related to reduced hunting effort and harvest (Huntington *et al.* 2013b). Walrus distribution and abundance, societal factors, and interactions with other subsistence activities also affect hunting effort and success (for instance, a very successful spring bowhead whale hunt may be followed by relatively lower walrus harvest).

Some environmental changes and perceptions reported by Northwest Arctic communities (Moerlein 2012) are likely applicable to the Bering Sea and Aleutian Islands.

- Variability in environmental and ecological factors and processes naturally occur. However, ongoing changes are outside the normal range of variability;
- Changing weather conditions are most noticeable in the periods of spring break up and fall freeze up;
- Spring break up is happening earlier and more quickly;
- Fall freeze up is happening later and more slowly, often with abnormal freeze-thaw cycles;
- Longer ice-free season;
- Loss of permafrost; and
- Unpredictable changes in timing of fish movements.

Some changes observed on St. Lawrence Is. (Noongwook *et al.* 2007):

- Savoonga respondents reported the occurrence of new songbirds, ones without Alaska Native names.
- The timing of the spring migration of bowhead whales has advanced from April–May to March in response to changes in ice conditions.
- The migration is also less predictable because of changing weather and ice conditions.
- In recent years, Savoonga whalers have had to end their whaling season earlier because of deteriorating snow conditions in their return travel to the village.
- Unfavorable hunting conditions have affected Gambell spring whaling.
- The presence of bowhead whales close to St. Lawrence Island in winter has been associated with the reduction of multiyear ice. Harvests in late fall and winter have been reported since the 1990s. In 1995–2005, about 40% of the whales harvested at St. Lawrence Is. were taken in winter rather than in spring.

Some changes reported by St. Paul, St. George, Adak, Atka and Togiak in the Eastern Bering Sea (Huntington *et al.* 2013, Fall *et al.* 2013):

- Recent summers have been rainier than usual, making it difficult to dry fish.
- Increase in the occurrence of windy days; windy conditions in September have negatively affected harvest of bearded seals.
- Residents of St. Paul reported reduced abundance of fur seal with possible causes being predation by orcas and decline in the prey base due to ecosystem changes and competition with commercial fisheries.
- Togiak, just outside the ABSI-LCC, reported concerns about reduced abundance of a number of species important to subsistence, attributed to commercial fishing of herring (an important food source for many species), and habitat impacts of bottom trawling (specifically on clam beds on which walrus rely on). The most visible indicator of climate change with extensive ecological implications in this area is that sea ice is thinner, and the ocean freezes later in fall and melts earlier and quicker in spring.
- Changes in the Central and western Aleutian Islands are expected to be more like those reported for this region than for the eastern Aleutian Islands.

Environmental changes potentially related to climate change reported in eastern Aleutian communities (Reedy-Maschner and Maschner 2012):

- More seaweeds piled on beach at Nelson Lagoon than in the past.
- Increased abundance of sea otters, and their impact on marine invertebrates, also removing subsistence resources (at Nelson Lagoon, Akutan).
- Increased abundance of jellyfish, which are nuisances because they get caught in fishing nets (at Nelson Lagoon).
- Increase abundance of flounders, which is seen as a nuisance by salmon fishers (at Nelson Lagoon).
- Increased abundance of octopus and Atka mackerel (at Akutan).
- Increased abundance of eagles (at Akutan).
- Increased abundance of seals at Port Heiden. The Bristol Bay Native Association conducted a multi-year study of TEK and seals.
- Occurrence of "weird bugs" presumably due to temperature warming.
- Increased abundance of salmon sharks.

Importance of Cultural Resources for Sustainability of Subsistence Communities

"*How will we know it is us without our past*?" The Grapes of Wrath, John Steinbeck

Cultural resources are tangible material artifacts and intangible concepts pertaining to prehistoric, historic, and contemporary human cultures. Cultural resources are repositories of centuries of ecological knowledge and information regarding environmental change and processes. Tangible resources include settlements, deposits, structures, ruins, sites, buildings, graves, landscape features, and artifacts. Cultural intangibles are present in language, songs, stories, worldviews, place names, and belief systems. People and culture are intimately linked

through time to landscapes and the wildlife and plants surrounding them. The essences of specific, though changing cultures, are as diverse as the people who made them and may emanate from physical, mental, or spiritual sources.

Cultural resources are voucher specimens of history and cultures. Cultural sites hold multiple layers of information about the lives of our ancestors. Without tangible places, we lose their stories, as if the people who came before never existed. Cultural sites maintain, both physically and symbolically, a sense of history and cultural continuity.

As repositories and archives, cultural resources (especially archaeological sites) contain stores of information on environmental conditions and processes usually not available anywhere else. Cultural resources document human societies, changes, and processes of innovation and adaptation to the ever changing physical and cultural world. For these reasons, it is very important to study and to protect cultural sites.

Resources and Services Most Likely to Be Affected by Climate Change

a. Vulnerable Biological Resources Important for Subsistence and Economic Activities

The ability to harvest and gather is a central point in Alaska's subsistence communities. Harvesting and gathering resources on the land determines peoples' feelings about themselves, structures their social relations, contributes to well-being, and provides a framework for relating with their environment (Callaway 1999). For these reasons, the possibility of loss, reduced availability, or reduced access to subsistence resources are a main source of concern for the subsistence communities.

- Ice-dependent marine mammals (walrus, polar bear, ringed, spotted, bearded, and ribbon seals) are important subsistence resources and represent large proportions of harvests in some communities.
- Appropriate ice cover allows access to resources such as some fish and crab during winter, when other resources are usually scarce.
- Species that are important subsistence and commercial fishing resources may have their timing, abundance, or distribution affected by climate change. Future studies may specifically identify resources in this category.
- Some commercial fishing species (salmon, halibut, crabs) are important for the sustainability of rural communities. An evaluation of commercial fisheries landing data may allow identification of the most relevant species and interactions with other local activities. Besides the economical relevance of local fisheries, removals from commercial fisheries are used for household consumption.

b. Vulnerable Habitats

- Sea ice,

- Areas subjected to coastal erosion and riverbank erosion,
- Areas subjected to floods by storm events, rising sea level, changes in raining patterns and freshwater dynamics,
- Loss of permafrost,
- Changes in vegetation cover and composition of plant communities,
- Changes in water circulation pattern due to changes in ice cover and increased fresh water runoff.

c. Vulnerable Cultural and Socio-Economic Resources

- Cultural, historical, and archeological sites and cemeteries,
- Cultural diversity,
- Social stability,
- Economic viability,
- Infrastructure subject to erosion and floods.

Processes Affecting Vulnerability of Resources, Habitats, and Services to Climate change

a. Changes in Abundance and Distribution of Subsistence and Commercial Fisheries Resources

Changes in abundance and distribution of species may affect access and harvest success (food security) and lead to changes in fishing and hunting regulations (vessel size, net mesh size, number of hooks, size of harvest, and allowable species). Previously formulated hypotheses relating effects of climate change on subsistence activities in the Bering Sea from the North Pacific Research Board state (Hypothesis 5b): “Climate-ocean conditions will change and thus affect the abundance and distribution of commercial and subsistence fisheries. For Subsistence users, these changes will lead to: (a) greater reliance on owners of larger vessels that can travel farther to harvest and distribute subsistence goods; (b) decreased consumption of species with decreased local abundance; and (c) adoption of new species into the diets these species colonize local areas” (NPRB 2012).

b. Changes in the Distribution and Prevalence of Pathogens

Climate change may create opportunities for the dispersion and establishment of new pathogens in the ABSI region, causing diseases in people, animals, and plants. This process may happen thru the establishment of pathogens or vectors for diseases not currently found or rare in Alaska. Some conditions involved include number of days above certain temperature thresholds, changes in temperature, and changes in precipitation (Bradley *et al.* 2005).

c. Unpredictable and Changing Weather, Wind, and Ice

(1) These changes may affect access, harvest success, and safety of subsistence fishing and hunting and commercial fishing. Changes to weather, ice, polynyas, ice leads, and other environmental conditions may vary across the geographic region. (2) Spring and fall conditions are a main determinant of harvest opportunities because conditions may not be suitable for travel by boat or snow machine. More variable and unpredictable travel conditions because of ice, water level, or storms increase safety issues and the possibility of damage to gear, with potential safety and financial hardships. (3) Increasingly unpredictable environmental (weather, ice) and ecological (animal migrations and behavior) conditions combined with time constraints imposed by wage employment narrows opportunities for harvesting and processing.

Changing and unpredictable environmental and ecological conditions affect traditional harvest and processing practices. Fishing nets have to be checked more frequently because warmer water temperatures affect the quality of the fish caught in the net. In warmer weather, flies and wasps appear earlier and negatively affect fish drying. Difficulties in properly drying or fermenting meat and fish leads to spoiling. Some people have switched to freezing their fish and meat in electric freezers at increased costs, or to initially freeze their harvest and wait for favorable conditions for drying and fermenting.

In 2013 sea ice packed the shoreline of St. Lawrence Island preventing hunters from harvesting 2/3 of the walrus normally captured. The loss of the meat to feed families, and ivory for craft production, created very real hardships in a community with few alternative resources. The Governor declared the island an economic disaster area (Caldwell 2013). No State funds were made available for relief and religious groups stepped in to fill larders (Presbytery of Yukon 2013).

Socio-economic and cultural factors interfere with traditional harvesting, processing, and consumption patterns, and how people perceive effects of environmental and ecological factors. In the past, when large amounts of fish and meat were necessary to feed dog teams, a few batches of fish unsuitable for human consumption were still appropriate to feed dogs. Nowadays, as dog teams have been replaced by snow machines, all harvests unsuitable for human consumption are wasted. This indirect process may have affected how people perceive environmental conditions leading to spoilage of harvests. Also, people nowadays have less flexibility to time their harvests with favorable processing conditions because of wage employment.

d. Reduced Ice Cover

Some likely consequences and processes related to reduced ice cover include:

(1) Increased shipping traffic in northern oceans, will have many direct and indirect effects on rural communities;

(2) Increased contamination and chronic pollution related to increased shipping traffic will lead to issues related to food safety;

(3) Increased access to ice-free regions may favor development of other economic activities (e.g., oil and gas industry, commercial fisheries, tourism). On one hand, increased economic activities

may bring more employment opportunities to rural communities. On the other hand, these activities may have negative effects such as increased competition for biological resources, chronic and acute pollution, and increased social pressure.

(4) Reduced ice cover causes increased coastal erosion during storms.

e. Impact of Coastal Erosion and Flooding on Infrastructure

(1) Damage and destruction of infra-structure such as buildings, water facilities, sewage lagoons, landfills, and roads due to erosion and flooding cause economic hardship, disruption of daily life, and health issues. Erosion caused by storm surges has caused damage to infrastructure on Diomede (in the larger Aleutian-Bering Sea ecoregion) and likely in sites within the ABSI region.

(2) Coastal erosion also threatens cultural resources such as cemeteries, settlements, sites, buildings, and landscape features.

(3) Destabilization of relict military sites, exacerbating contamination issues and re-exposure of contaminated materials in sites that have had a superficial clean-up.

(4) Coastal and riverine camps, caches, drying racks and other infrastructure used for subsistence activities are being washed away across the Kawerak region due to storms and erosion.

f. Threats to Archeological Sites, Cemeteries, and Other Cultural Heritage Sites

Threats to cultural sites directly or indirectly related to climate change include:

(1) Reduced ice cover, rising sea levels, and increased frequency and severity of high water events may cause complete destruction of sites through erosion. Apart from complete loss, erosion-related damage to cultural sites include mixing of contexts, exposure of delicate artifacts leading to decay, crushing of artifacts, and exposure to looting. Most archeological sites in the ABSI region include human burials, increasing the concerns of Native communities about the preservation these sites. Damage to cultural sites lead to loss of scientific and humanistic interest in the sites.

(2) Exotic species (e.g., bison, cattle, muskox, reindeer, and sheep) have been historically introduced to many areas in Alaska, including the ABSI region, as a supplement to local resources or to replace local resources that have become less available. These introduced animals have caused extensive damage to cultural resources. Grazing of vegetation and trampling causes soil erosion, which may lead to destruction or damage of sites as explained above. New introductions of exotic species may be proposed to mitigate reduced availability of biological resources resulting from climate change.

(3) Looting of archeological sites can increase when people need supplementary sources of income. Direct and indirect economic costs of climate change may further increase the need of supplementary sources of income in the already economically stressed rural communities. Looting is defined as any digging for or removal of artifacts from archaeological sites when these activities are not authorized by the landowner. Looting is illegal on federal and state lands. Under Alaska state law, unauthorized digging is also illegal on private lands, but is unlikely to be

enforced unless the landowner has policies against such activity. Recreational digging on federal or state lands is looting. Many Native corporation landowners are much concerned about unauthorized digging on their lands, but have few tools to prevent or stop it.
(4) Looting of archaeological sites is directly related to ease of access to sites. Changed climate related processes increase opportunity for access to sites. Looting has been reported when crews of fishing boats or canneries (e.g., Margaret Bay site in Unalaska) are idled by fishing closures, shortened seasons, or other reasons that may generate spare time. Loss of sea ice, shifts of economically valuable fisheries to the north, and the opening of Arctic shipping routes increases number of people moving into and through this region. Archaeological sites are likely more vulnerable to looting in summer when they are visible, accessible, and the ground is not frozen. As discussed above, climate change may affect fishing activities and fishing regulations. Looting by construction workers during development projects has been reported (e.g., Akutan airport, Shemya Island) and may increase as a consequence of climate change if construction projects are implemented to repair damaged infrastructure or to build new ones. As discussed above, climate change can cause damage and destruction of existing infrastructure, generate the need for alternative infrastructure, or to create the opportunity for new development projects.

g. Interactions with Economic and Demographic Processes, Social and Cultural Well-Being

(1) Increased travel distances because of changes in weather, ice, and species abundance and distribution may reduce ability to afford continued participation in hunting and fishing.

(2) Reduced productivity of commercial fisheries may affect sustainability of communities involved in those commercial fisheries.

(3) Loss of economic opportunity and of the subsistence base will further accelerate outmigration from communities as people seek better economic opportunities. A minimum population size is necessary to keep basic services such as school, post-office, and regular flights.

(4) If communities are no longer sustainable, outmigration to larger urban centers will result in loss of cultural diversity.

(5) Increased commercial fishing and other economic opportunities will bring many newcomers, that may destabilize subsistence cultures and social organizations.

(6) Demographic and socio-economic process related to expansion or reduction of communities may affect social and cultural sustainability. Progressive loss of cultural identity based on subsistence life style exacerbates social problems (dependence on welfare programs, substance abuse, violence, high suicide rates, etc).

(7) Alaska rural communities are already under strong economic stress. The per capita wage in general is very low. Therefore, all components of the total income (wages, dividend, retirement, public assistance) are important to meet needs, even if individual components are small (Callaway 1999:71). Although wages usually represent a large proportion of the total income, this component is subject to substantial variation, because many jobs are temporary. Many families are barely making ends meet and relatively small fluctuations in their income or expenses have a strong effect on their ability to fulfill basic needs. Increased expenses resulting

from climate change (erosion mitigation, longer hunting trips, reduced harvest success) increase the likelihood that families may not be able to fulfill their basic needs.

Exposure and Vulnerability to Climate Change

a. The northern and southern areas of the Bering Sea seem to be experiencing different patterns of physical changes with different consequences for the ecosystem. At the seasonal margin of sea ice extent, the Southern Bering Sea is more likely to see changes in the timing and extent of ice than the Northern Bering Sea, which maintains more consistent patterns of winter and spring sea ice. Northward expansion of species ranges, especially fish, are more likely to occur in the southern Bering Sea where differences in temperature and ice extent are greater between warm and cold years while the northern Bering Sea is expected to remain cold despite potential warming in the south (Stabeno *et al.* 2012). The occurrence, abundance, and distribution of ice-related marine mammals in the southern Bering Sea and their availability as subsistence resources may be negatively affected. For instance, the community of Togiak, in the Eastern Bering Sea has reported much decreased abundance of ice seals (Fall *et al.* 2013, Huntington *et al.* 2013).
b. Changing weather conditions have been most noticeable in the periods of spring break up and fall freeze up. Generally, spring break up is happening earlier and more quickly and fall freeze up is happening later and more slowly, often with abnormal freeze-thaw cycles. Subsistence activities specifically carried out during these periods may be more vulnerable to climate change. Variability and unpredictability are hallmarks of current weather patterns.
c. Archeological and cultural sites may be more vulnerable to erosion in stormy periods coinciding with open water (fall in Northern Bering Sea, fall and winter in Southern Bering Sea).
d. People have less opportunity to harvest and to properly time their subsistence activities because of time constraints imposed by wage work. This makes it difficult to cope with variability and unpredictability of resource abundance and access due to climate change.
e. Wage work and financial challenges limits the amount of time some families spend together in subsistence pursuits and therefore may limit the transfer and acquisition of local and traditional knowledge. On the other hand, changing and more unpredictable ecological conditions require larger amounts of knowledge to cope with variability and uncertainly in factors affecting travelling, harvesting, and processing of resources.
f. Financial challenges and high prices of harvest equipment and supplies constrain the capacity of rural residents to respond to changing ecological conditions. For instance, if walrus are migrating further from communities, it takes harvesters more gas, time, and bigger boats to access hunting grounds. This increases the cost of the activity. Traveling further is also more dangerous for hunters. Therefore, walrus hunting may become less viable for many hunters. Similar issues have been reported in the marine mammal hunt in the North Slope (Callaway 1995:60).
g. Increasing vessel traffic through the Bering Strait and northern Bering Sea is perceived as a major threat to marine mammals and subsistence communities. Vessel traffic has the potential to disrupt marine mammal migrations and to interfere with subsistence hunting (Raymond-Yakoubian *et al.* 2014, Kawerak 2013b).

Adaptive Capacity

Some Documented Ongoing Adaptations:

a. More people rely on electric freezers to preserve their harvests and traditional processing methods are less used (drying, aging, fermenting, permafrost ice cellars) (Moerlein 2012, J. Raymond-Yakoubian 2013, B. Raymond-Yakoubian *et al.* 2014).

b. When other constraints allow (wage work, gear, water level), people try to get to camps and other harvest locations earlier so they do not miss earlier fish runs and other animal movements. Some people are focusing on alternate subsistence resources or activities, abandoning some fish runs, as documented in the community of Teller, on the Seward Peninsula (Raymond-Yakoubian 2013).

c. In Akutan, hunters and fishers that own larger boats face increasing fuel costs and have tried to find efficiencies by fishing locally, limiting search time, and removing resources and incidental harvests from commercial fisheries rather than making subsistence harvest trips (Fall *et al.* 2013).

d. Communities readily take advantage of harvest opportunities resulting from changes in the environment and ecological conditions. For instance, a fall whaling season has developed in Savoonga in response to delayed freeze-up (Noongwook *et al.* 2007).

e. Increased reliance on readily accessible subsistence resources in an effort to lower grocery bills (Reedy-Maschner and Maschner 2012).

f. Social networks for production and sharing of resources are changing in response to variation in resource abundance and distribution. Some communities and individuals report less sharing due to increased costs and risks to obtain subsistence resources.

Case Study: Past Responses to Change on St. Lawrence Island and the Pribilof Islands

Aleut residents of the Pribilof Islands and St. Lawrence Island Yupik residents of St. Lawrence Island have experienced many major changes in the past two centuries. These include social change from increased interactions with persons from other places, economic change from modernization, competition in whaling and fishing, ecological change from cyclical regimes and recent warming, political change from ANCSA, and more. Although changes may bring disruption and turmoil, individuals and communities have displayed considerable resilience, which may shed light on possible responses to future change.

The following text is a brief overview of some of the major changes that have occurred since the 1870s on St. Lawrence Island (based on Bockstoce 1986, Noongwook *et al.* 2007, and personal communications from local residents) and since the 1980s on the Pribilof Islands (based on Huntington *et al.* 2009 and Fall *et al.* 2013). This exercise attempts to assess characteristics of changes and their relation to climatic, ecological, and socio-economic factors. It may help generate a better understanding of how past experiences relate to the types of changes expected

in the coming decades. Although the changes discussed here are not all or solely related to climate change, the objective was to gain insight on how communities deal with change, whatever the underlying cause. This exercise also recognizes that the effects of climate change do not happen in isolation, but rather in interaction with ongoing, rapid socio-economic and cultural changes.

Pribilof Islands

The Pribilof Islands have been permanently occupied since the late 1700s, when Russian fur traders forcibly brought Aleuts there to harvest northern fur seals. The commercial fur trade lasted until 1984, when the United States' withdrawal from the Fur Seal Treaty put an end to commercial seal hunting, which had already shown signs of decline, especially on St. George. This event effectively removed northern fur seals as an economic resource, though subsistence use of fur seals continues at a modest level.

The sudden removal of a major prey species is a large shock to a social-ecological system. To help in the transition, some $20 million in grants were obtained by the communities of Saint Paul and Saint George to promote the development of commercial fisheries, including catching and processing. Commercial fisheries have been a variable success. Snow crab were abundant in the 1990s, leading to an increase in the human population on St. Paul, which declined after the crab harvests crashed around 2000. It seems this population increase was predominantly composed of young, non-Native males who moved to St. Paul during the economic boom, and left once the opportunity was gone. The loss of another major prey species again affected the social-ecological system, though the local Aleut population appears to have been relatively resilient to the change, at least in terms of total population.

Commercial fisheries continue today, though the economies of both communities have expanded to related areas such as harbor facilities (St. George especially) and contracts with the federal government (St. Paul especially). Grants for capital improvement projects, such as a new runway or road, provide temporary employment. Income levels in both communities have been high compared with other small, remote fisheries-oriented villages in Alaska, though incomes have also been highly variable. Population level does not appear to track income, suggesting a disconnect between economics and demography.

With the exception of the snow crab boom and bust, changes in the economic role of commercial fisheries in the Pribilof Islands appear to have been largely driven by regulatory and other change, rather than by ecosystem change. Requirements about where fish may be processed or the allocation of harvests among various users affect the economic attractiveness of the Pribilof Islands as ports, sites for fish processing, and bases for fishing operations. Nonetheless, such changes may be useful proxies for the loss of prey species, because the immediate effect is largely the same: loss of opportunity to use the resource.

Subsistence harvests also appear to be decreasing, likely as a result of changes in taste and preference, rather than in response to ecosystem change. The harvest of fur seals on St. Paul declined during the first decade of the 2000s, a period in which the fur seal population also declined sharply. However, the decline in fur seal harvest seems to be unrelated to availability, because far more fur seals come ashore on the island than are harvested. Requests for fur seals

from tribal harvesters have declined, suggesting a lack of demand rather than a limitation of supply. If this trend continues, the impact of ecosystem shifts on the local communities may be lessened because of a weaker connection between people and the local ecosystem.

In summary, the Pribilof communities have experienced major shifts in economic opportunity and, in the case of the snow crab crash, ecosystem productivity of commercially desirable species. The communities have persisted through these changes, though perhaps with some degree of privation. Community and regional leaders have worked hard to obtain grants and contracts for the transition to commercial fisheries in the 1980s and various capital improvement and other projects in the 1990s and 2000s. Considerable hard work has contributed to the resilience both communities have displayed. Looking to the future, we can see that major shifts in the environment—or one's access to resources as a result of political or regulatory action—lead to major economic and social re-organizations. So far, these re-organizations have blunted the negative effects of the loss of major ecosystem services. However, further studies are necessary to assess the well-being and quality of life in communities that have endured such changes and to better understand the conditions that make successful re-organization possible.

St. Lawrence Island

St. Lawrence Island has been inhabited since time immemorial, and there are many archeological sites around the island. Its location is well suited for hunting marine mammals, as it lies across the migration routes of bowhead whales and walrus, and it is at the northern extent of subarctic species such as the Steller's sea lion. As many as five separate villages existed in the mid-19th century. At that time, commercial whaling for bowhead whales began, leading to regular contact between Native peoples of the northern Bering Sea and peoples of European and other descent involved in whaling. Trade provided goods such as metals and firearms to local people, but also brought disease and alcohol, which ravaged Native populations throughout the Americas.

The success of the commercial whaling greatly reduced the bowhead whale population and commercial whalers also pursued walrus, leading to a great decline in the walrus population. The combined reduction of availability of the two species most used by local people for subsistence culminated in a major famine in the winters of 1878-1880. Communities in the Russian mainland were affected as well, but St. Lawrence Island was particularly hard hit. About 1,000 lives were lost and only the community at Gambell remained. Savoonga was established in 1912 as a reindeer camp, and gradually grew to become its own community, now about equal in population to Gambell.

The loss of two major subsistence species, coupled with a lack of alternatives or outside support, led to this disaster. If such an event occurred today, humanitarian relief and other such interventions would reduce or prevent the loss of life as illustrated by relief efforts for St. Lawrence Island in 2013 (Presbytery of Yukon 2013). No famine occurred because island leaders could apply for state and federal aid, charitable organizations provided food and there are meal programs at schools and through other organizations.

In a more positive light, another adaptation to environmental change has occurred in Savoonga over the past two decades. Climate change has greatly altered the timing and characteristics of sea ice in the northern Bering Sea, so that freeze-up occurs later than it used to, and multi-year ice rarely drifts south through the Bering Strait. Also, unfavorable weather in spring has hampered whaling and walrus hunting, and rapid break-up and melt of ice in spring has reduced the duration of the walrus hunt. However, changes occurring in fall have produced a new opportunity to hunt bowhead whales in November and December. Since the early 1990s, about 30% of whales harvested by Savoonga have been taken in fall, representing an entirely new activity at that time of year. Had there been regulatory restrictions about hunting seasons, Savoonga would not have had the flexibility to adjust to this unpredicted opportunity in the midst of what are often perceived as unilaterally negative impacts from climate change.

In ecological terms, the favorable location of St. Lawrence Island means high productivity in most years, but poor weather conditions can prevent access to resources and thus lead to shortages of food. The fact that subarctic marine mammals already come as far north as St. Lawrence Island suggests that shifts in the distribution of marine mammals might bring new opportunities while others are lost. This is not to say that such shifts would, on balance, be positive or negative, just that there are offsets to consider rather than solely the loss of one set of opportunities.

Conclusions

On the Pribilof and St. Lawrence islands, past changes have often been met with innovation and adjustment. There are of course limits to how well individuals and communities can adapt. The St. Lawrence Island famine is an extreme example of how severe the effects of changes in abundance of key food species can be. On the other hand, the diversification of the Pribilof Islands economies, the new fall whaling in Savoonga, and other adaptations display a considerable capacity for innovation and resilience. Nonetheless, if reductions persist the cultural impact of reduced harvests can be substantial. For example, in the wake of the *Exxon Valdez* oil spill, many communities in the Gulf of Alaska and Aleutian Islands experienced lost or greatly reduced harvests of harbor seals and other resources, with the result that there were few or no opportunities for boys to learn the necessary skills for hunting, and for girls to learn how to process and care for the meat and organs. Such disruptions of knowledge transfer may have permanent consequences on social and cultural systems.

Changes of all kinds have occurred in the Bering Sea region over the past century or more, and are likely to continue for the foreseeable future. The immediate effects of many of these changes appear to be negative, as familiar ecological patterns are altered and the ways people gain livelihoods and well-being appear to be reduced. However, the extrapolation of current trends onto future conditions does not account for unforeseen changes in conditions that may occur and it is difficult to account for many involved factors. It is difficult to forecast innovation, and it is dangerous to simply assume that innovation will occur. Nonetheless, assessments of the implications of future change should also acknowledge that individual and community responses may well be adaptive across a wide range of conditions, and that disturbance need not lead inevitably to disruption and loss. Further development of this assessment should include

case studies of abandoned communities that failed to cope with changes in an effort to further clarify key factors and processes involved in community resiliency.

Relevant Available Information to Assess Climate Change Vulnerability

While an extensive data compilation and analysis was beyond the scope of this assessment, it was relevant to identify some available data that could be integrated with outputs of climate models to identify the most vulnerable components and to prioritize mitigation actions.

a. Subsistence Harvest

- Comprehensive or resource specific household harvest surveys: conducted in selected years and communities surveyed by the ADF&G Division of Subsistence and other research bodies. The Community Subsistence Information System (CSIS) compiles information generated by the ADF&G Division of Subsistence and other compatible studies (http://www.adfg.alaska.gov/sb/CSIS/). Other information is available as project reports produced by organizations such as Kawerak, Inc. Subsistence Resources and Social Science programs (e.g., Ahmasuk and Trigg 2008, Tahbone and Trigg 2011, Raymond-Yakoubian 2013, Kawerak 2013a, 2013c, 2013d, B. Raymond-Yakoubian *et al.* 2014, Kawerak 2013a, 2013c, 2013d).
- Harbor seals and Steller sea lion: annual harvest monitoring program conducted by the Alaska Native Harbor Seal Commission (ANHSC) and ADF&G Division of Subsistence (1995–2008, covered about 60 communities, including all communities of the Aleutian-Bering Sea Islands). Information available online at the CSIS and as annual reports.
- Birds and eggs: harvest monitoring program of the Alaska Migratory Birds Co-Management Council (AMBCC), better annual coverage for Gambell and Savoonga (data available at village level only for these villages, at regional and subregional level for other areas), poor coverage of Aleutian and Pribilof Islands.
- Halibut: NOAA-NMFS subsistence halibut harvest monitoring implemented by ADF&G Division of Subsistence (2003–2012, villages). Data available as annual reports.
- Walrus: Eskimo Walrus Commission and USFWS marine mammal marking, tagging, and reporting program (1989–present)
  http://www.fws.gov/alaska/shellfish/mmm/mtrp/pdf/factsheets/stats_walrus.pdf
  Alaska Department of Fish and Game, Village-based Walrus Habitat Use Studies in the Chukchi Sea.
  http://www.adfg.alaska.gov/index.cfm?adfg=marinemammalprogram.walrustracking
- Polar bear: marine mammal marking, tagging, and reporting program conducted by USFWS (1987–present)
  http://www.fws.gov/alaska/shellfish/mmm/mtrp/pdf/factsheets/stats_pbear.pdf
- Sea otter: marine mammal marking, tagging, and reporting program conducted by USFWS (1989–present)
  http://www.fws.gov/alaska/shellfish/mmm/mtrp/pdf/factsheets/stats_sea_otter.pdf

- Ice seals (ribbon, spotted, bearded, and spotted seals): limited harvest monitoring conducted by ADF&G Division of Wildlife Conservation (Mark Nelson) in collaboration with the Ice Seal Committee (2006–present).
- Bowhead whale: annual harvest reports produced on behalf of the Alaska Eskimo Whaling Commission.
- Beluga: Alaska Beluga Whale Committee (for further information contact Robert Suydam, Lori Quakenbush).

b. Commercial Fisheries Data Relevant for Subsistence Systems

- ADF&G Subsistence Reports at http://www.adfg.alaska.gov/index.cfm?adfg=subsistence.harvest
- Commercial Fisheries Regulations at http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareanortonsound.main http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareaaleutianislands.main
- Fish Count Database at http://www.adfg.alaska.gov/sf/FishCounts/
- Information on each Fishery http://www.adfg.alaska.gov/index.cfm?adfg=fishingCommercialByFishery.main

c. Demographic and Economic

Local governments, Native corporations, and other organizations have developed economic and development plans for individual communities (e.g., for Diomede http://www.kawerak.org/ledps/diomede.pdf). These plans describe the socio-economic setting; identify infrastructure, social, and economic needs; and propose mitigation actions including issues related to climate change (e.g., erosion). Information is also available from the Alaska Department of Community, Commerce, and Economic Development (DCCED).

d. Cultural Heritage

The Alaska Heritage Resources Survey (AHRS) is a statewide inventory of cultural properties maintained by the Alaska Office of History and Archaeology (OHA). The information on this database is limited to that provided by individuals to the OHA and coverage is uneven. The data refers to tangible remains such as archaeological sites, old settlements, structures, ruins, buildings, graves, and artifacts. Less tangible culturally important areas such as landscape features and sites with few visible remains are absent from the inventory. Local residents, tribal entities, Native social and cultural service organizations such as Kawerak Inc., Native Corporation landowners, and government land managers possess other sources of relevant information.

e. Weather and Other Environmental and Ecological Factors

(1) In some villages, interested individuals have been keeping periodic observations (daily, weekly) on environmental and ecological factors for years or decades (e.g., Nelson Lagoon; Reedy-Maschner and Maschner 2012). Researchers could seek partnership with these individuals to develop the potential of these data sources, integrate other sources of information, and make the information available for the local people and larger public. These collaborations

have the potential to develop research capacity within communities while recognizing local partners as primary research authors.
(2) Relationships between marine mammals and ice are very specific and involve different ecological factors and conditions necessary to meet animals' needs. For instance, walrus depend on sea ice strong enough to support their weight, furthermore this kind of ice needs to be over water shallow enough to allow walrus to reach the sea bottom to feed. Local and traditional knowledge includes a wealth of information on how marine mammals relate to and depend on sea ice (Gibson and Schullinger 1998, Callaway 1999:67). Specific collaborative projects designed to document and compile this knowledge may help understanding effects of loss and changes to sea ice on marine mammals and to people dependent on them.

Recommendations

Information Gaps

1. Fine-resolution information on variation of sea level and local topography may help assess vulnerability of coastal cultural and archeological sites.
2. Change and variation in ice condition (extent, thickness, age, kind of ice).
3. Variation in conditions affecting occurrence and distribution of polynyas and ice leads, what affects distribution of birds and marine mammals.
4. Variability in strength and volume of inter-island currents, upwellings, and coastal currents.
5. Variation and change in range distribution and seasonal timing of species. From a subsistence perspective, definitions of seasons are variable depending on resources, location, and annual variations of climate and ecological processes.
6. Indicators of storminess.
7. Affects of cold pool changes on subsistence systems.
8. Develop better understanding of how climate change interacts with other ongoing socio-economic and cultural processes affecting life in rural Alaska.
9. Support applied approaches to integrate TEK into research, management, and policy development.
10. Conduct ethnographic research to understand past and current adaptive responses by local communities to ecological and socio-economic drivers of change.
11. Increase community awareness of potential changes and necessary preventive and mitigation actions to respond and adapt to increasing vessel traffic in Bering Sea.

Mitigation Actions

The socio-economic and cultural settings of Alaska Native Villages are complex and interact in many ways with environmental and ecological changes. Therefore, it is difficult to isolate drivers of change and forecast directions of change and adaptive responses by communities. Nevertheless, consequences of climate change are yet another stressor in Alaska rural communities. Given many uncertainties, climate change mitigation actions derived from optimal strategies that maximize benefits while minimizing costs and negative consequences have the best potential to promote the long-term sustainability of subsistence cultures and

communities. Such optimal strategies yield benefits to communities even if climate is eventually not a main driver of change.

Cultural Sites

1. Develop a comprehensive inventory of historic, cultural, and archeological sites, including information on topography, geology, and identified threats (erosion, flooding, trampling, and looting). Involve communities in this process.
2. Document (excavation, research) and protect (stabilize) threatened sites based on priorities defined by local communities and researchers.

Harvests

1. Identify alternative subsistence and commercial resources that are sustainable in the short and medium term.
2. Assess needed changes to harvest regulations to allow sustainable harvest opportunities given changing timing and abundance of resources.
3. Design and implement food safety monitoring program to assess levels of contamination in subsistence and commercial harvests, which may result from increased shipping traffic and other economic activities.
4. Develop measures to limit and direct shipping traffic during certain times of the year to protect subsistence resources, harvesters, and harvest activities.
5. Support local participation and the inclusion of local and tradition knowledge in resource management (co-management bodies, regional advisory councils).

Socio-Economic Well-Being

1. Develop and improve multi-agency coordination to detect and respond to sources of contamination related to increased shipping traffic and other economic activities (e.g., chronic and acute oil spills).
2. Communities affected by coastal erosion may need mitigation actions including relocation. Develop sustainable economic and cultural approaches to identify new sites and implement relocation, considering issues of access in and out of the community, geology, and access to subsistence resources.
3. Develop and refine approaches to communicate climate model output scenarios and vulnerability assessment with rural communities (language, time and spatial scale). The need for better communication has been identified in previous assessments (Cohen 1997, Callaway 1995:62).
4. Work with communities to develop approaches to prevent and reverse outmigration that may cause communities to disappear (development of local economic opportunities, support education, financial assistance with changing equipment needs, training in using new technology, licensing, permitting).
5. Support and promote cultural heritage activities, participation of youth in subsistence activities, programs to preserve and recover proficiency in Native languages.
6. Directly involve communities in climate related research. One approach to achieve this objective is to develop and support environmental community-based monitoring

programs incorporating western science and local and traditional knowledge (Callaway 1999:62).

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INUIT CIRCUMPOLAR COUNCIL-ALASKA

ALASKAN INUIT FOOD SECURITY CONCEPTUAL FRAMEWORK

HOW TO ASSESS THE ARCTIC FROM AN INUIT PERSPECTIVE

PUBLISHER PAGE

All information and concepts within this report are the product of a collaborative effort among 146 contributing authors (all Indigenous Knowledge (IK) holders), the project's Food Security Advisory Committee and the Inuit Circumpolar Council-Alaska. Information and concepts from this report should be cited as: Inuit Circumpolar Council-Alaska 2015. Alaskan Inuit Food Security Conceptual Framework: How to Assess the Arctic From an Inuit Perspective: Summary Report and Recommendations Report. Anchorage, AK.

This report and associated materials can be downloaded for free at iccalaska.org.

Graphic design/layout by Northwest Strategies.

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ACKNOWLEDGMENTS

Inuit Circumpolar Council-Alaska is grateful to the Tribal Councils for providing feedback, logistical planning and support throughout this project and to the contributing authors listed. We are also grateful to those individuals who chose not to be listed but continued to provide information and review of the project.

Inuit Circumpolar Council-Alaska wishes to thank the project's Food Security Advisory Committee for their guidance and information provided throughout the project and for the contributions provided to this report.

Thank you to the funders of this project: Alaska Native Fund at Alaska Conservation Foundation, Arctic Slope Regional Corporation, Calista Corporation, ConocoPhillips, Donlin Gold LLC, Maniilaq Association, NANA Regional Corporation, North Slope Borough, Northwest Arctic Borough, Norton Sound Economic Development Corporation, Oak Foundation and World Wildlife Fund.

Thank you to the organizations that provided important, invaluable in-kind contributions: Alaska Commercial Company, Alaska Native Fund at Alaska Conserative Foundation, Association of Village Council Presidents, Atmautluak Traditional Council, Bering Air, City of Emmonak, Hanson Trading Company (Safeway), Iñupiat Heritage Center, Kawerak, Inc., Kobuk Clinic, Lower Kalskag Tribal Council, National Park Service, North Slope Borough Department of Health and Social Services, North Slope Borough Department of Wildlife Management, Northwest Strategies, Pilot Station Tribal Council, Shungnak Tribal Council and Yupiit Piciryarait Cultural Center.

Thank you to the note-takers, language interpreters and photographers: Angie Whitman, Alvira Downey, Barbara Atoruk, Caroline Cannon, Chloe Naylor, Denali Whiting, Diane Wasuli-Dock, Doris Mute, Elizabeth Cravalho, Freida Moon-Kimoktoak, Grant Ballot, Heather Dingman, Jeffrey Egoak, Joann S. Andrew, Josaphine Sampson, Julie Raymond-Yakoubian, Kevin Bartley, Kevin Jernigan, Maija Lukin, Martha Whitman-Kassock, Meghan Topkok, Michelle Durant, Millie Stalker, Nicole Kanayurak, Nicole Ranklin, Pauline Harvey, Robert Suvlu, Sharon Rodgers and Virginia Charlie.

Thank you to everyone who provided photographs for this report. Your photos assist in demonstrating what Alaskan Inuit food security is: Amos Oxereok, Jackie Cleveland, Maija Lukin, Mary Sage and the North Slope Borough.

During this project we lost three Elders who served as contributing authors and/or provided invaluable guidance during the project. We are humbled by their knowledge and thankful for their generosity in sharing information. Quyana, Chief Paul John, John J. Evan and Mike Andrew Sr..

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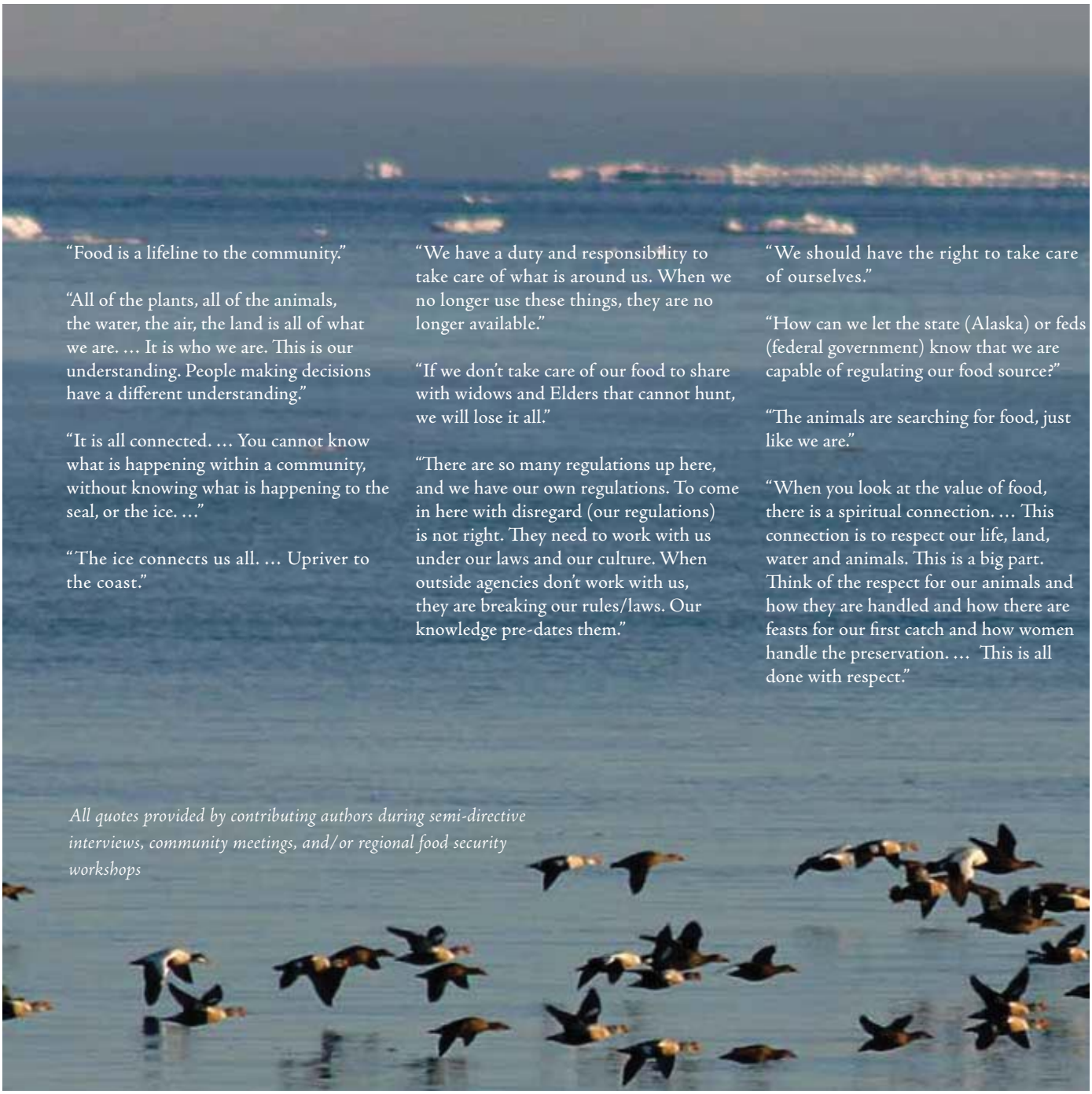


"Food is a lifeline to the community."

"All of the plants, all of the animals, the water, the air, the land is all of what we are. … It is who we are. This is our understanding. People making decisions have a different understanding."

"It is all connected. … You cannot know what is happening within a community, without knowing what is happening to the seal, or the ice. …"

"The ice connects us all. … Upriver to the coast."

"We have a duty and responsibility to take care of what is around us. When we no longer use these things, they are no longer available."

"If we don't take care of our food to share with widows and Elders that cannot hunt, we will lose it all."

"There are so many regulations up here, and we have our own regulations. To come in here with disregard (our regulations) is not right. They need to work with us under our laws and our culture. When outside agencies don't work with us, they are breaking our rules/laws. Our knowledge pre-dates them."

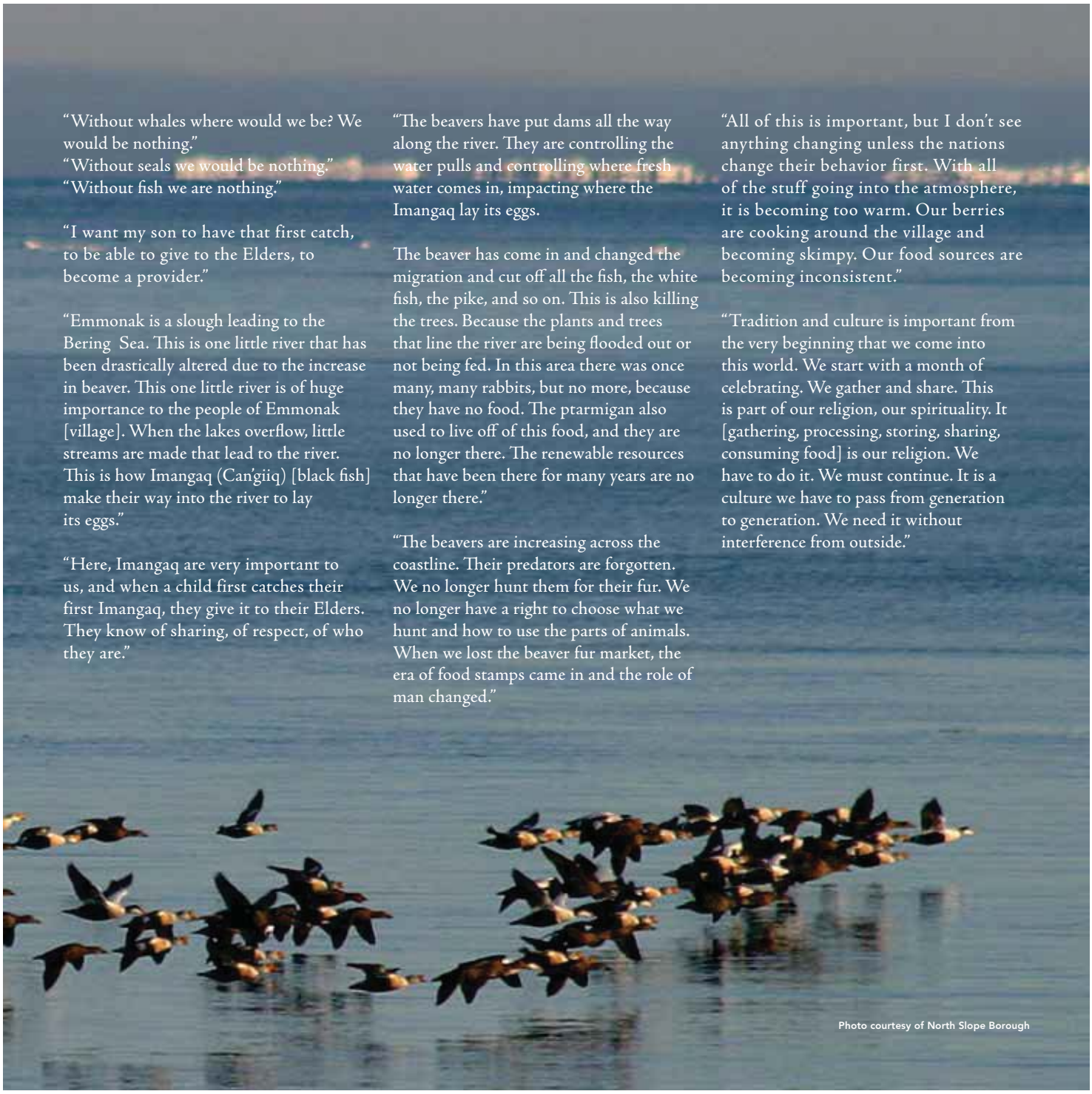
"We should have the right to take care of ourselves."

"How can we let the state (Alaska) or feds (federal government) know that we are capable of regulating our food source?"

"The animals are searching for food, just like we are."

"When you look at the value of food, there is a spiritual connection. … This connection is to respect our life, land, water and animals. This is a big part. Think of the respect for our animals and how they are handled and how there are feasts for our first catch and how women handle the preservation. … This is all done with respect."

All quotes provided by contributing authors during semi-directive interviews, community meetings, and/or regional food security workshops



"Without whales where would we be? We would be nothing."
"Without seals we would be nothing."
"Without fish we are nothing."

"I want my son to have that first catch, to be able to give to the Elders, to become a provider."

"Emmonak is a slough leading to the Bering Sea. This is one little river that has been drastically altered due to the increase in beaver. This one little river is of huge importance to the people of Emmonak [village]. When the lakes overflow, little streams are made that lead to the river. This is how Imangaq (Can'giiq) [black fish] make their way into the river to lay its eggs."

"Here, Imangaq are very important to us, and when a child first catches their first Imangaq, they give it to their Elders. They know of sharing, of respect, of who they are."

"The beavers have put dams all the way along the river. They are controlling the water pulls and controlling where fresh water comes in, impacting where the Imangaq lay its eggs.

The beaver has come in and changed the migration and cut off all the fish, the white fish, the pike, and so on. This is also killing the trees. Because the plants and trees that line the river are being flooded out or not being fed. In this area there was once many, many rabbits, but no more, because they have no food. The ptarmigan also used to live off of this food, and they are no longer there. The renewable resources that have been there for many years are no longer there."

"The beavers are increasing across the coastline. Their predators are forgotten. We no longer hunt them for their fur. We no longer have a right to choose what we hunt and how to use the parts of animals. When we lost the beaver fur market, the era of food stamps came in and the role of man changed."

"All of this is important, but I don't see anything changing unless the nations change their behavior first. With all of the stuff going into the atmosphere, it is becoming too warm. Our berries are cooking around the village and becoming skimpy. Our food sources are becoming inconsistent."

"Tradition and culture is important from the very beginning that we come into this world. We start with a month of celebrating. We gather and share. This is part of our religion, our spirituality. It [gathering, processing, storing, sharing, consuming food] is our religion. We have to do it. We must continue. It is a culture we have to pass from generation to generation. We need it without interference from outside."

Photo courtesy of North Slope Borough

EXECUTIVE SUMMARY

Drastic changes are occurring within our world. We are on the forefront of these changes. We have lived here for millennia and have grown and changed with all that is around us. All that is around us physically and spiritually nourishes us, and our culture reflects the Arctic because we are part of this ecosystem.

With these rapid changes comes the need for holistic information based on Indigenous Knowledge (IK) and science. With this understanding, we brought our concerns regarding the impact of Arctic changes on our food security to forums throughout the Arctic. Through these conversations, it quickly became evident that we were referring to something different than those we were holding the discussions with.

We have often heard people within academia, policy and management speak to us of nutritional value, calories and money needed to purchase food. All of this is important, but not what we are talking about when we say food security. We are speaking about the entire Arctic ecosystem and the relationships between all components within; we are talking about how our language teaches us when, where and how to obtain, process, store and consume food; we are talking about the importance of dancing and potlucks to share foods and how our economic system is tied to this; we are talking about our rights to govern how we obtain, process, store and consume food; about our IK and how it will aid in illuminating the changes that are occurring. We are talking about what food security means to us, to our people, to our environment and how we see this environment; we are talking about our culture.

From the realization that we need to fully share what our food security means within the Alaska Arctic, this project was born. There has been a lot of positive work completed and ongoing to increase academic and governmental understanding of food security. The outcomes of this project come directly from us, Alaskan Inuit, to share what our food security is, how to assess changes occurring and how to move forward in a way that will strengthen our food security.

The objectives for the project were clear from the beginning – define food security, identify what the drivers (or causes) of food (in)security are, create a conceptual framework and provide an assessment process to determine Alaskan Inuit food security. What resulted is something much more. As we came together through community meetings, one-on-one and group interviews, regional workshops and numerous conversations, we realized that the drivers of our food security are all the same and that what make up food security within each of our identities, villages and regions is the same.

A Project Led by Alaskan Inuit

Over a three-and-a-half-year period, a group of IK holders, regional youth representatives and two cultural anthropologists acted as the Food Security Advisory Committee. The Committee guided ICC-Alaska through the development, implementation and analysis of information gathered. The final products of the project are the result of 146 Inuit contributing authors – a title fitting for those who provided all concepts, philosophies and recommendations that have come out of this project.

Photo courtesy of Jacki Cleveland

ALASKAN INUIT FOOD SECURITY CONCEPTUAL FRAMEWORK

Defining Alaskan Inuit Food Security

Alaskan Inuit food security is the natural right of all Inuit to be part of the ecosystem, to access food and to care-take, protect and respect all of life, land, water and air. It allows for all Inuit to obtain, process, store and consume sufficient amounts of healthy and nutritious preferred food – foods physically and spiritually craved and needed from the land, air and water, which provide for families and future generations through the practice of Inuit customs and spirituality, languages, knowledge, policies, management practices and self-governance. It includes the responsibility and ability to pass on knowledge to younger generations, the taste of traditional foods rooted in place and season, knowledge of how to safely obtain and prepare traditional foods for medicinal use, clothing, housing, nutrients and, overall, how to be within one's environment. It means understanding that food is a lifeline and a connection between the past and today's self and cultural identity. Inuit food security is characterized by environmental health and is made up of six interconnecting dimensions: 1) Availability, 2) Inuit Culture, 3) Decision-Making Power and Management, 4) Health and Wellness, 5) Stability and 6) Accessibility. This definition holds the understanding that without food sovereignty, food security will not exist.

From here on, this is what we are discussing when we say food security.

Summary and Technical Report

A summary report and technical report have been created from this project. The summary report was created for those who are looking for a quick glimpse at what food security means to us, what it means to apply a food security lens to assessments and recommendations for strengthening food security. For a deeper understanding and more in-depth discussion, a technical report has been created. Within both reports you will find: 1) recommendations, 2) key barriers, 3) the Food Security Conceptual Framework, and 4) drivers of food security and insecurity.

ALASKAN INUIT FOOD SECURITY CONCEPTUAL FRAMEWORK

Photo courtesy of Jacki Cleveland

Following the introduction of this report, we present the Alaskan Inuit Food Security Conceptual Framework. The framework is the product of semi-directive interviews and analysis of information conducted through community meetings, regional workshops and at times with assistance of computer software to pull out themes. These themes were further analyzed and evaluated through regional meetings. During this process, IK holders and the project's Food Security Advisory Committee provided continuous guidance, feedback and direct involvement in the development of the conceptual framework. The framework provides an understanding of all the components that make up our food security and further begins to demonstrate the relationships that exist between all that is in the Arctic.

To discuss Alaskan Inuit food security, it is important to understand the connected nature of the Arctic. To aid in illustrating this point, we provide two conceptual maps that demonstrate connectivity, cumulative impacts and shows how to apply a food security lens to understanding the Arctic.

The report ends with recommendations to strengthen different parts of our food security. Additionally, we provide a list of key barriers identified throughout the process of completing this project. The recommendations may include components that are familiar – points that we have made for many years. Through this report, we have another opportunity to express the need for particular actions, to define how we are involved in research, management and policymaking and to lay out what is needed to support our culture and overall food security.

We expect the results of this project to be useful to multiple audiences, such as national decision-makers developing policies and programs to ensure community-level food security and the support of ecosystem resiliency through disturbances; local Indigenous organizations in communicating with outside interests, such as mining companies or environmental organizations; and international institutions, such as the Arctic Council, that are interested in understanding the Arctic and the changes that are occurring. Though this report is the product of Alaskan Inuit, it is hoped that Indigenous Peoples from across the Arctic will find it of use.


Photo courtesy of Maija Lukin


Photo courtesy of Jacki Cleveland

Indigenous Knowledge
Indigenous Knowledge (IK) is a systematic way of thinking applied to phenomena across biological, physical, cultural and spiritual systems. It includes insights based on evidence acquired through direct and long-term experiences and extensive and multigenerational observations, lessons and skills. It has developed over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed on from generation to generation.

Under this definition, IK goes beyond observations and ecological knowledge, offering a unique "way of knowing." This knowledge can identify research needs and be applied to them, which will ultimately inform decision-makers. There is a need to utilize both,Indigenous and scientific knowledge. Both ways of knowing will benefit the people, land and animals within the Arctic.

*Note: Inuit at times may refer to their knowledge as Indigenous Knowledge, Inuit Knowledge or Traditional Knowledge. The definition provided above is understood by ICC to apply to all three terms.

ALASKAN INUIT FOOD SECURITY CONCEPTUAL FRAMEWORK

INTRODUCTION

Food security is a term being used more often in research, politics and media to describe the associated consequences of food insecurity and whether a group of people is obtaining enough food. There is a growing appreciation for the complexities of the concept of food security, and the hundreds of definitions developed in the last 40-plus years are evolving to account for this understanding. Today, the multiple food security definitions and assessment mechanisms do not necessarily match the Arctic ecosystem or our culture. For example, most of the world considers food security in terms of purchasing power, nutrients, caloric intake and access to food and a lot of research has concentrated on land use changes in agricultural development. [1]

There is a deep connection between our Alaskan Inuit food systems and the understanding of the Arctic. We have developed a rich culture, shaped by the dynamic environment in which we live and centered on the obtaining, processing, storing and consumption of Arctic flora and fauna. Traditional foods, such as caribou, waterfowl, salmon, seal, salmonberries and sura (diamond-leaf willow), provide spiritual, cultural and traditional values, shelter, medicines, energy, identity and more. Over time immemorial, the obtaining, processing, storing and consuming of these foods have involved storytelling, dancing, drumming, art, education, language, traditions and ceremonies. All of these components play a part in defining our food security. After all, our traditional foods are much more than calories or nutrients; they are a lifeline throughout our culture and reflect the health of the entire Arctic ecosystem.

The Arctic environment is changing at an unprecedented rate. Where ice and cold temperatures once acted as a barrier, today, shifts in sea ice coverage and thickness, increasing temperatures and other factors are issuing in a new Arctic, one filled with possibilities. How we react to these changes will influence levels of adaptability, resiliency and health in our communities. To understand the rapidly occurring changes, there is a need to apply a food security lens. Doing so will provide a deeper understanding of the interconnections and relationships between all within the Arctic ecosystem and reveal the cumulative impacts occurring.

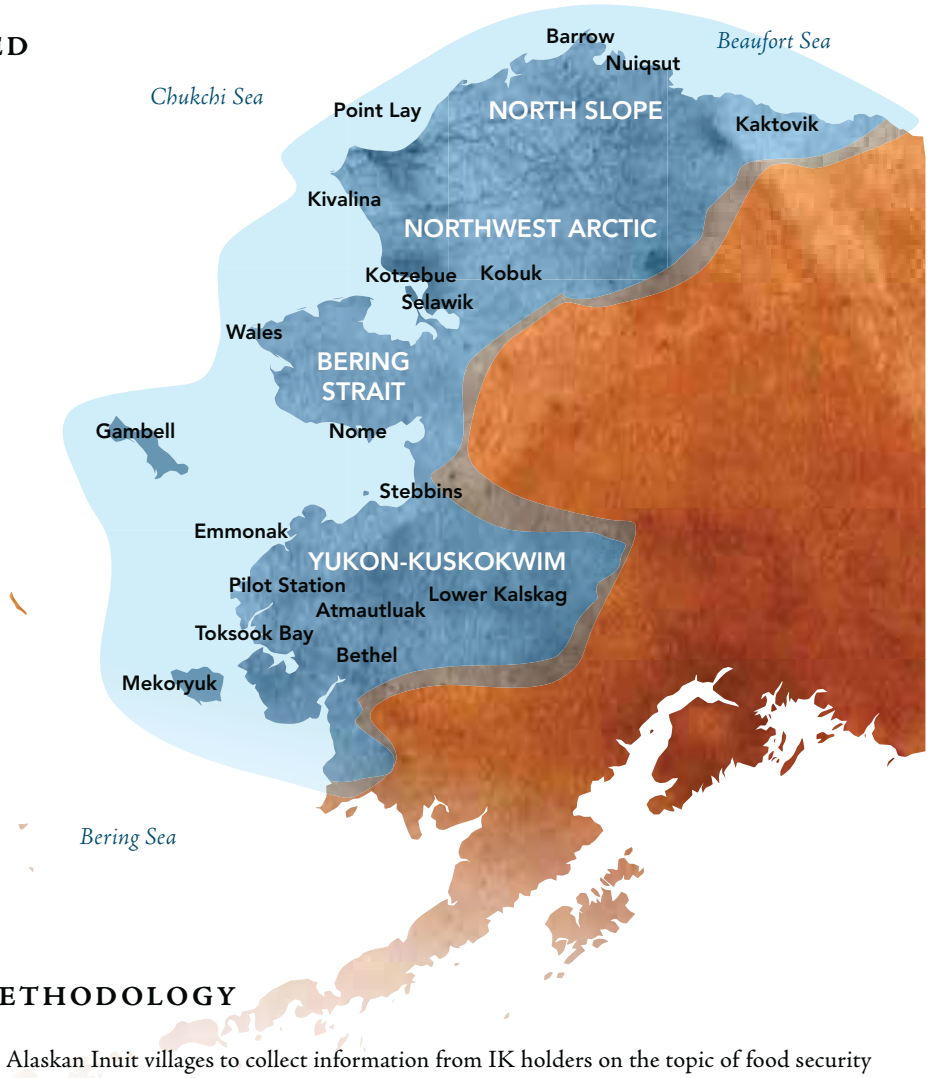
The following summary report focuses on sharing the collective efforts of ICC-Alaska, 146 Inuit contributing authors, an 12-member Food Security Advisory Committee and many other Inuit, who provided input and guidance. Here we aim to illuminate what food (in)security through our way of knowing.

This project has been ongoing for three-and-a-half years. Since the beginning of the project in 2012, the impacts resulting from rapid changes have escalated. Where before we discussed changes that had never seen, today, these changes are persistent, and inconsistency is becoming a new norm. For example, before people mentioned having less meat to dry, and today some have no meat to dry.

There is no time to waste; we must begin to make changes today, not just for the sake of our culture but also for the sake of the entire Arctic ecosystem. Using a food security lens, the tools provided through this project and applying the recommendations will help us be able to make the changes needed.

[1] Today there is a growing number of initiatives that expand upon previous work conducted. For example, work done by the Council of Canadian Academies, Tebtebba Indigenous Peoples' International Centre for Policy Research and Education, Nunavut Food Security Coalition, Alaska Food Policy Council and academic researchers, such as Michael Carolan and Philip Loring, seeks to expand the understaning or address the complexities of food security. This work is important and has a lot to offer. The products of this project come directly from us, Alaskan Inuit, to explain and share our own conclusions and our way of knowing. It is important to also acknowledge that our regional organizations, Kawerak, Inc., Bering Straits Native Corporation, Maniilaq Association, NANA Corporation, Northwest Arctic Borough, North Slope Borough, Inupiat Community of the Arctic Slope, Association of Village Council Presidents, Arctic Slope Regional Corporation and Caslista Corporation have historically all addressed food security through various avenues on a daily basis.

MAP OF VILLAGES VISITED



The four Alaska regions that ICC-Alaska advocates on behalf of and the 15 villages and hub communities visited throughout this project.

SUMMARY OF PROJECT METHODOLOGY

Since July 2012, ICC-Alaska has visited 15 Alaskan Inuit villages to collect information from IK holders on the topic of food security through semi-directive interviews and community meetings. The information gathered was then compiled and analyzed to obtain a greater understanding of food security and to identify drivers of food security and insecurity. Preliminary findings from the interviews were presented at four regional workshops held in Barrow, Kotzebue, Nome and Bethel. The workshops were part of the evaluation and validation process. Those attending the workshop (chosen by their respective Tribal Councils), analyzed, validated and approved information that had been provided by IK holders within villages. Additionally, they offered information that had been missing and provided further guidance on what needed to be communicated through this project. This process followed an IK methodology. Additional information on the project methodology and IK is in the project technical report.

ALASKAN INUIT FOOD SECURITY CONCEPTUAL FRAMEWORK

Photo courtesy of Jacki Cleveland

UNDERSTANDING ALASKAN INUIT FOOD SECURITY

The Alaskan Inuit food security definition is provided on page 5. The definition states that food security is characterized by environmental health. We understand the Arctic environment to encompass all. As an Elder explains, the Arctic environment is like a puzzle, with all pieces having a place and all pieces necessary to make up the entire picture. These pieces include Inuit languages, retention of IK, animal health, oceans and rivers, etc. This description of the environment helps explain how the Arctic ecosystem is made up of multiple parts. Scientists may also understand this explanation in terms of systems. Each puzzle piece can be envisioned as a system that together makes up the entire ecosystem. The Inuit culture is a system within this larger ecosystem, just as the hydrologic system is part of the same ecosystem. And just as the Arctic ice system is interlinked within that system, so is the Inuit culture interconnected with all aspects of the larger ecosystem.

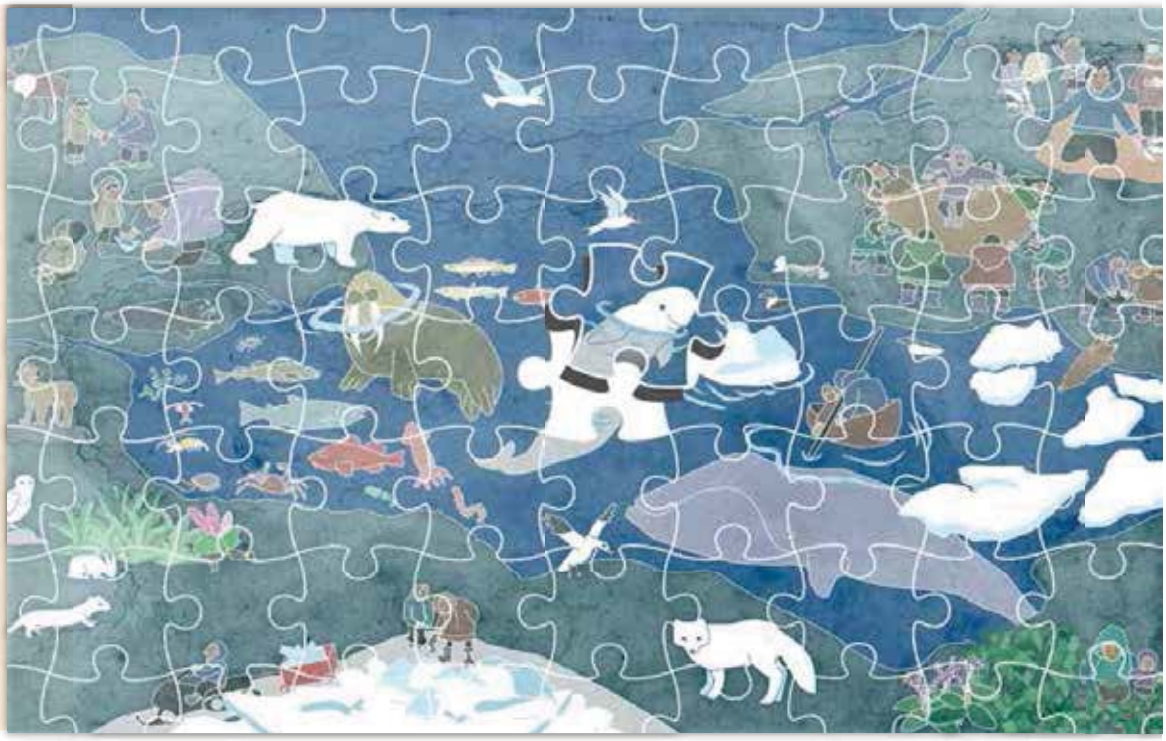
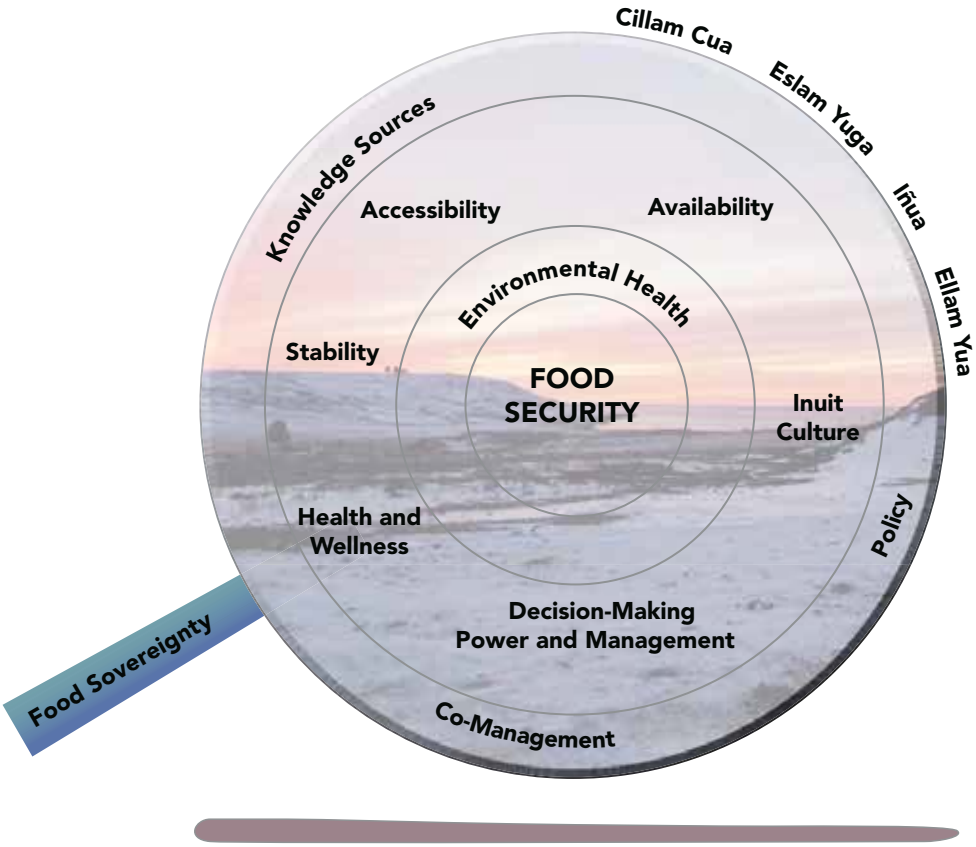


Figure 1. Image of Arctic interlinking puzzle pieces. (**systems**). *Note that the puzzle pieces may have multiple systems nested within one piece and that all demonstrate an interlinking between social and natural phenomena.*



ALASKAN INUIT FOOD SECURITY CONCEPTUAL FRAMEWORK

The development of a conceptual framework provides a platform for understanding the pieces that make up the Arctic ecosystem and the interconnections between the many pieces that make up food security. The framework provides direction for what information is needed and how to interpret that information in order to assess food security.

The conceptual framework is provided through an image of a drum and explains that food security is characterized by environmental health; environmental health is achieved with the stability of six dimensions: 1) Availability, 2) Inuit Culture, 3) Decision-Making Power and Management, 4) Health and Wellness, 5) Stability and 6) Accessibility. Three tools support the stability of the six dimensions: policy, knowledge sources[2] and co-management. All of this is held together by the spirit of everything[3] (Cillam Cua, Eslam Yuga, Iñua and Ellam Yua). The drum is held up by food sovereignty – a requirement for food security.

[2] Both IK and science are needed.
[3] The spirit of all spoken in all four of our languages. Cillam Cua is from the Cup'ik language, Eslam Yuga is from the St. Lawrence Island Yupik language, Iñua is from the Iñupiaq language and Ellam Yua is from the Yup'ik language.

The six dimensions of food security are defined as follows:

Inuit Culture – Food is the cornerstone of our culture and self- and shared identity. Harvesting of traditional foods is how cultural values, skills and spirituality are learned – this is how all learn to be within their environments and to be part of the ecosystem. The relationship between Inuit and all else that makes up the Arctic environment aids in the maintenance of cultural and environmental integrity.

Availability – The ability of the Arctic ecosystem to maintain a high variety of life (biodiversity), allowing adequate transfer of nutrients and energy. It is the knowledge of seasons and how to collect, process, store and consume traditional foods, allowing for Inuit to eat what has been gathered from the previous season and harvest a variety of medicines.

Accessibility – The ability to live off the land, ocean and air and to obtain sufficient access to a diverse source of healthy food, water, animals, plants, fish, ice, etc. The ability to maintain Inuit traditional economic practices, such as trading, sharing and providing foods and medicines. It is the ability to access and maintain an economic system based on cash in connection to an Inuit traditional economic system. It is the ability to obtain skills, tools and technologies needed to collect, process and store traditional foods.

Health and Wellness – Physical health of all life within the Arctic and of the land, water and air; adequate passage and absorption of nutrients throughout the Arctic ecosystem; mental health related to community and household relations and self- and cultural identity; environmental integrity and productivity to withstand pollution, habitat destruction and other disturbances.

Stability – The ability of the puzzle pieces (systems) to adjust to each other as shifts within the ecosystem occur. The ability to maintain sustainability through the management of human actions that support and ensure younger generations will have sufficient healthy food to harvest and that all pieces of the puzzle maintain connected. Stability is obtained through a level of Alaskan Inuit mental security and is in reference to the legal protections for the environment against harm caused by pollutants. Mental security is also in reference to legal protection against forced assimilation, which allows for the maintenance of a level of cultural confidence and hope.

Decision-Making Power and Management – The Alaskan Inuit ability to use and value IK to manage daily activities; to build and rely on self-governance across space and time; for Alaskan Inuit to use their knowledge system in synergy with other knowledge systems, such as Western science, to equitably manage human activities within the Arctic environment and to better understand changes occurring; to apply holistic knowledge to understanding the Arctic environment through IK philosophies and methodologies; to manage activities within the Arctic in a way that ensures younger generations will have healthy and nutritious foods to harvest; for Alaskan Inuit to have control over their own fate and to use their cultural value system.

Food Sovereignty – The right of Alaskan Inuit to define their own hunting, gathering, fishing, land and water policies; the right to define what is sustainable, socially, economically and culturally appropriate for the distribution of food and to maintain ecological health; the right to obtain and maintain practices that ensure access to tools needed to obtain, process, store and consume traditional foods. Within the Alaskan Inuit Food Security Conceptual Framework, food sovereignty[4] is a necessity to supporting and maintaining the six dimensions of food security.

[4] The food sovereignty definition presented here accounts for all points identified by Alaskan Inuit and has been adapted from the definition written by Hamm and Bellows in First Nations Development Institute's Food Sovereignty Assessment Tool, 2004 and in addition to the definition provided in the Declaration of Nyéléni (2007).

DRIVERS OF FOOD (IN)SECURITY

The conceptual framework aids us in seeing the underlying issues. We describe these issues as drivers. The term driver is used to communicate actions, components or causes of food (in)security because they are pushing food security in a particular direction. The six dimensions of food security are made up of a total of 58 drivers (Behe, 2013. Inuit Circumpolar Council-Alaska). Below the drivers are linked to food security (FS), food insecurity (FI) or both.

Inuit Culture

1. Value of food (FS)
2. Spirituality (FS)
3. Language and terminology (FS)
4. Education and transfer of knowledge (FS)
5. Sharing systems (FS)
6. Respect (FS)
7. Celebrations, games and feasts (FS)
8. Social interaction (FS)
9. Dance, art and music (FS)
10. Self- and cultural identity (FS)
11. Clothing and tools (FS)
12. Maintaining Inuit leadership and knowledge holders (FS)
13. How to be within the environment (cosmology) (FS)
14. Time constraints (FI)
15. Gathering, processing, storing and consuming traditional foods (FS)
16. Physical safety (e.g., navigation skills) (FS)
17. Knowledge of food systems of yesterday and today (FS)
18. Relationship with animals (socio-ecological system) (FS)

Availability

1. Variety – number of different animals and plants in the area (may also be referred to as biodiversity (FS)
2. Knowledge of how to obtain, process, store and consume traditional foods (FS)
3. Knowledge of seasonality – Inuit calendars (FS)
4. Being able to eat what has been gathered from last season (FS)

Decision-Making Power and Management

1. Ability to manage lands, waters and resources (FS)
2. Power dynamics – self-regulation (FS)
3. Perceived and actual reality of control over fate (FS)
4. Strength of co-management structures (FS and FI)
5. Loss of resource benefits and income (FI)
6. Federal and state regulations/jurisdiction (FS and FI)
7. User conflict (FI)
8. Burden of conservation (FI)
9. Increase in competition (FI)
10. Taxation without representation and representation with low understanding of Inuit culture and Inuit ecological regions (FI)
11. Respect for and equality of knowledge systems (IK and science)(FS)
12. Preparedness for large disturbances, such as preparedness for oil and emergency response (FS)
13. Meaningful, equitable involvement in research (FS)
14. Institutional racism (FI)

Health and Wellness

1. Environmental integrity and productivity to withstand pollution (noise and light pollution, garbage, contaminants, wastewater, etc.), erosion, habitat destruction, etc. (FS)
2. Increased vulnerability throughout the food chain (FI)
3. Degradation of healthy food systems and overall health (e.g., increases in chronic diseases such as cancer) (FI)
4. Nutrition – ability to access and absorb (FS)
5. Accessibility to traditional medicines and healers (FS)
6. Accessibility to Western medicine and health care professionals (FS)
7. Landfill system (FS and FI)
8. Sanitation system (FS and FI)
9. Mental health (FS and FI)
10. Housing structures (FS and FI)
11. Mixed diet of traditional and non-traditional foods (FI and FS)

Stability

1. Adapt to changes (FS)
2. Rapid speed of change (FI)
3. Inuit mental security – confidence in the legal protections for the environment from harmful actions, such as those that result from pollution. Legal protection for the Inuit culture against forced assimilation. (FS)
4. Integrity of interconnection systems – marine, terrestrial, cultural, etc. (FS and FI)
5. Change in sea ice thickness, timing of formation and break-up (FI)
6. Hope (FS)

Accessibility

1. Access to traditional territories (FS)
2. Ability to live off the resources of the land, water and air (FS)
3. Economics – (Inuit economy, cash [market] economy, government subsidies (FS and FI)
4. Water sources (e.g., multi-year ice, river ice, etc.) (FS and FI)
5. Access to tools and possessing the ability to access healthy animals, plants, fish, ice, water, etc. (FS)

Most of the drivers of food security may quickly become drivers of food insecurity when not adequately supported. For example, access to traditional territories is a driver of food security. However, lack of access to traditional territories is a driver of food insecurity. There are 37 drivers linked to food security; 11 drivers are directly linked to food insecurity; 10 drivers are linked to either food security or food insecurity.

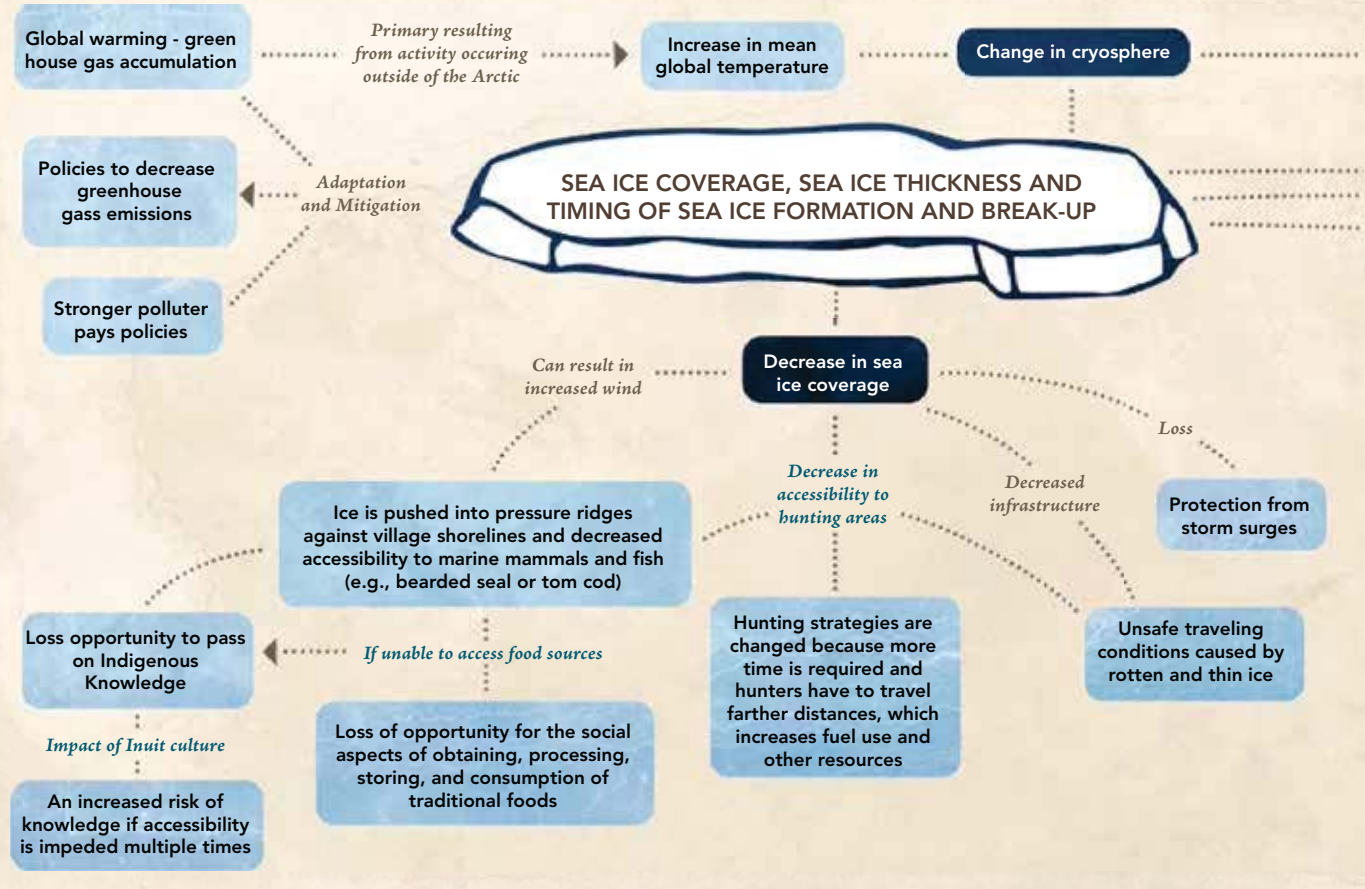
Photo courtesy of Jacki Cleveland

CONNECTIVITY AND CUMULATIVE IMPACTS

The connectivity of all food security dimensions, and subsequently all drivers, are key to understanding the Arctic ecosystems. Within our IK the interconnections of these systems are an indication of resilience to disturbances. It is important to understand the components and resiliency of each dimension. Of equal importance, our IK guides us to look closely at the relationship between the dimensions and between the drivers. This IK methodology allows for a greater understanding of cumulative impacts.

Consider the rapid changes resulting from climate change and the many connections that may need to be considered when determining points of vulnerability. Within the physical world there is a change in sea ice coverage, thickness and timing of formation. There is a decrease in multi-year ice and melting permafrost. Erosion is increasing freshwater lakes and ponds drying up. There is a change in water and atmospheric

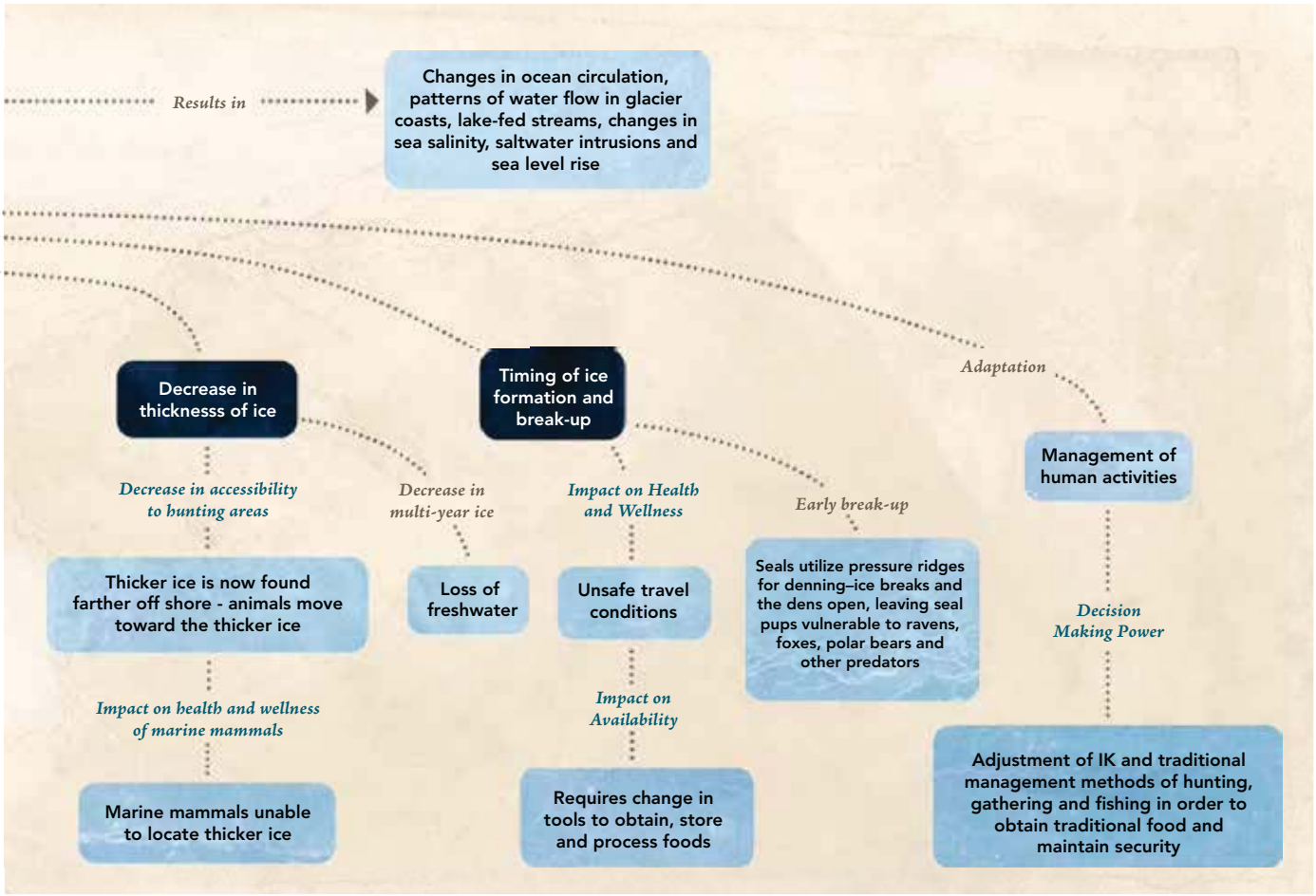
Figure 2. Changes in sea ice coverage, thickness and formation: cumulative impacts on interconnected dimensions of food security



temperatures. Many areas are experiencing an increase in shallow waterways, narrowing and widening of streams, change in precipitation rates, an increase in storm surges and an increase in flooding. There are changes in salinity levels, shifts in saltwater lines, changes in ocean micro-current and shifts in sandbars. Many of these changes are interlinked with each other.

These changes in land, air and water contribute to changes in all of life found within the Arctic. For example, shifts in animal migration patterns and shifts in vegetation are occurring as a result to changes in temperatures, salinity levels, precipitation rates, snow coverage, erosion, ice coverage, etc. Such changes require adjustments in gathering, hunting and fishing strategies.

Additionally, we face new dangers as we attempt to navigate through storms, rotting ice, change in sea ice thickness and time of sea ice formation, and an overall shift season (Inuit Circumpolar Council-Alaska. 2014. Bering Strait). Many of these changes began to occur between 15 and 20 years ago. The rate and intensity of these changes have increased in recent years.



ALASKAN INUIT FOOD SECURITY CONCEPTUAL FRAMEWORK


Photo courtesy of North Slope Borough

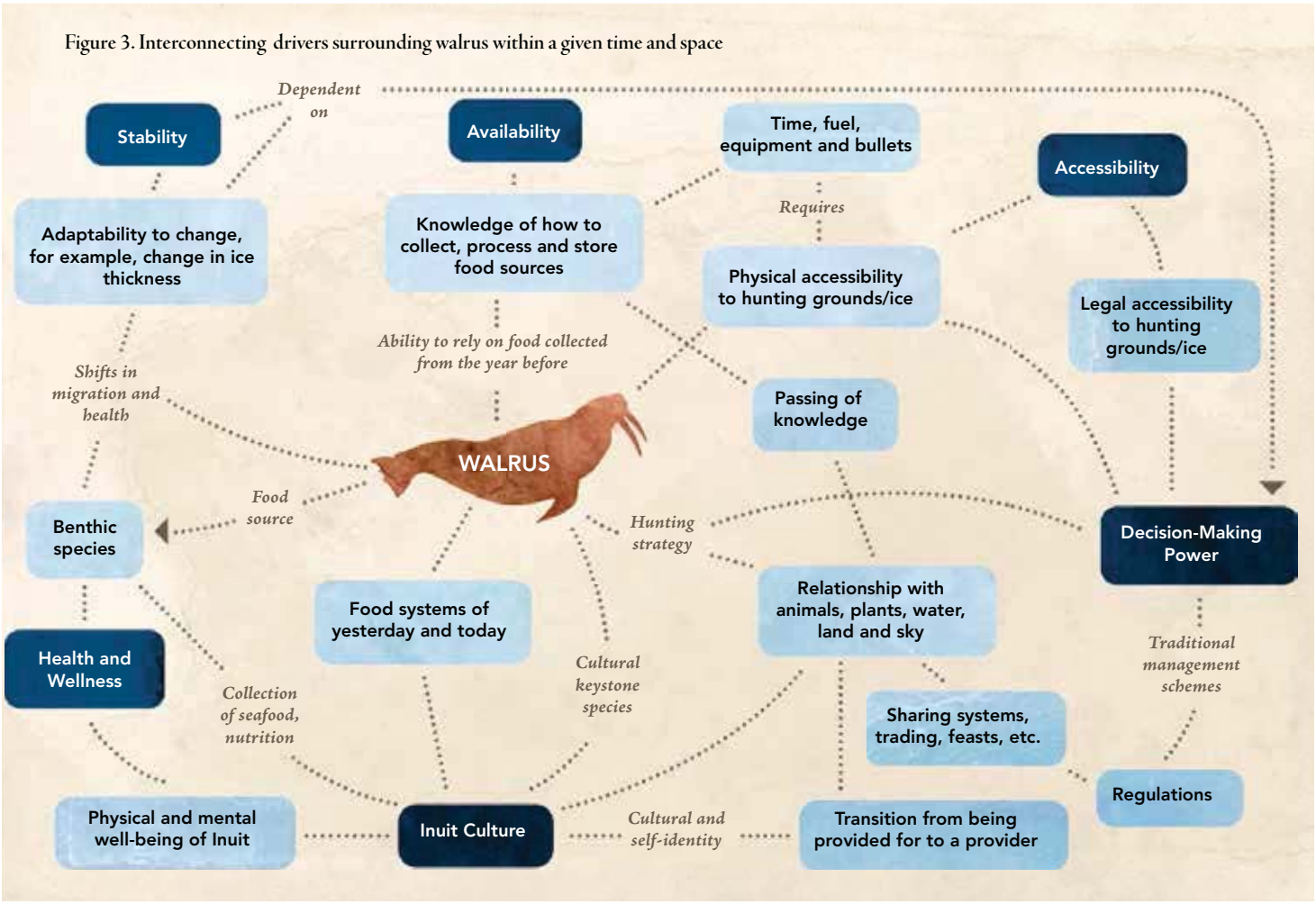
HOW WE SEE THE ALASKAN ARCTIC

In the previous section we stressed the connective nature of the Alaska Arctic. The Food Security Conceptual Framework aids in seeing the connections and cumulative impacts. To further the discussion, consider the relationship between humans and walrus health and sea ice thickness.

There is a strong link between sea ice thickness, walrus location and health; between benthic species distribution and health (a key food source for walrus); between a young person taken out to learn how to hunt for walrus, being taught his language, accessing knowledge from older generations, and providing a first catch to an Elder, becoming a provider. The connection continues between the self- and cultural identity rooted in these practices and sea ice thickness (Behe, 2013). And through the processing of the caught walrus, as community members come together to assist in the processing and storing of the food. Here again, education and language are passed to younger generations as youth learn how to make clothes and art. The feasts, celebrations and games that follow build social cohesion. The connections runs through our economic system and back to our ability to hunt. We rely on parts of this animal to make art. The art created is often sold, and the cash received supports the obtaining, processing and storing of foods through the purchase of items such as, fuel, tools and bullets.

The connections described includes the nutritional and overall physical health of the community. Many of us rely heavily on walrus for physical and spiritual nourishment. The monitoring of these connections helps inform an understanding of the environment, changes that are occurring through cumulative impacts and decision-making.

Figure 3. Interconnecting drivers surrounding walrus within a given time and space



ALASKAN INUIT FOOD SECURITY CONCEPTUAL FRAMEWORK

RECOMMENDATIONS

Recommendations generated from this project are meant to inform possible actions that should be taken by Inuit organizations, state and federal agencies, environmental non-governmental organizations, policy-makers, resource managers and all others who engage in the Alaska Arctic. Some recommendations address large-scale changes needed in decisionmaking processes or information needed to build baseline data, while others address issues of inequality. Each recommendation is categorized under baseline data and research needs or under the dimensions and tools that make up the Food Security Conceptual Framework.

There are many positive examples throughout Alaska in which IK holders are engaged in a respectful and positive way, where equitable relationships lie between Inuit and those working with them to better understand the Arctic and address challenges faced today. With these recommendations, we support such relationships and actions and aim to make them the norm as opposed to the exception. All recommendations aim to strengthen food security.

Suggested Actions to Support Assessments, Creation of Baseline Data and Research

- Utilize the Alaskan Inuit Food Security Conceptual Framework to guide development of research questions and projects. Collection of needed baseline data should be generated through scientific and/or IK questions and methodologies.
- Establish a virtual clearinghouse to allow for easy access to previous and current work conducted within a given area. Utilize interoperability tools to establish such a virtual clearinghouse. Close attention will be necessary to review how IK is categorized and accessed to ensure that information is viewed and used under IK philosophies (e.g., avoiding cause and effect singular rationalizations).
- Develop regional research protocols. Protocols may include pathways to generate community-driven research, engagement of Inuit, involvement of Inuit in research activities, such as collection and analysis of information generated, and the development of a regional and/or Alaskan Inuit review board. Through the review board proposed research is reviewed, commented on and approved by Alaskan Inuit.
- Increase understanding of food security through the identification of combined variables. Allow for community-level identification of interconnecting stressors and drivers to identify level of vulnerability.
- Document IK methodologies and evaluation processes, key questions that drive IK decisions and IK monitoring methodologies throughout all six dimensions of food security.
- Document health and wellness indicators based on IK (flora, fauna and social) across scales (those addressing ecosystem, national, regional and community scales).
- Establish ecological baseline data rooted in IK. For example, there is a need to identify highly sensitive ecological areas through IK. Additionally, close attention needs to be given to how such information is categorized and shared.
- Move toward a co-production of knowledge approach, based on the use of both IK and science. Through this approach, IK and science are not translated into each other.
- Develop indicators through a co-production of knowledge approach, based on both IK and science, that cross over both natural and physical phenomena (e.g., identify keystone species important to both cultural and ecological processes).
- Enhance monitoring of pollutants throughout habitats.
- Enhance monitoring programs throughout all Alaskan Inuit communities; enhance monitoring programs based on both IK and scientific methodologies; enhance monitoring programs through the use of modern technology (e.g., recorders, cameras, etc.).

Photo courtesy of Amos Oxercok

Suggested Actions Listed Under the Inuit Culture Dimension of Food Security

Education System/Passage of Knowledge

- Give equal weight to IK within the formal education system.
- Fund Elders to continuously provide IK education within the formal education system.
- Provide traditional foods within formal education institutions.
- Promote the indigenization of education frameworks to more clearly align with Inuit ideologies (ICC-Alaska, 2015).
- Research, advocate for and promote the development, implementation and sharing of culture-based curriculum that focuses on students' identities as Inuit.
- Promote education of Inuit languages.

Sharing Systems

- Support the current Inuit sharing system through subsidizing the transport of traditional foods and medicines between villages, regions and across the state.
- Adopt and support regulations that reflect and account for the sharing of traditional foods and medicines across space.
- Develop community freezers to store traditional foods and medicines. It is suggested that such a program should provide youth with the responsibility of obtaining foods and medicines.

Cultural Activities

- Continue support of cultural activities, such as celebrations, feasts, dancing, drumming, singing and the creation of art through funding of programs that provide a platform for Elders and Youth and for Inuit of differing regions to come together.
- Encourage all within a given area to participate in cultural activities (including non-Inuit).

Suggested Actions Listed Under the Availability Dimension of Food Security.

Focus of the following recommendationsare on obtaining, processing, storing and consumption.

- Support documentation of traditional recipes and preparation processes. Note, such documentation cannot replace being taught by an IK holder and/or actively "doing" to learn but could be used as a tool.
- Support learning how to make tools and utilize flora and fauna to create clothing.
- Aggregate documentation of ways and methods for obtaining, processing and storing all food sources throughout the four Alaskan Inuit regions. Establish community programs for passing on this knowledge and encourage use of knowledge.
- Aggregate documentation of medicinal plants and foods throughout the four Alaskan Inuit regions. Establish community programs for passing on this knowledge and encourage use of knowledge.
- Encourage understanding of Inuit calendars (seasonality) within a given area and associated activities for the obtaining, processing, storing and consumption of traditional foods.
- Adopt and support regulations that reflect and account for the consumption of traditional foods and medicines within education institutions and hospitals.

Suggested Actions Listed Under the Accessibility Dimension of Food Security

- Provide culturally appropriate subsidies that support environmental health (e.g., providing bullets or fuel).
- Increase understanding of change in use patterns and ensure priority of access to traditional areas is maintained.
- Increase communication on potential disturbances, quick shifts in weather and information generated from scientific research within a given area and between scientists, decision-makers and IK holders.
- Document all that impedes accessibility (e.g., policies, limited access to traditional lands and waters, loss of knowledge, lack of economic resources, regulations, etc.).

Suggested Actions Listed Under Health and Wellness Dimension of Food Security

- Develop housing architecture in collaboration with IK holders and focus on cultural and village needs, energy efficiency and ventilation. For example, the University of Alaska Fairbanks Cold Climate Housing Research Center has developed a strong process for working with Alaskan Inuit communities through a participatory approach.
- Determine the location of sanitation systems and landfills in collaboration with IK holders.
- Continue to monitor contaminants associated with sanitation and landfill systems.
- Monitor flora and fauna using both IK and scientific methodologies.
- Implement an active communication of pollutants system.
- Mitigate persistent organic pollutants (POPs) and other contaminants generated from outside the Arctic but that have an impact on Arctic ecosystems.
- Develop indicators of health and wellness throughout an entire ecosystem as defined by IK holders.

Suggested Actions Listed Under Stability Dimension of Food Security

- Use the food security conceptual framework as a guide to document current and future impacts of increasing ship traffic in the Arctic.
- Support research focused on gaining a stronger understanding of the changes occurring within the physical elements of the ocean in association with changes in food web dynamics.
- Allow for flexible policies. There is a need for ecosystem-based policies and IK management utilization to support adaptability and the health of the ecosystem.
- Support and encourage an increased understanding of socio-ecological systems to provide a greater understanding of how to support the health of all within the Alaska Arctic.

Suggested Actions Listed Under the Decision-Making Power and Management Dimension of Food Security

- Document Alaskan Inuit traditional management practices across space and time. The following are two examples of Inuit traditional management practices that may be documented. In one region, five villages within a given area meet once a year to develop maps of the area and discuss potential safety needs and changes in hunting strategies. In another region, Elders from three villages come together to discuss and analyze information and decide on beluga hunting strategies for a given year.
- Create an Inuit food security board to address vulnerabilities identified through the drivers of food (in)security.
- In collaboration with Inuit, develop federal and state flexible regulations that are able to account for shifts in the environment, such as a shift in animal distribution or early ice break up.

Suggested Actions Listed Under Tools That Support the Six Dimensions of Food Security

Policy

- Adopt policies that recognize the connective nature of the Arctic and cumulative impacts within the Arctic.
- Involve IK holders directly in the interpretation of current policies.
- Review types of protected areas utilized by Indigenous Peoples to safeguard their food sovereignty and identify what practices may be utilized within Alaska air, land and waters.
- Uphold state and federal regulations that identify subsistence activities as a top priority. For example, obtaining salmon for food is a top priority, second only to escapement goals.
- Adopt policies and practices for the avoidance of expropriating Inuit food sources.

Co-Management

- Investigate co-management structures of other Inuit countries to determine practices that may strengthen co-management.
- Increase IK holder input to decide what information is needed to make management decisions.
- Increase equality of IK within co-management bodies through the increased involvement of IK holders throughout all processes.
- Support the building of Inuit capacity to demonstrate the applicability of IK and allowing for equal footing in managing and developing policies for Arctic resources.
- Integrate strategic planning based on information generated through IK and science.

Knowledge Sources

- Recognize IK as a systematic way of knowing with multiple methodologies.
- Base decisions on the best available information generated from both IK and science.
- Involve IK holders in the identification of questions, research methods and analysis of information.
- Adopt a co-production of knowledge approach to gathering information through research.
- Develop protocols for the storage and ethical use of information derived from IK holders to ensure that intellectual and cultural property rights are maintained.
- Increase networking capability across Inuit organizations to allow for information to be easily shared and used.

BARRIERS

Fourteen key barriers that are limiting the understanding of the Arctic ecosystem and addressing food security were identified.

- Little synergy of information generated from natural and social sciences.
- Limited sharing of available scientific data with Inuit communities.
- Need for community-managed and accessible information from IK holders and/or scientific data.
- There is a lack of infrastructure and tools that allow for the sharing and analysis of information derived from community monitoring (based on IK and/or science) between Inuit organizations across villages, regions and the other Inuit countries.
- Need for a methodology and/or process to assess Alaskan Inuit food security.
- There is little attention given to connectivity and cumulative impacts in current assessment processes.
- There is little use or understanding of IK methodologies and evaluation processes outside of Indigenous communities.
- Current scientific research demonstrates limited understanding of socio-ecological systems.
- Research that only takes a scientific approach. Such research is commonly focused on the identification of singular attributes based on specific hypotheses and vulnerabilities and/or is centered on cause and effect correlation.
- There is little documentation of indicators of health and wellness throughout an entire ecosystem as defined by IK holders.
- There is a lack of Inuit-initiated and -defined research

protocols, Inuit research approval processes and Inuit guidelines to ethics in research.

- There is a lack of tools that support the ethical use of information derived from IK holders to ensure that intellectual and cultural property rights are maintained.
- There is a lack of tools to ensure that information generated from IK is appropriately categorized.
- There is a lack of biological and ecological significant areas defined by IK.
- There is a need to increase meaningful engagement with IK holders within national environmental reviews, such as environmental impact assessments, allowing for the time and resources needed to collect information through IK processes.

CONCLUSION

The Food Security Conceptual Framework aids us in sharing what our food security is by identifying the underlying drivers of food (in)security and stresses the importance of connectivity. Our IK guides us to understand the importance of relationships among the pieces that make up the Alaska Arctic in order to see the environment through a holistic lens (Inuit Circumpolar Council-Alaska. 2014. Bering Strait). By applying a holistic lens, we take a food security approach to monitoring and gathering information and understanding this environment.

The state of our food security today holds both encouraging and concerning points. The decision-making power and management dimension of food security is unstable within Alaska and is directly influencing the strength of all other dimensions. We are lacking in our ability to make daily adaptive decisions due to policies, regulations and other intervening factors. On the other hand, food security drivers are still working to maintain the wellbeing of our people. Many of these drivers are found within the Inuit Culture dimension of food security. For example, there is a large focus on the use and preservation of our languages; sharing systems are evolving to account for new tools needed to acquire traditional foods; education programs are being developed to provide an increased use of IK and engagement with Elders to support the transfer of IK; ways of obtaining, processing, storing and consuming traditional foods, feasts, games, celebrations, and dances continue on.

In taking the lead in defining our food security, identifying the drivers of food (in)security, creating a conceptual framework and outlining a food security assessment process we are taking a step toward food sovereignty. With this step we aim to increase communication between scientists and our communities, the involvement of our IK and provide the best information to carry out adaptive ecosystem-based management.

The Alaska Arctic is our home. Our food defines who we are. We need to make the commitment collectively to fight for food security.

Photo courtesy of Jacki Cleveland

GLOSSARY

Baseline - Reference for measurable quantities from which an alternative outcome can be measured, e.g., a non-intervention scenario used as a reference in the analysis of intervention scenarios (IPCC, 2007).

Biodiversity - The total diversity of all organisms and ecosystems at various spatial scales (from genes to entire biomes) (IPCC, 2007).

Conceptual Framework - A tool used for organizing and representing knowledge (Flavel, Miller & Miller, 2002) and allows for a mental grouping of different entities into a single category (a concept) on the basis of some underlying similarity.

Co-Production of Knowledge - The collaborative process of bringing a plurality of knowledge sources and types together to address a defined problem and build an integrated or systems-oriented understanding of that problem (Armitage et al., 2011).

Cosmology - The branch of philosophy dealing with the origin and general structure of the universe with its parts, elements and laws, and especially with such of its characteristics as space, time, causality and freedom (Dictionary.com, 2015).

Disturbance - A large force upon a given area, such as the food security system of the Arctic. Such forces may be large-scale changes within the system of a given area that results in impacts across scales and time. This definition is adapted from the definition of ecological disturbance (Encylopedia Britannica.com, 2015).

Ecosystem - A system of living organisms interacting with each other and their physical environment. The boundaries of what could be called an ecosystem are somewhat arbitrary depending on the focus of interest or study. Thus, the extent of an ecosystem may range from very small spatial scales to, ultimately, the entire Earth (IPCC, 2007).

Erosion - The process of removal and transport of soil and rock by weathering, mass wasting and the action of streams, glaciers, waves, winds and underground water (IPCC, 2007).

Fauna - All the animals that live in a particular area, time period or environment (Merriam-Webster, 2015).

Flora - All the plants that live in a particular area, time, period or environment (Merriam-Webster, 2015).

Food Chain – All the pieces that make up a food system. The Alaskan Inuit food system comprises multiple food chains operating at the global, national and local levels (Dictionary.com, 2015).

Food Insecurity – The Food and Agriculture Organization of the United Nations defines food insecurity as the opposite of food security (Clay, 2002). This is also true for Alaskan Inuit food security. Food insecurity will occur when instability to any of the six dimensions or a combination of overarching drivers results in an accumulation of disturbances.

Food Security Assessment - A tool to identify the areas faced with the greatest vulnerabilities and measures a level of food security. Traditionally food security measurements have been based on ordinal scales (a scale on which data is shown in order of magnitude), such as those to gauge the level of hunger as severe or less severe (FAO, 2003). Within this project, contributing authors discuss what is needed in a food security assessment process that gauges level of strength across an entire ecosystem.

Food Systems – describes all that goes into the production, processing, distributing and consumption of traditional foods. An Inuit food system will be composed of items from the local, natural environment that are culturally acceptable.

Vulnerability – The degree to which a system is susceptible to, or unable to cope with, the adverse effects of change (IPCC, 2007). The IPCC (2012) has since changed the definition of vulnerability to the propensity or predisposition to be adversely affected.

Photo courtesy of Mary Sage

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About ICC-Alaska

Inuit Circumpolar Council (ICC) – Alaska is a 501(c)(3) non-profit organization that exists to be the unified voice and collective spirit of Alaskan Inuit, to promote, protect and advance Inuit culture and society. ICC-Alaska membership includes regional organizations that represent the Inupiat of the North Slope, Northwest and Bering Strait; the St. Lawrence Yupik; and the Central Yup'ik and Cup'ik of the Yukon-Kuskokwim region.

Member organizations include the North Slope Borough, Arctic Slope Regional Corporation, Inupiat Community of the Arctic Slope, NANA Regional Corporation, Northwest Arctic Borough, Maniilaq Association, Bering Straits Native Corporation, Kawerak Incorporated, Calista Corporation and Association of Village Council Presidents. Representatives from these membership organizations, along with the President, Vice President, and Youth and Elder representatives, compose the ICC-Alaska 14-member Board of Directors.

ICC-Alaska is a national member of ICC International, an international, non-governmental organization founded by Eben Hopson Sr. from Barrow, Alaska, in 1977. Its creation came out of the realization that Inuit need to speak with a united voice on issues of common concern. Today ICC represents approximately 160,000 Inuit in Russia (Chukotka), the United States (Alaska), Canada and Greenland.

ICC holds Consultative Status II with the United Nations and is a Permanent Participant of the Arctic Council. ICC strives to strengthen unity among Inuit of the Circumpolar North; promote Inuit rights and interests on an international level; develop and encourage long-term policies that safeguard the Arctic environment; and seek full and active partnership in the political, economic and social development of the Circumpolar North.

ICC receives its mandate from Alaska, Canada, Greenland and Chukotka delegates gathered in a General Assembly held every four years. The ICC-Alaska Food Security Project began under the Nuuk Declaration (2010-2014) and continues through the Kitigaaryuit Declaration (2014-2018).

Photo courtesy of Mary Sage

Photo courtesy of Maija Lukin


INUIT
www.iccalaska.org

THE SECRETARY OF THE INTERIOR
WASHINGTON

DEC 17 2010

Mr. Tim Towarak
Chair, Federal Subsistence Board
P. O. Box 89
Unalakleet, Alaska 99684

Dear Mr. Towarak:

First, I want to thank you for your service on the Federal Subsistence Board (FSB). I recognize that your work represents a significant commitment of time and energy to a task that is complex and often controversial.

Under the terms of Title VIII of ANILCA, we have a duty to provide an effective program that serves rural residents of Alaska. In October 2009, at the Alaska Federation of Natives convention, I announced a review of the Federal subsistence program to ensure that the program is best serving rural Alaskans and that the letter and spirit of Title VIII are being met. That review, conducted through my Alaska Affairs office, included meetings with stakeholder groups and individuals throughout Alaska as well as Federal, State, and local officials. Following an analysis of the wide variety of comments, concerns, and suggestions expressed, a number of recommendations for programmatic changes were presented for consideration. On August 31, 2010, Secretary of Agriculture Tom Vilsack and I announced our decision to pursue a number of those recommendations to provide a more responsive, more effective subsistence program. A copy of the press release is enclosed for your information.

A number of these proposed actions are best accomplished by the FSB. With concurrence of the Secretary of Agriculture, I respectfully request that the FSB initiate the following actions at the earliest practical time:

1. Develop a proposed regulation to increase the membership on the FSB to include two additional public members representing subsistence users;

2. As a matter of policy, expand deference to appropriate Regional Advisory Council (RAC) recommendations in addition to the "takings" decisions of the Board provided for under Section 805(c) of ANILCA, subject to the three exceptions found in that Section;

3. Review, with RAC input, the December 2008 Memorandum of Understanding (MOU) with the State to determine either the need for the MOU or the need for potential changes to clarify federal authorities in regard to the subsistence program;

4. Review, with RAC input, and present recommendations for changes to Federal subsistence procedural and structural regulations (Parts A&B of the CFRs) adopted from the State in order to ensure Federal authorities are fully reflected and in accord with subsistence priorities provided for in Title VIII;

5. Review, with RAC input, the customary and traditional use determination process and present recommendations for regulatory changes;

6. Review, with RAC input, rural/nonrural determination process and present recommendations for regulatory changes;

7. Review the Board's written policy on executive sessions and minimize the use of executive sessions to those cases specifically prescribed;

8. At the request of the Director of the Fish and Wildlife Service and under Departmental procedures, review and submit recommendations for Departmental consideration of the annual budget for the Federal subsistence program;

9. Ensure the Secretaries are informed when non-Department rule-making entities develop regulations that may adversely affect subsistence users;

10. To the extent practicable, utilize contracting and use of ANILCA Section 809 cooperative agreements with local tribes and other entities in the Board's review and approval of proposals for fulfilling subsistence program elements; and

11. Prepare and submit a status report on these actions to me, with a copy to the Secretary of Agriculture, within a year of this letter.

Again, thank you for your service. I look forward to further recommendations the FSB may have to strengthen our subsistence management program.

An identical letter is being sent to Mr. Tim Towarek, Chair, Federal Subsistence Board.

Sincerely,

Ken Salazar

Ken Salazar

Enclosure

OFFICE OF THE SECRETARY
U.S. Department of the Interior

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News Release

Tim Towarak Appointed Chairman of Alaska's Federal Subsistence Board; Will Lead Board Revitalization Initiative

Comprehensive Review of Subsistence Program Calls for Board Action to Strengthen Rural Representation, Regional Advisory Councils

08/31/2010

Contact: Kate Kelly (DOI) 202-208-6416
USDA Office of Communications 202-270-4623

ANCHORAGE – Secretary of the Interior Ken Salazar and Secretary of Agriculture Tom Vilsack today announced the appointment of Tim Towarak as the Chair of the Federal Subsistence Board in Alaska. Towarak, an Alaska Native and a life-long resident of the rural village of Unalakleet, Alaska, is president of the Bering Straits Native Corporation and co-chair of the Alaska Federation of Natives.

"Tim has participated in subsistence activities all his life and has demonstrated a keen understanding of the needs of rural residents of Alaska as well as the workings of government and the private sectors," said Secretary Salazar, whose department recently completed a review of the subsistence program management. "With his experience and understanding, he is uniquely qualified to lead the Board in carrying out improvements that will strengthen its role in managing fish and wildlife on the public lands in Alaska."

Secretary Vilsack commended Towarak, saying "We are confident Tim can lead the Board's revitalization initiative. The federal subsistence management program embodies key USDA roles and priorities, including sustaining livelihoods of rural families, ensuring access to healthy and affordable food, providing jobs in rural communities, sustaining culture and traditional ways of life, and strengthening relationships with Alaska Native tribes."

The Federal Subsistence Board manages the fish and wildlife harvest for rural residents who depend on these resources for their lives and livelihoods. The board includes the Alaska Directors for the Fish and Wildlife Service, the National Park Service, the Bureau of Indian Affairs, the Bureau of Land Management, and the Alaska Regional Forester for the Department of Agriculture's Forest Service. The Board works through Regional Advisory Councils.

The program review proposed several administrative and regulatory changes to strengthen the program and make it more responsive to the concerns of those who rely on it for their subsistence needs. One proposal calls for adding two rural Alaskans to the Board, which allows additional regional representation and increases stakeholder input in the decision-making process. This change would be open to public comment through the rule-making process.

The Secretaries also are asking the new Chair and the Board to ensure that the Regional Advisory Councils are given the full authorities in the rule-making process that they are granted in the Alaska National Interest Lands Conservation Act (ANILCA), and that the board take on greater responsibilities for budget preparation as well as hiring and evaluating the director of the Office of Subsistence Management.

The Board also is being requested to evaluate the Memorandum of Understanding (MOU) it negotiated in 2008 with the State of Alaska to ensure it does not constrain federal subsistence management responsibilities. This evaluation will include all parties, including the Regional Advisory Councils.

Reviewers also received recommendations for statutory changes to better meet the goals of ANILCA and the Alaska Native Claims Settlement Act. While these proposals are acknowledged, they fall outside the authorities of the Secretaries but will be forwarded to concerned Members of Congress and the relevant committees with oversight of the statutes.

Additional changes to the subsistence program may follow. Secretary Salazar has asked his Policy, Management and Budget team at Interior to conduct a professional management review of the Office of Subsistence Management to ensure that the organizational structure created nearly 20 years ago, and the budgets they live with, meet the increasingly complex research and management demands that have accrued through nearly two decades of court decisions and resource allocation challenges.

Additionally, the USDA Forest Service's Washington Office recently reviewed its Alaska Region's portion of the program. Recommendations based on that review are being evaluated and will be integrated with Interior's findings for consideration by both Departments.

Under Title VIII of ANILCA, rural residents of Alaska are given priority for subsistence uses of fish and wildlife on federal lands. The State of Alaska managed for the rural resident subsistence priority until a 1989 Alaska Supreme Court decision ruled the priority conflicted with the state's constitution. The Interior and Agriculture departments began managing the subsistence priority for wildlife on federal lands in 1992. Six years later, following a federal court ruling, federal management for subsistence fisheries in certain waters within or adjacent to federal lands was added to the responsibilities of the Interior and Agriculture departments.

The federal subsistence management structure was crafted as a temporary DOI/USDA program to meet the requirements of ANILCA until the state could amend its constitution and comply with Title VIII of that law. This DOI/USDA review was predicated on the assumption that the state is no longer attempting to regain management authority for the ANILCA subsistence priority, and that federal management will continue for the foreseeable future.

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Federal Subsistence Board
1011 E. Tudor Rd., MS 121
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APR 2 7 2012

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U.S. FOREST SERVICE

FWS/OSM12029.PP

The Honorable Ken Salazar
Secretary of the Interior
U.S. Department of the Interior
Office of the Secretary
Washington, DC 20240

Subject: Status report on the Secretarial Review of the Federal Subsistence Management Program

Dear Secretary Salazar:

In December 2010, the Federal Subsistence Board received a letter from you containing a number of proposed actions based on your review of the Federal Subsistence Management program. I'm happy to report that the Federal Subsistence Board (Board) has made good progress on those actions. The purpose of this letter is to provide you with a status report for your reference as requested in your letter.

Background

In 1992, the Federal government took over the management of subsistence wildlife uses on federal lands when the State of Alaska (State) did not meet the requirements of Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA) for the granting of a preference to rural residents. After a court judgment in 1998, the Federal government extended their authority to subsistence fishery management on certain navigable waters.

After nearly two decades, action by the State to regain management is not being pursued, and it is assumed that Federal subsistence management will continue in the foreseeable future. In October of 2009, you initiated a review of this program to determine if the program established in 1992 is still meeting the letter and spirit of Title VIII of ANILCA and serving rural Alaskan residents.

On August 31, 2010, findings of this review were presented, and specific actions were identified to address concerns raised during the review.

All of the actions identified can be implemented by the Secretary of the Interior or by the Secretary jointly with the Secretary of Agriculture, or by the Federal Subsistence Board. Most can be accomplished as a matter of Secretarial directive or policy. However, some would be regulatory changes requiring a formal rule-making process. A summary of the specific actions, their status, and estimated costs are described below.

Federal Subsistence Board

The Federal Subsistence Board prioritized the specific actions and began working on a subset in December 2010. Work is proceeding as follows:

1. Develop a proposed regulation to increase the membership on the Federal Subsistence Board to include two additional public members representing rural Alaska subsistence users.
   - **Status**: Final rule has been published, candidates interviewed, and final selections were made, appointing Charles Brower from Point Barrow and Anthony Christianson from Hydaburg to the Federal Subsistence Board.
   - **Cost:** $100,000 to cover travel and staff support (salary costs for the two new members and the Federal Board Chair are the responsibility of the Office of the Secretary of the Interior).

2. As a matter of policy, expand deference to appropriate Regional Advisory Council recommendations in addition to the "takings" decisions of the Board provided for under Section 805(c) of ANILCA, subject to the three exceptions found in that Section.
   - **Status**: Federal Board has addressed and has expanded deference to include customary and traditional use determinations.
   - **Cost:** Agency reprioritization

3. Review, with Regional Advisory Council input, the December 2008 Memorandum of Understanding (MOU) with the State to determine either the need for the MOU or the need for potential changes to clarify federal authorities in regard to the subsistence program.
   - **Status:** MOU provided to all ten Regional Advisory Councils for comment during winter 2011 meeting cycle; comments were summarized for Board; a workgroup made up of representatives from the state and federal agencies was formed to work on revisions to the MOU; Board will review with the State and finalize the revised MOU in January 2013.
   - **Cost:** Unknown; depends on whether or not there is a change in approach

4. Review, with Regional Advisory Council input, the customary and traditional use determination process and present recommendations for regulatory changes.
   - **Status**: Completed. All ten Regional Advisory Councils were asked for their perspectives on the existing process during the Winter 2011 meeting cycle; the Board noted that nine of the Regional Advisory Councils approved of the existing process and

said that proposals could be submitted for changes, should they be desired. The Southeast Alaska Subsistence Regional Advisory Council formed a workgroup to take a closer look at the process. The workgroup has requested additional information on customary and traditional use determinations and if needed will submit proposals for changes. At this time the Federal Board will maintain the current process.

- **Cost:** No additional costs are anticipated.

5. Review, with Regional Advisory Council input, the rural/nonrural determination process and present recommendations for regulatory changes.
   - **Status:** During their January 2012 meeting and consistent with the Secretaries' direction, the Board initiated the review of the rural determination process and the rural determination findings through direction to publish a proposed rule. Also at this meeting, the Board voted to publish a rule to extend the compliance date of the Board's previous decision to revise the areas or communities from rural to non-rural status as they were published in the Federal Register on May 7, 2007. The final rule was published on March 1, 2012.
   - **Cost:** Unknown; depends on whether or not there is a change in approach

6. Review the Board's written policy on executive sessions and minimize the use of executive sessions to those cases specifically prescribed.
   - **Status:** Completed. (Executive session policy revised and approved in May 2011, changes better describe when executive sessions will be used and how the public will be informed about the purpose of the executive session)
   - **Cost:** Agency reprioritization

7. At the request of the Director of the Fish and Wildlife Service, and under Departmental procedures, review and submit recommendations for Departmental consideration of the annual budget for the core Federal subsistence program. In developing the annual budget, the Secretary asked that the Board consider a number of actions that could improve the responsiveness and effectiveness of the Program. It should be noted that implementation of these actions will result in additional costs to all agencies, and the projected costs outlined below reflect only the Office of Subsistence Management core functions.

   a. Hold Federal Board meetings in rural areas
      - **Status**: As funding permits, issue driven. Recently, the Federal Subsistence Board met jointly with the Southeast Alaska Subsistence Regional Advisory Council on March 21-23, 2012, to review a petition, submitted by Kootznoowoo, Inc., to exert extraterritorial jurisdiction to non-Federal marine waters adjacent to Admiralty Island. This meeting marks several firsts for the Board: It was the first time the Board has met jointly with a subsistence regional advisory council, and the first time the Board has met outside Anchorage.
      - **Cost**: $100K; will require additional funding to implement

   b. Increase Training and support to Regional Advisory Councils
      - **Status**: Pending additional funding
      - **Cost:** $100K; will require additional funding to implement

c. Implement Wildlife Monitoring Studies
   - **Status:** Pending additional funding
   - **Cost:** $2 million; will require additional funding to implement

d. Increase Tribal Consultation
   - **Status:** In progress (met with tribes in January 2011 to get input; draft policy under development; goal is to finalize by summer 2012)
   - **Cost:** $300K; will require additional funding to fully implement

e. Increase capacity within Office of Subsistence Management for research and implementation
   - **Status:** Pending additional funding
   - **Cost:** $200K; will require additional funding to fully implement

f. Reinstate the annual regulatory cycle
   - **Status:** Not a high priority, The Board believes the biannual cycle in conjunction with special action regulations is responsive to subsistence users and believes this is not a high priority item at this time.
   - **Cost:** Will require at least $800K to implement

The Federal Subsistence Board has not yet begun work on the following actions:

8. Review, with Regional Advisory Council input, and present recommendations for changes to Federal subsistence procedural and structural regulations (Parts A&B of the CFRs) adopted from the State in order to ensure Federal authorities are fully reflected and in accordance with subsistence priorities provided for in Title VIII.

9. Ensure the Secretaries are informed when non-Department rule-making entities develop regulations that may adversely affect subsistence users.

10. To the extent practicable, utilize contracting and use of ANILCA Section 809 cooperative agreements with local tribes and other entities in the Board's review and approval of proposals for fulfilling subsistence program elements.

Director of U.S. Fish and Wildlife Service

1. In coordination with the Assistant Secretary for Policy, Management, and Budget (AS-PMB), modify the budget to include a line item for the Alaska subsistence program.
   - **Status:** In progress
   - **Cost**: None

2. In the annual budget formulation process, seek input from the Federal Subsistence Board and other stakeholders on budgetary requirements and priorities for the subsistence program.

- **Status**: The Federal Subsistence Board held a retreat in March 2012 to discuss budget issues and agreed on funding priorities based on the projected budget.
- **Cost:** Will likely require additional funding

3. Coordinate with AS-PMB in conducting an evaluation, in concert with other involved bureaus, of the subsistence program including the budgetary requirements, organization, and diversity.
   - **Status:** No progress to date
   - **Cost:** Unknown

4. In conformance with appropriate processes and procedures, encourage the utilization of contracting and ANILCA Section 809 cooperative agreements with local tribes and other entities in fulfilling subsistence program elements.
   - **Status:** Working with Refuges in Region 7 to address. Meetings have occurred with some tribal leaders.
   - **Cost:** Would likely require additional funding to effectively implement

5. Consult with the Federal Subsistence Board in the hiring and the annual evaluation of the Assistant Regional Director (ARD) of the Office of Subsistence Management.
   - **Status:** The Federal Subsistence Board members were consulted on the ARD's evaluation during the past year and will continue to be consulted as appropriate.
   - **Cost:** None

Assistant Secretary for Policy, Management, and Budget: *The progress and associated cost of the following actions is unknown.*

1. In coordination with the Director of the FWS, modify the budget to include a line item for the subsistence program. Evaluate the need to identify subsistence funding in the other bureaus to maintain a crosscut for tracking.

2. In the annual budget formulating instructions and in coordination with the Director of FWS, seek input from the Federal Subsistence Board for the subsistence budget.

3. Lead an evaluation, in concert with the involved bureaus, of the subsistence program including the budgetary requirements, organization, and diversity.

Summary - Budget Implications

The Secretaries' 2010 Report recognizes that the Federal program will be in place for the foreseeable future and as such, it must fulfill the commitments made in ANILCA relative to providing for the rural subsistence priority. In light of the Secretaries' emphasis on the Federal Subsistence Management Program and resultant heightened expectations of rural Alaskans and Alaska Natives, additional funding is needed for the Federal Subsistence Management Program to implement actions called for as a result of the Secretarial review and other mandates. Administrative and regulatory changes are expected to cost approximately $1,600,000. An

additional $2,000,000 would be needed to develop and implement a wildlife monitoring program. The latter is less than an optimal level, recognizing the current budget situation, and does not include contributions from the Department of Agriculture. A brief summary is provided below detailing the cost projections needed for implementing the actions called for as a result of the Secretarial review and other mandates.

Highest Priority:

- Increase the membership on the Federal Subsistence Board to include two additional public members representing rural Alaska subsistence users - $100K
- Increase Tribal Consultation - $300K (mandated by Executive Order 13175)
- Increase Training and support for Regional Advisory Councils - $100K
- Hold Federal Subsistence Board meetings in rural areas - $100K

Second Highest Priority:

- Wildlife monitoring program - $2.0 million
- Increase capacity within the Federal Subsistence Program for research and implementation - $200K

Low Priority:

- Reinstate annual fish and wildlife regulatory cycle - $800K*

* The Federal Board recommends maintaining the every other year cycle.

In closing and on behalf of the Board, I believe the progress which has been made on these actions have already resulted in making a more responsive and effective subsistence program. We will continue to keep you and Secretary Vilsack informed on our future progress as well as pursue further recommendations from constituents to further strengthen this very important program.

Sincerely,

Tim Towarak, Chair
Federal Subsistence Board

cc: Secretary Vilsack
Federal Subsistence Board
Interagency Staff Committee
Regional Advisory Council Chairs
Peter J. Probasco, Office of Subsistence Management
Kim Elton, Senior Advisor for Alaska Affairs
Pat Pourchot, Special Assistant for Alaska Affairs