

2009 Arctic Yukon Kuskokwim Sustainable Salmon Initiative Project Final Product¹

Climate-Ocean Effects on Chinook Salmon: Local Traditional Knowledge Component

by:

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ABSTRACT:

The local traditional knowledge (LTK) work outlined in this report is a component of a larger project to identify and evaluate life history patterns of use of marine resources (habitat and food) by Chinook salmon (*Oncorhynchus tshawytscha*), and to explore how these patterns are affected by climate-ocean conditions in the Bering Sea and North Pacific Ocean. The LTK component comprised approximately 6.5% of the overall budget for the *Climate-Ocean Effects on Chinook Salmon* project. One of the reasons that Chinook salmon were chosen as the focus of this project is because of their importance as a subsistence food for Western Alaska communities. New analyses and syntheses of historical data, as well as the collection and analysis of new field and laboratory data, including LTK, are being used to address this issue. **The LTK component of this project included interviews with Local Experts in three communities in the Bering Strait/Norton Sound region (Brevig Mission, Golovin and Unalakleet) on the topics of changes to salmon populations, the environment and the climate.**

This report concludes that, among other things, subsistence harvesters have seen the average size of Chinook salmon (weight and girth) decrease over the last decade and that population numbers, particularly in the vicinity of Unalakleet, have declined. Several areas for further investigation were also identified through this research. The report suggests that additional research on the amount of food available to Chinook at the end of its lifecycle be investigated due to decreased size of salmon and harvester observations of empty Chinook stomachs. Because subsistence harvesters have also noted an increase in Chinook with health issues, it also suggests that more effort be dedicated to obtaining samples from such fish and determining if disease is having an impact on overall Chinook population numbers. Additionally, residents of the three study communities have experienced a variety of climactic changes that may potentially be connected to variations in Chinook and other salmon populations, and which should be investigated further (i.e. changes in wind timing and strength, timing of freeze- and break-up, warming water temperatures, etc.). These conclusions and recommendations, and others, are detailed in this report.

Key Words: Alaska Native; Brevig Mission; Chinook salmon; climate changes; environmental changes; Golovin; local traditional knowledge; salmon; subsistence; traditional ecological knowledge; Unalakleet

TABLE OF CONTENTS

ABSTRACT: 2

INTRODUCTION: 5

OBJECTIVES: 6

METHODS: 7

 Bering Strait Region8

 Brevig Mission9

 Golovin9

 Unalakleet.....9

RESULTS:..... 10

 CHINOOK SALMON.....10

 Declines in Chinook Salmon 11

 GENERAL COMMENTS REGARDING SALMON.....13

 NON-CHINOOK SALMON.....14

 Sockeye Salmon (O. nerka, red salmon)14

 Coho Salmon (O. Kisutch, silver salmon).....14

 Pink Salmon (humpback salmon).....15

 Chum Salmon (O. keta, dog salmon)15

 OTHER NON-SALMON FISH15

 Trout15

 Tomcod (Microgadus proximus, Pacific tomcod)16

 Jellyfish.....16

 ENVIRONMENTAL CHANGES16

 Brevig Mission17

 CHANGES IN WEATHER19

DISCUSSION: 21

 POTENTIAL AREAS FOR FURTHER INVESTIGATION21

 Availability of Food.....21

 Increase in Disease22

 Climactic/Environment Impacts22

 Harvest Regulations.....22

 Other Factors22

 CULTURAL IMPACTS OF THE DECLINE IN SALMON.....23

REFERENCES: 24

DELIVERABLES:..... 25

PROJECT DATA: 26
ACKNOWLEDGEMENTS: 26
PRESS RELEASE: 26
APPENDIX 1: Project Participants..... 28

TABLE OF FIGURES

Figure 1. Salmon drying on a fish rack in Norton Sound. 6
Figure 2. Map of the Bering Strait region, showing the three communities that participated in this study (Brevig Mission, Golovin, Unalakleet). (Map Image ©2006 TerraMetrics and ©2005 Google)..... 7
Figure 3. A variety of ulu knives used for processing subsistence foods, like salmon. 9
Figure 4. Tukkaayuk (sea lovenge, ligusticum scoticum) greens collected by region residents for subsistence. 17
Figure 5. Weather system at Golovin, Bering Strait region, 2009. 20
Figure 6. Dry salmon and salmon strips contributed to a community potluck. 23

INTRODUCTION:

The goal of the *Climate-Ocean Effects on Chinook Salmon* project, of which this report is a component, is to identify and evaluate life history patterns of use of marine resources (habitat and food) by Chinook salmon (*Oncorhynchus tshawytscha*), and to explore how these patterns are affected by climate-ocean conditions in the Bering Sea and North Pacific Ocean (AYK SSI Project #712, http://www.aykssi.org/ProjectDB/project_profile.cfm?project_id=71). Chinook have rarely been the direct subject of ocean research because of their low relative abundance compared to other salmon species, but are an important subsistence resource for Western Alaska communities.

Our portion of the work was conducted in conjunction with another AYK SSI sponsored project titled “Using Local Traditional Knowledge to Understand Long-Term Variability in Norton Sound Salmon Populations” (project #601), the results of which will be available in a separate report in 2010.

Kawerak, Incorporated (Kawerak) contracted to complete the “capacity building,” local traditional knowledge portion of the *Climate-Ocean Effects on Chinook Salmon* project. Kawerak is a Native non-profit association organized to promote the social and economic welfare of residents in 20 villages in the Bering Strait Region. Kawerak provides services to 3 culturally distinct groups of Eskimo people (Inupiaq, Yupik and Saint Lawrence Island Yupik). Kawerak’s Vision Statement serves as the guiding principal for Kawerak’s role and function in the region: “Building on the inherent strength of our cultural values, we shall assist our tribes to create and control their future.”

This report describes individual observations regarding Chinook salmon, other fish, and the environment and climate of the region using interview data from three communities. The report is intended to provide an overview and summary of changes that Local Expert interviewees have observed over the course of their lifetimes.

A variety of subsistence salmon harvest survey-type research has taken place in the Bering Strait region over the past several decades (i.e. Daniel 1980; Magdanz and Punguk 1981; Daniel 1982; Wolfe et al. 1986; Olanna and Magdanz 1990; Magdanz 1992; Magdanz et al. 1994; Magdanz et al. 2002), but the most recent and comprehensive was carried out by Ahmasuk et al. (2008) and included two of the study communities in this project, Brevig Mission and Unalakleet, but not Golovin. Household harvest surveys are a critical part of determining intensity and seasonality of resource use and the importance of difference resources to communities. While harvest surveys typically include a “comments” section to obtain non-numerical data about species, in-depth ethnographic interviews are more successful in documenting topics such as change over time in species health or climactic conditions. The research for this project did not include harvest surveys and was based on in-depth interviews with Local Experts identified by the tribes we collaborated with.

Work for this project was carried out concurrently with research for AYK SSI project #601, which was an investigation of changes to salmon species and the environment in Brevig Mission, Golovin, Unalakleet and six additional Bering Strait region communities.



Figure 1. Salmon drying on a fish rack in Norton Sound.

OBJECTIVES:

While the larger overall project had multiple objectives, the local traditional knowledge component of this project engaged only the first objective.

Objective 1. Develop a comprehensive high seas Chinook salmon database (1955-2009) for AYK SSI: *We will assemble a comprehensive database on Chinook salmon in the Bering Sea. The majority of work will be completed by the end of the first year of the project, although we will update the database annually throughout the 3-year project. AYK SSI-funded SSSF project #45489 [# 601]: “Using Local Traditional Knowledge to Understand Long-Term Variability in Norton Sound Salmon Populations” will provide a template for future incorporation of LTK from projects in other AYK sub regions. We will also develop a metadatabase that will include biological, geographic, and database location information, data formats, and descriptions of variables. We will incorporate elements of National Spatial Data Infrastructure/National Biological Information Initiative “Biological Data Profile” schema into our metadatabase to enable possible future expansion to more complex digital schema metadatabases.*

Kawerak’s aim with Objective 1 was to develop and incorporate into the database a timeline of LTK related to salmon abundance, salmon biological characteristics, marine conditions, and climate using the results of work for this project and another ongoing AYK SSI-funded project (#601). This objective has changed slightly from the original proposal. While information regarding salmon abundance, salmon biological characteristics, marine conditions, and climate were all collected, it was not possible to put this information into a database timeline. Local experts were able to provide a variety of temporal data, however, difficulties were encountered in obtaining the type of temporally specific data

appropriate for presentation in a ‘timeline’ format. The temporal data collected will be summarized, along with the other data collected, in the “results” section, below.



Figure 2. Map of the Bering Strait region, showing the three communities that participated in this study (Brevig Mission, Golovin, Unalakleet). (Map Image ©2006 TerraMetrics and ©2005 Google)

METHODS:

All research done by Kawerak is carried out with the consent of local regional tribal councils and individual participants. To collect data for this project, in-depth semi-structured ethnographic interviews were conducted with Local Experts in each of the three participating communities. Local Experts are defined as individuals who have lived in the area for an extended period of time and are intimately familiar with salmon fishing activities and the local environment. Local Experts were identified by their respective tribal councils and were paid an honorarium for their participation; a symbolic recognition of the fact that the time and knowledge of Local Experts is valuable. The majority of Local Experts were interviewed independently, but several married couples were interviewed together (the Anungazuk's, the Katongan's and the Koutchak's – see Appendix 1). The interviews were conducted by Kawerak Social Scientist Julie Raymond-Yakoubian and a local assistant from each community. The interviews were semi-structured and used a standard interview protocol to guide the topics of conversation, but were open-ended in nature, allowing participants to dictate the pace and specific details of the interview. In addition to the general flexibility of the interviews, interviewees were also given an opportunity at the conclusion of the session to bring up any other topics that they felt were relevant to the interview objectives, but had not yet been addressed. Tribal councils had the opportunity to review and comment on the interview guide prior to the start of work. All interviews were digitally recorded. One Local Assistant was hired in each community to assist with interviews and to act as a local guide. Ms. Raymond-Yakoubian trained each Local Assistant in the interview protocol and recording equipment operation prior to the start of work.

Some key topics discussed during Local Expert interviews included the following:

- Changes in Chinook population numbers over the lifetime of the interviewee
- Changes in Chinook health over the lifetime of the interviewee
- Changes in Chinook behavior over the lifetime of the interviewee (e.g. colonization of new streams, run timing)
- Chinook fishing locations and harvest strategies
- Changes in other species of salmon over the lifetime of the interviewee
- Changes in the environment/climate in and around the community over the lifetime of the interviewee (e.g. timing and character of spring ice break-up, water temperatures)

Data from the communities of Brevig Mission, Golovin and Unalakleet is detailed in this report. Unalakleet is the largest Kawerak-region community, is located in southern Norton Sound, and has historically had the highest harvest of Chinook salmon of the three communities and has experienced the most significant declines in Chinook abundance (e.g. Ahmasuk et al. 2008; Olanna and Magdanz 1990; Georgette and Utermohle 2000; Georgette et al. 2002, 2003, 2004). Brevig Mission and Golovin were chosen in an effort to have representation from throughout the geographical range of the region – Brevig Mission being more northerly, Golovin being located centrally. In Brevig Mission the local assistant was Matilda Nayokpuk and the Local Experts interviewed were Robert Rock, Sr., Rita Olanna, Helena Seetot, Elmer Seetot and Delbert Seetot. In Golovin the local assistant was Carol Oliver and the Local Experts interviewed were Irene Aukongak, Maggie Olson, Robert Amarok, Thomas Punguk and Toby and Debbie Anungazuk. In Unalakleet the local assistant was Mike Eakon and the Local Experts interviewed were Shane Johnson, Benjamin Eakon, Jerry Ivanoff, Laura Paniptchuk, Leila Eakon, Mildred and David Katongan, and Oscar and Mae Koutchak.

Bering Strait Region

The study area is the Bering Strait region, which is located in Northwest Alaska, 60 miles south of the Arctic Circle and includes the Seward Peninsula. The vegetation is mostly tundra with the tree line starting about 50 miles south of Nome and with scattered spruce forests in the vicinity of the Fish River drainage. The region is home to three distinct linguistic and cultural groups of Eskimo people; the Inupiaq, Central Yupik, and Saint Lawrence Island Yupik. There is documented evidence of human habitation dating as far back as 10,000 and 11,000 years. The region stretches from the village of Shishmaref in the north, south to the village of Stebbins, and also includes Little Diomedede Island and St. Lawrence Island (as well as other currently uninhabited islands). There is approximately 570 miles of coastline, including shoreline in the southern Chuckchi Sea, the Bering Sea, and Norton Sound. The total population of the Bering Strait region is about 9,000 people. Alaska Native people make up 75% of the population. There are 15 year-round villages outside of Nome that range in population from 144 to 747. Nome is the largest community in the region with approximately 3,500 people, and is the transportation and service hub for the region (Norbert et al. 2008)

A subsistence lifestyle of hunting, gathering, and dependence on environmental resources continues throughout the region along with limited wage-based employment. Food gathering is a year around activity. In the springtime whale and walrus are hunted, eggs are gathered, greens, berries, and roots are gathered; during the summer and fall fishing and waterfowl hunting take place; caribou and moose are hunted in the fall; in the winter tomcod and king crab fishing takes place. Seal hunting is a year-round activity. Reindeer herding was introduced to the region about a hundred years ago and continues to this day. Muskox were reintroduced to the region in 1970.

Brevig Mission¹

Brevig Mission is located approximately 70 miles northwest of Nome, directly across from Port Clarence and the village of Teller. Port Clarence has an active Coast Guard Station that is staffed year round. Brevig Mission has no road access to Nome and must receive all goods by air or barge in the summer. The 2000 US Census indicates Brevig Mission has a total population of 276, of those 139 are male and 137 are female. Two hundred and fifty of the resident population is American Indian or Alaska Native. The most recent subsistence salmon harvest data (Ahmasuk et al. 2008) indicates that the community of Brevig Mission harvested approximately 30 Chinook salmon in 2006.

Golovin

Golovin is located approximately 67 miles west of Nome on the eastern shore of Golovnin Bay. It has no road access to Nome and must receive all of its goods by air or barge in the summer. The 2000 US Census indicates Golovin has a total population of 144, of those 78 are male and 66 are female. One hundred twenty one of the total population is American Indian or Alaska Native. The most recent subsistence salmon harvest data for Golovin (Olanna and Magdanz 1990) indicates that the community harvested approximately 98 Chinook salmon in 1988.

Unalakleet

Unalakleet is located approximately 147 miles southeasterly of Nome at the mouth of the Unalakleet River in Norton Sound. It has no road access to Nome and must receive all of its goods by air or barge in the summer, and is a sub-regional hub with more air access options than other villages. The 2000 US Census indicates Unalakleet has a total population of 747, of those 399 are male and 348 are female. Six hundred thirty seven of the total population is American Indian or Alaska Native. The most recent subsistence salmon harvest data for Unalakleet (Ahmasuk et al. 2008) indicates that the community harvested approximately 2,343 Chinook salmon in 2006.



Figure 3. A variety of ulu knives used for processing subsistence foods, like salmon.

¹ Population data for these communities is from the Alaska Department of Commerce, Community, and Economic Development (available at http://www.commerce.state.ak.us/dca/comddb/CF_BLOCK.htm)

RESULTS:

The information gathered from the interviews is presented below. While the focus of this report is on Chinook salmon, data was also gathered on other species of salmon and other non-salmon fish, as well as on climate and environmental changes observed by participants over the course of their lifetimes. As some of this information may be relevant or useful in determining impacts to Chinook salmon, it has been included here. As noted in the introduction, this project was carried out concurrently with AYK SSI project #601, for which detailed information was collected on a variety of topics relating to salmon, other species and environmental changes.

Transcripts of the Local Expert interviews were reviewed in detail and examined to determine if there was consensus among interviewees on particular subjects. The results below detail where and if consensus exists between interviewees in each community, and across all three communities. Areas of disagreement, novel observations, or areas where there is lack of information are also presented. While reports documenting harvest survey-type data most typically present information in table, chart or other numerical format, such an approach is not suitable for the amount and type of data collected for this project. The data is presented in summary format, with direct quotes from interviewees, which is more fitting to the ethnographic nature of the information and the number of Local Experts it was derived from.

CHINOOK SALMON

This section presents information provided by interviewees on their observations regarding Chinook salmon. It should be noted that the majority of the information comes from Unalakleet. The Unalakleet River has experienced the greatest declines in Chinook returns and of the three communities involved in this study has utilized Chinook at a much higher level, followed by Golovin and then Brevig Mission (Ahmasuk et al. 2008). Local residents primarily use the term “kings” to refer to Chinook salmon, and the two terms are used interchangeably below.

Health of Chinook Salmon²

“...but the king salmon – there’s lotta jack kings mostly, I think. Compared to the big ones we used to get. But we smoke them anyway.”
-Unalakleet fisherwoman



Residents of *Unalakleet* noted that Chinook salmon they are catching today are much smaller than those in previous decades (1960s to early 1990s). Formerly there was variation in the size of Chinook salmon that would be seen and harvested, but the kings now seem to be almost uniformly small. Individuals noted that they catch and see many more “jack kings” than previously. Jack kings are smaller, sexually mature male Chinook. Residents estimate that the average size of Chinook caught in recent years has been 15-40 pounds, whereas previously people regularly caught kings as large as 60-80 pounds. Also related to overall size of the fish, one Unalakleet resident noted that the Chinook, “used to be real thick, like footballs, just massive.” This resident, and others, noted that the Chinook appear to be a lot skinnier than they previously were.

² Drawings of salmon in the following sections are from the USDA Forest Service, © Joseph Tomelleri, and were accessed from the following website: <http://www.fs.fed.us/r6/fishing/regional/fishresources/salmon.html>

In addition to the size of Chinook declining, their overall health appears to have deteriorated as well. Some Unalakleet residents regularly check the contents of the stomachs of fish that they harvest –both out of curiosity and a general concern over the health of the fish they are harvesting for consumption. One fisher noted that when she has checked the stomachs of king salmon over the past few years that, “their stomachs are just empty, nothing in them. Just kind of a yellowish liquid.” In previous years this same woman had often caught kings with shrimp in their digestive systems, sometimes even hanging out of the mouth of the fish. Other Unalakleet residents have seen other changes in Chinook health, such as changes in the meat itself. Fishers have noticed “funny” looking meat that is either very pale or very dark in color, in multiple salmon species, sometimes accompanied by a foul smell. Some residents have noted an increase in parasites like tapeworms in the Chinook, but other residents are of the opinion that such worms have not increased in number. This may be due to the fact that some people are not bothered by worms, and therefore notice them less or find them less comment-worthy. Additionally, some residents believe that they have seen an increase in abnormalities such as cysts, sores and scabs on the skin of all salmon, including Chinook. These changes seem to have all occurred over the past 10 years.

Declines in Chinook Salmon

“I want to see numbers like I saw when I was growing up, on the kings. It was amazing. I think back on those times and I think, man, it’s unbelievable, because those times are gone. It’s like, was it real? But I seen it with my own eyes. Massive, massive amounts of king salmon. Big ones. B-i-i-i-g, bright, beautiful kings.”

-Unalakleet fisherman

One of the reasons this research project was undertaken is because of the variation in Chinook population numbers, sometimes drastic in particular fishing districts. Unalakleet residents interviewed for this project unanimously agree that Chinook populations have significantly declined in their lifetimes. One resident summarized it thusly, “The kings, they’re the biggest concern of ours – I think the whole town, the whole region, Norton Sound, that the kings are just not coming back like they should be.” This has also, of course, been acknowledged by the Alaska Department of Fish and Game (ADFG) which has put strict limitations on Chinook fishing in place in several districts across the Bering Strait region. The information presented here can be supplemented by examination of both subsistence and commercial harvest records for the region documented in ADFG harvest reports (which can be found at http://www.adfg.state.ak.us/pubs/dept_publications.php) as well as in Ahmasuk et al. 2008 and other similar reports.

The seriousness of the decline in Chinook salmon has been observed by Unalakleet residents as occurring over the past 3-25 years, since the late 1980s and early 1990s, with the more drastic declines becoming noticeable in the 1990s. This period was followed by a closure of commercial fishing for Chinook in 2001, with commercial fishing only occurring once (2005) since, with additional subsistence restrictions also being put in place during this same time period. The former commercial king salmon fishermen interviewed don’t believe that there will ever be a commercial king harvest again. One Unalakleet resident noted that when he was younger (1950s - 1960s) his family used to catch as many kings as they wanted. While he doesn’t remember the exact number, it was not more than a few hundred. Another fisher noted that his family would put away several hundred kings each year, during the same time period. Unalakleet fishers interviewed for this project said that they

typically harvest less than 50 Chinook each season in recent years, and that this is a drastic decrease from their former harvests. Fishers also often have difficulty obtaining even that small harvest of Chinook. Some Unalakleet area fishers have changed their fishing locations in order to either attempt to obtain more fish, or to get them in a shorter period of time. One woman noted that the summer of 2008 was the first time that her family had ever subsistence fished for Chinook in the ocean, as opposed to in the Unalakleet River; "...we had to go out into the ocean to get fish we couldn't get in the river." Despite this change in harvest strategy, her family was still only able to get 20-25 Chinook, and her husband also believes that many other families have made the same change to ocean fishing. The primary reason for the change is because subsistence fishing for Chinook in ocean waters is typically not subject to the same timing and duration closures imposed by the Alaska Department of Fish and Game on the Unalakleet River. Even though most people have traditionally subsistence fished in the river because they prefer the characteristics of river kings as opposed to ocean kings, there are currently fewer restrictions on ocean fishing which increases the chances of obtaining more fish. The family described above, as well as others, noted that it also sometimes takes longer to obtain the same amount fish than it did in the past. For example, one woman noted that in the late 1970s her family would only have to set their net maybe three times to get all the king salmon they needed, but more recently they have only been able to catch three or four king salmon a day, which is a big change for them. Similarly, another Unalakleet fisherman noted that he used to be able to get thirty kings in three hours, but now it could take him ten days to get twenty eight. Yet another said that subsistence fishers used to be able to set a 20 foot net in the river overnight and get about 90 kings, but that now it can take several days to just get ten kings.

Due to concerns over the decline of Chinook salmon returns, some Unalakleet residents have made conscious decision to not target them at all, or to only harvest a very small number. One individual noted that he just wants a few kings each season, and only fishes for kings until he has obtained that small number, just so his family can have the "taste" of it and to share. He has changed his family's harvest strategy for kings over concern for the health and sustainability of the population. The community of Unalakleet has also, on several occasions and with high compliance, asked all their residents to voluntarily not fish for Chinook because of the same concerns. No specific numbers are available as to how many Unalakleet residents have voluntarily stopped or curtailed their fishing for Chinook in recent years, but it is generally acknowledged that many people have.

One final note on Unalakleet area king salmon has to do with the timing of salmon runs. A resident fisher has been keeping track of when the first king salmon is caught by someone in Unalakleet. Her observations indicated that the first king has typically been caught in the middle of May, but in more recent years no kings were caught until June.

As noted earlier, of the three villages included in this study, Unalakleet historically has harvested the most Chinook salmon, followed by Golovin and Brevig Mission.

Golovin residents primarily target species of salmon other than Chinook for their subsistence harvests. Those interviewed for this project did not agree on the changes in king salmon populations over time, though they did agree that catches of Chinook were primarily incidental by Golovin fishers. Golovin residents primarily fish for salmon in front of the village (set nets) or north of Golovin at Katchavik River (seining) and kings are primarily caught in set nets in front of the village. One elder fisherman, who no longer fishes for kings, said that he believes the Golovin area king runs are healthy, though small, and did not note a decline over his lifetime. This same elder described how when he was

younger (1940s–1950s) his family’s harvest of king salmon was primarily as incidental catches when targeting other species, which seems to still be the case today. One elder fisher in her 80s recalled catching her first king salmon as a young woman and not knowing what to do with it because “it was so big!” One fisherman noted the 2009 fishing season as his second best for Chinook and said that he had harvested around 50. He is the only Golovin resident interviewed who was making an effort to target kings in his fishing, and he believes that there has been an increase in Chinook in the Golovin area over the past 10 years.

Brevig Mission interviewees for this project indicated that they do not target king salmon when subsistence fishing. One resident noted that the village had not historically targeted king salmon because they are “too fatty.” This practice may be an expression of a local preference for less oily salmon that are easier to dry (a reason also expressed by some Unalakleet residents to explain their preference for river kings as opposed to ocean kings). *Brevig* interviewees seemed to have less information on the migration routes and habits of Chinook salmon than for other salmon species, particularly sockeye salmon, which is a highly targeted species for residents. One fisher believed that king salmon “bypass” the fishing locations that *Brevig* people use in front of the village on the north side of Port Clarence. *Brevig Mission* residents primarily fish for salmon in Port Clarence and Grantley Harbor and small creeks and rivers that feed into them, but also fish along the Kuzitrin River, Agiapuk River and in the Imaruk Basin area.

A memorable harvest of king salmon for one *Brevig* resident was seven or eight fish, and another *Brevig* fisherman noted that, “sometimes you’re lucky to get maybe at least half a dozen of those kings when they come around and they vary in sizes.” It is notable that *Brevig* residents were able to remember specific harvests of king salmon (“...we were only able to get three.” “Pauline and Leonard said they got fifteen...,” and see above). As the interviewees expressed, their harvest of king salmon is far less common than the harvest of other salmon species.

GENERAL COMMENTS REGARDING SALMON

This section presents information provided by project participants that relate to all or multiple species of salmon.

Residents from all three communities expressed concern about boat traffic disturbing the spawning grounds for salmon. People are concerned that jet boats, as well as regular outboard motors, may be disturbing the eggs and “blowing [them] out of their riverbed.”

Additionally, many interviewees detailed negative changes in the health of salmon that they have observed. The majority of the comments detailed stories of people finding more worms in the meat of salmon that they harvested, more open sores and scarring on the skin, more deformities (including internal organs being “fused” together), and more discolorations of the skin and meat. Any changes specific to a particular species are noted elsewhere in the report.

Elders from *Golovin* noted that silvers, humpbacks and dog salmon have all been increasing in number in Cheenik Creek, next to the village. Though some species have been increasing in this particular creek, *Golovin* interviewees noted a general decline in salmon numbers, particularly since the advent of commercial fishing in the area, but seem to agree that there is usually enough to meet subsistence needs.

NON-CHINOOK SALMON

This section presents some of the information provided by project participants on other species of salmon.

Sockeye Salmon (O. nerka, red salmon)

In *Brevig Mission* two interviewees noted that they have observed a change in the migration of red salmon in the vicinity of his village. They believe that the fish are taking something of a “short cut” from Point Jackson, across Port Clarence, to Teller at the point where they enter Grantley Harbor – rather than going along the coastline in front of Brevig. Not all Brevig area fishers harvest salmon in Port Clarence, some traditionally harvest further inland. In terms of the size of red salmon, one of the same interviewees noted that there are still some large red salmon but that she has been catching small red salmon and that they are a “little different species that we never used to [have].” She also has observed red salmon that appear to be ready to spawn in July – earlier than previously; possibly because of warmer water. This same interviewee has also seen an increase (compared to the 1970s and 1980s) in worms and a “milky substance” in the meat of the red salmon she is processing and more abnormalities on their skin, like round purple-ish scars.



One *Golovin* resident said that red salmon were uncommonly caught when he was growing up (1940s - 1950s) and that his family primarily targeted pink and chum salmon. Over the past two years he did report observing an increase in red salmon based on what children in the community were catching via rod and reel in Cheenik Creek. He said that kids were bringing him and others what they thought were small king salmon, but were actually red salmon. He was surprised to find that red salmon were becoming common in this creek.

Two *Unalakleet* fishers have noticed an increase in red salmon in their region, while several others said that they are still fairly unusual to catch. One fisherman who processed the few reds he caught in 2008 found some kind of abscess in several of them and called the meat, “just a big puss-y gooey mess.”

Coho Salmon (O. kisutch, silver salmon)

Unalakleet residents interviewed for this project had comments on the status of silver salmon in their region. Several residents who are, or have formerly been, involved in commercial fishing for silver salmon expressed concern over the long-term viability of local stocks and commented that they believe there are too many permit holders for the amount of fish available. One fisherman stated that silvers are now the most abundant salmon species due to the declines in others and that silver salmon runs seem to be starting earlier than in previous decades. Though declines in silvers have not been observed by interviewees, there is general concern over their status. Several interviewees also commented on the health of silver salmon and noted that they have encountered more fish with “scabs” and sores on the skin as well as silvers with deformed snouts, such as where the upper part is smaller than the bottom.



A *Golovin* resident discussed silver salmon that she and other fishers had caught in 2008 that had unusual bumps on their skin. People were not comfortable keeping them for human consumption, but the Alaska Department of Fish and Game told her that they were safe to eat. Silver salmon were noted

as appearing in Cheenik Creek in the early 1990s.

Pink Salmon (humpback salmon)

One *Brevig Mission* fisher has observed that pink salmon are much smaller than they used to be, while another noted that they seem to be in more streams and creeks than formerly.

Interviewees in *Unalakleet* were not in agreement as to the status of pink salmon in their region. Three *Golovin* interviewees commented that pink salmon numbers had increased or were stable in their region, with one also noting that the fish seemed to be smaller in size, and another noting that the runs seemed to be starting later. One fisher observed, approximately 4 years ago, many pink salmon with deformed bodies (“like cheeks puffed out”), very pale flesh, and with a lot of worms. She noted that they never used to see such things when she was younger.



Chum Salmon (O. keta, dog salmon)

One change relating to chum salmon in the *Brevig Mission* area is that they have begun to spawn in a creek behind the village since about 2000. A *Golovin* fisherman noted that chum decreased significantly in their area during commercial fishing (through the 1970s), but that chum returns seem to be healthy right now. Another fisher, however, also noted that chum returns to the *Golovin* area had substantially decreased since commercial fishing, but that they have not recovered. One fisher has observed that the stomachs of chum she catches are usually empty. Two *Unalakleet* fishermen who formerly fished commercially for chum described them as drastically decreased since the mid 1990s. They understood these declines as being a result of the False Pass fishery (which has had a high amount of chum bycatch) in the 1980s and 1990s, how hard the chum had been fished locally during periods of commercial fishing, and that they believe trout are eating chum eggs and fry (as noted below).



OTHER NON-SALMON FISH

This section presents information provided by interviewees on some of their observations regarding other non-salmon fish in the region.

Trout

The term “trout” was used in a general sense by interviewees and they did not differentiate between different species. The most comments received about non-salmon fish relate to trout and were provided by interviewees from *Unalakleet*. Regarding the health of trout, one fisherwoman said she has noticed that trout livers seem to be yellowish, and are not very good to eat anymore. Overall, concern over the impacts that trout are perceived to be having on Chinook salmon populations in particular, but all salmon in general, was expressed by several *Unalakleet* interviewees.

“I think now the trout feed quite a bit on king salmon eggs... When I was growing up we didn’t have a problem with trout because everybody had dog teams to feed. They rely on the trout. ...[There used to be] thirty to forty dog teams in town, [but] now there is only about three or four teams in town. Because of that, the trout has really multiplied because people aren’t seining for them. ...When I was growing up people would seine maybe three thousand pounds of trout for their dog teams. ...When my

wife and I go fishing we'd catch trout through the ice. We would get curious what they were eating so we would open up their stomach, you know, and we would find little fry, like salmon frys and sardines... The trouts have multiplied and every time the chums or kings spawn they would mill around and eat the eggs that are coming out of the females.”
-Unalakleet fisherman

Several Unalakleet and Golovin residents interviewed for this project have also observed what they identified as salmon eggs and fry in the stomachs of trout they had caught. While the Unalakleet fisherman quoted above noted an increase in trout, a Golovin fisher who has observed salmon eggs and fry in trout stomachs stated that she did not think trout populations were increasing in her area. She also has observed trout in Cheenik Creek, next to the village, and that more fish in general have been seen in that creek than in the past (see Non-Chinook Salmon section, also). Additionally, the researcher has had multiple informal conversations, outside the bounds of interviews for this project, where sentiments similar to those of Unalakleet fishers about the impact of trout on salmon have been expressed by residents of the region.

Tomcod (Microgadus proximus, Pacific tomcod)

One Brevig Mission fisherman said that it has been harder to catch tomcod in Grantley Harbor, perhaps because of late freeze up. Three Golovin interviewees have noticed a decrease in tomcod and another has caught a tomcod with skin lesions. Similarly, in Unalakleet one fisherwoman has, over the past two to three years, been catching tomcods with “big, purple-ish” markings on their skin.

Jellyfish

While not technically a “fish,” I have included jellyfish observations in this section on “other fish” because that is how they were usually introduced by interviewees. Several Unalakleet fishers noted that over the past few years there has been a dramatic increase in the number of jellyfish in area ocean waters. These jellyfish are a big nuisance to fishing as they get caught in fish nets (and beluga nets) and weigh them down, and also make them visible to the species being targeted. In the summer of 2008 one interviewee had to go shake his net every fifteen minutes to keep the jellyfish off it. Another resident thought that these dense swarms of jellyfish might be keeping the salmon away, as well.

“But the last two years we been seeing humongous, humongous jelly fish like a foot long in diameter, in some colors we never seen before. Blue, pink, orange, which we never seen before and I think that is because the water temperatures been warmer and the production is higher because the warmer weather...”
-Unalakleet fisherman

ENVIRONMENTAL CHANGES

This section presents information provided by interviewees on their observations regarding changes to the environment they have observed over the course of their lives. This information in this section is presented by village, rather than by change observed. This is because the three villages that contributed to this report are widely spread across the Bering Strait/Norton Sound region and observations from one community may not be applicable to the other two, or the region as a whole. Summarizing comments are provided in the conclusion of this section.

Brevig Mission

Four of the five Brevig Mission residents interviewed mentioned increased erosion as a big environmental change in their lifetimes. Erosion was noted as happening along both the ocean shoreline and river banks. Interviewees have observed increases in the frequency of erosion events and the extent of erosion. One resident described a new “channel” that formed near spring seal hunting camps in the vicinity of Port Clarence, where there used to be only one. Erosion is impacting various area camps as well, and cabins have fallen into the water in several locations. Similarly, the locations where some Brevig residents go to pick berries and greens have also eroded away.

“...we used to pick those greens. There’s no more bank where they grow, it erode where we pick berries. That whole thing was uncovered, we could see just ice underneath. ... Yeah, the bank was washed away and that’s where I used to go pick akpik [salmonberries]... That’s where the greens hardly grow anymore because it’s just all mud where they used to grow.”
-Brevig Mission resident

Melting permafrost and ice lenses, which several interviewees have seen, are posited as possible reasons for some of the erosion, as are storms and wind, and ice movement during breakup (see Changes in Weather section, below). One interviewee has noted an increase in deposition in front of one part of the village where the beach has raised in height by “a couple feet.”



Figure 4. Tukkaayuk (sea lovage, ligusticum scoticum) greens collected by region residents for subsistence.

In addition to the loss of some berry and green picking areas, Brevig residents interviewed have also noted other changes in plant life. For example, interviewees have noticed an increase in algae and “weeds” in Grantley Harbor, Kuzitrin River, and other area waters. The local Community Development Quota organization, Norton Sound Economic Development Corporation (NSEDCC), has conducted lake fertilization activities intermittently since the early 1990s at Salmon Lake in the upper reaches of the Brevig Mission area watershed. Multiple residents (within and outside the context of interviews for this project) identify these fertilization activities as the potential source of the increase in both algae and water weeds.

Several residents also commented on willows, saying that they were much larger than they formerly had been in their youths, and that they were also growing in areas where they had not previously. Additionally, some Brevig interviewees have also observed tundra ponds or small creeks that have dried, or have begun to dry up; “All over it’s just like the land is getting dry back there. Where there used to be lakes there’s just nothing. Just clumps of mud.” Similarly, one resident has seen sink holes in the vicinity of Fish River and Agiapuk River and another has noted lower water levels in area rivers.

Golovin residents have also observed a variety of changes to their environment. Similar to the Brevig participants in this study, *Golovin* residents have noticed an increase in algae in rivers near their community (fertilization activities do not occur in this area). One *Golovin* couple noted that when seining they have encountered algae as deep as one foot at the bottom of a river, and that it is stringy and is initially green but later turns black. Another *Golovin* fisherman identified the algae in *Golovin* Bay (as opposed to the rivers) as “red algae” and also noted an increase in sea grasses. The red algae, at least, seems to appear intermittently and unpredictably.

One elder fisherwoman who has been fishing at *Katchavik* since she moved to *Golovin* in 1960 noted that there used to be “seining trails” along the banks of the river in deep areas that were created by generations of people walking with their nets while seining. She had formerly used these trails but they have mostly eroded into the rivers now.

In terms of other plant life, several *Golovin* residents say that willows are growing in new locations where there were formerly none, and in one case where people used to pick blueberries. Erosion has also been notable and, like near Brevig, areas where plants and berries were regularly picked have been eroded away. Possibly related, the character of *Golovin* Bay has changed in several locations where shallow areas have become deep and deep areas have become shallow and in the upper reaches of the *Katchavik* River the water has become too shallow to travel by boat. Additionally, small lakes in the vicinity of *Katchavik* River has also dried up, and some greens that grew along their shores are also gone. Some residents have also noted that spruce trees are growing closer to *Golovin* (other than willows, no tree species grow within several miles of the village).

One experienced seal hunter has seen fewer seals on the ice in *Golovin* Bay over the past several years and has also seen less old, thick ice in the bay.

Similar to Brevig and *Golovin* interviewees, *Unalakleet* residents interviewed for this project have also seen multiple changes to their environment. There was no consensus, however, regarding changes to plants. *Unalakleet* residents reported increases and decreases, as well as no changes, in both willows and in berry bushes.

Unalakleet residents did agree that erosion is a growing problem, however. Erosion is occurring on the shores of the ocean as well as along area rivers, including the *Unalakleet* River, which seems to be growing wider and perhaps shallower. Much of this erosion is attributed to melting permafrost, storms and high winds with concurrent lack of shore ice to protect the beaches (see *Changes in Weather* section, below). One resident expressed his belief that ocean water levels have risen since the 1970s and that they are causing some of the erosion being seen.

Summary: Erosion is a growing issue in all three communities and is affecting structures as well as plant life. Interviewees from two communities, Brevig and *Golovin* discussed both an increase in algae

and water grasses, which are impacting fishing activities, and the drying up of water bodies around their communities.

CHANGES IN WEATHER

This section presents information provided by interviewees on their observations regarding changes in weather patterns that they have observed over the course of their lives. The information in this section is presented by village, rather than by change observed. This is because the three villages that contributed to this report are widely spread across the Bering Strait/Norton Sound region and observations from one community may not be applicable to the other two, or the region as a whole. Summarizing comments are provided in the conclusion of this section.

Brevig Mission residents interviewed for this project agree that the weather in general is much less predictable that it was earlier in their lives. Weather changes are also believed to happen much more quickly and without warning. All other changes can be seen as deriving from this unpredictability.

“Now everything is so unpredictable. Weather can change in just an instant, especially when you’re way out there.”

-Brevig Mission resident

Changes in the wind, including increase in strength, increase in duration, changes in direction and seasonality were all also commented on by Brevig interviewees. Wind was described as impacting the ways that ice forms in front of the village (including the timing of freeze up), whether or not it gets blown away from shore, and thus how protected the shoreline is from storms. In general, Brevig residents noted that they also used to experience many more calm days, which were used to pursue subsistence activities.

In general, winter freeze up is occurring later in the year than it did several decades ago, and spring break up is occurring earlier. Brevig interviewees varied on exactly how much of a difference there was in the timing of these events, with ranges from a few weeks to over one month. Some other changes noted by residents were generally cooler summers with more rain, and rain during the months of December and January.

Golovin residents have also experienced later freeze up (November) than what it was several decades ago (October), with Golovnin Bay still being open water into December. Freezing and then thawing of bay ice is also more common in recent years, as is ice being blown out by the wind. Ice in the bay has also been observed to be much thinner, frequently with areas of open water. One resident noted that there is less ice to auger through now when fishing for tomcod during the winter months than was present when he was younger, and another noted that ice on the east side of the bay is not stable and frequently breaks up and moves out. One elder remembered stories from her elders about people walking from Cape Darby to Rocky Point, across the frozen bay, to have potlucks, dancing and trading during long ago winters. No one would consider walking across the bay now because of the conditions described above.

Breakup was noted as remaining fairly consistent and happening in May. Two Golovin residents remembered ice piling up on the beach very high during breakup, when the ice would move back and forth, which hasn’t happened for about five years. Breakup was formerly a big event and people would make a fire on the beach and stand around to watch the ice go out.

Golovin interviewees have also noticed changes in the wind, including strength and duration, though one interviewee said that he has not noticed any changes. One couple has seen an increase in “whirlwinds” in the area (it is not clear if these were ‘waterspouts’ over open water or ‘dust devils’ over dry land).



Figure 5. Weather system at Golovin, Bering Strait region, 2009.

One elder interviewee commented on how quick the weather seems to change, as opposed to when she was younger:

“When we were growing up we would see clouds coming, say 'Well, it's going to storm.' Maybe a day or a couple of days after it would storm. But now, all of a sudden it storms. It comes so fast. We used to go across the bay to berry pick, when they didn't even have motors. They would pick all day and then come back – real calm.”

-Golovin resident

A different interviewee said that he believes weather is mostly predictable, citing the frequent use of radio and television to get weather forecasts, though he noted that the weather does change quickly some days and people do get caught in storms. Two residents noted that they believe the Golovin area is having more storms that cause flooding. Much of the village is very close to sea level and several severe floods have occurred in the last few decades.

Unalakleet residents, like those in Golovin and Brevig, have experienced changes that have led them to characterize current weather patterns as “unpredictable.”

“You can't predict the weather. You don't know what's going to happen next.”

-Unalakleet resident

“It seems warmer, but there are still real cold spells each winter. It's not like it used to be – consistent. Now it seems like: warm spell, cold spell, back and forth, back and forth. A winter used to be a winter.”

-Unalakleet resident

Unalakleet has always been a windy place, but residents have noted more consistent, sustained winds over the past approximately 10 years. They have also noticed changes in the direction of wind. One resident noted that because of change in wind direction, Unalakleet area beaches are getting much less driftwood from the south. This same resident has also noticed changes in the migratory patterns of cranes, which he attributes to changes in wind direction; cranes now take a “short cut” directly over the hills behind Unalakleet, as opposed to flying along the coast on their way south in the fall. Cooler summers with more rain have been typical of recent years, and more thunder and lightning was noted by one resident. Several interviewees mentioned more severe winter storms, but less snow in general.

Unalakleet interviewees have experienced later freeze up and earlier break up, as well. Freeze up in the vicinity of the village was typically late October in the 1960s and 1970s, but more recently is happening at the end of November, or even as late as December. Several residents noted that ocean used to be frozen “as far as you can see.” Oftentimes now the ice does not extend out into the Sound very far. Residents interviewed say that this is in part due to the wind pushing thin ice out to sea and not allowing stronger, thicker ice to form. The ice that does remain is thinner and often unsafe for travel. One resident noted that he used to drive out to Besboro Island on a snowmachine in the spring for bird hunting, and another remembered being able to go “straight across” Norton Sound by dog team. Both said that the ice does not get thick enough to do either activity anymore. The character of break up, in particular, was commented on by several residents who noted that it used to be like the water was “boiling” because the break up was so violent, whereas now, “it’s just like, little at a time.”

Summary: There are quite a few commonalities in the changes to weather patterns discussed by residents of Brevig Mission, Golovin and Unalakleet. All three communities noted later freeze up than was the case several decades ago. All have noticed changes to local wind patterns. And every person who made a statement about the weather in general said that weather patterns have become less predictable, with many saying that change happens very quickly.

DISCUSSION:

The information collected for this project indicates that for the Unalakleet region there have been significant declines in the number, health and size of Chinook salmon. Less data on Chinook salmon was obtained from the Brevig Mission and Golovin areas as these communities have access to and harvest far fewer Chinook than Unalakleet. Additional data was also collected on observed changes to the environment, climate and other species of fish. All three communities have noted significant changes to the environment of the region including a change towards the increasing unpredictability of local weather patterns. This project was carried out in conjunction with AYK SSI sponsored project #601, which collected similar data from six other Bering Strait region communities, which will be detailed in a separate report available in 2010.

While definite causes of the changes in Chinook abundance and health in the Unalakleet region cannot be determined, participants in this study (from all three communities) have offered important observations that may lead to the development of hypotheses for testing. Potential areas of investigation for future research are discussed below.

POTENTIAL AREAS FOR FURTHER INVESTIGATION

Availability of Food

Overall decreases in the size of Chinook salmon (smaller in terms of weight and girth), combined with

observations about the empty stomachs of Chinook and other salmon, may indicate decreases in the amount of food available, at least at the end of the lifecycle, prior to the fish entering freshwater to spawn.

Increase in Disease

Interviewees have noted an increase in the number of salmon that have health issues. Problems included skin lesions, discolored skin and meat, bad smelling meat, puss-y meat, an increase in worms, as well as occasional (but more frequent than in the past) deformities. Obtaining samples of salmon with these types of problems may help identify the causes and whether they are having a measurable impact on overall population numbers.

Climactic/Environment Impacts

Local Experts interviewed for this project have discussed a variety of climactic changes in and around their communities. While these changes cannot, at this time, be connected directly to changes in Chinook or other salmon populations, they may be useful avenues for investing climactic impacts on Chinook populations. Suggested areas for further research include changes to the strength and direction of wind, changes in the timing of freeze- and break-up, and potential warming of ocean and river water temperatures (possibly indicated by increases in algae, water grasses, jellyfish and erosion). Additionally, it is unclear if increases in erosion events (frequency and size), particularly along river systems, may be impacting salmon populations through their addition of silts, gravels and organic materials into waterways.

Several Unalakleet interviewees noted that, in general, their village gets less snowfall today than it did in the past. One resident suggested that less snowfall to insulate the river ice may be leading to a complete freeze up, down to the riverbed, on some parts of the Unalakleet River, leading to an increase in salmon mortality. It is not clear how often this type of complete freeze-up may have happened, or on which segments of the Unalakleet River it may have happened.

Harvest Regulations

When asked about current regulations for subsistence fishing, one Unalakleet fisherwoman said that she believed that some regulation was necessary, “for the king salmon’s sake” and to ensure that Chinook populations go back up. One local, Unalakleet area suggestion regarding harvest regulations about how to improve Chinook returns came from an experienced commercial and subsistence fisherman in Unalakleet. He feels that there should be more days per week when fishing is not allowed in both the marine and river waters. He would like to see the Chinook have several days per week when they have full, unimpeded access to the Unalakleet River to enable them to get to their spawning grounds. He believes that seven days a week subsistence fishing in marine waters may be putting too much pressure on the Chinook populations.

Other Factors

The potential impact of trout on salmon populations was discussed by multiple Unalakleet residents as a very likely cause for salmon declines. As detailed above, residents have both seen trout eating the eggs of spawning salmon and have harvested trout with salmon fry in their digestive systems. Residents also noted that tens of thousands of pounds of trout were formerly harvested from the Unalakleet River on a yearly basis for subsistence and for dog feed. This harvest dropped dramatically when residents began to replace their dog teams with snow machines and they no longer needed to harvest trout for dog feed. Local Experts interviewed felt strongly that the increase in trout populations

was a result of the drastically reduced harvest (over the past few decades) of trout and that trout are preying intensively on salmon eggs and fry. One resident also noted that these concerns had been expressed to NSEDC, which also conducts some regional fisheries research, but that it had been dismissed as not a relevant factor in salmon abundance. Directed research into trout/salmon interactions may be called for based on local observations.

One last factor to be noted as an impact to salmon populations is bycatch in the pollock fishery. While there has been and continues to be research directed at determining the role of bycatch on the abundance of Western Alaska salmon population, it should be clear that interviewees for this project have also expressed concern over bycatch and support continued and additional research into this issue.

CULTURAL IMPACTS OF THE DECLINE IN SALMON

One of the reasons that Chinook salmon were chosen as the focus of this project is because they have been identified by Alaska Native residents of Western Alaska as an important subsistence food. Chinook, and other salmon, also have importance beyond the realm of “food,” however. Some of the economic and cultural impacts of decreased salmon abundance that were discussed by interviewees for this project are presented below.

The decrease in size of salmon is important to note in terms of overall subsistence harvest. While some individuals in some communities may be catching approximately the same amount of fish as they did 10 or 20 years ago, those fish were much larger and had more meat overall (i.e. the total body weights of 20 fish today and 20 fish 30 years ago are not equal). And if you are catching smaller numbers of fish, the decreased size of the salmon even further decreases the overall amount available for consumption.



Figure 6. Dry salmon and salmon strips contributed to a community potluck.

The combination of decreases and resultant State of Alaska-imposed harvest regulations, have initiated changes to harvest and processing strategies. Unalakleet fishers interviewed for this project talked

about changing their salmon fishing location from the Unalakleet River to the adjacent marine waters. This is primarily because marine waters are accessible for fishing for longer periods of time, due to regulations, and because people have had difficulty meeting their subsistence harvest needs in river waters. This is clearly not a solution for all Unalakleet area subsistence fishers, however. One reason is that many people do not have the necessary boats or other gear to fish in marine waters and such a change would also likely have impacts on the availability of salmon. In terms of processing, king salmon strips are a highly valued and sought after product of subsistence fishing. Fishers have noted that with decreases in availability of Chinook, they have begun to, or are considering, trying to make strips from silver salmon. This is an accepted substitute, but less than ideal. Other species of salmon are also being targeted more intensively to make up for the decrease of Chinook available for subsistence harvest.

Time spent fishing is also impacted by the decreases in salmon abundance. Interviewees noted that it oftentimes takes much longer than previously to obtain the same amount of salmon. Additionally, the necessity of spending more time fishing potentially requires more fuel and/or time away from any wage-based employment, all of which have financial and other repercussions for families.

Salmon is a critically important food item for many individuals and families in communities across Western Alaska. For many families, salmon harvest is necessary for their yearly economic survival. It is a nutritional input that people expect and need to have. However, even for families that are able to financially survive without a large input of subsistence harvested salmon, it can still be stressful to have less than you were formerly able to harvest and less than you would ideally want. One wife and mother from Unalakleet stated, "It's stressful to figure out how often you can have a taste of this, trying to make it last all winter until we can get some the next year." Salmon is a culturally important food that people frequently talk about wanting to have a "taste" of, and that reminds them of their heritage and important cultural values.

In addition to its importance for the economic survival of individuals and families, the importance of customary barter and trade, particularly of fish, has also been documented for the Bering Strait region (Magdanz et al. 2007). One very important impact resulting from a decreased availability of salmon is that individuals have less salmon available for barter and trade and sharing. A fisherwoman from Unalakleet talked about being distressed over having to tell friends from other communities that she did not have enough dry fish (salmon) to participate in their annual exchange; she typically barter with dry salmon for sea mammal products.

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DELIVERABLES:

Semi-annual progress reports were provided to AYK SSI during this project. This document is the final report on the project. Two posters for presentation at the 2008 and 2008 Alaska Marine Science

Symposiums were developed with information from this project (and project #601).

This final report will be distributed to the participating communities' Tribal Councils in CD format, along with paper copies. Individual participants will also receive copies. Copies of the final report, along with digital recordings of the interviews will be placed in Kawerak's Eskimo Heritage Program archives, which are open to the public for research and educational purposes. Electronic copies of the final report will be made available to researchers who request them.

PROJECT DATA:

The data collected for this project consists of a series of digitally recorded interviews conducted in the participating communities (Brevig Mission, Golovin and Unalakleet). These interviews will be stored on archival quality CDs in the Eskimo Heritage Program archives housed at the offices of Kawerak, Inc. in Nome, Alaska. The archives are accessible to the public and researchers for educational purposes. Copies of interviews can be obtained by contacting the Eskimo Heritage Program at:

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PRESS RELEASE:

The local traditional knowledge (LTK) research outlined in this report is a component of a larger project to determine whether the ocean environment is a more important cause of variation in the

abundance of salmon populations than marine fishing. One of the reasons that Chinook were chosen as the focus of this project is because of their importance as a subsistence food for Western Alaska communities. The goal of the overall project is to identify and evaluate life history patterns of use of marine resources (habitat and food) by Chinook salmon, and to explore how these patterns are affected by climate-ocean conditions in the Bering Sea and North Pacific Ocean. New analyses and syntheses of historical data, as well as the collection and analysis of new field and laboratory data, including LTK, are being used to address this issue. The LTK component of this project included interviews with Local Experts in three communities in the Bering Strait/Norton Sound region (Brevig Mission, Golovin and Unalakleet) on the topics of changes to salmon populations, the environment and the climate.

This report is intended to provide an overview and summary of changes that Local Expert interviewees have observed over the course of their lifetimes. The report also provides suggestions for further investigations into the causes of decreases in Chinook population abundance, such as: the availability of food for Chinook, increases in disease, climactic changes such as increased wind and changes in prevailing wind direction, and the impacts of predation on salmon eggs and fry by other fish.

This report concludes that, among other things, subsistence harvesters have seen the average size of Chinook salmon (weight and girth) decrease over the last decade and that population numbers, particularly in the vicinity of Unalakleet, have declined. Several areas for further investigation were also identified through this research. It is suggested that additional research on the amount of food available at the end of the Chinook lifecycle be investigated due to decreased size of salmon and harvester observations of empty Chinook stomachs. Because subsistence harvesters have also noted an increase in Chinook with health issues, it is also suggested that more effort be dedicated to obtaining samples from such fish and determining if disease is having an impact on overall Chinook population numbers. Additionally, residents of the three study communities have experienced a variety of climactic changes that may potentially be connected to variation in Chinook or other salmon populations, and which should be investigated further (i.e. changes in wind timing and strength, timing of freeze- and break-up, warming water temperatures, etc.).

APPENDIX 1: Project Participants

Project Participants: Brevig Mission



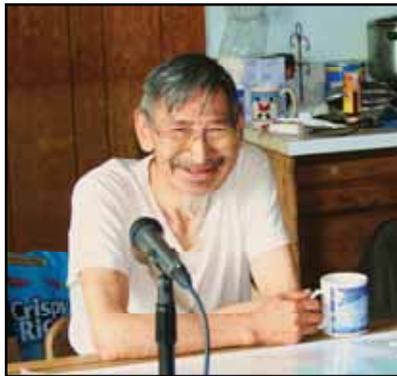
Delbert Seetot



Elmer Seetot, Jr.



Helena Seetot



Robert Rock, Sr.



Rita Olanna

Project Participants: Golovin (no picture available for Robert Amarok)



Irene Aukongak



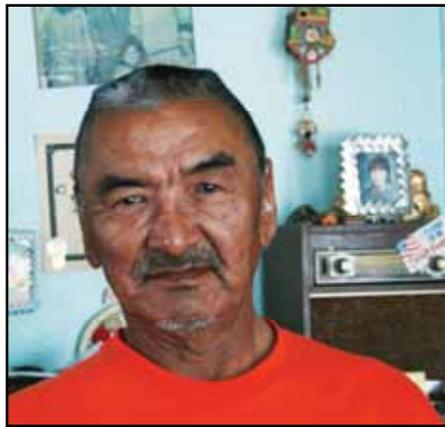
Toby and Debbie Anungazuk



Florence Doyle



Maggie Olson



Thomas Punguk

Project Participants: Unalakleet



Ben Eakon



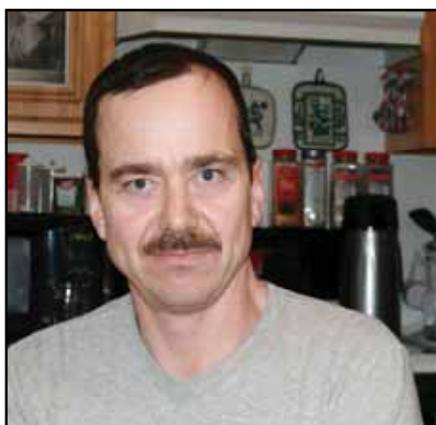
David and Mildred Katongan



Jerry Ivanoff



Mae and Oscar Koutchak



Shane Johnson



Laura Paniptchuk



Theresa Nanouk