

*Indigenous Knowledge and Use of Bering Strait Region
Ocean Currents*



Final report to the National Park Service, Shared Beringian Heritage Program
for Cooperative Agreement H99111100026

By

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PREFATORY NOTE

This final report consists of two parts. Part One is a report on the work conducted in Alaska, and is authored by Julie Raymond-Yakoubian. Part Two consists of a report on the work conducted in Russia and is authored by Yury Khokhlov and Anastasiya Yarzutkina.

Part One

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Ocean Currents*

(Alaska)

By

Julie Raymond-Yakoubian, Kawerak Inc.

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Map 1. Ocean Currents in the Bering Strait Region of Alaska (and other marine features)

ABSTRACT

Indigenous Knowledge and Use of Ocean Currents in the Bering Strait Region (Alaska)

This report documents work completed by Kawerak, Inc., the regional Alaska Native non-profit corporation serving the people and villages of the Bering Strait region of Alaska, and by the Chukotka Branch of Pacific Scientific Research Fisheries Center in Anadyr, Russia. The study goal was to document the traditional and contemporary use of and knowledge about ocean currents by communities in the Bering Strait region.

The study included interviews with ocean currents experts in Alaskan and Russian communities including Shishmaref, Wales and Diomede in Alaska, and Lorino, Lavrentiya, Inchoun and Neshkan in Russia. Experts were interviewed regarding their knowledge of the location and characteristics of ocean currents, how currents are and have been used for hunting and travel, how currents interact with other environmental factors, traditional stories relating to ocean currents, safety considerations, as well as changes to ocean currents and the marine environment, in addition to other topics. In Alaska, community meetings, tribal council meetings, and a workshop were also held.

This study determined that knowledge of ocean currents is a critical part of the body of traditional knowledge held by indigenous communities in the Bering Strait region, that this knowledge has practical applications in marine policy and planning, and that there is a strong desire for this knowledge to be passed on to younger generations and to be shared with other indigenous communities as well as individuals, agencies and organizations outside the region.

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This project would not have been possible without the support and participation of the local experts in each community. We thank each of the following individuals, who were interviewed as local experts for this project, and who generously contributed their knowledge, experience and time: in Shishmaref: Francis Kakoona, Morris Kiyutelluk, Curtis Nayokpuk, Harvey Pootoogooluk, John Sinnok, Davis Sockpick, Clarence Tocktoo, and Vincent Tocktoo, Sr.; in Wales: Michael Ahkinga, Sr., Luther Komonaseak, Gilbert Oxereok, Raymond Seetook, Sr. and Winton Weyapuk, Jr.; and in Diomede: Arthur Ahkinga, Orville Ahkinga, Sr., John Ahkvaluk, Jerry Iyapana, Patrick Omiak, Sr., Edward Soolook and Robert Soolook, Jr.

As part of this project, Kawerak held an *Indigenous and Western Knowledge of Ocean Currents* workshop and we thank the participants in that workshop: Seth Danielson of the University of Alaska Fairbanks, Institute of Marine Science, and Rebecca Woodgate of the University of Washington, Applied Physics Laboratory; Raymond Seetook, Sr., Debra Seetook, Rueben Oxereok and Jessie Ongtowasruk of Wales; Curtis Nayokpuk, Vincent Tocktoo, Sr., John Sinnok, and Johnny Pootoogooluk of Shishmaref; Fred Tocktoo of the National Park Service; Guy Martin of the National Park Service Shared Beringian Heritage Program, Beringia Panel; and Kawerak staff Melanie Bahnke, Meghan Topkok and Brandon Ahmasuk. John Sinnok of Shishmaref and Winton Weyapuk, Jr. of Wales also greatly assisted the project by reviewing and correcting the Iñupiaq words and phrases in Table 1. Meghan Topkok compiled and designed Appendix 3. All photos were taken by the author unless otherwise noted.

Thank you also to the local assistants in each participating community. The local assistants assisted the principal investigator with interviews, facilitated communications with tribal councils and local experts, acted as local guides and provided other valuable assistance. In Shishmaref, Lucy Iyatunguk and Edwin Weyiouanna were local assistants. The Native Village of Shishmaref provided logistical assistance. In Wales, Gene Angnaboogok was the local assistant. Logistical assistance was provided by the Native Village of Wales. In Diomede, Robert Soolook, Jr. was the local assistant. The Native Village of Diomede provided logistical assistance.

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the interviews from this project. Obie Simonis, Kawerak Land Management Specialist, created the ocean currents map included as Map 1 (in the map pocket). Meghan Topkok, Social Science Program Intern, transcribed and proofed interviews, assisted with Table 1, helped organize and facilitate the workshop, helped organize and carry out various community meetings, and provided invaluable help during the final months of the project. Bridie Trainor, Kawerak Wellness Program Director, is thanked for providing funds for the youth participants in the workshop. Kawerak also thanks the staff of the National Park Service Shared Beringian Heritage Program for their cooperation and assistance during the course of this project. In particular we would like to thank Elizabeth Shea, Janis Kozlowski, and translator Marina Bell. We also thank Jeanette Koelsch and Janet Klein of the Nome office of the National Park Service for their assistance in facilitating lodging for workshop participants.

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INTRODUCTION

Kawerak, Inc. initiated this project in 2010 with the goal of documenting indigenous knowledge and use of ocean currents in the Bering Strait, in collaboration with Shishmaref, Diomedes, Wales and colleagues at the Chukotka Branch of Pacific Scientific Research Fisheries Center (ChukoTINRO) and villages in Chukotka. We aimed to document this information both spatially (in map form) and in narratives (through interviews and meetings). The results of this work, in both Alaskan and Russian communities, are presented in this two-part report.

Knowledge of ocean currents, and the importance of this knowledge for hunters and boaters in the Bering Strait region, cannot be overstated. For indigenous people of the region, a thorough understanding of how the marine environment operates is crucial for safety as well as for predicting where animals may be found and harvested in the ocean, where marine (or marine-transported) resources may wash ashore, where hunters or boaters in distress may be located, where spills of hazardous or other materials may be transported, as well as for other purposes. Ocean currents and physical oceanography are also studied by western scientists in an attempt to understand local and global ocean circulation (e.g. Woodgate and Aagaard 2005, Danielson et al. 2006, Danielson et al. 2012), changes in sea ice extent (e.g. Woodgate et al. 2010, Danielson et al. 2011), and other climatological questions (e.g. Zhang et al. 2008, Hu et al. 2012). While it is beyond the scope of this project to review the existing western science research on Bering Strait currents, a workshop was held (see Results) as part of this project to make a first effort at connecting indigenous and western science bodies of knowledge regarding Bering Strait ocean currents (similar work has been conducted in the Chukchi region, see Johnson et al. 2014). Additionally, it is a recommendation of this report (see Recommendations) that indigenous knowledge of ocean currents and western science knowledge of ocean currents be more fully integrated and that western scientists and indigenous knowledge holders work together in the future.

This work could not have been completed without the cooperation and collaboration of local ocean currents experts in Alaska and Chukotka. Information about ocean currents has not received a large amount of attention in the anthropological literature of the Bering Strait¹. Within the region, however, there is a tradition of story-telling and knowledge-sharing related to ocean currents. The Kawerak Eskimo Heritage Program Archive, in Kawerak's Nome office, holds information from all of the tribal communities in the region, including stories and knowledge related to ocean currents (e.g. Eutuk 1983a). These stories can be both instructional as well as entertaining, though many involve disasters befalling hunters out in the marine environment. One of the most well-known stories involves the plight of three King Island hunters in 1949 which was published as a story in *Alaska* magazine and later as the book *One Survived* (Fortier 1978). The research presented here contributes to and documents some of the regional knowledge and stories about ocean currents, contributes to previous anthropological work touching on the topic, and compliments other work in the region on related topics (e.g. Oozeva et al. 2004, Weyapuk and Krupnik 2012, Kawerak 2013a).

¹ See Giddings 1952, Bogojavlensky 1969, Ellanna 1983, Jolles and Native Village of Diomedes 2006, Krupnik et al. 2010 and Alix 2012 for examples of work where Bering Strait ocean currents are discussed.

Background

The Bering Strait Region

The Bering Strait region is located in northwest Alaska 60 miles south of the Arctic Circle (Figure 1). The region includes the Seward Peninsula, the islands of Big and Little Diomede, St. Lawrence Island, and several other small islands. The Bering Strait region extends as far south as the southern shores of Norton Sound. The region is home to three distinct linguistic and cultural groups of Eskimo people: the Iñupiaq, Central Yup'ik, and Saint Lawrence Island Yupik. There is evidence of human habitation in the area dating back at least 10,000 years (Hoffecker and Elias 2003). The population of the Bering Strait region (the Nome Census Area) is about 9,500 people. Alaska Native peoples make up approximately 75% of the population. There are 15 year-round occupied villages outside of Nome that range in population from approximately 120 to 700. Nome is the largest community in the region with approximately 3,700 people (DCCED 2013). Nome is the transportation and service hub for the region.

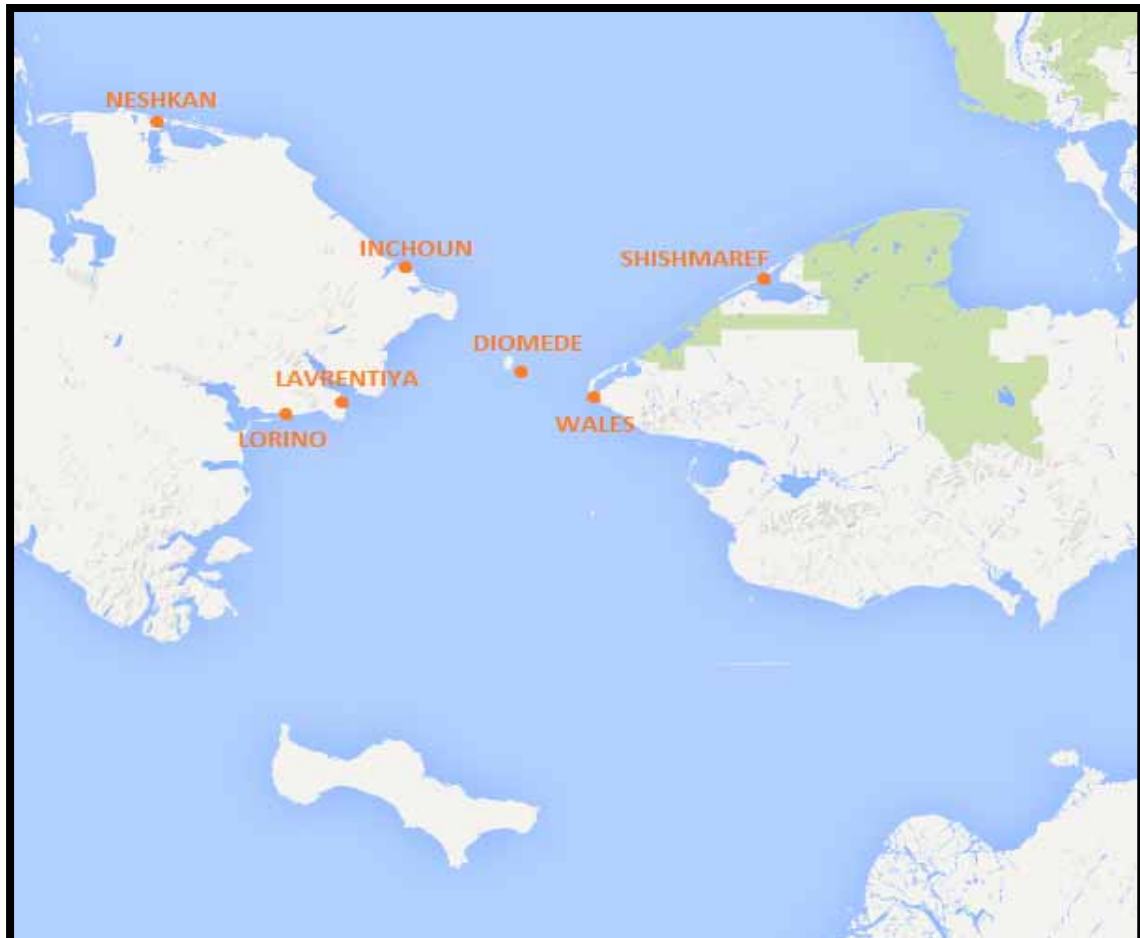


Figure 1. Bering Strait region communities that participated in this project.

Kawerak Incorporated

Kawerak, Inc. (Kawerak) is an Alaska Native regional nonprofit corporation authorized by tribal resolution to provide services throughout the Bering Strait region of Alaska. Kawerak's main offices are located in Nome, Alaska. The Kawerak Board of Directors consists of the Presidents of the 20 federally recognized tribes in the region, two elder representatives, and the Chair of the Norton Sound Health Corporation. This project was completed by Kawerak's Social Science Program, which is part of the Natural Resources Division. Kawerak's vision statement reads, *"Building on the inherent strength of our cultural values, we shall assist our tribes and residents to create a positive future."*

Shishmaref

The community of Shishmaref is located on Sarichef Island, a barrier island off the northwestern coast of the Seward Peninsula in the Chukchi Sea (Figure 1). The current population of Shishmaref is 605 and approximately 95% of village residents are Alaska Native (DCCED 2013), most of whom are Iñupiat. Sarichef Island has been experiencing rapid and severe erosion, and as a result the community would like to relocate to a more stable location on the mainland (U.S. Army Corps of Engineers 2004). There is no road access to the mainland or any other community; all travel is by small plane, boat, or snowmachine during the winter months. There are a limited number of wage-based employment opportunities and many are seasonal. Subsistence hunting, fishing, and gathering remain very important to Shishmaref residents. The most recent research on the subsistence harvest by Shishmaref residents estimated a total of over 630,000 pounds of subsistence foods harvested for the period of July 2005 to June 2006 (Ahmasuk and Trigg 2008:289).



Figure 2. View of Shishmaref in the winter.



Figure 3. View of Wales in the summer.
Photo courtesy of Vernae Angnaboogok.

Wales

The community of Wales is located at Cape Prince of Wales, which is the westernmost point of the Seward Peninsula and directly adjacent to the Bering Strait (Figure 1). The current population of Wales is 152 and approximately 85% of village residents are Alaska Native (DCCED 2013), most of whom are Iñupiat. Wales is approximately 110 miles northwest of Nome. There is no road access to any other community; all travel is by small plane, boat, or snowmachine during the winter months. There are a limited number of wage-based employment opportunities and many are seasonal. For Wales residents, subsistence hunting, fishing, and gathering continue to be highly valued activities. The most recent research on the total subsistence harvest by residents of Wales estimated a total of over 53,500 pounds of subsistence foods harvested for the period of July 2005 to June 2006 (Ahmasuk et al. 2008:289).

Diomede

The community of Diomede is located on Little Diomede Island, in the middle of the Bering Strait, approximately 135 miles northwest of Nome (Figure 1). The current population of Diomede is 115, and approximately 92% of the residents are Alaska Native (DCCED 2013), most of whom are Iñupiat. Diomede does not have road access to any other communities; all travel is by helicopter (year round), small plane (during winters when an ice runway can be built) or by boat. The International Dateline is located between Little and Big Diomede Islands. There are a limited number of wage-based employment opportunities on the island and many are seasonal. Subsistence hunting, fishing, and gathering remain very important to Diomede residents. There is no comprehensive subsistence harvest data for the village of Diomede.



Figure 4. View of Diomedes.

STUDY OBJECTIVES

The main goal of this project was to document indigenous knowledge about, and uses of, ocean currents and to foster information exchange.

The objectives of the project were to:

- 1) Document knowledge related to ocean currents, and their uses, prior to the widespread use of boats with outboard motors, as well as following the widespread use of boats with outboard motors
- 2) Document physical changes to ocean currents over time
- 3) Document indigenous taxonomy related to types of ocean currents and their uses
- 4) Map spatial information documented on ocean currents
- 5) Promote the exchange of this information internally within communities, between Russian and Alaskan indigenous communities, and between these communities and Western science researchers

METHODS

Overview

This project was conducted with the prior consent of village tribal councils and individual participants. Prior to submitting the funding application for this project, the principal investigator requested letters of support from the Shishmaref, Wales and Diomedes tribal councils. Each council was sent a summary of the proposed project and a draft letter of support. All three tribal

councils provided letters of support which were included in the funding application. After funding was received, the principal investigator informed the tribes and requested permission to conduct the proposed research via tribal governing resolution. A resolution was received from each tribe. Participation in the research was completely voluntary; individuals were given the opportunity to decline participation, or to decline to continue participation at any time in the research process, with no negative consequences to them. Each interview participant signed a written consent form prior to participating in the project. Interview participants were local experts on the project topics, identified by their tribal councils.

The methods used to collect data for this project included local expert interviews, including mapping. Community meetings, tribal council meetings and a workshop were also held. Archival research was conducted primarily at the Eskimo Heritage Program archives, which are housed at Kawerak's Nome office. These archives include audio, video, and written records on each community in the Bering Strait region.

Community meetings were held to both inform project participants and other community members about the purpose and status of the project, and to gather feedback and suggestions from meeting attendees. Meetings with village tribal councils were held for the same reasons, as well as to ask for assistance or feedback on particular issues. The workshop, held in November 2013, was held to share project data among communities, to review a draft ocean currents map, to allow project participants and western scientists to exchange information, and to discuss possible future research topics or collaborations.

The methods used to conduct the semi-structured interviews are described below. The interview guide is included as Appendix 1.

Semi-Structured Interviews

Kawerak's Social Science Program has been conducting semi-structured interviews with local experts on many topics for over six years. This study utilized a standard interview guide (Appendix 1) and included a mapping procedure that was carried out with a purposive sample of elders and active hunters (local experts).

Study Design

The principal investigator, Julie Raymond-Yakoubian, asked each tribal council to provide a list of ocean currents experts in their communities ("local experts"). Local experts are defined as individuals who have lived in the area for an extended period of time and are intimately familiar with ocean currents, the marine environment, and boating on the ocean. Local experts are recognized by their tribal council and peers as subject matter experts. Each local expert was paid an \$80.00 honorarium for participating in an interview in recognition of their time and knowledge.

The principal investigator held meetings in each participating community to introduce the project in detail to the tribal councils and the public and to answer questions about the project. Local assistants were hired in each community to help conduct the study. The principal investigator made a trip to each community to conduct interviews with local experts. These trips lasted approximately one week in duration and some communities were visited more than once. A

workshop was held in 2013 with local experts and youth representatives from Shishmaref and Wales (two Diomedede representatives were invited but did not attend), and with two western science experts on ocean currents (described in the Results section).

Data Collection

The semi-structured interviews were conducted by the principal investigator. Local assistants were temporarily hired by Kawerak in each community to assist with interviewing and to act as local guides and liaisons. The principal investigator trained each local assistant how to use the interview guide, operate equipment, and conduct the mapping technique (described below). An intern was also hired during the course of the project to assist with transcriptions, workshop preparations, data analysis and other project activities.

The interview guide for this project was developed in collaboration with the tribal councils. The local assistants from each community also provided input for the interview guide. The guide covered several topics including knowledge needed to operate a boat safely in ocean currents, indigenous words related to ocean currents, how animals use ocean currents and other topics (see Appendix 1).

The principal investigator digitally recorded each interview (with permission of the interviewees). The majority of interviews were transcribed by two individuals. Each local expert was provided an opportunity to review their transcript prior to it being finalized and archived by Kawerak. The Eskimo Heritage Program at Kawerak is the repository for the transcripts and audio files.



Figure 5. Shishmaref expert John Sinnok mapping ocean currents during an interview.

Mapping

Local experts were asked to map locations of ocean currents or other spatial features of the marine environment related to ocean currents. National Oceanic and Atmospheric Administration nautical charts topped with mylar sheets and colored markers were used to record this information on the maps (c.f. Andersen et al. 2004). The spatial data was digitized in ArcGIS 9.3 by Kawerak Land Management Specialist Obie Simonis, who also produced maps for community review and inclusion in this report (see Map 1, map pocket).

Data Analysis

Kawerak used Atlas.ti qualitative data analysis software to code and organize the interview transcripts. The principal investigator used the software to identify patterns and trends in the data through keyword, co-occurrence, and other queries. A list of codes was created (43 total) and applied to the interview data by the principal investigator. This was an iterative process in which each transcript was reviewed multiple times during the coding process as codes were created, deleted, combined and otherwise revised (e.g. Friese 2012). The 43 codes were applied to over 760 individual quotations. Quotations were organized by code, community, and other factors during the process of analysis to determine patterns, trends and anomalies in the data.

During analysis, the principal investigator and project intern created summaries of information on various topics of interest (hunting and ocean currents, safety and ocean currents, etc.). After compiling these summaries, several experts from each community were invited to attend a data review and information sharing workshop. The experts were also asked to invite a youth from their community to participate in the workshop. Two western scientists who research ocean currents, as well as some Kawerak and National Park Service staff were also invited to participate in the workshop. A draft ocean currents map and map guide were also reviewed at this workshop. Information from the workshop is included in this report (described below).

Project wrap-up meetings were held in 2014 with each of the three communities while this report was still in draft format to update communities and tribal councils about the status of the project and to answer any questions and solicit feedback. The draft ocean currents map was also displayed for review and comment at these meetings, and a copy of the draft map and map guide were left with tribal councils so that participants and councils could review it in more detail. A draft of this report and the ocean currents map was also sent to all project participants, local assistants and tribal councils. The report and map were also reviewed by multiple Kawerak staff.

RESULTS

Experts in each of the three participating communities were interviewed about their knowledge and use of ocean currents in the Bering Strait. The information below is loosely divided into different categories such as “Animals”, “Safety”, and “Hunting.” All of these categories, however, are intimately connected and really cannot truly be separated. For example, it is impossible to talk about hunting without also talking about reading weather signs, the ways animals use ocean currents, ice conditions, etc. Wind affects currents, which affect ice, which in turn determines animal distributions, and on and on. Individuals and boat crews venturing into

the marine environment must have an understanding of all of these factors, have the ability to evaluate them all on the fly, and be able to make quick (and good) decisions. We hope the information below will give the reader an indication of the depth and complexity of the indigenous knowledge held by local experts in Shishmaref, Diomedes and Wales about ocean currents.

Ethnographic Interviews

Ocean Currents

There are numerous ocean currents operating in the Bering Strait region. As part of our research, Kawerak created a map of currents and other ocean features described by local experts. To accompany this map, a map guide was created that provides information about each feature on the map. Only some of the currents and features on the map are detailed in the body of this report, and the reader is directed to Map 1 (in the map pocket) and Appendix 4 for additional information. Appendix 4 is the map guide that provides information on each feature numbered on the map. An overview of Bering Strait region ocean currents is given here.

Experts discuss three main currents between Wales, on the mainland, and Little Diomedes Island. One that is closer to Wales, one in the middle of the Strait, and one closer to Diomedes. Diomedes experts identify approximately seven main currents that operate around their island. Shishmaref experts are knowledgeable about currents to the south, in the vicinity of Wales, up to the north in the Kotzebue Sound area, including the powerful current approximately 50 miles offshore from Shishmaref.

There are a variety of different types of ocean currents operating in this area. Some currents are continuous for hundreds of miles or more, some are small and localized. Other currents are impacted by the tides, either temporarily switching direction (e.g. at channels leading into inlets), or changing their speed (e.g. becoming slower or “weaker” at high tide). Seasonal currents are also present, only appearing during certain times of the year and under certain environmental conditions.

Currents can move at different speeds at different points along their courses. This is not always predictable and boat captains must be able to judge speed visually (i.e. watching debris, chunks of ice, etc. See also, Elder’s Conference 1984) or with their GPS units. Some currents are known for being particularly swift and dangerous. For example,

“And then when you go into the [Kotzebue] Sound, sometimes we’ll go on this side. And that’s when the current is real fast, right along here, and it’s real deep, super deep. ...if we sink an ugruk, we’ll throw our sink hooks down, and we’ll get it from the bottom. ...my hook has [a] lead sinker on the front, so it will stay down no matter how strong the current is around here. But over there, it was just floating.” –John Sinnok, Shishmaref

Currents can also dramatically decrease in speed of flow, and even reverse or temporarily stop under the right conditions. These temporary changes are caused primarily by sustained wind

from a generally northern direction. Reversals in ocean current direction were described as typically happening between November and January.

Most boat captains have a very respectful attitude towards currents, recognizing their strength, particularly if they have experienced them firsthand or have seen them “tossing around big chunks of ice” or otherwise demonstrating their power. The sections that follow discuss some of these specific aspects of currents and how hunters adapt and respond to them.

Table 1 includes words and phrases related to ocean currents or the marine environment. These words were documented in the participating communities through interviews with local experts.

Table 1. Iñupiaq terms and phrases related to ocean currents.

Iñupiaq Term	Village/Dialect	English Translation
aaluk	Diomedede	Rope
aġvianiituk aġvianik	Diomedede	Current flowing in an easterly direction
Attu	Diomedede	Name of a current around the southeast corner of Little Diomedede Island
qagri	Diomedede	Social, political, and educational institution in Iñupiaq communities; also the name of physical structure
qanukatuq	Diomedede	Current flowing in a westerly direction
qulutaaq	Diomedede	Splash guard on a skin boat, but can also be used on an aluminum boat
sagvaluk	Diomedede	Eddy or weak current
savġaaq	Diomedede	Current (any)
ugruk	Diomedede, Shishmaref, Wales	Bearded seal
aġikaq	Shishmaref	Blubber of whale
anaaġluq	Shishmaref	Dirty, sandy ice that is not good for hunting
aġatkuq	Shishmaref	Shaman
apauraq	Shishmaref	Nickname for Ear Mountain (“grandpa”); see also iġiġaġik , below
asaanaaluk	Shishmaref	Very fast current going outward at the channel
asaanaaq	Shishmaref	Slow current going outward at the

		channel
asaaniq	Shishmaref	Outgoing current from Shishmaref
ayaktaq	Shishmaref	Person that floats away on ice, boat, etc.
Ikpik	Shishmaref	Place name
iktuḡaq	Shishmaref	Sail positioned in front of the bench on a boat (umiaq)
iluqnauq	Shishmaref	Large sheet of ice
iluqnausugvak	Shishmaref	Very large iluqnauq
Inugutaak	Shishmaref	“Indian” – Native person from the interior (Athabaskan)
iḡiḡaḡik	Shishmaref	Iñupiaq name for Ear Mountain
itiqsaanaaq	Shishmaref	Slow current going into/toward the channel
itiqsaanaluk	Shishmaref	Very fast current going into/inward at the channel
itiqsaaniq	Shishmaref	Incoming current towards Shishmaref at the channels
itqaaniq	Shishmaref	Current that runs west to east; this is also a current that lets ocean animals migrate
iuniq (sg.) iunit (pl.)	Shishmaref	Pile of ice; can also mean “iceberg”
izrikaniisiq	Shishmaref	Little birds that come in the spring; Lapland Sparrow
kaataq	Shishmaref	Skin of whale
kaimigzizruq	Shishmaref	The current speeds up and becomes so fast it does not slow down
kaimik-	Shishmaref	Speed [verb base]
katuq-	Shishmaref	To drop [verb base]
kiakmuinaq	Shishmaref	‘Towards the east’ [incomplete phrase]
kiakmun	Shishmaref	‘Towards the east’ [incomplete phrase]
kiaknaituami	Shishmaref	On an east wind
kiaknaituq	Shishmaref	Wind from the east
kiaknaq	Shishmaref	East wind
Kigiqtaq	Shishmaref	Place name: Shishmaref
mauzraḡaq	Shishmaref	To jump from one piece of ice to another

nagunaq	Shishmaref	Type of clam
niiqsuaq	Shishmaref	Light north wind
pizriqtuaq	Shishmaref	When the current is stronger than the wind. Alternate meaning: when someone is taking a chance
pizruġaaniq	Shishmaref	Current that runs in opposite direction/backwards; current that runs east to west
pizruġaaniqtuq	Shishmaref	The current is going east to west
qagitaq (sg.) qagitat (pl.)	Shishmaref	Piled driftwood
qanitaq	Shishmaref	Storm shed
qausuitaagani	Shishmaref	Where the sun never rises
qayaq	Shishmaref	Kayak
qinu	Shishmaref	Slush ice
saġvaaluzruaq	Shishmaref	Place that has lots of current
saġvaatuzruaq samna	Shishmaref	“That one out there that has a very strong current”; referring to the strongest current running north between Wales and Point Hope
samunaaqtuq	Shishmaref	Something is going or passing by further out in the ocean
savġaq	Shishmaref	Current
sigu kaimigzilaatuq	Shishmaref	The ocean ice will gain speed
silu	Shishmaref	Something that drifts ashore, especially something usable like an animal carcass, logs, etc.
Siġik	Shishmaref	Place name: Fourth channel east of Shishmaref
siu	Shishmaref	Bow of a boat
taimana aituraġumaipsiġnatauq, niġiq...niġiuramik tauq niġisuktunġnatauq	Shishmaref	“Just like that you [guys] can give me some too, a little share of what was caught [like seal, etc.]...I would like to eat a little bit of the share [of whatever they caught seal, whale, etc.]” What hunters tell killer whales encountered while out hunting.
tijilġaun	Shishmaref	Sail for an umiaq
tuluqtitaq (sg.) tuluqtitat (pl.)	Shishmaref	Ice pushed over shore ice or on the beach by a strong current/wind

uazruaq	Shishmaref	Ice that does not move, stays in one spot
uinniq	Shishmaref	Open lead in ice; non land-locked ice
umiapiaq	Shishmaref	Skin boat (“real boat”)
umiaq (sg.) umiat (pl.)	Shishmaref	Boat
unaaq	Shishmaref	Hunting tool with an ice tester on one end (used to make sure ice is solid enough to walk on), and a hook on the other end to pull up catch, such as ugruk
usrraavak	Shishmaref	Stink walrus flipper or skin, blubber and meat
uunniq	Shishmaref	Sunburned, dead walrus, seal, etc.
waknaluk	Shishmaref	Bad west wind
sagvaq	Shishmaref, Wales	Ocean or river current
iᅇalim sagvaa	Wales	Name of a strong current close to Little Diomede on west side of the island
kaivsraaqtuaq	Wales	The one that spins (an eddy)
kiᅇigim sagvaa	Wales	Name of a strong current close to Wales
Nuughaq	Wales	Place name: South side of Big Diomede Island; hunters watch to see what weather is going to be like
qamaiyaq	Wales	Name of eddy near Wales
qaᅇitat	Wales	Pile of driftwood
quliitaq	Wales	Boards added to the edge of a boat frame that act as splash guards
sagvaatainaq	Wales	Current increasing in strength
sagvaavak	Wales	Very strong current
sagvaiq	Wales	For a current to stop flowing
sagvaq qitiqliq	Wales	“in the middle”; current in the middle of the Strait between Wales and Little Diomede
sagvaq taatuq	Wales	Current “coming in” towards shorefast ice or land
sarvaumaniq	Wales	Name of a shoal 8 miles north of Wales

Ugiyaaq	Wales	Place name: “Place where someone spent the winter”; name for Fairway Rock
Umiivik	Wales	Place name: “Place to build skin boats”; there is a lot of driftwood here

Animals

Just like humans, marine mammals and other animals utilize ocean currents for a variety of purposes. Shishmaref, Diomede and Wales experts described their observations of animals using currents in the Bering Strait region. One of the primary reasons animals spend time near ocean currents is because the currents are a source of food. The currents are used by and move large mammals, as well as the food sources of those mammals.

“[They stay around currents] [b]ecause they are getting food. There is food.” –Edward Soolook, Diomede

“Also, coming back to the current along the shoreline, that’s where fish use this current. All kinds of fish like salmon, whitefish, and things like those type of fish.” –Davis Sockpick, Shishmaref



Figure 6. Walrus passing between Little and Big Diomede Islands in the current.

The currents move plankton around the Strait which can bring whales close to communities like Diomede. Additionally, at Diomede, residents know that if the current is not moving “just right” that they will most likely not be successful when they go crabbing or ice fishing. According to Orville Ahkinga, Sr., when the current weakens, there is “less activity, especially around here.”

“When the current is running just right, not too strong a current, not too weak a current, but good current, on this side [southwest side of the island], when we go crabbing, that’s where we go crabbing. When there is no current, we don’t get nothing.” –Edward Soolook, Diomede

Importantly, the currents also help move the sea ice around. Ice-associated mammals such as walrus and ringed, bearded, spotted and ribbon seals, use the ice, and therefore the currents. These animals pup, calve, mate and rest on ice, and also use ice as a platform to escape predators. When using the ice for these purposes the animals are moved along with the currents. Hunters know that if animals cannot be found near the ice edge that they are probably out in the current.

“The sea mammals, they use it [currents] very well. Like walrus and ugruk, and even spotted seal, common seal...they know they will be safe. ‘Cause they’re heading north anyway, that walrus will stay on ice for up to one week, just sleep. And they know that predominant current will take them up.” –Morris Kiyutelluk, Shishmaref



Figure 7. Walrus in front of the village of Diomede.

Some animals, walrus in particular, also use the currents themselves, without ice. For example, male walrus will inflate their throat sacks and just rest, floating along with the current, as will birds such as ducks.

“And then we went out to the current, (chuckles) there was like THOUSANDS of walrus just floating with the current. (Laughs) Just with their air sacs [inflated].” –Francis Kakoona, Shishmaref

The currents between Little and Big Diomed Islands typically maintain a crack in the ice throughout the winter. This crack forms in approximately the same location each winter and residents use it regularly for fishing.

The Bering Strait itself is a “bottleneck” for marine mammal migrations, and there are even certain places within the Strait that condense animals even more during certain times of the year. For example, there is a large shoal, with associated currents, north of Wales. When ice gets piled or packed into areas because of ice or currents animals must move around it, concentrating animals in the open locations.

“...we search for walrus when there’s ice packs here.” –Davis Sockpick, Shishmaref

There are some areas, such as eddies, or places where there will be open water, maintained by the current, where hunters often look to find animals.

“That was one story my dad told me one time. ...he said even if you can’t find walrus or anything out here, always check out this...big eddy in there. ...So we found walrus there one time.”
–Curtis Nayokpuk, Shishmaref

“I know this will stay open from the [eddy] current here.” –Francis Kakoona, Shishmaref

Some experts have observed animals of different age classes using different currents. For example, young seals staying in currents closer to shore and stronger, older animals more frequently using currents further off shore.

Currents can also bring to shore the carcasses of animals such as whales. Certain places or stretches of shoreline are known as areas where a variety of debris regularly washes ashore (for example, map #35). This was important knowledge both in the past and today. In the past, drifted carcasses were harvested if the animal was still edible. Today, because hunters have such detailed knowledge of currents, they can often predict where a struck and lost animal may drift to or come ashore, and are then able to recover it.

Animals also play in, and enjoy currents, at times. For example:

“I think that’s why they [seals] like to play around in the inlets, ‘cause it’s got a current, an’ they just float around there...” –Luther Komonoseak, Wales

Table 2 provides a summary of the ways that animals and ocean currents may interact, as observed by local experts.

Table 2. Summary of the ways animals and ocean currents interact.

Animal	Ocean current use / behavior
Seals	Use currents to locate food (such as fish), to travel, are drifted by currents when on ice, “playing” behavior in currents

Walrus	Use currents to travel, to move between food sources, are drifted by currents when on ice
Whales	Use currents to locate food, to travel
Fish	Use currents to travel, and are drifted by currents
Birds	Are drifted by currents
Plankton	Are drifted by currents
Animal carcasses	Drift with the currents, sometimes to shore

Other Resources

In addition to marine mammals, birds and fish, ocean currents also bring other important resources to Bering Strait communities. Driftwood and clams are two important resources to Bering Strait communities that are affected by local currents.



Figure 8. Clams collected on the beach at Wales in September.
Photo courtesy Brenden Raymond-Yakoubian.

Clams, of various species, are regularly washed ashore in the fall time in the vicinity of Shishmaref and Wales after stormy weather. Crabs, fish and other animals such as “sea peaches” (*Halocynthia aurantium*) can also be washed ashore during or after storms. While primarily the result of wave action, ocean currents also play a role in moving the clams, crabs and other animals onto the beach.

“People usually wait for northwest winds [to beach comb]. The waves get a little bigger, starting washing in the clams. Some days you’ll get lucky, find live clams. ...it all depends on the current and the wind. ...Sometimes we walk and we’ll find some regular crab, the kind we get out there, they wash right up.” –Michael Ahkinga, Sr., Wales (and Diomedea)

“Sometimes the wind creates its own current; wind pushing the water. In the fall, late September to November, we watch for big swells, waves from the north or northwest, which push the clams ashore. ... They’d tell us to watch for the water to get muddy and dirty looking right close to the beach, then the sand and all those little animals, etcetera, kind of color the water. And then you know that they’ll get pushed ashore.” –Winton Weyapuk, Jr., Wales



Figure 9. A sea peach that washed on shore at a Bering Strait community.

Communities have observed changes relating to the abundance of such animals washing ashore. This is primarily the result of changes in the weather and ocean currents, which have impacted the bathymetry of the near shore area.

“There’s not very much right now [clams]. There used to be clams long ago, lots all the time. ... Weather change and ocean change. Causes clams not to wash up anymore. ...the frequent storms that we have...take the sand away. Because of real deep dips out there, which were not there before, built by current, strong current from westerly winds. Storms, they cause those dips in the ocean, which cause clams to go in there and not wash up anymore.” –Davis Sockpick, Shishmaref

Driftwood is another important resource that is often brought to shore by currents, wind and wave action. In traditional times, driftwood was extremely valuable to communities, particularly for the community of Diomedé on Little Diomedé Island.

“[Driftwood was] a real treasure for people here, because they use the logs. Nowadays, we don’t really use the logs anymore. They were used for meat racks, skin racks [for] drying, for holding up their house, anything.” –Edward Soolook, Diomedé



Figure 10. A driftwood pile (*qaġitat*) on the beach at Wales.

Driftwood was also used to make utensils, *umiat*, sleds, hunting equipment and other items. While driftwood was especially important to Diomedes because of their location on an island, it was also very important to mainland communities who used the wood for the same purposes (see also Olanna 1979). Because driftwood was so valuable, communities had different ways to indicate ownership. On Diomedes, if you retrieved driftwood from the water or from the rocky shoreline, you had to move it up off the shoreline. This indicated that the wood was “claimed” and it would not be taken by anyone else. In Shishmaref, driftwood collectors would pile their wood into “cones” and some would also mark them with their initials. Men, women and children would all participate in the collection of driftwood, both in the past and in contemporary times.

Today, driftwood is rarely retrieved from the currents passing Diomedes, unless someone has a specific project or need for it. Homes on Diomedes are heated with oil, not wood stoves. Some homes in Shishmaref and Wales use wood as a heating source (usually in conjunction with oil) and some households put a lot of effort into collecting driftwood to put up a supply for their winter heating needs.

Driftwood was a very important component of a traditional skin boat, or *umiaq*. One location, south of Wales and Tin City, is known for its abundance of driftwood. This location, called *Umiivik*, was where driftwood for building boats could be found. *Umiivik* translates to “place to build skin boats.” Wales residents traveled to the area around July to take advantage of “good, fresh, new” logs and saplings that had recently washed there. Stumps from large trees were particularly sought after as they were used to build the bow and stern of the traditional skin boat. Diomedes residents would have to travel to the mainland to get enough driftwood of the correct size, shape and quality needed to build a traditional boat.

Driftwood is also dangerous to hunters and others out boating. Logs of various sizes are carried along with the currents and boat captains must be very aware of them, as they could destroy outboard motors or cause holes or leaks in boats, among other problems.

“...month of May, June we see lots of driftwood down every current, sometimes great big trees.”
–Raymond Seetook, Sr., Wales

“...if you’re boating out there, you gotta watch yourself, ‘cause there’s lotta that wood floating out there. [Partially sunken logs] [t]hat are sinking, that you can’t see...your motor will hit it.”
–Francis Kakoona, Shishmaref

“And then summertime, like for instance when I’m going to Teller, I’ll be running into driftwood, right alongside this blue [shallow area on the map along the shoreline].” –Luther Komonaseak, Wales

“...sometimes in spring the current brings the wood. Oh, you can’t even cross to Wales one time...too much [driftwood].” –Orville Ahkinga, Sr., Diomede



Figure 11. Drying racks constructed of driftwood at Diomede.

Trash, while not a subsistence resource, is something else that ocean currents bring to the shoreline in the vicinity of Bering Strait communities. Trash, like any other form of pollution, is a concern for communities because of the potential impacts it could have on subsistence resources like marine mammals, birds and fish. Experts expressed concern about increases in vessel traffic through the Bering Strait, and the possibility of not only trash, but also other discharges such as “grey water”, or spills of hazardous materials, being transported to their communities by ocean currents.

“I noticed that, just walking on the beaches, there’s just a lotta bottles, and lotta foreign ship trash.” –Curtis Nayokpuk, Shishmaref

“Yeah, we see debris like from Siberia side or mainland, our side. See different types of debris – plastic bottles, cans, trash bags, wood, plywood, logs, any kind of debris, even dead animals sometimes, like whale.” –Michael Ahkinga, Sr., Wales (and Diomedede)

Some Shishmaref experts have noted that there is less driftwood coming ashore near their village than in the past.



Figure 12. A Wales storage platform and drying rack constructed of driftwood.

Table 3 shows some of the resources that are brought to shore by ocean currents and how they may be used locally.

Table 3. Resources that are brought to shore by ocean currents and how they are used.

Resource	Local use
Clams	Consumed if in good condition
Other marine life (crabs, fish, sea peaches, etc.)	Consumed if in good condition
Driftwood	Used for firewood, to build food and skin drying racks, other building projects
Trash	Not used. Some items may be retained for their value as curiosities (i.e. bottles with foreign languages on them)
Marine mammal carcasses	Usable parts salvaged (sometimes just tusks, teeth, baleen, etc.)

Currents may also be used to take materials away from communities. For example, in the past, some communities would place trash on the ice, for the currents to take away from their village once the ice breaks up (e.g. Schaaf 1996:66). Diomede does not have land available for a landfill and some trash is burned in an incinerator, some is back-hauled off the island, and some is placed on the ice (though the community has expressed that this is not their preferred method of disposal).

Boats and Travel

Both traditionally and today, boat captains had to be extremely aware of ocean currents, the strength and capabilities of their boats, and the skills and experience of their crews. Boats are essential equipment for obtaining food as well as visiting other communities for trade, social gatherings, or other purposes. Many of the local experts interviewed had experienced both traditional skin boats (*umiak*) as well as the aluminum boats most commonly used today (and some also had experience with fiberglass and wooden boats). Below we discuss experts' views on different types of boats, as well as their knowledge about ocean travel with them.

Experts described some of the advantages and disadvantages of traditional skin boats and aluminum boats, which are shown in Table 4.

Table 4. Advantages and disadvantages associated with traditional skin boats and aluminum boats.

Advantage	Disadvantage
<i>Skin boat</i>	
Smooth ride due to flexible frame and skin cover	Have to search for appropriate hard woods to use in frame construction

Narrow bow cuts through waves	Usually takes longer to travel same distance as in an aluminum boat	
Greater capacity, can carry more people and animals	Walrus skins used for the cover require a lot of labor to produce	
Because of large capacity, hunters can stay out longer	More work to maintain than aluminum boats	
Considered safer by some experts	Have to be stored on racks to protect the skins	
Easy to patch if it gets a hole while boating and easier to repair in general		
Lighter than an aluminum boat; easier to pull over the ice, easier to carry		
Handles high wind and wind gusts better than aluminum boats (rests lower in the water)		
Can easily accommodate a sail		
Quieter when approaching animals		
Can easily be used as a shelter		
<i>Aluminum boat</i>		
Have high powered motors, travel fast		Rougher, bumpier ride than skin boats, especially older aluminum boats (ones that do not have a narrow bow to cut through waves)
Can generally go further than skin boats in search of animals	Smaller than skin boats, cannot carry as much of a load	
Not dependent on walrus harvest to maintain (i.e. do not need skins for a cover)	Become leaky over time as parts become loose	
More convenient after a hunting or boating trip (i.e. do not have to put the boat up on a rack, etc.)	More difficult to repair, need special equipment for some tasks	
More maneuverable than a skin boat	Harder to handle in rough water, especially with a heavy load	
	Expensive to buy	
	Difficult to move on sand	

Skin boats are no longer in use in any of the three participating communities, though some experts and residents have expressed interest in reviving the use of them. The wooden frames of formerly used skin boats are present in all of the communities. Despite the fact that skin boats are no longer used, many experts said that if they had a choice, they would prefer to use a skin boat (see also Wales Elders 1981).



Figure 13. Diomede boats hauled out onto one of the only boat storage locations on the island.



Figure 14. Remains of a skin boat frame (foreground) and a more modern aluminum boat on a rack, Wales. Fairway Rock and the Diomede Islands are visible in the distance.

“Nothing beats skin boats.” –Patrick Omiak, Sr., Diomede

“Skin boats are better for traveling through rough water, and they can haul bigger loads, more meat. They’re light, easy to carry when they’re empty. Disadvantage is you have to replace the skin cover every two years, two to three years. Aluminum boats, they’re light, easy to pull over the ice, but they’re little small for rough water or carrying big loads. Plus the riveted kind, when you’re pulling them over the ice, it’s kinda hard on the boat ‘cause it makes the boat flex and

makes the rivets start getting loose, and the boat gets leaky.” –Winton Weyapuk, Jr., Wales

“The skin boat will ride the current, we don’t bounce as much. Because the skin boat is very flexible. It goes with the waves. They don’t go crawling all over. Aluminum boats, they are just a little wider in the way they are made. The skin boats are narrow up in front, they just cut right through the waves, into the current... [I prefer a] skin boat. Because they will hold more load. With aluminum boats you could put maybe three, about three walrus in them. And these skin boats, you put about, I don’t know, six... I would say they are little more safer. Because when it gets rough, they don’t go bouncing all the way and coming up like that because we have splash guards, qulutaaqs. We extend it up so water won’t come in, to make it more safer. They do that with the aluminum boats, too. But I don’t see anybody do that, put qulutaaqs on their [aluminum] boats.” –Edward Soolook, Diomedede

“Very big advantage, a skin boat. ...easily repaired, very maneuverable, and it goes with the water. And, it’s not as solid as aluminum boat or any metal or wooden boat. You cannot repair an aluminum boat as easily as skin boat. Whether it’s got a hole or tore or it’s broken. We always have accessories in the boat to repair it [a skin boat]. So, I prefer a skin boat. And it’s good for shelter when you are out on the mainland and what not.” –Robert Soolook, Jr., Diomedede

A unique feature of skin boats was that captains would often attached extra hides to the bow of the boat when traveling through thick ice, to prevent damage to the boat. Skin boat crews would also put up splash guards (*qulutaaq / quliitaaq*), boards along the edge of the boat frame, to help keep water out of the boat in rough weather. Some experts noted that similar boards could also be raised on aluminum boats, but that this is not done frequently.

Skin boats (and more recently aluminum or other boats) were critical equipment for communities for reasons other than being used for marine hunting. Travel by boat was also undertaken for social purposes (i.e. to visit family, to attend celebrations) and for economic purposes (i.e. to attend trade fairs, to visit a trading partner, to purchase supplies from a store, to access a particular resource). Travel into what are now Russian waters was also much more common in traditional times. Boat captains are described as using the currents to carry them over to areas off the Chukotka coast where they wanted to hunt.

In the past, travel by boat was much more common than it is today. For example, Diomedede residents formerly traveled to Shishmaref to deliver walrus skins that were requested by Shishmaref hunters as covers for their skin boats; Shishmaref residents used to travel to the Kotzebue area to attend trade fairs; and Wales residents would travel to the Imuruk Basin area during the summer to harvest various subsistence resources. In the more distant past, boats from all three communities would also travel to the Russian mainland for similar reasons. Most travel between Alaskan communities today is by airplane. In order to safely travel on the ocean for hunting, visiting, trading or other reasons, boat captains must be skilled with a large body of knowledge, including reading weather patterns, which are discussed in the following section.

In terms of other modes of travel, there are also stories from the past of people walking from Diomedede to Wales, or across other expanses of moving sea ice (e.g. Elder’s Conference 1979, Milligrock 1981, Lopp Smith and Smith 2001: 336-341).

Weather, ice and ocean currents

Ocean currents experts repeatedly emphasized the importance of being able to read weather patterns, predict weather based on signs in the environment, make informed decisions on how to proceed, and knowing how different weather conditions will impact ocean currents. Boat captains have multiple sources of information ranging from using the internet to find weather forecasts and satellite images of ice conditions, to consulting with others in the community, to observing landmarks, clouds, and the water itself. The relationship between currents, ice and wind is very complex and ultimately is a major factor controlling the distribution of animals and ice (see also Olanna et al. 1982).

“That’s why we rely on the currents; we rely on the wind, the weather. We see how it looks first.” –Robert Soolook Jr., Diomedede

Elders of a previous generation were described as true experts at reading and predicting the weather. They spent extensive amounts of time outside observing their surroundings, animals and environmental conditions. One expert described how young men were instructed to always look at the weather conditions when they went outside to “wet the ground” (i.e. urinate) each morning. Sharing observations is also important.

“His dad [Gene Angnaboogok’s], I was surprised that he would be able to tell me what’s happening a day, day and a half ahead. I always wondered how he did that. And he used to watch the water and currents. He’d sit up on that rock behind his house and just watch. Every once and a while I’d ask him, ‘What are you looking at?’ He’d say, ‘Nothing.’ ... You gotta be observant. You gotta watch the ice, how it moves, direction, wind, coloration of the water, depth. And just the way the waves move. You have to observe and watch and notice the slight changes, otherwise you’re putting everybody else in danger and when you see that you gotta let the people know around you what’s happening ‘cause they might know something you don’t. Sot it’s a sharing of information.” –Gilbert Oxereok, Wales

Ocean currents are perceived by some experts as being one of the more consistent features of the marine environment. As one expert from Shishmaref explained, “The current is always there. And it will always be there” (Davis Sockpick). While knowledge about the location and characteristics of ocean currents is considered to be crucial for boat captains, other factors such as wind and ice are viewed as playing a larger role in determining whether or not to go out in a boat. This is because these other factors are much less predictable and much more changeable than ocean currents.

The north side of Little Diomedede Island is usually avoided by residents during the ice season. This is because residents know that the currents operating at that end of the island often break shore ice away from the island. Anyone on the ice when it gets broken off will be in danger and will float north with the current. Hunters must be very cautious when hunting on the ice edge between Little and Big Diomedede Islands (map # 4).

The ice and the currents cannot be separated from each other. One Diomedede elder explained that, “the currents, they operate the ice.” Changing ice conditions in the Arctic have led to thinner ice which behaves differently than thicker, older ice. For example, the ice in front of Diomedede (on

the west side of the island) would often freeze flat, in the past. These conditions allow hunters easier access to hunt by foot on the ice, and easier transport of boats to the ice edge for hunting with boats. It also facilitates the building of an ice runway for the transportation of people and goods to the island, and allows crabbing through the shorefast ice. Today, while the ice initially freezes flat, it is often “crumbled up” and piled by the currents and the winds because it is thinner and can be pushed around more easily. The force of currents and winds pushing on thin ice pans causes them to pile, ice pan upon ice pan, creating jumbled, “crumbled” ice. This can be very dangerous, particularly on the south side of the island (see also Iyahuk 1987).



Figure 15. The south side of Little Diomedede Island where currents are pushing ice up against and around the island (map #3 and 9).

“Before, all this was flat [ice in front of the village]. Now all crumbled up.” –Arthur Ahkinga, Diomedede

“...when I was young you could crab anywhere along this Island, I could see snow machines coming home like [in] a row; they crab ‘till it’s dark. You don’t see that anymore. ...’Cause the currents and the wind we always get storms and it always piles it up [the ice].” –Jerry Iyapana, Diomedede

This piling of ice can happen anywhere, not just at Diomedede. For example, Wales residents have also experienced this and it has impacted their subsistence activities (J. Raymond-Yakoubian 2013: 53, 124). Thinner ice is also more easily broken up by currents (and wind). An example of this is the shorefast ice in the vicinity of all three participating communities. Diomedede experts have commented that the (generally) thinner shore ice that has formed in recent years is more easily broken off by the currents. Around Shishmaref, experts have observed a lead opening up

much closer to shore than in the past. And Wales experts have described the ice edge as “thin and wet and soggy.”



Figure 16. Ice conditions at Cape Prince of Wales, January 2014.

“[The shorefast ice has] started to become unstable, even in winter, month of December, mid-winter. We get cracks that are not supposed to be formed or be even happening. And we’ve seen open water develop over here, right in front of the channel over here, in mid-winter. That never used to happen.” –Morris Kiyutelluk, Shishmaref

There are several large eddies in the Bering Strait that are well-known and usually avoided by hunters. These eddies pull in ice, floating debris, animals, and boats if they get too close, and can be very dangerous. Some experts had experienced these eddies first-hand, others had not but had received instruction about their location and how to avoid them (see also Elder’s Conference 1987). Hunters have become trapped in eddies (with ice, debris and animals) and some have been stranded for days or longer while trying to get out. The most well-known eddies form at the northeast end of the Wales Shoal (map # 28A and 28B) and north of Little Diomed Island (map # 6A and 6B). Some Diomed Island hunters described two eddies, one closer and one further from the island, while others described only the eddy further away. It is likely that depending on conditions, multiple eddies form, or that the eddy forms different distances from the island under different conditions. Similarly, Wales hunters described only one eddy northeast of their community, but in varying locations. This eddy also likely forms in slightly different locations under different conditions. Two eddies may also form, one on either side of the tip of Wales Shoal, under certain conditions. Hunters have been instructed to stay to the south and west of the shoal, so may have never observed the more easterly eddy, or not observed both at the same time.

“There is an eddy up here. ... That’s where you don’t want to get caught in spring hunt. Because when the ice goes up, the ice tends to go around. ... I have seen it. Like a big whirl pool, just like.” –Edward Soolook, Diomede

“They always caution us of that one that goes around, the ice, I mean the eddy. Get caught in the eddy, you’ll be in the middle. (Chuckles) You have to just wait it out. And when it gets caught in there, they say it’s like it’s maybe a day, just sitting there, until you actually get out on the outer rim of the ice floe.” –Luther Komonaseak, Wales

The currents also act on the ice between the Diomede Islands to create a crack, which typically forms each year in approximately the same place. This crack, which runs roughly north-south, and which forms roughly midway between the islands, is several inches wide and will open and close throughout the ice season based on the behavior of the currents.

In all communities, the currents, wind and ice determine when and where hunters can travel. Experts from all three of the participating communities have discussed certain periods of time when ice, for example, has been pushed by the currents and wind into places which have then prevented hunters from getting their boats in the water. Wind and currents can pack ice into channels that lead from coastal lagoons into open water - areas often used by Shishmaref hunters.

“...when it start packing in [the ice], we’d have to get back ashore where we could go into, close to the channel, where it always open – the current, in and out. And when the current start coming out, they’d be open. But if it come in, it’ll be tight... if it is tight, we’d have to wait until it open [the channel] to get in.” –Clarence Tocktoo, Shishmaref



Figure 17. Ice conditions in the Bering Strait, January 2014. Wind effects can be seen on the surface of the water.

While experts note that currents are typically stronger than the wind, currents can be impacted by the wind and may shift their direction or location if very strong winds are consistently present. Even the main, stronger currents (such as the main current between Big and Little Diomedé islands, and the currents between Wales and Diomedé) which flow north for the majority of the year, can dramatically slow, temporarily stop flowing, or switch direction and flow south. This generally happens when strong winds from the north blow consistently for an extended period of time. Currents are also typically weaker during the winter, and during that time the wind is the major factor determining which way the ice moves, and currents become stronger in the spring (see also Eutuk 1983b).

The currents alone, as well as the currents in combination with wind, can form pressure ridges of ice in shallower waters; along the shoreline, on shoals, or other shallow areas (see also, 1912: 3, 95). Under the right circumstances, ice can pile very quickly and very high. Experts have reported pressure ridges up to 100 feet tall.

Wind from certain directions can also cause large swells on the ocean, particularly when the direction of the current and the direction of the wind are not the same. For example, in the Shishmaref area, west and northwest wind is unfavorable for ocean travel and a south wind generally means that there will not be a lot of animals close by. Northeast winds, in the Shishmaref area, can be good for boating.

“West wind is – you can’t go in – and it’s dangerous, the west wind in the summer time. And after break-up, the ice, dangerous [to have] west wind like that.” –Harvey Pootoogooluk, Shishmaref

“When it’s northwest wind, that’s a bad one, northwest wind or west wind. When there’s ice, northwest wind, you get trapped out there if you don’t be careful... The northwest wind bring ice and STRONG current. That’s dangerous.... That’s a waknaluk, that’s a bad one, west wind, mm-hm” –Vincent Tocktoo Sr., Shishmaref

“Or if there is south wind, and you’re planning to go out – usually not that much game close by anyway on south wind... I’m not sure if it’s the smell of the land that doesn’t let the animals come closer, or what’s going on, but that’s what I always think.” –John Sinnok, Shishmaref

Ocean currents can also be impacted by tides. For example, at Diomedé, the current that runs out from the village helicopter pad (map #7) sometimes “goes away” or slows down when the tide is high.



Figure 18. Ocean current in front of the Diomede helicopter pad (map #7).

Landmarks and Weather Signs

Ocean currents experts have a variety of landmarks which they use both to navigate when boating out on the ocean and to predict weather conditions. When the weather is clear enough to see the Russian mainland, Diomede and Wales experts look to a specific valley on Cape Dezhneva. Any fog forming in this valley is a clear sign to head home and get off of the water.

“When fog forms up in that valley, just forming up, head straight home, never stop. By the time you turn back you’re gonna see storm coming right behind you.” –John Ahkvaluk, Diomede

Fairway Rock, between Wales and the Diomede Islands, is also an important feature that experts monitor to understand weather conditions.

“...Fairway Rock is the same way, this is our early warning system.” –John Ahkvaluk, Diomede

When a “cap” of clouds forms on Fairway Rock, the Diomede Islands, or other tall mountains in the area, this is another indication that boaters should head to shore because rough weather is coming. Other landmarks that boat captains use, either when on shore deciding whether or not to go out, or when out on the ocean deciding whether or not to go home, include Cape Mountain, Ear Mountain, Devil’s Mountain, mountains behind Sisualik (across from Kotzebue) and other tall peaks that are visible. Boat captains may climb high peaks to observe weather, water and ice conditions prior to going out boating. Wales residents climb the slopes of Cape Mountain, and Diomede residents climb the slopes of Little Diomede Island, to get better views of the surrounding area. Shishmaref residents have also occasionally climbed Ear Mountain, which is

quite far from the village, in order to get a view of ocean conditions. This usually only happened when hunters had been prevented for some time from going out by packed in ice conditions.



Figure 19. Fairway Rock.

“That wind changes anywhere, anytime. You can’t play around with Mother Nature. I mean you can’t beat it, when you have to, you have to go.” –Raymond Seetook Sr., Wales

Winton: *“We look at the mountain tops, or the tops of the island, see if there’s any clouds sitting on top up there. We look at the horizon, on a clear day, see if there’s a thin, dark band, indicating fog or wind coming. We look at the cloud formations, see if they’re stretched out at a certain direction, meaning the wind up there...might come down to the ground. Sun dogs, stuff like that.”* Interviewer: *“What do sun dogs tell you?”* Winton: *“Weather might change quickly, or get windy.”* –Winton Weyapuk Jr., Wales

Mirages are another indicator experts use to judge and predict the weather. When an island or the mainland appears to be “floating” or is elongated to appear much taller than it really is, this is an indication that there is very calm weather. If you notice that the mirage is starting to sink (becoming shorter), this indicates that the weather is changing. Shishmaref hunters also use Ear Mountain mirages to predict the weather.

“That Ear Mountain is very important to us, where we’re out there. If we’re out on the ice, and it’s north wind, and you look toward Ear Mountain – that Ear Mountain is probably this high [small] when you’re out there. And it’s still north wind. And all of a sudden Ear Mountain is this high [taller], and it’s still north wind, and there’s still the same kind of conditions out there. When Ear Mountain from this size grow to this size, that means we’ll have to head to shore because it’s telling us that it’s gonna turn south pretty soon .” –John Sinnok, Shishmaref



Figure 20. A seal meat drying rack constructed from driftwood at Shishmaref. *Iñigāgik*, or Ear Mountain, is visible in the distance.



Figure 21. Clouds forming on the horizon to the south of the Bering Strait.

The sudden appearance of a cloud formation or a fog bank in the distance is a sign of an imminent weather change. Additionally, clouds that look like “waves” are in indication that windy weather is coming. And on calm days, impending bad weather can be predicted if small amplitude, long waves start appearing. These waves indicate that a north wind will be coming. Foam in the water along the shore is also observed to determine the predominant wind direction. Experts are aware of many other weather signs and indicators.

In addition to monitoring landscape features, and other environmental indicators, experts also observe the currents themselves to try and predict impending weather conditions. For example, there is a current that runs north along the northeast portion of Big Diomedes Island (map #5). Little Diomedes boat captains will closely observe this current if they are planning to travel east of the island (between Little Diomedes Island and the mainland). This current is an accurate indicator of the conditions of currents to the east of the island. If the Big Diomedes current is choppy and rough, the currents east of the island will be choppy and rough, and if it is flat and calm, the same conditions will prevail in the currents to the east of the island.

“...we always look on this current, though [map #5]. Our elders told us, always look in that current and if it’s flat, calm, real nice or just starting to get nice, it’s gonna be the same way out there on these currents. Same thing. If it’s swelling while it’s nice [at Diomedes], real swell-y, we still can’t go ‘cause it’s gonna be larger. These out here [to the east of the island] gonna be bigger and stronger. So we have to wait ‘till it’s calm enough. Real flat calm, not looking dark or anything up here, real good to go. That’s how they taught me, always that current. Towards this Big Diomedes area you could see it real simple, it’s real easy to see, you won’t miss it.” –John Ahkvaluk, Diomedes

Shishmaref boat captains know that if they feel the current getting stronger and stronger that a west wind is coming, usually a strong west wind. The color of the water can also indicate changing weather conditions. If the water becomes more silty it means that wind is picking up and the current may be changing in some way (i.e. direction, strength).

Most boat captains today also consult the internet prior to going out hunting or boating. There are many websites where weather forecasts can be obtained and others where information about sea ice, including satellite photos, can be viewed. Experts emphasized that information from the internet is one piece of the larger puzzle of weather conditions. There are also phone numbers that hunters can call to hear updated weather forecasts, which are used by some. Weather forecasts must be used with caution and a boat captain has to take all information into consideration and use their best judgment.

“Every time now. I mean it’s my main planning [satellite imagery]. ... [I use] GINA. They got nice satellite pictures. And the NOAA, their forecasting. So you combine it, see what’s happening next few days in planning trips or anything. ... It’s a planning tool. You can’t bank on it. Things happen out there, especially with the current and ocean. ... You could argue [that a] lot of these forecasts you hear, they don’t either happen or they are day ahead. They’ll be there sooner or they don’t come at all. You have to still gauge things out there by the actual weather pattern.”
–Curtis Nayokpuk, Shishmaref

Weather in general is described as being very unpredictable and being highly changeable. Experts noted that the weather could change significantly, and quickly, several times over the course of one day; this differs radically from what was experienced in the past, when long stretches of good weather could be depended upon. A point stressed by many experts was that if signs indicate changing, bad weather, head to safety immediately (see also Okpowruk 1983).

Learning about ocean currents

Knowledge of ocean currents, as well as the entire marine ecosystem of which they are a part, is crucial for boat captains to operate safely and effectively on the ocean, and to be successful in hunting. Experts were asked how they learned about ocean currents and the importance of passing this information on to younger generations.

“[How I learned was to] watch what they [elders, older men] doing. I watch how they motion...pointing and looking at the sky, the clouds, the wind direction, the wind speed, the current speed. Whatever’s around them, they use that as a tool, the whole weather system. Not just the current.” –Michael Ahkinga, Sr., Wales (and Diomedé)

“Those who did not listen to instructions will make mistakes.”
–Albert Iyuhuk, Diomedé (Iyahuk 1987)

Experts gained their knowledge of ocean currents over lifetimes of experience and from instruction by elders. As one expert responded when asked how he learned about currents, “Live with that, live with the current all my life” (Arthur Ahkinga, Diomedé). Young people are expected to learn about ocean currents primarily by watching what is happening around them and listening to elders, and through direct experience. When taken out boating, or when on shore as older men planned trips, young boys or young men would watch what older men on the boat were doing and listen to what they were saying. They were encouraged to be very observant. Elders would also bring specific attention to some aspects of the ocean current system, such as a particularly dangerous eddy or other feature.

“When we were out in the fog – after just brining my nephew and my cousin out there for one year – near the end of the season it go so foggy. I said, ‘Well, I guess we’ll travel the shore ice and try to find home.’ No GPS back them days. And then my nephew said, ‘Hey, there’s that pressure ridge we always pass, right there.’ In the fog. So they were already started to learn and observe, because we we’re always telling them, ‘Look for landmarks, things that will let you know where you’re at.’” –John Sinnok, Shishmaref

Instruction also happened in the men’s house or *qagri*. None of the three participating communities has a men’s house today, but in more traditional times that is where men and boys would gather for various tasks and activities, including rehashing the details of recent hunting and boating trips. These critiques of recent events and storytelling sessions were very important for the education of young men. Today, hunters will often gather on the beach while observing the ice and weather conditions to talk.

“You know, hunters years ago, they have a gathering place in the qagri. They go there every night, tell stories of today’s hunting, and the younger ones learn fast from listening to the elders. Especially do’s and don’ts.” –Orville Ahkinga Sr., Diomedé

It is also important to have an elder, or very experienced person, in the boat whenever possible. This ensures that someone on the boat is likely to have the knowledge or experience to deal with any situation that is encountered. The practice of having elders go out on hunting trips is not as common today as it was in the past. If not part of the actual crew, elders would and do, often

provide guidance to boat captains and crew members (see also Jones 2003: 78). While the safety and success of the crew is ultimately the responsibility of the boat captain, all the men on the boat are expected to have knowledge of the ocean currents, navigation landmarks and other relevant information.

“Usually when you’re out – as I was growing up, anyway – you always had an elder in the boat. And he brings it down to the next person. Like for instance, if I was hunting with my grandfather’s boat, you bring it down to dad, the information to dad, and then dad would bring it to me. ... Nowadays you always see them with maybe hardly any elder or none at all. And they don’t know, or they don’t ask. We try to give the information as best as we could, when they come around but, yeah, that needs to be brought out more.” –Luther Komonaseak, Wales



Figure 22. Skin boat frame in Diomede.

Some experts are concerned that young people are not learning all the information needed to be safe and successful in the marine environment (see also Iyahuk 1987). Elders and experts interviewed for this project were very interested in making sure that young people who want to learn traditional knowledge about currents, hunting, boating, or other topics have the opportunity to learn.

“Yeah, anytime these guys ask me for something I tell them what I know. Encourage them. ‘Cause that’s what I basically came from, too.” –Curtis Nayokpuk, Shishmaref

“Usually when I get a crew of different guys, I try to show them whatever knowledge I have. Share my knowledge with them and, just good experience for me teaching them. Sometimes I learn from them, too, you know, we all have different styles.” –Michael Ahkinga, Sr., Wales (and Diomede)

“I point it out. Lots a times I have my boys and my wife hunting with me. ...I point these things out to them. And I tell them, ‘You watch Ear Mountain. Watch Ear Mountain when you’re out

there.’ Lotta pointers I give to my boys. ...I try to teach what I was taught, too, try to pass it on to these younger guys.” –Francis Kakoona, Shishmaref

“If you don’t know, you got to listen to old people, those old people. Yes.” –Harvey Pootoogooluk, Shishmaref

Some of the challenges related to passing on knowledge to younger people include the fact that some of them are simply not interested in hunting or other traditional practices and some are reluctant to ask elders or experienced hunters for advice. Some experts pointed out that when they were growing up they were being instructed in Iñupiaq or were listening to everything that was taking place in a boat in Iñupiaq, whereas today English is predominantly spoken in the village as well as out in boats. Conveying information through Iñupiaq is considered by most experts to be superior than doing so in English because of the complexity and detail inherent in the Iñupiaq language.

“...just about all my instruction when I was growing up [was] in Iñupiaq. All of our communication was in Iñupiaq back then. But now it’s all English. Maybe it’s a little bit harder trying to teach in English, or tell people in English, rather than Iñupiaq. ... I don’t think our traditional knowledge is being effectively passed on because of the language change. They [youth] do seem to know quite a bit, even if they only speak English. They absorb that knowledge.” –Winton Weyapuk Jr., Wales

“I think it would have to be second best [English]. [For example,] in our language when we say iluqnausugvak, the people that know the language, they would understand what it is. All the things about how you’d have to go around...the things that you’d have to make sure you have enough of in order to go around. This way? Or do you go on it toward the left? When you say that, you know where it is, you learn roughly about how the currents are... If you don’t know the language, and you’re not experienced in hunting, you’ll just see a big piece of ice.” –John Sinnok, Shishmaref

Experts recognize that it is important to pass on the knowledge they have, as well as the importance of younger people listening to what they say and asking when they have questions.

“This is a way of life. Learning these things young will feed you and your family for the rest of your life.” –Gilbert Oxereok, Wales

Hunting

It is critical for hunters to understand and be familiar with all of the different ocean currents they may interact with while out hunting. Marine mammal hunting can take place from boats, as well as by foot on the ice. In traditional times, communities and families were much more mobile. Families or groups of families would disperse to seal camps, hunters might have spent days or longer at a time in boats or on the ice during hunting trips, and people would generally not return to more central locations (like present day villages) until enough meat had been secured for the year. It was also not unusual, in more traditional times, for hunting trips to take place in what are now Russian waters. In the past, hunting crews would even sleep with their boats on the ice

during the course of hunting trips (e.g. Eutuk 1983a). Today, the majority of hunting trips (for seals, walrus or other marine mammals) are typically day-trips and infrequently last longer than overnight.

In order to be successful, hunters must understand animal behavior and how that relates to weather patterns and the currents, including ice movements.

“I like to think they’re just jumping into my boat. (Laughs) But, no, you gotta go out and find them. That’s part of knowing where they are and how they live, and then using the weather conditions to get to them. Like I say, the migrating patterns and stuff, you have to know where they are when they’re out there, and when they’re not, or when they’ve already moved through.”

–Curtis Nayokpuk, Shishmaref



Figure 23. Community meeting in Shishmaref.

Photo by Meghan Topkok, Kawerak Social Science Program

One, but not the only, reason that hunting trips are often shorter than in the past is due to changes in the weather (see section on Changes). Because weather is more changeable and less predictable than in the past, it is often not safe to stay out for longer periods of time. The amount of fuel available to a crew can also constrain their hunting activities as can employment or other responsibilities. Gasoline and oil are very expensive in all Bering Strait communities. Hunters must have the knowledge needed to calculate their fuel needs, including knowing how much more fuel is used when traveling against currents or strong winds or in rough seas. Miscalculations can lead to crews being stranded.

“We try to calculate. Say I have three jugs of gas, 18 gallon, me and my crew would say, maybe we’re going north, we would say we’ll use one tank of gas going up, save one tank for home, and have a tank to use or burn while we boat around and hunt. We kinda guesstimate like that somehow, sometimes. And if we plan to go further, we would get more jugs. ...Sometimes we don’t have any gas or can’t afford to buy the gas. Or we can’t afford to buy very much and can’t go very far.” –Winton Weyapuk Jr., Wales

Hunters prefer to stay as close to shore or shorefast ice as possible for both safety reasons and to save on fuel costs. Because seals and walrus are so ice-dependent, hunters are therefore very reliant on the presence of ice to find mammals. Because of changes in sea ice (see section on Changes), the ice has been breaking-up earlier than in the past, and dispersing earlier. When the ice breaks up and moves away on the currents, taking animals with it, it often means that the window of opportunity for hunting is shorter and that hunters have to travel further to find ice and animals. Even with faster outboard motors and technology like satellite images, hunters often have to travel far from their communities. Understanding how local currents operate and where the most likely places are to find ice and animals is extremely important to both obtaining food for the community as well as for economic considerations like saving fuel.

In Shishmaref, hunters know that the area near the entrance to Kotzebue Sound is an area where walrus can often be found later in the season because currents will pack the ice in there. This is often the only ice left in the region late in the season and so animals will move into this area.

“...and sometimes people from Kotzebue or anywhere else can’t get out. So we’re kinda assuming there’s no hunters there. We’re always lucky to find walrus there, the last of the walrus.” –Curtis Nayokpuk, Shishmaref

More powerful outboard motors allow hunters to more easily travel to areas, such as the Kotzebue Sound area, when resources are not available close to their own communities. However, there are also risks associated with traveling further, or traveling in particular directions to hunt. For example, the currents near Kotzebue Sound can be very strong and pull hunters even further from their community. Some experts believe that powerful motors are a big improvement to the safety of hunters because they can get boats out of many dangerous situations quickly. Other experts pointed out that while that may be true, if your engines break down far from shore or far from their community, it can be a very dangerous situation. They point out that the broader your base of knowledge and skills, the safer you and your crew will be. These experts believe it is foolhardy to go hunting or boating without enough experience or without bringing a more experienced person with you.



Figure 24. Morris Kiyutelluk (L) and Davis Sockpick (R), Shishmaref experts.

“...looking at the ice that follow it [the current], seems like the [Kotzebue] Sound sucks it in this area somewhere. ... One time my cousin, two boats, we went walrus hunting to this area. ... We’re butchering walrus, by the time we get done didn’t know we got drifted waaaay far. And it took us from – when we finally left – it took us seven and a half hours to reach home.... So very strong current there.” –Davis Sockpick, Shishmaref

There are two major eddies, and other smaller or weaker ones, on the Alaskan side of the Bering Strait. One is located northeast of Little Diomed Island and the other is located northeast of Wales. Hunters consider these eddies to be very dangerous, particularly in the spring when broken ice is caught in them. Hunters avoid these areas whenever possible, even though there are often many animals on the ice trapped in eddies. Though hunters are aware of these eddies, they sometimes still get caught in them, or get too close for comfort. Because the eddies rotate fairly slowly, hunters may not realize their boats are being pulled in, especially if they are occupied butchering or looking for animals, or if other activities have their attention.

Hunters look for various specific kinds of ice when hunting in the winter. One type of ice they seek out is large chunks of ice that have become grounded into the sea floor by the currents. Once grounded, these large chunks of ice rarely move and are a good place to hunt from for seals.

“...when you’re hunting ugruk, they always mostly hunt where there’s an iceberg So it won’t move, ‘cause it’s kinda like an anchor on the shore ice. ..when they sink ugruk, that’s when they always know that the ice won’t move. So where they sink, they just put markers on them. And then they throw their lines out and pull them in, and they get them. So anything permanent, anchored from big icebergs, that’s a good place to hunt when wintertime.” –Clarence Tocktoo, Shishmaref

Experienced hunters will use the currents to their advantage when hunting. Hunters from Diomed and Wales typically prefer to go south when hunting for walrus because the current will then move them northwards, back towards their communities. If they hunt to the north, the currents will constantly be taking them further from their villages.

“We do the same here, too. But usually it’s when there’s a southerly breeze, and we go hunting towards the breeze – whichever way it’s coming from. And when there’s a southerly breeze, we usually go out hunting this way [south]. ...And when we catch walrus here, on ice, we butcher them and then the current carries us close to the village.” –Winton Weyapuk Jr., Wales

“We mainly prefer to go south. That’s where the game come from and the current is always flowing towards north. And, so if we try to go and hunt north, it will take us a lot farther, a lot faster. So, lot of us, for sure like to hunt on south side during spring.” –Robert Soolook, Diomed

*“Yeah, our parents, uncles, elders, used to always tell us to butcher fast, and get the animal butchered and loaded quickly. And it’s especially important when you get walrus out here somewhere [in the middle of the Strait], ‘cause the current is carrying you *away* from the village as you’re butchering.” –Winton Weyapuk Jr., Wales*



Figure 25. Robert Soolook, Jr. and Edward Soolook review a draft ocean currents map.
Photo by Meghan Topkok, Kawerak Social Science Program.

For Shishmaref, hunters try to go out hunting when the wind is coming from the northeast. These winds will disperse the ice, making it easier to boat around. Additionally, sounds made by hunters do not travel as far when there is north wind. Some experts noted that hunters have a better chance of getting animals on the ice (which is ideal) during these conditions. East and south winds make sound travel further and are not favorable for hunting during the winter. South winds do, however, often push the ice offshore. Hunters are particularly aware of west winds which may add force to west-flowing currents in the area. These west-to-east currents, *itqaaniq*, can pack ice in towards shore very quickly and block hunters from returning to shore.

“There is an old man...he told me, ‘You got south wind, you can’t go.’ He said we can’t go hunting in south wind, only north wind; good way to hunt when winter time. Summer time, it’s alright [south wind].” –Harvey Pootoogooluk, Shishmaref

This kind of knowledge about currents is also important, for example, in calculating how much fuel is needed for a trip. Having the knowledge and ability to use currents to your best advantage also allows boat captains to use less gas and save money. Even so, as one expert described, “Sometimes you go long ways, you have to go long ways to do a little hunting” (Raymond Seetook Sr.).

Shishmaref hunters also prefer to travel to the west, generally, when out hunting. They know that if they travel in that direction they are likely to encounter animals and save fuel.

“Yeah, I’ve planned it that way, lotta times. I do a lot of my hunting on the west side of Shishmaref, here. And so, like if we are hunting ugruk, I know we’re gonna get closer this way. But that ugruk was getting closer to the shore, at camp. And I planned it that way, to hunt.”

Especially with that gas going up, too. ...Lotta times when I look for walrus, when we have to bring our boats out, I go west, if there's a trail, and avoid going this way [east]. 'Cause I know this will stay open from the current here, more." –Francis Kakoona, Shishmaref

"I just hear them [elders], 'that saġvaatuzruaq samna' [that one out there that has a very strong current], from Wales to Point Hope. ... 'Cause when we hunt, that's one of the things we look for is that current, especially for walrus after we're done ugruk hunting. We'll head northwest, at a good speed, until we hit it. Then, if there's ice we'll slow down, because the animals will always be around it. ...even if there's no ice around, you'll know when you hit it [the current], because there'll be a line, just like this crack on this table. One side will be going real fast. And it's hard to miss." –John Sinnok, Shishmaref

Being a boat captain comes with substantial responsibility. Captains have the safety of their crews, as well as the welfare of their communities weighing on them. If they make a mistake, other crews may have to risk their lives to rescue them. If they are not successful finding animals, the community may not have enough subsistence foods. Good boat captains recognize all of this and do their best to understand weather and ice conditions, climate changes, crew ability, and all the other factors that must be taken into consideration before heading out on the water.

"He's the responsible person. He's the captain, that's his boat. He's the person that is very responsible. He's making sure that no one forgets anything. He's a big man there. He's the man that takes care of everything; food animal, whatever you need, make sure you are dressed properly and what not. He knows the weather. He knows the current. He knows everything. Even in conditions where it gets so bad when we are hunting. He's got to know this stuff, he got to know what to do, what to expect and what not to expect." –Robert Soolook, Diomedé

"And then, fist of all, we try to look for where we think the game is. ...we estimate how long it will take from where we see it, then get ready, and how long we think it will drift – head to that spot. ...And then at the same time you're doing that, you as a captain have to try to calculate how much gas to carry to reach that area, and come back. Course you're gonna be fighting against the current, you must figure that part out, too. It's a serious calculation. You have to be serious about it. And then you have to communicate with other captains that are going out there, too. Communication is very important." –Luther Komonaseak, Wales

Safety

Much of the information shared by ocean currents experts relates to safety, as can be seen in the results presented above. In this section, we share some additional information on safety not already discussed elsewhere in this report. Some of this information is specific to particular communities or locations, while other information is applicable to any geographical location. This knowledge is crucial for boaters as it helps keep them and their crew and passengers safe. As experts have explained, the more experience you have, the more you listen to and learn from elders, and the closer attention you pay to the environment, the more confident and safe you will be out in the ocean.

“I feel confident on the ice because I know the current. I know how far to go out on the ice.”
–Edward Soolook, Diomedede

“This is no play time. This is gathering food, or being a fool. You prepare food a certain way. You hunt a certain way – safely. You prepare food so that it’s safe. You hunt for food so it’s safe for yourself and your people around you. And you give people safe food, the best you have, so you know the food is safe. Safety, safety, safety, all the way through from preparation.”
–Gilbert Oxereok, Wales

“My uncle Dwight told me when I was young, and we started hunting with his crew, he just said we have to use all of our senses – eyes, ears, nose, sense of touch, even – to be safe or find out where the walrus or seals are. He always said, ‘Be safe, number one.’... He say if you’re standing on shorefast ice and you can feel it moving, it might break off, so move back to safer ice.” –Winton Weyapuk, Jr., Wales

As mentioned previously, experts emphasize the importance of listening to your elders. If elders instruct you about something it is because they are trying to help you and keep you out of danger. It is also important for hunters to share information with other crews if they know something about the conditions that could improve their safety.

“Always listen. If elders say something to you about that, you got to pay heed to it. You have to. ...Always obey, always listen.” –Robert Soolook Jr., Diomedede



Figure 26. Curtis Nayokpuk showing workshop participants some of the satellite imagery he uses during trip planning.

Photo by Meghan Topkok, Kawerak Social Science Program.

It is important to always be aware of your surroundings. Boaters should always be observing the weather, ice, currents, animals, other boats and anything else in their environment, at all times. Learn as much as you can about reading and predicting the weather (as discussed above). Utilize all the sources of weather information that you can – your own observations, information from others, online weather forecasts and satellite imagery. Online information is important, but not always accurate.

“The GINA [Geographic Information Network of Alaska] – they got nice satellite pictures, and NOAA [National Oceanic and Atmospheric Administration], their forecasting. So you combine it, to see what’s happening next few days planning trips or anything. ...It’s a planning tool. You can’t bank on it. Things happen out there, especially with the current and ocean. It can change out there.” –Curtis Nayokpuk, Shishmaref

Experts also emphasize that no one should ever underestimate the power of the environment, especially the currents.

“Always watch their direction, which way it’s going, which way it’s flowing. Never consider it just a small, little current.” –Robert Soolook Jr., Diomedede

Never go out alone. Local experts recommend that two or three boats travel together. Always tell someone where you are going, when you will be back, and who is with you.

Do not hunt when you are angry. This is dangerous for the rest of the crew and is also disrespectful to the animals. If you get a reputation for being a trouble-maker, many boat captains will not want to take you in their boat as a crew member.

Make sure your equipment is well maintained, especially your motor, and bring two motors with you if possible, as well as spare parts. It is also beneficial to have mechanical skills for engine repair.

Bring extra clothes, water and food. Carry life vests for each person in the boat, flares, a tarp, a radio and paddles. Carry more gasoline than you will need.

Always stay calm; if you are calm you will be able to make better decisions.

*“Don’t ever panic; [if] you panic you won’t know where you’re at. ...You’ll lose your sense.”
–John Ahkvaluk, Diomedede*

Know where especially dangerous areas are. Eddies, which were discussed above, can be dangerous for boaters. Experts recommend avoiding areas known to have eddies. Channels that lead in and out of lagoons can also be dangerous because ice can move quickly in and out of them. Boaters must know the tidal cycle and other weather conditions to operate safely in these areas. The Map Guide (Appendix 4) and Map 1 (map pocket) contain additional information about dangerous areas.

Always be aware of the possibility of the currents pushing ice together. Your boat could get stuck between ice pans and get crushed (see also Okpowruk 1983). You may need to pull your boat out onto the ice very quickly.

“Yeah, we were told, ‘If you see a crack out there, don’t cross it.’ That’s the only [way] you could avoid getting washed away with the ice. ‘Don’t cross that crack.’” –Francis Kakoona, Shishmaref

If you have to pull your boat out of the water on to the ice, or are otherwise in trouble, large, grounded icebergs are a safe place to go.

Experts instruct hunters to always try to get walrus on the “outside” of the ice, as opposed to inside of the ice pack. This is safer because there is less chance that the ice will close in on your boat, and you will be able to leave the area quickly if necessary without having to navigate through ice pans.

“That’s the main thing you try to do is get them in the ideal conditions on the ice where you won’t lose them. Then you can butcher them right there, too.” –Curtis Nayokpuk, Shishmaref

Beware of cracks in non-shorefast ice. Many experts recommend never crossing cracks in the ice if you are not on shorefast ice.

“...one of the main taboo, or practice that elders always passed down, was that when that first crack –uinniq [open lead between shore ice and non-shore ice] is formed, do not cross it. If you can, hunt from this side [shore side], not on that side. ...Sometimes the current is more stronger than the wind direction even. And it’ll move that ice. And then when someone does that [cross the crack], they call it pizriqtuaq, someone that step down, like from a step. They’re taking a step down, taking a chance. ...they’re breaking a precaution.” –Morris Kiyutelluk, Shishmaref



Figure 27. Shishmaref expert Clarence Tocktoo.

Similarly, it is a bad idea to cross “chunk ice” that is packed into an area by the currents (such as near the entrance to Kotzebue Sound). If you cross from open water through the chunk ice, it may shift and you can become trapped, sometimes for a very long time.

When hunting on the ice, always have a walking stick with you to test the ice (see also Weyiouanna 1983). If you are going to cross open water or a crack, make sure you test the opposite side before jumping. Sometimes the ice looks solid but is not.

“Yes, I miss the old days, I miss the elders. ... Always there to teach you what to do and what not to do in the boat. ...And they teach you how to walk on the ice. You got to always have your walking stick. You don’t have your walking stick, they tell you to go home. Because that walking stick will save your life. If you fall in, it will block you from going all the way in. ...It has a metal tip. ...So it just poke. If it goes through, don’t step on it. And if it doesn’t go through, just step on it [the ice].” –Edward Soolook, Diomedea

Make yourself a “marker” when hunting on the ice – find a landmark, such as a building or mountain and memorize its location. Check your marker periodically and if it has moved, the ice you are on is moving and may not be safe.

If the weather patterns indicate bad weather is approaching, do not hesitate and head back home immediately. Indecisiveness could put you in a dangerous situation.

Fairway Rock is a place that boaters can pull up if they need to wait out rough weather. However, it is a very dangerous place to try and land, and boats must be pulled up onto the flat rock that is the one landing spot on the island. When at Fairway Rock at least one person must stay in the boat at all times to prevent it from being pulled back out into the currents.

Whenever a boat is pulled out on the ice, or anywhere else, it must be secured extremely well. When on the ice, butchering an animal for example, the bow line can be wrapped around a walking stick firmly pushed into the ice. The current is always moving and there is a potential that the boat could be carried away. Each crew member is expected to be aware of their surroundings. One person should always stay in the boat at all times in case it needs to be moved quickly or becomes dislodged from its position. If there are only two people out hunting, one must stay in the boat, even if it is difficult for the other person to bring the *ugruk*, for example, back to the boat to butcher it. Unfortunately local experts had experienced or knew of situations where hunters had drowned trying to retrieve boats that had become dislodged or drifted away with no one in them.

Always bring a compass and know how to use it. Most boat captains today use GPS units to navigate, and if you have a GPS, you should be familiar with its functions. GPS units can run out of batteries, may not work if cloud cover is too thick, or could be lost or damaged during a trip. A compass can be used if a GPS is not available or is not working and should be carried in every boat. Some experts can also use the position of the sun to navigate.

Another piece of safety advice from elders is to grow a mustache; the moisture it traps could save you if there is no access to freshwater for drinking.

“And then most of the time, they encourage the hunters, especially in the winter, to grow a mustache. Do not cut your whiskers. They say once in a while when you’re caught, and then you go out, you’ll get to a place where even the surface snow is salty. You can’t quench your throat, your mouth with it. And then when it gets cold, the frost builds right here, by breathing. That’s your fresh water.” –Morris Kiyutelluk, Shishmaref



Figure 28. A moustache can provide fresh water in the form of frost. Shishmaref expert Curtis Nayokpuk during an interview.

When boating, be on the lookout for driftwood and other floating debris. At certain times of the year, in certain locations, there can be large amounts of driftwood and debris transported with the currents. This debris can damage or destroy outboard motors, or cause damage to boats.

When on the ice hunting or butchering an animal, always try to move quickly. Weather conditions can change unexpectedly and the current is always moving

When the ice starts packing in towards the shore ice – head back to shore or you may have to wait a long time before you can navigate through. Areas with large icebergs are safe places to pull up boats when ice starts closing in, because they are grounded and unlikely to move.

Diomedede specific safety information:

If hunting, or otherwise out on the ice on the west side of the island (in front of the village), when ice breaks off, do not run towards Little Diomedede. In this situation you should run “out”, towards Big Diomedede because the current will rotate the ice pan in a clockwise direction. If you

move toward Big Diomedé, the rotation of the ice pan will bring you back closer to Little Diomedé so you can move to safer ice.

If lost in the fog in the spring and you cannot see the island, listen for birds. Tens of thousands of birds use the island in the spring, so if close enough to the island, boaters should be able to hear birds and use the sound to navigate back towards the island.

Diomedé boat captains must be very careful when trying to land at Diomedé. The current in front of the landing area is very strong and must be approached with caution.

If the ice you are hunting on breaks off and you are not able to get back to shorefast ice, you should hang your hunting bag from your walking stick so people on shore can see you and know where to go to retrieve you.

Shishmaref specific safety information:

If you are out on the ice, and the ice you are on breaks off, you should walk east because the ice will likely hit shorefast ice in that direction

Wales specific safety information:

When hunting near the eddy northeast of Wales, be sure to stay to the south or west. Never hunt on the east (shore) side of it because you can become trapped by ice, winds and the current.

Changes

Ocean currents experts have observed many environmental and social changes over the course of their lifetimes. Many of these changes are significant and have altered the way that travel, hunting, and various subsistence activities are carried out in Bering Strait communities. Some of these changes have been previously documented in research conducted by Kawerak and others (e.g. J. Raymond-Yakoubian 2009, 2013; B. Raymond-Yakoubian 2014) and other changes are documented here for the first time.

All local experts were asked about changes to ocean currents. Many experts reported that they had not observed any changes to ocean currents over their lifetime. These experts described ocean currents as being very consistent, in both location and other characteristics. Other experts reported that ocean currents seemed to be flowing faster (“stronger”) than in the past – the degree of increase in speed reported varied by expert. The experts who reported an increased speed, reported other characteristics of currents as remaining unchanged. Only one expert reported that ocean currents near his community (Diomedé) were weaker than in the past (and that other characteristics of the currents remained unchanged).

One major change discussed by local experts is that weather conditions are much less predictable than in the past. Conditions also change much more quickly and often than in the past.

“...Nowadays weather changes real fast. Back when we were kids, like if the weather just turn nice, it’ll be good at least for a week, if not longer. It’ll be like that. But nowadays, if it’s real

nice out, and all of a sudden storm, strong winds will come. Which is different, something that we've never experienced.” –John Sinnok, Shishmaref

Changes in wind direction and seasonality were discussed by experts from all three communities. The main characteristic of wind today is that it is frequently unpredictable and changeable. Some experts have noticed patterns, however. For example, Shishmaref has reported that there is more wind in the fall time now than in the past, that there is a lot more east wind (which pushes ice away from shore and up north), and that there are now stronger west winds. Communities have also reported stronger storms in recent years.

“Yeah, it seems to be less predictable. Maybe winds pick up quickly. Sometimes the weather changes three or four times in a single day.” –Winton Weyapuk Jr., Wales

These stronger storms, with large waves, moving a lot of water (and ice) around appear to be changing near shore bathymetry, also. Wales and Shishmaref have reported that “dips” and “valleys” have developed offshore of their communities. These bathymetric changes may impact how shore ice develops, where ice piles, and seem to be impacting the availability of clams to these communities. Clams used to wash on shore during certain conditions (see Other Resources, above). These changes to the bathymetry are thought to be trapping clams in the low areas and preventing them from being washed ashore, as in the past.

Changes to ice conditions were some of the biggest changes that local experts reported. Experts from all three communities reported later freeze-up (when the ocean and other water bodies freeze) and earlier break-up (when the ice on the ocean and other water bodies begin to melt and break apart). Experts noted that the timing of freeze-up and break-up is variable from year to year, but in general freeze-up was reported to be happening approximately one month later than several decades ago, and break-up was reported to be approximately one month earlier than in the past.

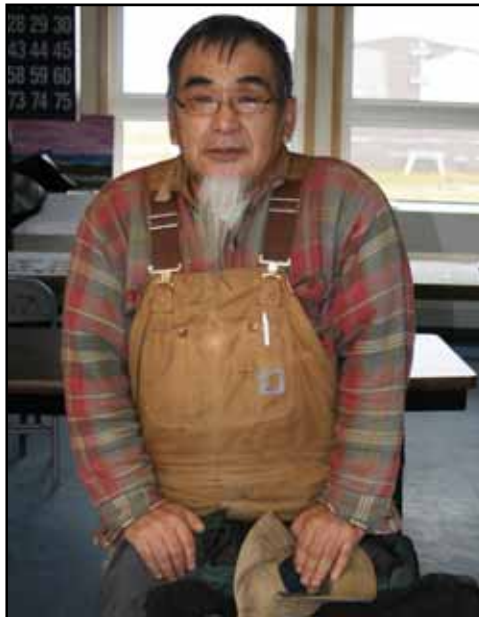


Figure 29. Wales expert Gilbert Oxereok.

When the ice breaks up earlier, it means that the current will quickly move the ice north, and the animals with it. This means that hunters may have less of an opportunity to hunt. The ice leaving early can also be a problem for drying seal meat, as Shishmaref experts have explained. It is important to get seals early; if it takes longer for hunters to find seals, and the weather is warmer, there may be flies around which makes it more difficult to dry the meat.

In addition to earlier break-up and later freeze-up, local experts have observed that ice has been thinner than earlier in their lifetimes. Thinner ice, of course, contributes to earlier break-up because the ice melts and is broken up by currents and winds more easily. Thinner ice is more easily crumpled, or piled, by wind and currents. Piled ice conditions make hunting more difficult, both when hunting on foot, or by boat. For boats, trails must be made to the ice edge so that boats can be launched, and the rougher the ice conditions, the more difficult to create a trail.

When ice conditions allow, the village of Diomedes builds an ice runway on the shorefast ice in front of the village (between Little and Big Diomedes Islands). In the past, the runway was constructed and usable in December or January. In more recent years, the ice is often not solid and stable enough to construct a runway until March, if one is able to be built at all. This severely restricts the ability of residents and guests to travel to and from the island, and also limits the amount and speed of freight items getting to the island.

Shishmaref experts have observed that open leads (cracks in the ice) have been forming closer to shore than in the past. Previously, these leads would typically form approximately 7-15 miles offshore, but in recent times they form much closer. This is attributed to thinner ice that is more easily broken and carried away by currents and wind. Shishmaref experts have also observed more open water during the winter in front of channels (i.e. channels that lead in and out of lagoons and inlets), in Shishmaref Inlet, and in Kotzebue Sound (e.g. map #53).

Other ice-related changes that have been observed by local experts include that the ice is younger. Older, thicker ice used to be transported from the north into the region during freeze-up (as large icebergs, or thick, old pans). Because of reductions in Arctic ice extent, this older ice no longer arrives (see also Elder's Conference 1987b). This means that the majority of the ice in the Bering Strait region is new, "young" ice that has just formed. In addition to being young ice, it is also thinner ice. This ice is also thinner, meaning it is more prone to deformation by wind and currents (see above). This contributes to the earlier break-up that experts have reported; shorefast ice and ice pans beyond the shore ice are thinner, break-up sooner, and leave the region sooner.

"No more thick ice, what we call them, 'blue ice'. Where we get fresh water, ice, blue ice. ... We used always go look around to find blue ice, to water. Get ice there, bring it to the house and thaw it out." –Edward Soolook, Diomedes



Figure 30. Ice for drinking water, Shishmaref.

Photo by Meghan Topkok, Kawerak Social Science Program.

This lack of thick ice has implications for animals and hunters. Walrus prefer thicker ice to haul out on and they also like to haul out in groups. A lack of thick ice large enough to hold big groups of walrus means that animals may be more difficult to find (i.e. they may spend more time in the water, and be more difficult to spot), that they may be dispersed over a larger area, or that they are congregated in an area that does have thick, large ice, but is far from communities. Experts have noted that they do not see large cakes of ice (which often had large numbers of walrus on them) as frequently as in the past. Additionally, if shore ice is breaking up and leaving earlier in the year, there is less near shore habitat for seals in the spring, making the spring seal hunt more difficult, as well. At Diomedede, the ice edge, between the northern and southern ends of Big and Little Diomedede Islands, has been receding also.

Experts from all three communities have described changes in animal distribution and have attributed them primarily to ice conditions. As described above, less ice generally leads to fewer sightings of animals. In some cases, when ice conditions are right, communities will see more animals than is typical. For example, Shishmaref sometimes sees more animals because of the way pressure ridges form and channel animals into particular areas. Overall, however, experts are reporting seeing fewer animals around their communities and having to travel further to find them during hunting trips. Experts attribute fewer sightings primarily to changes in animal (i.e. ice) distribution, however, not declines in species populations.

Other changes that have been reported by experts in the participating communities include:

- An increase in erosion, particularly in the Shishmaref area, but also in the Wales area.
- Changes in the channels near Shishmaref; some are more shallow, some have disappeared, and some are present during break-up but not during the summer.

- More frequent flooding at Shishmaref.
- More incidences of high water and there being “more water” in general.
- Rises in water levels.
- An increase in water temperatures.
- Observations of “dirty water” – water with a lot of silt and grasses/water plants in it, probably from erosion.
- Fewer belugas have been observed around Shishmaref than in the past.
- Seals are staying closer to shore in the winter in the Shishmaref area, likely due to thinner ice that they are able to maintain breathing holes in.
- Some hunters go out less because of the unpredictable weather.
- Fewer clams washing on shore in the Shishmaref and Wales area.
- Unusual or unknown animals showing up (e.g. unknown types of clams, Aleutian skates and a narwhale have washed on shore).
- Extremely long pressure ridges/areas of piled ice, that stretch for tens of miles, have formed during some winters.
- Changes in the technology and equipment available to and used by hunters.
- Currents are no longer used for travel because of high horse-power outboard motors.

Traditional and Western Knowledge of Ocean Currents Workshop

In November 2013 Kawerak held a two-day workshop on *Traditional and Western Knowledge of Ocean Currents* at our offices in Nome. The purpose of the workshop was to provide a venue for local experts from different communities and western scientists to exchange information about Bering Strait ocean currents, and to review data collected during the project. Several youth from Wales and Shishmaref also participated in the workshop as an opportunity to learn about currents directly from experts and western scientists. Kawerak and National Park Service staff attended the workshop as participants and observers (Appendix 2 contains the workshop agenda and participant list).

The workshop began with opening remarks and an overview of the goals of the workshop. Workshop goals included reviewing some of the data collected during the project and having local experts review, correct and approve it, to hear from some colleagues in western science fields about their ocean currents research, and to talk as a group about how this information – from traditional knowledge and western science – could be applied to some of the challenges that the Bering Strait region is currently facing. Another workshop goal was for participants to talk about ways that communities and western scientists could work together in the future, what regional research needs are, and to discuss recommendations that could be made to regulatory agencies and others.

Two western scientists who have been conducting research on ocean currents were invited to discuss their work with the group and to participate in the overall workshop discussions about Kawerak’s ocean currents project. Dr. Rebecca Woodgate, from the University of Washington, and Dr. Seth Danielson, from the University of Alaska Fairbanks both presented on their research during the first day of the workshop. They were invited to participate in the workshop

specifically because of their interest in learning about local experts' observations of currents and in coming up with ways that the academic and indigenous communities can work together.



Figure 31. Dr. Rebecca Woodgate discussing her research.
Photo by Meghan Topkok, Kawerak Social Science Program.

Among the topics that Dr. Woodgate discussed in her formal presentation were various mooring systems that have been deployed in the Strait and the types of measurements that they record, ocean circulation, including why currents flow predominantly north in this region, the effects of wind on ocean currents, and the need for an improved model of Bering Strait circulation. Dr. Danielson presented to the group on topics such as his work on Bering Shelf circulation, research using drifters, the role of winds, bathymetry, tides on circulation, and various circulation models.

Following presentations by Drs. Woodward and Danielson, project staff reviewed various data collected during the course of the project with the group. The principal investigator and project intern had previously prepared summaries of data on various topics such as the use of ocean currents for hunting, the ways that animals use currents, and other project data. Each participant was given a summary for each topic which included narrative and bulleted synopsis of data and quotes from project participants that exemplified some of the main points or themes in the data for that topic. The group reviewed each summary and discussed any corrections, additions, or other changes needed to the information presented. Project staff digitally recorded these discussions and took written notes, which were later incorporated into the results presented in this report.

Another portion of the workshop was spent reviewing a draft map of Bering Strait region ocean currents that was created based on interviews with all of the local experts that participated in the project. Also reviewed was a Map Guide that includes a narrative description of each map feature. The workshop participants were divided into two groups; one with primarily Shishmaref

participants, and one with primarily Wales participants (Diomedede representatives had been invited to the workshop, but did not attend). Julie Raymond-Yakoubian facilitated the Shishmaref map review group, and Meghan Topkok facilitated the Wales group. Both groups reviewed all of the map features in the vicinity of their community for accuracy, and revisions and clarifications that were needed in the location or character of the features were made directly on the maps. Notes were also taken on any revisions or clarifications that the Map Guide required. All of these revisions were incorporated into the final map and Map Guide (see Map 1 and Appendix 4).



Figure 32. Dr. Seth Danielson, Curtis Nayokpuk, Fred Tocktoo, Vincent Tocktoo Sr., John Sinnok and Guy Martin review and ocean currents map.



Figure 33. Raymond Seetook Sr. explaining ocean currents near Wales.

Photos by Meghan Topkok, Kawerak Social Science Program.

Workshop participants also had a discussion about the similarities and differences between traditional knowledge and western knowledge, including the “methods” used to gain information, the length of time information has been collected and gaps in the two data sets. The group also discussed the kinds of questions that local experts can answer for western scientists, and the questions western scientists can answer for local experts and communities. Kawerak staff also facilitated a discussion regarding how our collective knowledge (traditional and western) can contribute to ongoing challenges and issues in the Bering Strait region, recommendations for future research, recommendations to policy makers and others, and the possibility for collaborations between Bering Strait communities and western researchers.

Based on group discussions over the course of the workshop participants generation a variety of recommendations relating to multiple topics. Some of the recommendations listed below are also listed in the overall project recommendations:

Workshop Recommendations

Safety:

- Make data from existing moorings available to hunters/boaters (i.e. swell height)
- Make map of ocean currents map available to Search and Rescue (SAR) teams
- Compile stories about previous SAR activities, including where people have been found, and why, share this information
- Use the ocean currents map as a youth educational tool

Models:

- A good storm surge model is needed for this region (in progress, but needs more funding)
- A model of sea ice movements is needed
- An oil spill model would be useful – to predict where currents are likely to move spilled materials

Shipping:

- Use existing instruments (already deployed) to measure noise from vessel traffic and to study its impact on marine mammals
- Prevent ship discharge in the Bering Strait region (participants have concerns about currents transporting pollutants to areas used by marine mammals)
- Create buffer zones around King, St. Lawrence and Diomed Islands that certain vessels will not be allowed to enter
- Create a list of contact numbers for villages where they can report discharges, unusual events, etc.

Oil Spills:

- More research is needed on how ice and oil interact, what the effects of oil freezing in ice might be
- More and better response equipment deployed throughout the region
- Use local knowledge of currents to design appropriate spill response

Future Research and Researcher/Local Expert Relationships:

- Researchers need to let communities know about the research they are doing (even if they are not working on tribal lands). The best way to do this is face-to-face presentations, school visits. At minimum, letters with research details should be sent to tribal councils.
- Researchers and communities should develop long-term relationships so that they can work together on questions of mutual interest.
- Do a week-long collaboration of researchers/hunters/students (similar to what Dr. Danielson does in the Yukon-Kuskokwim School District)
- Researchers should incorporate village residents into their research process (e.g. have hunters participate in data collection, hunters can help get researchers out into the field to see ocean currents first hand)
- Researchers should send research results to communities
- Future research projects: How fast does ice travel through the Strait? A satellite tracked drifter program for the Bering Strait. Do different types of oils behave differently in water, around ice?

Based on participant feedback, workshop participants found the event to be very useful and successful. Local experts enjoyed being able to hear about the experiences and knowledge of their neighbors in other communities, about the research of western scientists, and having a chance to review data that all participants contributed to the project. The western scientists expressed interest in and appreciation for the knowledge and observations of local experts and a desire to develop channels for long-term discussions about topics of mutual interest. Both groups noted an interest in developing more opportunities, such as additional workshops, where we can continue to exchange information and develop research relationships. Additionally, both the western scientists and local experts commented on how each group had something to offer the other in terms of knowledge or other expertise.

CAPACITY BUILDING

This project included considerable capacity building efforts in the Bering Strait region. Training and employment were provided to residents in each community, an intern had substantial learning opportunities, and a workshop was held where local experts, Kawerak staff, and western scientists had an opportunity to interact and share information (discussed above in Results). Additionally, Kawerak had the opportunity to partner with Russian colleagues at the Chukotka Branch of Pacific Scientific Research Fisheries Center and learn from local ocean currents experts from Chukotkan villages.

The project included the hiring and training of a local assistant in each Alaskan community to assist the principal investigator in making contact with local experts and tribal councils, carrying out interviews, and other tasks. We also collaborated closely with local experts and tribal councils over the course of the project. Tribal councils were involved in the project from its inception, approving the project, reviewing interview protocols, selecting local experts, and reviewing draft products. Local experts have contributed their knowledge and reviewed and commented on draft products.

An intern, Meghan Topkok, was hired in 2013 to assist with and gain experience in transcription, data analysis of linguistic and other information, workshop organization, and community outreach. Meghan's work was critical to the success of community meetings and the project workshop. Additional activities that Meghan carried out for this project include the organization of the table of Iñupiaq words in Table 1 (including consulting with local experts to ensure its accuracy), and compilation of Appendix 3, the photographs of hunting signals.



Figure 34. Meghan Topkok, project intern, at Diomedede, with Big Diomedede in the background, 2.5 miles to the west.

"This internship, particularly working on this project, has been an incredible opportunity to apply my undergraduate education to the work of documenting, revitalizing and sharing of our traditional knowledge. The narratives contained within this report have inspired me take the next step in my education – attending law school with a primary focus on environmental and indigenous law with the express purpose to come back to this region to protect our subsistence way of life. This project illuminates how intelligent our ancestors were to accumulate such a complex body of knowledge and how critical it is for hunters and communities today to be acutely aware of their surroundings. This becomes particularly important as we see changes in the climate and environment that we continue to rely on for physical, spiritual and cultural nourishment. I hope this report will be a valuable resource to future generations, as well, that we will always remember where we come from and to continue to maintain a relationship built on reciprocity with the environment around us. Quyanaqpak to all the individuals who contributed their invaluable knowledge to this project and to the Social Science Program for putting it all together." –Meghan Topkok, Project Intern

This project has significantly contributed to Kawerak's and the region's ongoing cultural heritage documentation efforts. In addition to this report, Kawerak has also produced an educational poster, in English and Russian, which will be distributed to region communities. This poster, and additional information, can be accessed at www.kawerak.org/socialsci.html.

DISCUSSION AND CONCLUSIONS

“Learning these things young will feed you and your family for the rest of your life.”
–Gilbert Oxereok, Wales

This study has documented knowledge and use of ocean currents in the communities of Shishmaref, Diomedea and Wales through ethnographic interviews, mapping and archival research. The ethnographic interviews and mapping detailed information on the location and characteristics of currents, human and animal uses of currents, the importance of this knowledge for safe and successful use of the marine environment, and other topics.

All of the objectives of this study have been met. In addition to meeting the project objectives, this research also had significant capacity building outcomes for Kawerak, region tribes, and the individuals hired to work on the project.

Interviews with local experts, as well as community and tribal council meetings, have emphasized how important knowledge about ocean currents is to safe and successful boating and hunting in marine waters. This research has also detailed the many and complicated ways that ocean currents, ice, wind and other environmental factors work together (or in opposition) to create the marine environment that humans must operate within.

Knowledge of ocean currents is critical to communities for maintaining their unique bodies of traditional knowledge, their distinctive subsistence practices, and their position as marine experts. Some ocean currents experts have concerns about the passing on of this body of knowledge and experiences to younger generations, a lack of Iñupiaq language skills related to the marine environment, and the safety of young boaters and boat captains. In order to stay safe and successful, younger generations must make efforts to learn, and older generations must make efforts to teach. This is happening in all three communities and experts expressed their desire for this to continue into the future.

Management Implications

This research has several implications for natural resource managers, vessel traffic regulators and others (see also, Recommendations, below). The Bering Strait is increasingly seeing more vessel traffic and offshore development activity as each year passes. Increases in traffic related to these activities is concerning to ocean currents experts and others for a variety of reasons, including the possibility of an oil spill or the spill or release of other materials. Ocean currents experts hold information that is valuable in planning and carrying out oil spill response activities. This includes information about the location of ocean currents, their flow direction, and other characteristics that would determine where spilled material may be dispersed to. Ocean currents experts and their communities would like their knowledge to be utilized in spill response planning and response activities.

Ocean currents experts are also concerned about the probability for increased Search and Rescue activities in the Bering Strait region, related to increased vessel traffic. With additional vessels transiting the Strait each year, the likelihood of accidents and emergencies that require such activities increases. While participating in response activities in the past, experts have been able

to greatly narrow the search area for vessels that have gone missing by using their knowledge of currents to predict how fast and far and in what direction a missing vessel would have been carried by the currents. They are also very experienced in navigating currents and dealing with other factors of the marine environment. Experts should be consulted for their knowledge in the planning and execution of Search and Rescue activities.

RECOMMENDATIONS

The recommendations below are directed primarily to Federal and State agencies responsible for monitoring vessel traffic and offshore development activities and enforcing relevant regulations, for preparing for and responding to spills of oil or other materials in the Bering Strait area, and for funding social science research. Some of these recommendations are also discussed in the Results, in the section on the project workshop.

1. Other communities in the Bering Strait region have expressed an interest in pursuing research similar to this project for their own communities. Agencies or organizations should fund and/or conduct research similar to this project in other Bering Strait region communities.
2. Though it was beyond the scope of work for this project, additional research that makes efforts to integrate indigenous and western knowledge of ocean currents, could lead to additional insights into Bering Strait region (or larger scale) ocean circulation and climate change questions. The workshop held as part of this project was a small step in this direction, and indicated a desire on the part of indigenous communities, western scientists and regional organizations in future collaborations, including integrating different knowledge bases.
3. Agencies should have more regular contact with village residents to gather information on emerging concerns and to develop stronger relationships.
4. The map included in this report (Map 1, map pocket), should not be used as a substitute for tribal consultation, but rather a tool to facilitate consultation and tribal involvement in decision-making and planning. Local experts can assist agencies and organizations in the interpretation of the information recorded on Map 1.
5. Tribes and experts are extremely concerned about the possibility of oil or other hazardous material discharges in the region. They would like the information in this report to be incorporated into spill response plans and used to help determine where spill response equipment should be stored and how responses should be carried out. Tribal local experts that collaborated on this project should also be consulted during emergency spill responses as they will be most knowledgeable about where and how currents are likely to disperse spilled materials.
6. Tribes and experts are also concerned about the possibility of increased Search and Rescue operations in the region as a result of increasing vessel traffic through the Strait.

Local experts should also be consulted, for their knowledge of currents, in any Search and Rescue operations in the region. Local experts have successfully carried out and assisted with such operations in the past by sharing their knowledge of ocean currents.

7. While not directly related to ocean currents, during the course of research experts discussed their concerns regarding increasing vessel traffic in general. Many experts would like to see seasonal restrictions regarding the routes that vessels travel to keep them away from main hunting areas or marine mammal migratory routes, particularly in the spring (see also Kawerak 2013b).

LITERATURE CITED

- Ahmasuk, A. and E. Trigg. 2008. Bering Strait Region Local and Traditional Knowledge Pilot Project: A Comprehensive Subsistence Use Study of the Bering Strait Region. North Pacific Research Board Final Report Project #643. Kawerak, Inc., Nome, AK.
- Alix, C. 2012. Using wood on King Island, Alaska. *Études/Inuit/Studies*, 36(1):89-112.
- Andersen, D., C. Brown, R.J. Walker and K. Elkin. 2004. Traditional Ecological Knowledge and Contemporary Subsistence Harvest of Non-Salmon Fish in the Koyukuk River Drainage, Alaska. Technical Paper No. 282, ADF&G, Division of Subsistence. Fairbanks, AK.
- Bogojavlensky, S. 1969. *Imaangmiut Eskimo Careers: Skinboats in Bering Strait*. Unpublished PhD thesis. Harvard University: Cambridge, MA.
- Danielson, S., K. Aagaard, T. Weingartner, S. Martin, Pl Winsor, G. Gawarkiewicz and D. Quadfasel. 2006. The St. Lawrence polynya and the Bering shelf circulation: New observations and a model comparison. *Journal of Geophysical Research*, 111, C09023, doi:10.1029/2005JC003268.
- Danielson, S., E. Curchitser, K. Hedstrom, T. Weingartner and P. Stabeno. 2011. On ocean and sea ice modes of variability in the Bering Sea. *Journal of Geophysical Research*, 116, C12034, doi:10.1029/2011JC007389.
- Danielson, S., T. Weingartner, K. Aagaard, J. Zhang and R. Woodgate. 2012. Circulation on the central Bering Sea shelf, July 2008 to July 2010. *Journal of Geophysical Research*, 117, C10003, doi:10.1029/2012JC008303.
- Department of Commerce, Community and Economic Development (DCCED). 2013. State of Alaska Community Database Online, Shishmaref Community Information, Accessed June 2013. <http://commerce.alaska.gov/cra/DCRAExternal/community/Details/c075af9a-a51e-47bb-9dfb-60fd2513da0a>
- Elder's Conference. 1979. Interview. Kawerak Eskimo Heritage Program Archives, EC/SH/WA/DI/79 Tape 2.
- Elder's Conference. 1984. Interview with Wales elders. Kawerak Eskimo Heritage Program Archives, EC84.026.
- Elder's Conference. 1987. Interview. Kawerak Eskimo Heritage Program Archives, EC/KI/LD 87-0-2, Side 2.
- Elder's Conference. 1987b. Interview. Kawerak Eskimo Heritage Program Archives, EC87.025.

- Ellanna, L. 1983. *Bering Strait Insular Eskimo: A Diachronic Study of Economy and Population Structure*. Alaska Department of Fish and Game, Division of Subsistence. Technical Paper number 77.
- Eutuk, Verne. 1983. Interview with Lucy Obruk. Kawerak Eskimo Heritage Program Archives, 1983.003.051 SHH.
- Eutuk, Verne. 1983b. Interview. Kawerak Eskimo Heritage Program Archives, 1983.003.052 SHH.
- Fortier, Ed. 1978. *One Survived*. Alaska Northwest Publishing Company: Anchorage, AK.
- Friese, S. 2012. *Qualitative Data Analysis with Atlas.ti*. Sage: Thousand Oaks, CA.
- Giddings, J. L. 1952. Driftwood and Problems of Arctic Sea Currents. *Proceedings of the American Philosophical Society*, 96(2):129-142.
- Hu, A., G. Meehl, W. Han, A. Timmermann, B. Otto-Bliesner, Z. Liu, W. Washington, W. Large, A. Abe-Ouchi, M. Kimoto, K. Lambeck and B. Wu. 2012. Role of the Bering Strait on the hysteresis of the ocean conveyor belt circulation and glacial climate stability. *Proceedings of the National Academy of Sciences*, 109(17): 6417-6422, doi:10.1073/pnas.1116014109.
- Hoffecker, J. and S. Elias. 2003. Environment and Archaeology in Beringia. *Evolutionary Anthropology*, 12:34-49.
- Iyahuk, A. 1987. Interview. Kawerak Eskimo Heritage Program Archives, EC87.012.
- Johnson, M., H. Eicken, M. L. Druckenmiller and R. Glenn (eds.) 2014. *Experts Workshops to Comparatively Evaluate Coastal Currents and Ice Movement in the Northeastern Chukchi Sea; Barrow and Wainwright, Alaska, March 11-15, 2013*. University of Alaska Fairbanks, Fairbanks, AK.
- Jolles, C.Z. and the Native Village of Diomed. 2006. *Iyaliq: The One Furthest Over: A cultural map of Little Diomed Island*. Copy of map on file at the Kawerak Social Science Program.
- Jones, S. (editor) 2003. *Eskimo Drawings*. Anchorage Museum of History and Art: Anchorage, AK.
- Kawerak. 2013a. *Seal and Walrus Harvest and habitat Areas for Nine Bering Strait Region Communities*. Kawerak, Inc. Social Science Program: Nome, AK.
- Kawerak. 2013b. *Policy-based Recommendations from Kawerak's Ice Seal and Walrus Project*. Kawerak, Inc. Social Science Program: Nome, AK.

- Krupnik, I., C. Aporta, S. Bearheard, G. Laidler and L. Kielsen Holm. *SIKU: Knowing Our Ice. Documenting Inuit Sea Ice Knowledge and Use*. Dordrecht, Springer.
- Lopp Smith, K. and V. Smith (editors). 2001. *Ice Window: Letters from a Bering Strait Village 1892-1902*. University of Alaska Press: Fairbanks, AK.
- Milligrock, Q. 1981. Interview with Lincoln Milligrock. Kawerak Eskimo Heritage Program Archives, DIO.81.002.
- Okpowruk, C. 1983. Interview. Kawerak Eskimo Heritage Program Archives. 1983.003.034 SHH.
- Olanna, H. 1979. Interview with Mrs. Harry Olanna. Kawerak Eskimo Heritage Program Archives, ERC 79.002 1979.011.009.
- Olanna, A., A. Weyiouanna, G. Barr, Sr., J. Nigealook and E. Weyiouanna. 1982. Interview with Johnson Eningowuk and John Sinnok. Kawerak Eskimo Heritage Program Archives. EC.82.038 SHH.
- Oozeva, C., C. Noongwook, G. Noongwook, C. Alowa and I. Krupnik. 2004. *Watching Ice and Weather Our Way / Sikumengllu Eslamengllu Esghapalleghput*. Arctic Studies Center: Washington, D.C.
- Pinson, E. 1912. *Alaska's Daughter: An Eskimo Memoir of the Early Twentieth Century*. USU Press Publications, Book 84. http://digitalcommons.usu.edu/usupress_pubs/84.
- Raymond-Yakoubian, J. 2009. Climate-Ocean Effects on Chinook Salmon: Local Traditional Knowledge Component. Final report to the Arctic Yukon Kuskokwim Sustainable Salmon Initiative for project 712. Kawerak, Inc. Social Science Program: Nome, AK.
- Raymond-Yakoubian, J. 2013. *When the fish come, we go fishing: Local Ecological Knowledge of Non-Salmon Fish Used for Subsistence in the Bering Strait Region*. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Resource Monitoring Program, Final Report (Study No. 10-151). Kawerak, Inc. Social Science Program: Nome, AK.
- Raymond-Yakoubian, B., L. Kaplan, M. Topkok and J. Raymond-Yakoubian. 2014. *The world has changed: Inalit Traditional Knowledge of Walrus in the Bering Strait*. North Pacific Research Board Final Project Report #1013. Kawerak, Inc. Social Science Program: Nome, AK.
- Schaaf, J. (editor). 1996. *Ublasau: First Light. Inupiaq Hunters and Herders in the Early Twentieth Century, Northern Seward Peninsula, Alaska*. Prepared by the Alaska System Support Office, National Park Service, Shared Beringian Heritage Program.
- U.S. Army Corps of Engineers. 2004. Shishmaref Partnership: Shishmaref Relocation and Collocation Study. Prepared by Tetra Tech, Inc. Seattle, WA.

- Wales Elders. 1981. Interview. Kawerak Eskimo Heritage Program Archives. WAA.002
1981.006.084.
- Weyapuk, Jr., W. and I. Krupnik (compilers). 2012. *Kinikmi Sigum Qanuq Ilitaavut: Wales Inupiaq Sea Ice Dictionary*. Arctic Studies Center, Smithsonian Institution: Washington, D.C.
- Weyiouanna, E. 1983. Interview. Kawerak Eskimo Heritage Program Archives. 1983.003.057
SHH.
- Woodgate, R., and K. Aagaard. 2005. Revising the Bering Strait freshwater flux into the Arctic Ocean, *Geophysical Research Letters*, 32, L02602, doi:10.1029/2004GL021747.
- Woodgate, R., T. Weingartner and R. Lindsay. 2010. The 2007 Bering Strait oceanic heat flux and anomalous Arctic sea-ice retreat. *Geophysical Research Letters*, 37, L01602, doi:10.1029/2009GL041621.
- Zhang, X., A. Sorteberg, J. Zhang, R. Gerdes and J. Comiso. 2008. Recent radical shifts of atmospheric circulations and rapid changes in Arctic climate system. *Geophysical Research Letters*, 35, L227701, doi:10.1029/2008GL035607.

APPENDIX 1

Semi-structured Interview Guide

- Where are the ocean currents you are familiar with? (Show on the map)
- Can you describe each ocean current that you are familiar with (speed, depth, direction, time of year present, etc.)?
- Have any of the ocean currents you are familiar with changed over your lifetime? If yes, describe the changes (and show on a map, if possible).
- Before people had motors for their boats:
 - How did they use ocean currents to travel from place to place?
 - How did they use ocean currents when hunting animals?
 - How did they use ocean currents, or were they helpful, when harvesting any other marine resources? (This might include driftwood clams, seaweed or other marine plants and animals.)
- After people started using motors with their boats:
 - Do they still use ocean currents to travel from place to place?
 - Do they still use ocean currents when hunting animals?
 - Do they still use ocean currents when harvesting other marine resources?
- How do ocean currents impact sea ice and the way hunters use it?
- How do animals use the ocean currents?
- How did you learn about ocean currents?
- Do you have any stories about your use or knowledge of ocean currents?
- Do you know any words or phrases in your language that describe ocean currents or things related to ocean currents?
- Is there anything else about ocean currents that you would like to tell us?

APPENDIX 2

Appendix 2 is the agenda for the *Traditional and Western Knowledge of Ocean Currents* workshop held in Nome November 25-26, 2013.



KAWERAK, INC. P.O. Box 948 Nome, Alaska 99762 (907) 443-5231 Fax: (907) 443-4452

Traditional and Western Knowledge of Ocean Currents Workshop

Hosted by the Kawerak Social Science Program

November 25-26, 2013

Kawerak Ublugiaq Board Room

- November 24:** Participants arrive in Nome from villages, Fairbanks and Seattle.
Lodging: National Park Service Bunkhouse
- November 25:**
- 8:30a – 9:00a Coffee/tea
- 9:00a – 9:15a Welcoming remarks by Melanie Bahnke, Kawerak President
Welcoming remarks by Guy Martin, Beringian Shared Heritage Program committee member.
Opening Prayer
- 9:15a – 9:45a Workshop participant and guest introductions
- 9:45a – 10:00a Introduction and overview of the workshop goals and purpose (Julie Raymond-Yakoubian, Kawerak Social Science Program Director). Assign youth rapporteurs their topics.
- 10:00a – 11:00a Presentation and discussion by Dr. Rebecca Woodgate, University of Washington
A Physical Oceanographer's View of the Bering Strait. Dr. Woodgate will review what the western science community has learned from 2 decades of measurement programs in the Bering Strait region.
- 11:00a – 11:15a BREAK
- 11:15a – 12:15p Presentation and discussion by Dr. Seth Danielson, University of Alaska Fairbanks
The Bering shelf circulation: ocean responses to local and remote forcing. Dr. Danielson will discuss the ways that Bering Shelf circulation depends on seafloor topography, winds, tides, ice, and water properties (temperature and salinity), both locally and across the greater North Pacific and Arctic oceans. This talk will focus on the central and northern Bering Sea circulation field and the forcing mechanisms that contribute to its variability. A variety of observations will guide the presentation, including data from satellite-tracked drifters and current meter moorings, ocean circulation numerical model results, wind hindcasts, and

satellite-based measurements of sea surface heights, ice concentrations, and ocean color.

12:15p – 1:00p LUNCH provided (Ublugiaq Boardroom)

1:00p – 3:00p Presentation and discussion of Kawerak project data re:
Use of currents for hunting
Use of currents by animals
Ocean currents and safety
Ocean currents and change (in currents, weather, ice, etc.)

3:00p – 3:15p BREAK

3:15p – 5:00p Presentation and discussion of Kawerak project data re:
Review Draft map of ocean currents (2 groups)
Review Inupiaq terms related to ocean currents (2 groups)

5:00p Go over agenda for tomorrow; youth homework assignment.
Adjourn for the day.
Dinner on your own.

November 26:

***Village participants: Please bring your luggage with you today.
You will depart to the airport from Kawerak***

8:30a – 9:00a Coffee/tea

9:00a – 9:15a Review yesterday's discussions; overview of goals for today

9:15a – 9:45a Hear from our youth participant rapporteurs

9:45a – 10:15a Follow up on any questions about information from yesterday

10:15a – 10:30a BREAK

10:30a – 12:00p Discussion of the similarities and differences between local expert knowledge of ocean currents and western science of ocean currents, data gaps, data uses

12:00p – 12:45p LUNCH provided (Ublugiaq Boardroom)

12:45p- 2p Bringing it all together: how does our collective knowledge about currents relate to ongoing challenges and issues in the Bering Strait region

2:00p – 3:00p Group discussion of: recommendations for future research, recommendations to regulatory agencies, others; how researchers and communities can communicate better/more

3:00p – 3:30p	Closing remarks, participant comments
3:30p	Workshop evaluations
3:45p	Depart for ERA. Wales and Shishmaref participants need to be at ERA by 4:00pm

Thank you to the National Park Service, Beringian Shared Heritage Program, for sponsoring this workshop and our overall project. Thank you to the Kawerak Wellness Program for sponsoring our youth participants!

Participant List

- **Shishmaref:** Vincent Tocktoo Sr., John Sinnok, Curtis Nayokpuk and Johnny Pootoogooluk
- **Wales:** Raymond Seetook Sr., Debra Seetook, Timothy Milligrock, Jessie Ongtawasruk, Reuben Oxereok , Luther Komonaseak (invited), Winton Weyapuk Jr. (invited)
- **Diomede:** Edward Soolook (invited), Eva Menadelook (invited)
- **National Park Service:** Fred Tocktoo, Guy Martin
- **Kawerak:** Julie Raymond-Yakoubian, Meghan Topkok, Melanie Bahnke, Brandon Ahmasuk
- **University of Alaska Fairbanks:** Seth Danielson
- **University of Washington:** Rebecca Woodgate

APPENDIX 3

This appendix is a compilation of hand signals used by hunters when in boats out on the water.

Hand Signals

Hand signals are a method of non-verbal communication used by hunters most frequently while out on a boat. These gestures alert others on the boat crew to the presence of a particular animal out in the water or on the ice. By using these hand signals hunters can avoid making unnecessary noise that could potentially scare an animal away. Included in this appendix are just a few of the many hand signals employed by hunters today for ducks, polar bears, seal, *ugruk* (bearded seal), whale, and walrus. Some signals may vary depending on the boat crew or village an individual is from. Typically, it is the job of the crew member the furthest forward, on the bow of the boat, to keep watch for any game and alert the others when any is spotted.

Thanks to Winton Weyapuk, Jr. (Wales), Jerry Iyapana (Diomedede), John Ahkvaluk (Diomedede), Rueben Oxereok (Wales), Jessie Ongtawasruk (Wales) and Johnny Pootoogooluk (Shishmaref) for demonstrating these signals!



POLAR BEAR:
move arms back and forth



DUCKS:
arms extended outwards



WHALE
arms raised and crossed



BOWHEAD:
paddle raised



SEAL:
fist raised by side of head



SEAL:
fist raised by side of head



UGRUK (BEARDED SEAL):
hand extended over head



UGRUK (BEARDED SEAL):
hand moves from front to back of head



WALRUS (SHH):
hands move vertically



WALRUS (DIO):
extend arms forward



WALRUS (WAA):
hands in front of chest, fingers
pointed down



FEMALE WALRUS:
hand in front of
face

APPENDIX 4

This appendix is a guide to Map1 (located in the map pocket on the back cover of the report):
Ocean Currents in the Bering Strait Region of Alaska (and other marine features)

Map Guide

Ocean Currents in the Bering Strait Region of Alaska (and other marine features)

Each number in this guide corresponds to a numbered feature on the map. The locations on the map are approximate. This map is not meant for navigation. Elders and experienced hunters in your community should be consulted for the most detailed information.

The following individuals contributed to this map and map guide: (Shishmaref) Francis Kakoona, Morris Kiyutelluk, Curtis Nayokpuk, Harvey Pootoogooluk, John Sinook, Davis Sockpick, Clarence Tocktoo and Vincent Tocktoo, Sr.; (Wales) Michael Ahkinga, Sr., Luther Komonaseak, Gilbert Oxereok, Raymond Seetook, Sr. and Winton Weyapuk, Jr.; (Diomedes) Arthur Ahkinga, Orville Ahkinga, Sr., John Avahkluk, Jerry Iyapana, Patrick Omiak, Sr., Edward Soolook and Robert Soolook, Jr.

1. Valley on Cape Dezhneva (Russia). This valley is used by Diomedes hunters to judge impending weather conditions. The valley is observed to see if clouds are forming in it, and if so, this is an indication that bad weather is approaching and boaters should head home.
2. A current to the west of Big Diomedes Island. It flows north and its speed is approximately 6 mph.
3. This is the main current between Big and Little Diomedes Islands. This current originates from the southwest, and when it reaches the islands it splits off to the east and west to go around the islands, as well as continuing north between the islands.
4. These two lines are the typical locations of the ice edge between Big and Little Diomedes Islands.
5. A very strong north flowing current near the northeast corner of Big Diomedes. Little Diomedes hunters will watch this area to determine what conditions are on the east side of Little Diomedes – between Little Diomedes and the mainland – because they are often the same as what can be observed on this current (i.e. if the Big Diomedes current is choppy and dangerous, the waters between Little Diomedes and the mainland are likely the same).
6. A. 6A is a dangerous eddy located north/northeast of Little Diomedes. Exact location unknown, approximately 5 miles north/northeast of the island.

B. 6B is a second located eddy north/northeast of Little Diomedede. Exact location unknown, approximately 15 miles north/northeast of the island.

It is possible that this is one eddy that forms in different locations under different conditions. Note: 6A and 6B are not to scale on the inset map, and are pictured closer to the island than they are in reality for illustration purposes.

7. A current that goes out, west, from the Diomedede helicopter landing pad, over a shallow area. The current extends out to the west towards Big Diomedede, up to 1.5 miles from the helicopter pad. It joins the main current between the islands that flows north. This is a very strong current and can slightly shift its location every day based on the tide or other conditions.
8. This is a weak eddy generally going south and clockwise (but can change directions depending on conditions). It is north of the helicopter landing pad current.
9. A current on the southeast corner of Little Diomedede Island, called *Attu*. This is a very strong current. It goes east then curves around the island to flow north.
10. This current is approximately 18mi offshore from Wales. It is strongest in the late spring and summer. It can be up to about 1.5 miles wide. Its speed is about 5-10mph.
11. There are strong currents around Fairway Rock which flow around the island and then head north. Sometimes they originate from the southwest, sometimes from the southeast. They go around both sides of Fairway Rock and continue north.
12. This current is approximately 9mi offshore from Wales. It is strongest in the late spring and summer. It can be up to about 1.5 miles wide. Its speed is about 5mph. It originates from the southwest (in the Saint Lawrence Island area).
13. This is where current #12 “splits” into different directions. Exact location of where this “split” occurs varies, but is approximately 25mi north of Wales. Some of the current flows north, some northwest and some northeast. The northwest portion of this current may join #2 and #3, as well, depending on conditions. See gray arrows on the map.
14. This current is present only in the spring.
15. This is the general migratory route of bowhead whales.
16. Around this approximate location, whales will either join current #18, or turn towards the Diomedede Islands
17. Place name: *Pularaq* (“place where you move out of sight”). This is the first point in an ESE direction from Tin City.

18. This location is called *Umiivik* (“place to build skin boats”). It is a place where a lot of driftwood comes ashore, transported on current #23. Wales residents used to travel here to find driftwood to construct their *umiaq* frames.
19. Cape Mountain or Wales Mountain. When out on the ocean, hunters use this mountain as a landmark and to help predict impending weather. If a cloud “cap” is forming on the mountain, the weather will get rough and boaters should head home. Hunters may also climb the slopes of this mountain to get a better view of ice and weather conditions in the Strait.
20. This is a current that is only present in the spring time.
21. This current is approximately 4 miles offshore from Wales. It is about ¼ mile wide.
22. Clams are brought in by northwest winds and storms in the fall (around October).
23. This current is approximately 4 miles offshore from Wales. It is present year round.
24. This is a current that is present in the spring. It comes from the northwest.
25. This current is a continuation of currents that flow between Diomedes and Wales. It flows north in the spring, is very strong – as strong as 20-30mph, and is approximately 36-50 miles offshore northwest of Shishmaref.
26. After passing the shoal, a portion of current #25 will split off and come closer in to shore. Exact location of “split” is approximate.
27. A current that splits off of current #25. It is not strong. It is present in the spring.
28. A and B. This is an eddy located northeast of Wales; exact location unknown. This eddy may form on either or both sides (#28A and #28B) of the tip of Prince of Wales Shoal (#30). It is strongest in the spring (especially May).
29. Approximate area where big pressure ridges form. This area was previously used as a good location for polar bear hunting.
30. This is Prince of Wales Shoal; the shoal (shallow area) that extends north from the Wales area. In Inupiaq, shoals are called: *sizmulniq*.
31. This current runs along the beach, mostly in the summer and fall. It goes back and forth with the tides; the direction of flow changes throughout the day. It can extend from 0-5 miles offshore.
32. Place name: *Sinjauraq* (“small inlet to a lagoon”). This is the first inlet north of Wales.

33. Place name: *aġġuligak* (“the one in the middle”). This is a channel between *sinjauraq* and *millitaġvik*.
34. Place name: *millitaġvik* or *misitaġvik*. This is an inlet and its name refers to a “place to jump across.”
35. This is a stretch of shoreline where a lot of driftwood, trash and debris comes ashore, pushed by wind, after being transported north by currents. Most of the shoreline from here, east to Kotzebue Sound, collects such materials.
36. Place name: *sinjasaat*. It is a very important place: a shelter area, a safe harbor. It is also an area of former reindeer herding camps.
37. An area where pressure ridges form. May also include much of the shoreline up to *siġik*.
38. This current is 2-5 miles offshore. It is strongest in the spring and fall. It always goes northeast, following the coastline. When approaching Kotzebue Sound, it begins to curve north as it joins water flowing out of Kotzebue Sound..
39. This is not a specific current – it is an area with a general movement of water east into Kotzebue Sound. It is a good area to find animals such as walrus or seal.
40. This is an area where ice will get very packed in because of shallow water.
41. *Iġiġaġik*, or Ear Mountain. When out on the ocean, hunters use this mountain as a landmark and to help predict impending weather. If a cloud “cap” is forming on the mountain, the weather will get rough and boaters should head home.
42. Ice will move back and forth through this, and similar, channels with the tidal currents. The same process happens at all inlets/channels. These areas can be dangerous and are avoided by boaters.
43. This is where a lead or crack in the ice usually forms during the spring and where people go to *ugruk* hunt. It is usually between 5-15 miles offshore, but can be as much as 25 miles offshore.
44. Place name: Third Inlet
45. This is Vincent Tocktoo Sr.’s camp, *Inaaqruk* (“big or huge house”).
46. This is an area along the shore with little or no current. It has dangerous ice in the spring and travelers on snowmachines have to be very careful. Ice here may look solid, but may be thin or rotten.
47. This is an area along the coast where ice can get “stuck” and persist later into the year.

48. Devil's Mountain. This mountain is used as a navigation landmark by hunters. Like other mountains, it is also used to predict weather conditions. If a cloud "cap" forms on top, rough weather is coming and boaters should head home.
49. Place name: Northwest Corner. There is a lighthouse here that is used for navigation.
50. Place name: *Sijik*. This is an area with a very strong current in the spring. A current flowing in a northerly direction will extend out from this area during the spring.
51. This is an area of very rough water and strong current. It is dangerous and is avoided by hunters.
52. Water moves out of Kotzebue Sound and meets other currents near Cape Espenberg and creates current #51.
53. This area used to freeze in the winter, but is now usually open water
54. Current #38 flows very fast in this area.
55. Walrus can be found in this general area in the spring. This is where late season hunting is done.
56. There can be a swirling ice eddy in this area. Ice will spend time in this eddy and then get pulled north by current #51.
57. This current comes out of Kotzebue Sound and joins #38 and #54 and brings a lot of ice with it.
58. Ice gets very packed in to this area because of the opposing forces of powerful current #38 and water flowing out of Kotzebue Sound.
59. The tallest mountain near Cape Krusenstern is used as a landmark. Experts were not able to determine exactly which mountain they used based on the topographic map. It is visible when out on the water hunting. Like other mountains, it is also used to predict weather conditions. If a cloud "cap" forms on top, rough weather is coming and boaters should head home.

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Part Two

Indigenous Knowledge and Use of Bering Strait Region Ocean Currents

(Russia)

Prepared for Kawerak Inc. by

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Introduction

This project has great importance for cultural, historic and scientific ties of native people on both sides of the Bering Strait, because it purports to record the disappearing traditional knowledge of oceanic currents and their use, as well as observed climatic changes affecting the distribution of water masses, migration of marine mammals and, in the long run, the life of aboriginal people of the Arctic.

From time immemorial the Yupik Eskimo and Chukchi people had lived on the Russian side of the Bering Strait in the Chukotsky Autonomous Region (or Chukotka) of the Russian Far East. Eskimos as a distinct autonomous culture can be traced back at least 4,000-6,000 years, while their arrival in the area is dated even further back. Chukchis and Eskimos depend on natural resources, which can be difficult to obtain in the Bering Strait area. They had to preserve their culture and language, including certain environmental knowledge, to survive and to be able to feed their families. In the modern and rapidly changing world survival of the Arctic people's indigenous culture finds itself in jeopardy.

The marine environment has always played an important, if not critical, role in the everyday life of the Bering Strait population. Traditional knowledge handed down from generation to generation coupled with ongoing observations of the environment provided Eskimo people sufficient information for successful harvest of marine resources, which ensured their stable existence for a long period of time. Knowledge of local currents, both river and oceanic, was also valuable for survival. Historic and contemporary events in which hunters were carried off into the ocean with ice and managed to get back to shore using their knowledge of currents and their directions, illustrates the importance of such knowledge for the survival of marine mammal hunters during harvest activities.

Changes in ocean currents recorded of late have a direct or indirect effect on the subsistence lifestyle of Chukotka indigenous people. Some villagers describe currents affecting ice breakup and speak of the general shortening of the ice season. Such changes have a negative effect on the traditional marine mammal harvest and its productivity, which may lead to food shortages in the villages. On the one hand, subsistence harvest plays an important role in Chukotka's economy. To support it, the government provides funds to villages to purchase boats, motors, gear, etc. On the other hand, the changing natural conditions and climate may have a negative effect on populations of marine mammals (such as walruses and whales) and methods of their harvest.

Despite the existing tradition of passing knowledge from elders to the youth, much of that knowledge turns out to be unusable in modern conditions. Native people are forced to adapt to the world around them and search for new ways of hunting and interacting with the ocean and nature. The situation is further aggravated by such problems (common to all native people) as loss of language, cultural traditions and subsistence skills, as well as alcoholism and outflow of youths to cities and their reluctance to continue traditional ways of life.

At the same time, according to our information, the contemporary cultures of the Bering Strait Chukchi and Eskimo people have retained traditional knowledge of the use of oceanic currents, as well as general knowledge of nature. Generational legacy is evident, and passing marine mammal hunting skills from older to younger generations is an integral part of community life. In this light it becomes vitally important to collect, summarize and analyze all available information to assist effective integration of traditional and scientific knowledge and, in the long term, help indigenous people of the Arctic survive and preserve their unique cultures in the contemporary world.

1. Materials and Methods

This project employed the method of interviewing Native villagers according to an interview guide shown below. A digital Dictaphone was used to record the interviews and a digital camera was used to take photos of participants. Experienced hunters and villagers involved in marine mammal hunting were selected for interviews. Several other villagers who had no marine mammal hunting experience were interviewed as control group.

Questions asked:

- Describe or show on the map the location of known currents.
- Describe the currents (speed, depth, direction, etc.).
- Have any of the currents changed during your lifetime? If yes, describe the changes and show on the map if possible.

- Before you had motorboats, did you:
 - use currents to travel from place to place?
 - use currents to hunt marine mammals?
 - use currents to gather other marine resources (mollusks, seaweed or other marine plants or animals)?

- Now that you have motorboats, do you:
 - still use currents when travelling from place to place?
 - still use currents when hunting marine mammals?
 - still use currents when gathering other marine resources?

- How do currents affect sea ice and how do hunters use it?
- Do animals use currents? If so, please describe how.
- How did you learn about currents?
- Do you have any stories to tell about your knowledge and use of currents?
- Do you know any words or phrases in your native language to describe currents or related phenomena? Please, record the words and their meaning.
- Is there anything else you want to tell us about the ocean?

Recorded interviews were then transcribed in a lab; the texts were summarized, and the data obtained were analyzed.

1.1. Research Area.

Members of four indigenous communities in the Chukotsky Autonomous Region - Lorino, Lavrentia, Inchoun and Neshkan – participated in our portion of this project (Fig. 1). Interviews were conducted in 2011. Material was recorded both in villages, where interviewers went on special assignments, and in the city of Anadyr whenever interviewees came to town on other business. A total of 26 people were interviewed in Chukotka for the project, of whom 11 were from Lorino, eight from Lavrentia, five from Inchoun, and two from Neshkan. The latter village was selected for two reasons: firstly, due to a technical failure that prevented us from interviewing the desired number of villagers in Inchoun, and secondly, due to a desire to compare information from villagers living directly on the Bering Strait with that from a village located at some distance from the Strait.

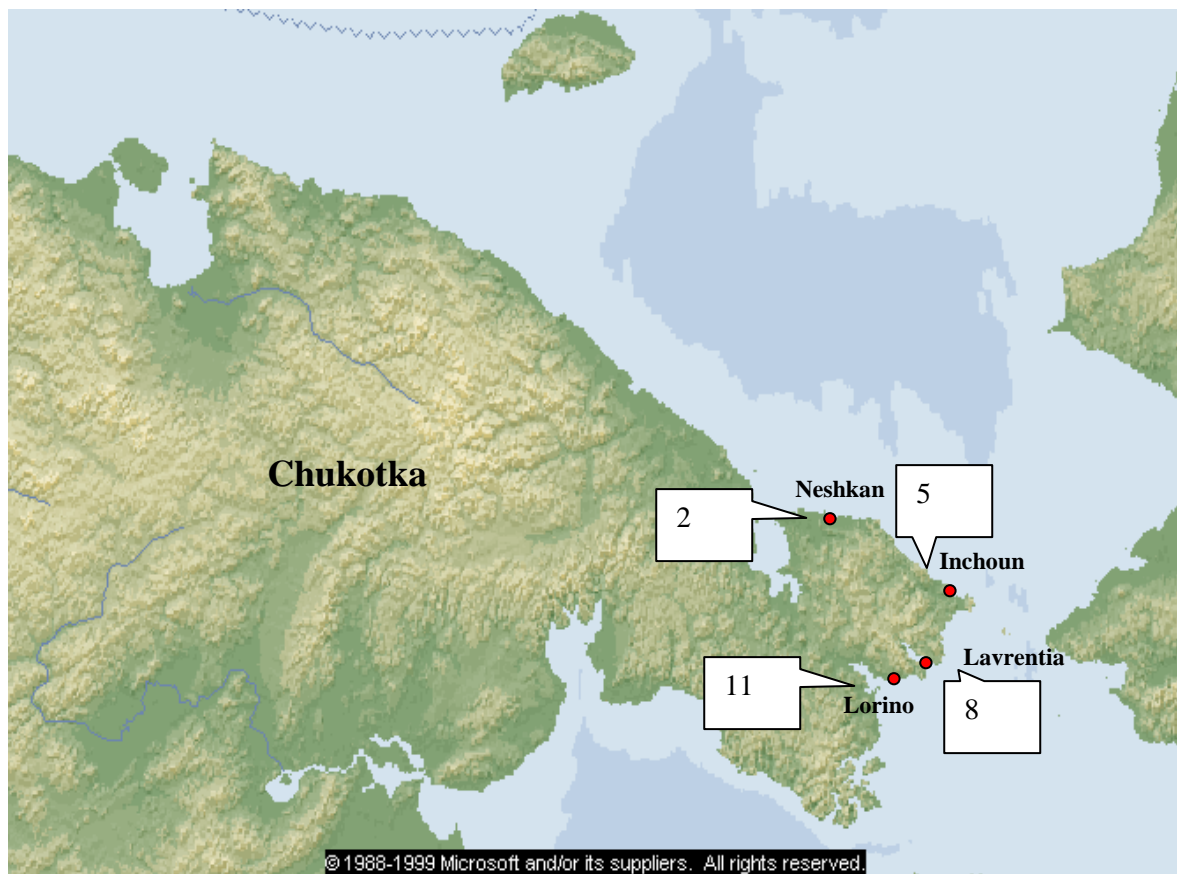


Fig. 1. Villages where interviews were conducted, and number of participants.

1.2. Distribution of participants by age.

Figure 2 features the age composition of interviewees. Most of the people interviewed (46%) were over 51 years of age and had extensive experience of marine mammal hunting and

the use of aquatic biological resources in general. Whenever possible, we interviewed experienced hunters, members of marine mammal hunting teams and community leaders. To evaluate generational inheritance and knowledge of the use of currents by the younger generation in Chukotka, we interviewed people under 35 years of age who lead a subsistence lifestyle and were thus connected to the sea. At the same time, the low percentage of the latter group indicates lower levels of involvement of young people in marine harvest.

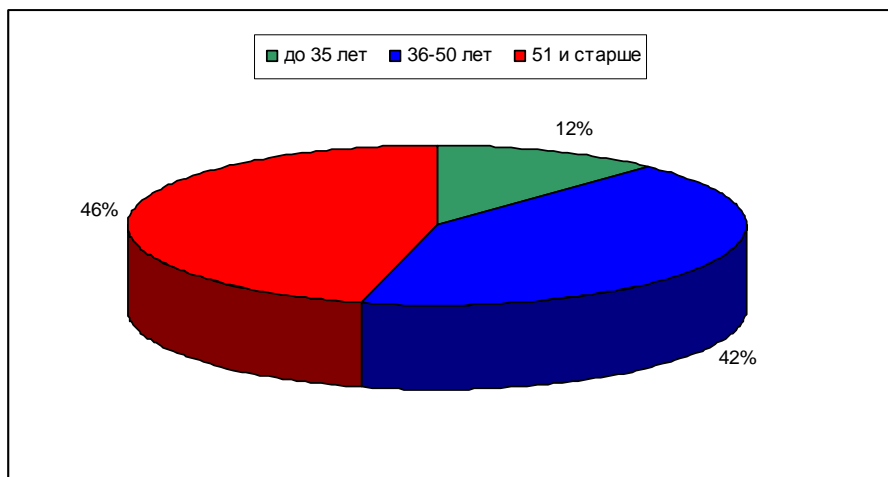


Fig. 2. Distribution of interviewees by age (35 years old and younger in red; 36-50 years in green; 51 years and older in blue).

1.3. Distribution of Interviewees by Sex

There were two women (8%) among the people interviewed (Fig. 3). One woman was under 35 years of age and the other was over 50 years of age. It is commonly known that women play only a small part in traditional hunting activities, especially marine mammal hunting. Their role consists mainly in butchering and preserving the meat, as well as cooking food. At the same time, since both sexes participate in gathering seaweed and mollusks washed up by the sea, and women have general observations of climatic changes, we thought it necessary to interview a few women, as well.

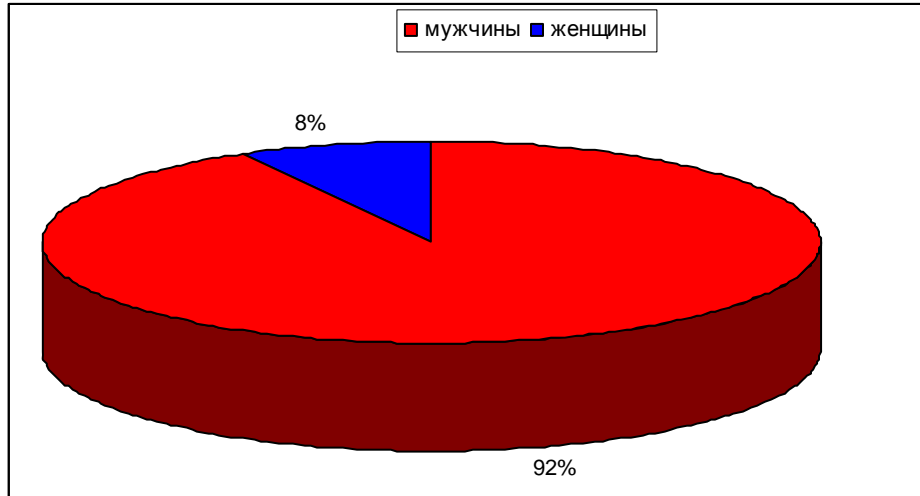


Fig. 3 Distribution of interviewees by sex (female is blue; male is red).

1.4. Distribution of interviewees by ethnicity

Figure 4 presents the distribution of interviewees by ethnicity. Most of the persons interviewed (85%) were Chukchis. Only 15% were Eskimos. However this division cannot be considered fully accurate since interethnic marriages have long been common among the coastal population. Thus, many of the interviewees who identified themselves as Chukchi, may have mixed ethnicity through one of the parents (usually the father) being Russian (most often), Eskimo, Ukrainian, one of the Caucasus peoples, etc. In view of this, we believe distribution by ethnicity to be a less significant index. We also believe that the concept of traditional subsistence lifestyle, including accumulation and passing down of knowledge about marine currents, can apply equally to any person, regardless of ethnicity, who has lived and participated in the life of a local community for a long time. In Chukotka, we know quite a few cases of ethnic Russians living a traditional subsistence lifestyle like indigenous people, as well as cases of ethnic Chukchis who do not practice a traditional subsistence lifestyle.

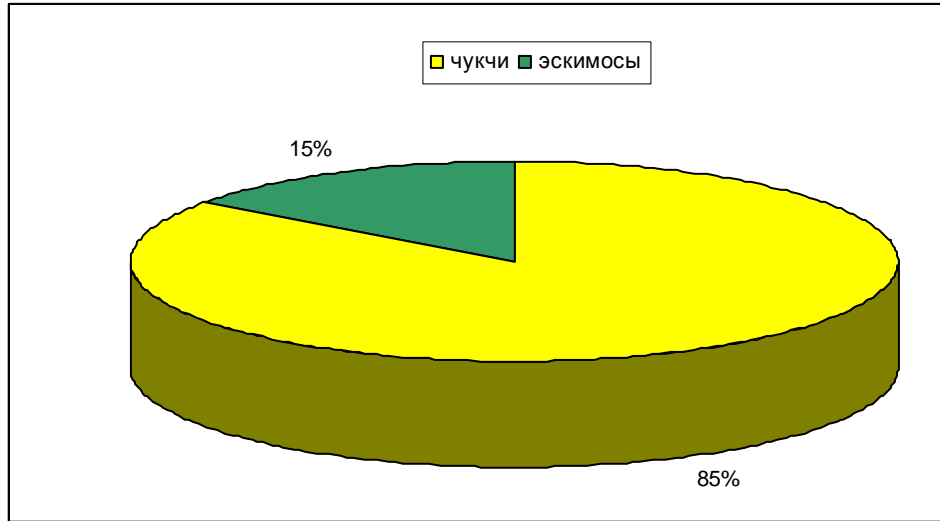


Fig.4 Ethnic composition of interviewees (Chuckchi is yellow; Eskimo is green).

It must be noted that ethnic Chukchis predominate in the population of Chukotsky Autonomous Region. According to the 2010 Social and Economic Report by the Department of Northern Native Affairs, Chukchis account for 77% of the total Native population of Chukotka.

2. Findings

2.1. Location and Description of Currents

Only 31% of interviewees (8 people) could describe the currents they knew and their directions. Only two of them agreed to point them out on the map. We believe that the explanation for this is not the lack of knowledge, but the specifics of Native perception and expression. It is much easier for the Native people to orient themselves in real-life conditions on location, than to deal with more abstract representations of space, such as maps. It is obvious that people who are currently involved in marine mammal harvest know and understand local currents, but have a difficulty describing them. Noticeably, the most extensive answers (including descriptions of currents) came from local community leaders (community chairmen and team leaders), who are more accustomed to dealing with such abstract representations.

Anatoly Napayuk (Lorino): *There is a current in the Bering Sea that may drive in lots of ice, or it may carry it off. You can walk to Alaska there. In the old days people travelled there on foot or on dogsleds.*

Gennady Inankuyaz (Lorino): *I work as a marine mammal hunter for the community and head the Chukotka Association of Traditional Marine Mammal Hunters. There are currents in the Bering Strait near our village. The currents are good and bring many nutrients. Marine mammal migration routes lie there. I think these currents are very rich.*

*In the summer, there is a steady current going north. In Mechigmentsky Bay the current turns around in a circle. And near Cape Acconee it also goes north, and there are many animals in that area. The current that flows north is always moving. It is called **Tliaurghyn**. The sea is always open there.*

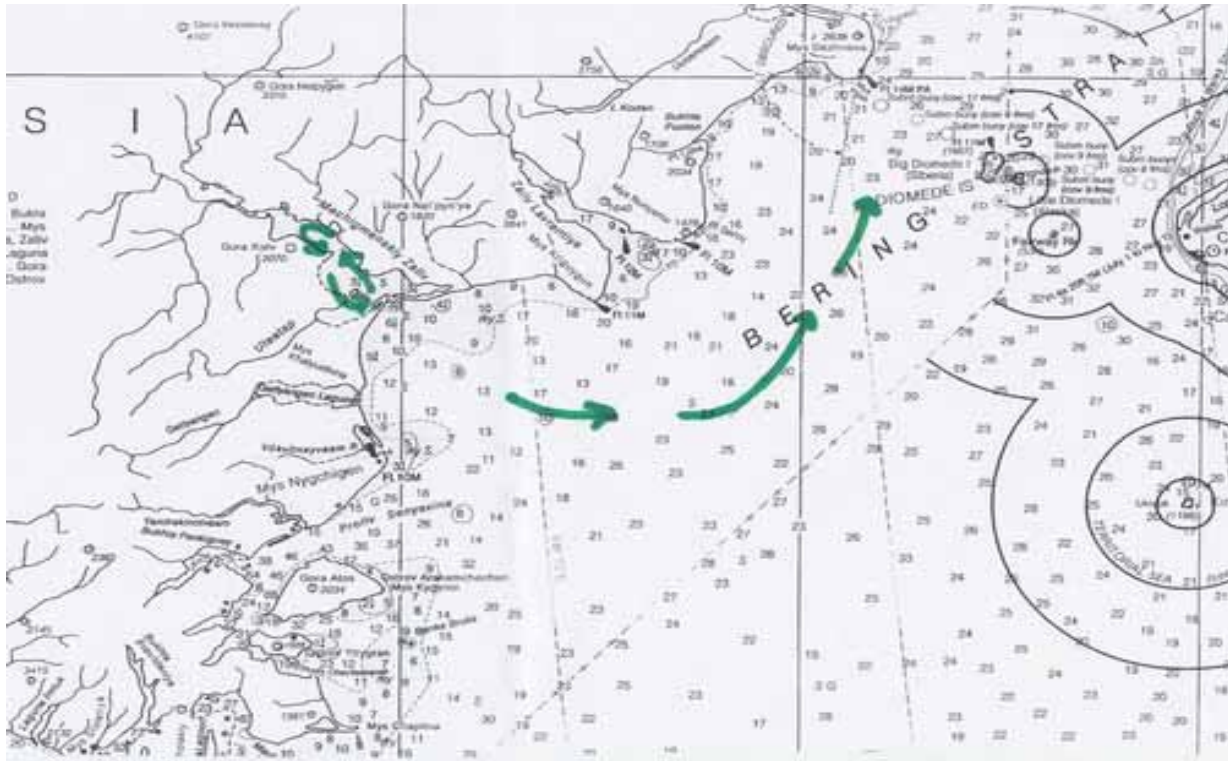


Fig. 5. Location of currents in the vicinity of the village of Lorino.

Yakov Etton (Lorino): *There is a constant current flowing north-east. In Mechigmentsky Bay, the current turns around. The current flows from the lagoon and off the shore. The direction of the flow changes approximately in 6 hours.*

Evgeny Einycheivun (Lavrentia): *There is a current flowing from Cape Yandagay towards Cape Nunyamo. After that it goes straight to Cape Dezhnev and on to the Chukchi Sea. Walrus use it every spring. It hits Cape Enma near Nunyamo so that part of it flows to Lavrentia Bay, makes a circle there and flows back towards Yandagay.*

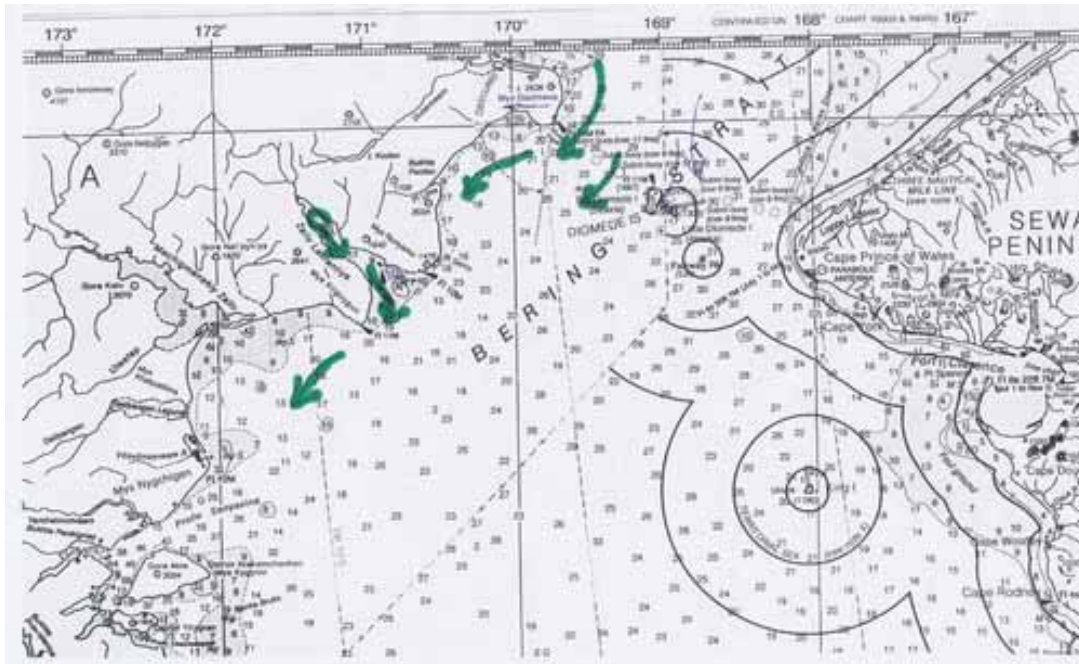


Fig. 6. Location of currents in the vicinity of the village of Lavrentia.

Oleg Dobriev (Lavrentia): *I know currents. There is one going from Nunyamo to Pinnacul. It has always been like that as far as I can remember. Currents affect marine mammal harvest, especially when you are chasing whales. You need to factor them in. There is a strong current in Alaska between the islands of Diomede and Ratmanov that interferes with hunting. Currents also affect the weather. If the wind blows from the east, it brings high water. But of course it depends on the season.*

German Gheukay (Lavrentia): *We have different currents. I don't know their names, but we know their directions and their behavior. There is a current that goes from Cape Yandagay towards Cape Nunyamo. It flows into the Chukchi Sea. Walruses use this current for travel, so we know it very well, because it is important. There are different currents in Lavrentia Bay. Tides affect life in the village. We always know when the tide will be high or low.*

Lorino and Lavrentia villagers describe currents flowing both north and south from the Bering Strait. They all mention a circular current in Lavrentia Bay and Mechigmentsky Bay. The circular current is well known, because people have to deal with it more often going out to sea or just travelling. It is better studied and is known even to people who do not have extensive hunting experience since it can be observed directly from the village (Fig. 7).

Local currents acquired particular importance in the years of economic crisis in Chukotka when, due to the lack of fuel (gasoline), the knowledge of currents allowed people to save gas when hunting or fishing.



Fig. 7. Lavrentia Bay.

Inchoun villagers described two currents in their area: one coming from the Pacific Ocean and one from the Arctic Ocean.

Arthur Nutevekiet (Inchoun): *Our currents change depending on which ocean influences them - Pacific or Arctic. The currents change depending on the season and phase of the moon. A big moon brings good weather; when it changes, the current changes too. The moon influences the ocean.*

Sergey Pucheneut (Inchoun): *There are currents flowing from the Arctic Ocean and ones from the Pacific. That's how it always was. We orient ourselves by currents depending on the season.*

The trans-boundary position of the village affects Native knowledge about currents. Marine mammal hunters all speak of changes in the currents timed to phases of the moon, which influences the ocean. People from Neshkan know and recognize only one oceanic current flowing east and which is easily discernible by driftwood from the Kolyma basin that can be seen in the current. The villagers also speak of local (lagoon and river) currents playing an important role in local travel and economy. But on the whole, Neshkan villagers are much less interested in currents and their use than people from the Bering Strait villages we worked with.

Eduard Zdor (Neshkan): *There are two currents that I know of. I know one of them from my own observations. My father-in-law told about the other one. I know a coastal current that flows past our village of Neshkan from west to east. In general, we have weak currents along the shore. I have never used them.*

Nikolai Ettyne (Neshkan): *The main current here flows along the shore from the north-east. We know it because it brings driftwood from Kolyma. We also have lagoons currents. Those have not changed during my lifetime.*

2.2. Changes in current locations and other observable natural changes

Only 58% of interviewees (equally distributed among the villages) spoke about natural changes. The following are some of the more detailed answers.

Anatoly Napayuk (Lorino): *There have been natural changes. In the past, the sea had more ice cover. The ice edge would form, and then the sea would freeze again. But now all ice gets carried off all the time. In Mechigmentsky Bay the sea stays open until spring, which means it may remain open throughout the winter. In the past we went out on ice to fish for Arctic cod. Now we have no ice and no Arctic cod fishing as the sea is open. Hunting too gets worse from year to year. It is probably linked to the warming as well. There are fewer fish, they don't like warm water. So we do not store enough fish. We don't have enough Arctic char, or pink salmon. In the past we would have stored 2-3 barrels (100 kg) of fish by the end of August. This year we hardly have anything. The sea loses its ice early [in the season] and that results in fewer seabirds as well.*

Vladimir Piny (Lorino): *There have been changes in currents: the Lorinka riverbed has changed. Before it went straight into the sea, but now it has moved off to one side by a whole kilometer. The current goes along the shore – it is very visible at high tide. In one place a spit was washed off, in another - a new spit has formed. This stuff affects our life and our work. I mean, this current's location has changed. Its speed is also changing, you can tell by the ice. The ice took just two days to drift down here from Lavrentia without any wind. That was a strong current.*

Gennady Inankuyaz (Lorino): *Now the climate is changing – ice-edge has formed yet. And it's already October. We get one only after the New Year. While the sea is open, ringed seals and bearded seals have nowhere to hide. It's bad for them and bad for our hunting. In spring, the ice moves north from the south. Animals used to move north with it, but this no longer happens. In the past we had traveler-seals. They were small and we harvested a lot of them, but now we seldom see them. There are fewer walruses in the fall. The wind has changed, and with it the tides are changing, so – no walruses. Polar bears too travel north with the ice carried by the current. In the past we had several occasions when many bears came to us with the ice that drifted with the current. Whales come when the sea is clear of ice. Now they come in mid or late May and many stay here. We have always had a lot of them. You encounter them where the current turns around. We have fewer belugas, perhaps, because we have fewer Arctic cod, and that is because we have less ice. We do have fish, but we have more of it when the current brings ice from the north. That does not happen every year, but when it does, a lot of fish come with it, like Arctic char, for instance. We had few pinks this year. Three years ago we had a lot of them – that's probably why this year we have so few. Not many chums either – mostly Arctic char. We catch a lot of **navaga** in Mechigmentsky Bay. Arctic cod does not come any more, and we used to feed it to our dogs. Now we don't have enough.*

Alexey Ottoy (Lorino): *The weather is changing. The seasons have shifted by about a month. It snows on the 1st of October instead of the 1st of September 1. The ice edge may not form until the New Year, and that affects our villagers' food supply. The currents have also changed. In the past they flowed south to north, but now they change more often. The climate has changed too*

compared to 10-15 years ago. In the past, we had the ice-edge hold for a long time, so we could travel out to sea on dogsleds. Now we don't do that because the sea breaks the ice edge off. For the third year in a row it has happened! This has affected polar bear migration. They no longer pass through our bay, nor do walruses. Last year we had waited for them for a long time, but this year they seem to be here already. Migration seems to be going on as usual, but there are some changes.

Vladimir Einycheivun (Lavrentia): *We have an intensive ice melt now. Ravines are forming everything gets eroded. The shoreline is changing in Nunyamo - the channel is moving. The same thing happens in Pouten. We see fewer walruses. They go straight north without coming here. The same is true of bearded seals. They also follow the current. There appeared a lot of chum and sockeye salmon too. But the Arctic cod are dying en mass because of high tides and warmer climate.*

Evgeny Einycheivun (Lavrentia): *The ice keeps breaking off - you can see it. That did not happen before. In the past we used to have a lot of shore-fast ice and large hummocks in Lavrentia Bay. Now we no longer have them. The same is true of Enurmino – the sea brings in crushed ice instead of ice floes. We have to ride on crushed ice all winter long. Or sometimes we get flat ice, but it is dead – no animals on it, nothing. I don't know where it comes from, but the animals don't like it.*

The climate is changing: there is no snow, only wind, so we cannot travel. The tundra is bare, and the sea is open. I went to Pouten once when sea ice drifted there in July which had a lot of dead Arctic cod frozen in it. It must have suffocated there. We also started encountering sea lions. They hang around the walrus haulout, they don't go any farther.



Fig. 8. Changes in the shoreline near the village of Lorino.

German Gheukay (Lavrentia): *I don't see any change in the currents, but the shoreline has changed and we have less permafrost now. In the past we used to fish and hunt on the shore-fast ice quite successfully. Now the shore-fast ice may take a long time to form. We hunt bearded seals and ringed seals in open water, but you cannot harvest many this way. We need to stock up on walruses. And they come with the ice.*

Sergey Pucheneut (Inchoun): *The climate is definitely changing. Warm currents come more often. Sharks have appeared in our waters, small sharks though. It is harder to hunt now. The ice moves farther away from the shore and the walruses go with it. In the past we had walruses lying on the ice for a long time and our hunting season was longer.*

Nicolay Etyne (Neshkan): *The ice comes late and goes away early. In the past we could have ice show up in August. Sometimes we had steamboats stuck in it near our village. Now the ice shows up in November. My brother went hunting with his friends on November 16. Still there was no ice. And then, suddenly, a northern wind kicked up, and their boat capsized. Compared to 1890 all seasonal events have shifted by about a month.*

Climatic changes are reported by 67% of interviewees in Lavrentia, 65% of Lorino interviewees, 50% of interviewees from Inchoun and 50% of those in Neshkan. If we compare these testimonies with the general information received from the same interviewees, we shall see that climatic changes were reported by people who are generally more knowledgeable about currents and nature, and generally more observant. The participants who were not very informative in general, did not report any climatic changes. All of the interviewees reported the warming of the climate in their regions, which manifests itself through shoreline changes caused by melting permafrost, as well as changes in the ice situation with packed ocean ice being replaced with crushed ice or no ice at all. Two interviewees (Alexei Ottoy of Lorino and Nicolay Etyne of Neshkan) noted a shift in the timing of the first snowfall by one month, i.e. from September 1 to October 1. Interestingly enough, specialists at the Anadyr Hydro-meteorological Center also speak of a similar shift in weather conditions, which testifies, firstly, to the widespread character of the changes in the Chukotsky Autonomous Region, and secondly, to the accuracy of local people's observations and potential usefulness of such interviews.

Natural changes have a direct effect on marine inhabitants. Interviewees spoke of changes in the timing of walrus migration, and their decreasing numbers (both corroborated by scientific haulout monitoring results). Researchers from the CukotINRO Marine Mammal Laboratory observing coastal haulouts have reported a decrease in walrus abundance by one half compared to the 1980s and a northward shift in walrus feeding areas.

According to a hypothesis proposed by Anatoly Kochnev (Marine Mammal Laboratory 2011 Report) who summarized and analyzed observations data for 30 years (both his own and from literature) the changes are largely due to the general warming of the Arctic observed in the last decades. The warming causes delays in ice formation and the resulting absence of ice during the summer-fall period, as well as powerful storms. These factors, in their turn, lead to the observed decreasing population abundance in conditions of a fairly stable local harvest of walruses in the last decade. A noticeably lower harvest (and only in the northern part of the habitat) was recorded only in 2008 following high mortality records in 2007.

Local people note that cold-loving species must be experiencing a lot of stress having to change migration timing and routes. That is particularly true of walruses and seals that prefer travelling by riding ice-floes or currents. Active predators, such as killer whales, are less affected by climatic changes. Hunters noted recent observations of Steller sea lions, which prefer warmer waters and are not typical for these latitudes.

The changes observed affect other aquatic organisms as well. More frequent storms wash up more mollusks and seaweed grows faster in warmer water. Interviewees (37.5%) also described periodic mass deaths of Arctic cod – a cold water fish of the Bering and Chukchi seas. This has not happened before. Local people used to harvest Arctic cod by ice fishing, which has now become unavailable due to the absence of ice. Salmon species (chum and sockeye), however, are spreading to northern areas and becoming a common summer catch. This information is also supported by scientific data. In the past such salmon species as chum were found only as far north as the Bering Strait in Chukotka. Now they are increasingly spotted in rivers of the Chukchi and East-Siberian Seas and even in rivers and streams of the Kolyma basin.



Fig. 9. An autumn storm in the Inchoun area

2.3. The use of currents before the appearance of motorboats and at present

Data analysis has shown that 92% of interviewees testify to the active use of currents by Native people in their everyday life, marine mammal hunting and in ice and sea travels. Hunters speak of a close connection between the currents, sea ice cover and marine mammals. The knowledge of this connection and its characteristics makes up the foundation of a marine mammal hunter's existence. While harvesting marine mammals hunters may use currents directly, for example to save fuel when transporting harvested animals or hunting whales.

Evgeny Einycheivun (Lavrentia): *We have always used currents when harvesting marine mammals. Old people would go from Nunyamo towards Yandagay. They would go out to sea, search for walrus on ice, kill them, and while they butchered them, they would drift with the current back to the village. Now they no longer use this trick – there are few walrus, and we have motors. Grey whales behave differently; you cannot get them that way. They flee from hunters in all directions and hide. But bowhead whales move along the ice edge, so hunters would attack one down-current, but they had to really know their trade.*

I don't know anything about the use of currents for other resources. Even our elders were already using technology and never mentioned using currents.

Eduard Ryphyrghin (Lorino): *Stronger currents in the spring affect the use of fuel, so we select places where the current is weaker. When hunting we approach animals downwind so they would not catch our scent. So we use the wind, but not currents. In the past we probably did use currents. When whales were plentiful hunters simply approached them and harpooned them. We use the current about 20 kilometers away from Lorino. There is a hunting camp called Acconee there. We wait there for the ice to drift from Lorino. When we know the ice is moving, we go hunting. This way we save fuel. In winter we use open sea areas there for hunting. The current brings ice that affects the weather. Animals come to the ice and we go hunting while they are still there.*

Currents were also used indirectly through their interaction with sea ice. The knowledge of this interaction was very important for the hunter since broken ice could potentially cost the hunter his life. Hunters were often carried off to sea with broken ice. But if a hunter knew how local currents flowed, he could get back to safety.

Currents played an especially important role in the harvest of walrus and other pinnipeds associated with ice cover. Hunters who knew the direction of the current could estimate the direction and speed of ice movements (or the speed of the current could be estimated from the speed of the movement of ice). All this knowledge helped the hunters to be more successful in their harvest and enhanced their safety.

Andrei Ettuvye (Lorino): *I remember, in the past we had a hunting camp in Acconee. We waited for the walrus there and harvested them when they arrived with the ice. Naturally we knew the currents. I don't remember well, but the elders always looked to the currents and used them. They also watched the wind. We have a current that flows north, and animals move with it. We have always known that, and we used the knowledge when hunting. We could tell the speed of the current by the drifting of the ice, because we knew the distance between villages and we had bases everywhere so we could exchange data over the radio.*

Before the use of motors, people probably knew more about currents. They always checked the weather and they relied on the wind and currents to travel from place to place. Now they may not check the weather at all, if only to see if a storm was coming. Even then they may not consult the weather, especially if they are young people. Last year a boat capsized and two people drowned because they went out in a storm, did not check the weather and trusted their motor.

Nicolay Ettitegin (Lavrentia): *We used currents during marine mammal harvest to determine whether it was safe to walk on ice, or to tow harvested animals without the risk of being carried off by the sea. The current may carry you off if you disregard it, especially in the old days when we had no motors. When we sailed we headed half way into the current to make up for the drift. I don't know [whether currents were used] for harvesting other resources. They were not used for travel, only for hunting... and also for weather forecasting. If a current flows that way – the weather will change. If a current flows south, then it will blow from the north, so the weather will change. We watch the current, the wind and the mountains – all together they give us the weather forecast.*

Vladimir Peeny (Lorino): *We use currents when we hunt marine mammals, especially in winter. We hunt bearded seals and ringed seals on the ice edge. When the current pushes ice against the shore, it is safe to go hunting. So we hunt when the tide comes in and squeezes the ice to the shore. In the past when we had no motor boats I did not hunt, but now we have motors. But we do participate in the regatta and then we row our boats and use the currents and the wind. When the current is good, rowing is easy. We try to go nearer to the shore so as to keep the baidara steady. It's largely intuitive, and the elders taught us to do that. We do not enter corrections into satellite navigators; we trust our helmsman's experience, because he feels the wind and the current better than any of us. I also check the current when I set my nets to make sure it would not get clogged with debris. If the current is strong, I don't set the net so it would not drift away or catch debris. We do not use the currents for travelling as much as we used to, but we still use them. We usually watch the wind and we go along the current where the waves are smaller. That is, if we are heading for Uelen.*



Fig.10. Hunters on the ice edge.

Gennady Inankuyaz (Lorino): *Now that we have motors, currents don't play as big a role, but in the past people always watched them if they wanted to get to their destination and not be carried off somewhere else. The current turns around in the Bay, and people always took that into account. In the past when people did not have motors, they counted on the wind to set the sails, or they caught the current and traveled with it.*

At the same time marine mammal hunters do not mention the importance of knowledge of currents for harvesting other marine resources, which we consider natural, since the hunters accumulate only the knowledge they need for subsistence. They all mention the importance of ocean currents for marine mammals associated with ice (ice-dependent pinnipeds), and say that whales, especially such active predators as killer whales, do not depend on it as much. Hunters say that walrus prefer to travel with the current to save strength. Some mention the role currents play in the transfer of nutrients (e.g. plankton) and other organisms that constitute the food base for cetaceans.

All of the interviewees (100%) who spoke of the role of currents in a hunter's life reported the decrease of their importance since the appearance of motor boats, especially when applied to the use of currents for travel. If in the past travelers had to look for currents to ease their transit but today, if they have enough fuel, they do not pay as much attention to currents. The same is true for hunting. Government subsidies to marine mammal hunters' communities allow them to use a lot of fuel. But during the 1990s crisis, when fuel was in short supply, people fell back on their traditional knowledge which allowed them to save fuel (many of our interviewees talked about the importance of that knowledge). This is what **Evgeny Siv-Siv of Inchoun** said: *In the past they used currents for travel when they hunted on ice. People knew where the ice would go and used that knowledge. If they found themselves in an unfamiliar place, they would take a piece of line with some weight and dropped through a hole in the ice to see which way the current went. But usually they already knew about local conditions. Naturally they used currents when hunting marine mammals, because it is really hard to tow a whale without a motorboat. Therefore they tried to catch a current and drift with it. People had always known the timing of high and low tides when they would gather seaweed and other sea creatures. But here people were mostly hunters, especially in the 90s when Chukotka was badly hit with hunger. We had no fuel, therefore the knowledge of natural conditions and currents was particularly important for getting food.*

Now that we have motors, it is not as important; our young people often put their trust in motors and GPSs, but we teach them anyway. And even though we do use technology, we know how to find our way without it.

The following are interviewees' answers to questions about currents and their role in rural life before and after the appearance of motorboats.

Evgeny Einycheivun (Lavrentia): *In the past people certainly used currents for travel. They always left the village down-current, and they always knew where the current would take them. Now there may be no ice all winter long, so motors are our only hope. In spring all [animals] move north from here, but they come back in winter. They all travel down-current, and killer whales follow them. We watch and we also hunt on migration routes. Killer whales swim against the current to hunt.*

Vladimir Einycheivun (Lavrentia): *We always look for a current to catch when we travel by boat. The current turns around between capes, so you hug the shore there to avoid tidal current. We once saw people in baidaras. They looked like they were sitting in one place as if at anchor – that’s how strong the current was. That is in the vicinity of Naukan. We also used the current when we lived in Nunyamo. We hunted walruses and bearded seals at sea and the current washed them up on the shore, so we were not afraid to lose them. That’s how currents were used for marine mammal harvest.*

Now that we have motorboats we hardly ever use the current when hunting. We used to rely on it a lot for travelling; now do it less, but we still use it to save time and fuel.

Oleg Dobriev (Lavrentia): *Currents affect the harvest. You need to take them into account especially when chasing whales. There is a very strong current between the islands of Ratmanov and Diomedes in Alaska, which makes it harder to hunt there. Currents affect the weather. If the wind blows from the east, the water level rises. Of course that also depends on the season. With [the appearance of] motors the role of currents decreased. In the past when we used sails and rowboats, currents were very important. You can tell where the current goes when you get to the middle of the Lavrentia Bay and you see waves from all directions. You can tell by the white caps. The current is important because it brings drifting ice. That is good, because animals also come with ice, walruses for instance. But it can also be bad, because when the sea is totally ice-locked you cannot use boats.*

We hardly ever use currents for travelling these days - we have motors and gas. In the past [people] used to rely on currents more, but that was before my time, the elders told me. My father passed his knowledge to me. He was a well-known marine mammal hunter and he knew the currents and various weather signs. Lately we have had a lot of powerful storms and the ice has not been forming for a long time, or keeping on for a long time. The animals (like walrus) are tied to ice. They get weak without it. They have to haulout on shore in great numbers. Polar bears are also linked to the ice. They suffer without it.

Arthur Nutevekiet (Inchoun): *Currents affect marine mammal harvest. When seals hang around breathing holes, we catch them with nets. When the tide comes, the ice rises and drifts away, so we hunt seals on the ice edge and in the water. That means we use different hunting techniques.*

It [the current] also influences travel. If you sail up-current the journey will take you more than 12 hours, but down-current you can be there in 3 hours. In the old days people knew where the current went, so they could survive if they were carried off into the sea; they knew whether the current would bring them back to shore or not. This was no joke – they knew how to use the currents. Villages were intentionally built on capes so that people could observe currents and marine mammal migration. Currents have a big effect on animals, and people knew it, because all of their life was linked to the sea. They could also learn about weather changes by looking at mountain tops. If the tops get covered with snow – the summer is over.

Currents wash up marine inhabitants. They also affect fish. If the tide is coming in, it makes no sense to go fishing – there will be no fish. So people used to watch the shoreline and the waves to determine phases of local currents, and they knew when to go fishing.

Even after the advent of motor boats people continued to use currents, because it's harder to sail [up-current] and it burns more fuel. The fog may come in – you must not forget that. The sea may wash up some sea weed, or Arctic cod may show up.

We hunt bearded seals in spring, but one needs to know where to hunt them. They can be seen better in the water where the water is clear. It's easier to hunt then there. Walruses too, they haul out on land in the fall. They know places where currents bring them food.

People used currents for navigation. June is the best month for hunting and travelling. If you see a cloud on the mountain top, the weather will become windy in one hour, so you need to hide. These omens never lie.

Interviewees highlight the importance of knowledge about currents even today, since this knowledge allows one to save both fuel and one's own energy, as well as helps in successful hunting and safe travelling. Young hunters often put their faith in modern navigation devices rather than in traditional knowledge, and that may lead to accidents.

Oleg Dobriev (Lavrentia): *Knowledge of currents is still important today if only for saving fuel. I use this knowledge and I tell young people to do it. For navigation as well... Many young people today buy GPS navigators. But they run on batteries. What if they run down and you don't have any knowledge of local conditions? One has to have that knowledge to survive.* Some interviewees spoke of the importance of tidal currents for weather forecasting:

Vladimir Einycheivun (Lavrentia): *This is how we use them for forecasting the weather: if the tide comes in, expect a northerly wind. At low tide the weather will either hold, or there will be wind from the south.*

Evgeny Einycheivun (Lavrentia): *[Currents] were used in weather forecasting. People knew if the tide is coming in, the weather will turn bad.*

But more often than not people used other natural phenomena, usually atmospheric (wind, clouds, etc.) to forecast weather. Other scientists also noticed the role those phenomena played in the life of native population (Golobtseva, 2008).

The role of currents in hunting and travel has somewhat diminished at present, but not enough to say that their knowledge is no longer important for the native people. Rather the use of currents has changed. If in the past they were instrumental for hunting, today when people have motor boats, the knowledge of currents is used to speed up travel or save fuel when hunting. With increasing speed of motor boat sea travel the issue of safety comes to the foreground. Experienced hunters always factor currents into their travels irrespective of the use of motors.



Fig.11. Cloud cover over a cape near the village of Lavrentia

2.4. The effect of currents on sea ice.

Seventy seven per cent of all interviewees (20 people) know how currents affect sea ice and actively use that knowledge today, or used it when they were younger. They confirm close links between currents, ice conditions and the subsistence lifestyle of the native people, emphasizing the importance of that knowledge for successful and safe harvest. Here is how Lorino villagers describe it.

Edward Ryphyrgin (Lorino): *Currents bring ice, and that affects the weather. Animals come to the ice and we hunt them while they are there. Fifteen years ago my friend Evgeny Ankarno and I went on our dogsleds to hunt bearded seals. We got to the ice edge. There was new ice there which was held in place by the current. We lowered the rope in the lead to see which way the current was going, and saw that the current would not break off the ice for a while. So we went hunting and killed three bearded seals, and the ice held. That allowed us to travel and hunt on new ice.*

Anatoly Napayuk (Lorino): *Currents have always played an important role in the life of local people, because currents regulate the opening and closing of the sea. When they bring drifting ice with walrus on it, people have meat. If there were no currents – there would be no meat. In winter, if the sea is covered with ice, there is no hunting, but if the current breaks off pieces of ice and forms an ice edge, animals will come and people will survive.*



Fig.12. Hunting walrus on ice

Gennady Inankuyaz (Lorino): *When we go hunting marine mammals, we always rely on the current when looking for the ice and we save fuel this way. We always checked the current before we went. In winter we would make holes in the ice and check what the current was doing. If the water was still, then the ice would remain unbroken, but if there was a strong current – that meant we could go hunting soon.*

Vladimir Piny (Lorino): *We use currents when we hunt, especially in winter. When we hunt ringed seals or bearded seals on the ice edge, we can hunt if the current pushes the ice against the shore. When the tide comes in, then we can hunt.*

The interviews demonstrate that the hunters are well aware of the importance of understanding natural processes for their own safety and success during hunting. Native people used this knowledge when harvesting walruses and seals (ringed and bearded), which was particularly important when other resources were unavailable. Whale hunting, for one, required a lot more fuel. During the economic crisis in Chukotka in the 1990s, the harvest of seals and walruses associated with ice was the main food source not only for the Natives of the Chukotsky Peninsula but in all native villages of Chukotka (Khakhovskaya, 2010). Interviewees highlight the importance of a comprehensive evaluation of the ice situation during hunting, the need to focus only on the hunt and natural signs that help evaluate the situation.

Nicolay Ettitegin (Lavrentia): *The current and the wind tell us when the ice will be pushed against the shore, when it will stop or get hummocky. If the current is pushing the ice onto the shore, you can go hunting. You come up to a crack in the ice, lower a leather strap there, and*

you see which way the current goes. If the strap sinks towards the sea, then this is new ice and you must not go. If the current is towards the shore, then you can go. You can also tell using a fishing line. If the current goes away from the shore, it can break off new ice. You can also tell the weather by looking at the mountains, or animals. If you have walked away from the main shore-fast ice, and there are leads around you, and the weather is still, and there are no hummocks, you need to watch which way ringed seals dive. If they dive away from the shore, you need to leave. They dive against the current, so you need to go. If the animals yawn a lot, bad weather is coming and you need to go back at once. Our elders used to teach us when we were little: "When hunting, think only about the hunt. Always be grateful to nature and take only what you need. Without an ice pick and fishing tackle, you are no hunter, because a hunter always checks the condition of the ice."

Thus, for the Native people knowledge of currents has always been linked to the knowledge of ice and its characteristics. People identified currents by both direct methods (visually with the help of fishing tackle or other means), and indirect ways (by signs) using their knowledge of animal behavior.

2.5. The use of currents by animals

Eighty one per cent of those interviewed are certain that marine animals make use of ocean currents. Having coexisted with marine mammals for a long period of time, aboriginal people understand that the laws of nature that work for them also work for the animals. Animals obviously save their strength riding currents or the ice. People from different villages mention that fact.

Edward Ryphyrgin (Lavrentia): *Animals use currents when drifting with the ice depending on the current direction. Bearded seals, spotted seals, walruses – all use seasonal ice movements for travel.*

Evgeny Siv-Siv (Inchoun): *Animals do use currents, but perhaps, not all animals do. Walruses use currents, because they arrive with the ice drifting on it. We hunt them when they arrive. Bearded seals and ringed seals are not tied to currents as much, because they swim in open water a lot, so we hunt them in the water. Whales and polar bears are not dependent on currents, although ice is important for polar bears – they rest on it. Whales just pass by.*

Vladimir Piny (Lorino): *Currents affect the life of marine mammals. When the water is high, there is a lot of plankton, so whales pass closer to the shore. Grey whales come close to the shore when the tide is higher. Walruses haul out in the vicinity of Haluskin in the fall because of the change in currents. There are fewer walruses now, probably because of changes in the ice situation. Before we could start hunting walruses and we had frosts on September 1. Now we had storms in mid-September, and we still have no walrus. We had many seals when fish shoals arrived – it happened for the first time this year. Killer whales came by as well. It's probably due to changes in the ice situation that we have such variations.*

Alexey Ottoy (Lorino): *Animals use currents. Whales leave when the weather is good and return when it's bad. And bearded seals as well... If a bearded seal surfaces and shakes its head, the weather will be bad.*

When the weather is bad, the sea washes up seaweed. I don't know about fishing, I am not a fisherman. I know it affects birds - they don't fly in bad weather.

Andrei Ettuvye (Lorino): *We have always taken currents and the ice situation into account when harvesting marine resources, walrus for instance. Sometimes we hunt them on the haulout – then we only check the weather, but that is rare. Mostly we have hunted them on ice, and that's when it is very important to know the direction of currents and the wind. If the wind blows from the south, it can easily break off shore-fast ice and carry it off to sea. Therefore, people would wait for the northerly wind, and then go hunting. Once they are out on the ice, people would look, where the hummocks are, where the ice had drifted from and under what kind of conditions. People drift off to sea with ice accidentally every year, but they all come back, because they can figure out which direction the ice will be moving and drift with it.*

Nicolay Aratyrgin (Lorino): *Walrus are closely linked to currents, because when they swim for a long time, they get tired if they don't ride the current. Whales and killer whales have an easier time; they can swim very well against the current when they feed. Killer whales often hunt walrus.*

Vladimir Einycheivun (Lavrentia): *The current affects marine mammals. Walrus go north with the tide in June-July so fast, we cannot catch them. They use currents... bearded seals too, as well as all other marine mammals. They can feel the current, why would they try and go against it? Perhaps only belugas and other predators who hunt actively – they may swim against the current.*

Oleg Dobriev (Lavrentia): *Of course currents affect marine mammals. They swim for long periods of time, so they look for currents to ride and rest. Seals do it, as well as whales.*

Igor Zdor (Lavrentia): *Animals do use currents – that is certain. Fish arrives with the tide, belugas follow it. Walrus and other animals are about 10 kilometers from the village. There is open sea there and no currents. They would lie there on ice and we would hunt them. When there was little ice, walrus rode the current to east. If the sea was stormy, we would travel on lakes, we would not go through because of the storms. This way we could cut down on distances in dangerous conditions. But we could only do that during high tide.*

Many villagers spoke of a close connection between currents and pinnipeds that use them for passive travel (drifting). At the same time whales (especially killer whales) and polar bears are tied to currents indirectly through their food resources. Knowledge of links between animals and currents is expressed through the use of various omens and signs, when animal behavior allows one to make conclusions about the weather, ice situation, etc. (see above). The villagers also mention changes in animal populations tied to the changing ice situation.

Gennady Inankuyaz (Lorino): *In spring the ice moves north from the south and animals used to move with it, but now they no longer do so. Also in the past we had traveler-seals. They were small and we harvested many of them. Now they are almost gone. There are fewer walrus in the fall. The wind is changing, and tides change with it – so there are no walrus. Polar bears also move with the ice drifting on the current north to south. In the past we had several occasions when we had lots of ice brought by the current and many bears came here too. Whales come when the sea begins to clear of ice. Now whales come in mid or late May and many of them stay here. We have always had many of them and we still do. They are where the current turns around. We have fewer beluga whales now, probably because there are fewer Arctic cod, and that happened because there is less ice. We have fish, but there is more of it when the ice arrives from the north. That does not happen every year, but there is a lot of fish coming with it like Arctic char, for example. We have few pink salmon this year, but three years ago we had a lot. Probably, that's why there are few of them now. Chum is not numerous either. We have lots of Arctic char. In Mechigmentsky Bay they catch a lot of navaga. Arctic cod does not come any more. There is no ice edge, so it does not come. We used to feed it to dogs. Now we are running short of dog food.*



Fig.13. Emaciated walrus

Such negative changes in natural conditions reflect on the subsistence lifestyle of the Natives, and are, therefore, quite noticeable to them. Connections between animals and currents and the ice situation have long been used for animal harvest, therefore any changes may affect the success of hunting which is very important for the villagers. Changes in the timing of ice movement, reduction of ice cover, and the warming of the sea lead to changes in abundance of animals forcing the Natives to look for new methods of hunting and survival. In 2011 due to the absence of ice cover near Mys Schmidta, polar bears attacked people on several occasions. The animals were emaciated and aggressive due to the absence of ice to rest on or pinnipeds to hunt.

This example illustrates the importance of studying the effect of currents and other natural phenomena on animals, since it allows foreseeing possible consequences of such influences for the Native people.

2.6. Emergence of knowledge about currents and their use.

Over one half (69%) of all interviewees reported that they had received the knowledge about currents from their elders including (but not necessarily) their relatives. Most interviewees named their fathers as the main source of knowledge about currents. The following are reports from representatives of four villages:

German Gheukay (Lavrentia): *I learned about currents from my father, to whom I am grateful for that. Now I try to pass this knowledge down to others, but my sons have gone to the city [Anadyr] and don't want to come back.*

Alexey Ottoy (Lorino): *I don't know local names – I would need to ask my father. I have hunted since childhood. My grandfather first told me about currents. Then I observed them together with my father. Now people watch TV or listen to the radio, but before, elders would get together and discuss things, tell stories or legends. I felt sleepy, but they kept on talking late into the night, and they did not drink.*

Evgeny Siv-Siv (Inchoun): *The elders told me about currents, and also showed them to me from the boat. I learned more by example. I have been on the water since childhood and I learned everything from observation.*

Nicolay Ettayne (Neshkan): *The elders told us about currents and other natural signs. They told us everything... they understood a lot about the sea and the weather.*

Andrei Ettuvye (Lorino): *My father and the elders told me about the currents. They did not tell me much during hunting, but I still learned, perhaps by example. What you need to do and how to do it right... I watched my elders and tried to do the same thing.*

Nicolay Aratyrgin (Lorino): *My father told me how to hunt correctly, how to fish, where and when to set my nets... He did not teach me about currents specifically, but when you are hunting, you cannot help learning everything the elders do, and you remember it.*

Interestingly, many interviewees speak of the absence of any special training regarding currents or their use saying that they acquired the knowledge during hunting, boat travel, etc., i.e. while living a subsistence lifestyle. Obviously, information received in such manner is best retained to be applied in similar circumstance. This method of information transfer is generally typical for the Native people and remains the main avenue for passing down traditional knowledge since there are no special schools or special disciplines in general schools to that effect. The subsistence lifestyle of native people is often fraught with risk to one's life, which runs counter to contemporary social and educational child rearing standards. Here is how **Nicolay Ettitegin of Lavrentia** describes his experience in this area: *“Of course I have always*

known about currents and used them when hunting, especially on ice. This knowledge is passed down from generation to generation. You cannot be a hunter without it. You will go out to sea and perish there when ice gets broken off and carried away by the sea. This knowledge must be transferred. I always teach young people when we hunt. I show them the currents and all. You need to teach hunters since childhood, because it is harder to learn these skills for an adult. Things are worse now, because the knowledge does not get transferred and that affects hunting skills. If we forget them like we did with the language, we will all die out. This is our traditional knowledge, and we must pass it on.

I want to say that we need to teach the young, those who want to learn, and those who are interested. You can see them. There are young people who are interested and that is good. I was a teacher in a school where we taught little ones right on the beach. But now we need to ask their parents because it is dangerous. There are many problems and people don't have enough responsibility. We use knives or harpoons – they are dangerous. So many people are not ready to send their children to a school like that.”

We can also note that acquisition of knowledge about currents was inalienably linked to the knowledge of natural phenomena, signs, omens or stories. This unique aspect of Native perception is reflected in the interviews when people appear unable to draw the line between one type of knowledge and another. For them, all are parts their traditional way of life, their everyday existence and survival.

Vladimir Einycheivun (Lavrentia): *Father would tell me about currents, but I no longer remember. If the sunrise is read, it will be windy. We forecast the weather by looking at capes and mountains. If there is fog, the weather will be bad. I do not speak Chukchi, I can only understand it a little. We had Chukchi warrior-men before who even went to Alaska to wage war. And they harvested whales that weighed 60 tons.*

Arthur Nutevekhet (Inchoun): *We learned about currents when we were still children. Hunters always tried to take children hunting with them...not very young children, but those who could learn. They never taught them specially, but as they hunted, they pointed out natural signs and explained how to use them in their work.*



Fig.14. Lorino youths with a baidara

Eduard Zdor (Neshkan): *I remember this about currents: we were fishing in the summer, and I saw an ice floe in late July with a polar bear on it. It was moving towards us. I have remembered it all my life.*

In winter the ice was usually stationary. There is also an island there that holds back the ice so it does not break off. In other words, we have special conditions, in which the influence of currents on the ice is not pronounced.

Walrus are tied to ice, they rest on it. Since the current affects the ice it affects walrus indirectly.

Once a year someone among the locals would be carried off into the sea, but that is mostly caused by the wind. We did have one occasion when a grey whale was washed ashore – that was clearly the current’s doing.

They always said that the sea fed us and we needed to respect it, since it’s a powerful force and one must understand it and know what to do. You must watch it and notice all changes, especially the wind.

It is obvious that some aspects of traditional knowledge are being lost due to the ever decreasing number of young people involved in traditional subsistence. As evidenced by previous chapters, young people increasingly prefer using contemporary navigation instruments, which partially replace their knowledge of surrounding nature. Such replacements are fraught with the danger of losing the knowledge, so that the youth of today will not have anything to pass on to their own children when that time comes. Even hunters aged 50 and older report that they know less than their fathers and grandfathers did. That is true not only of traditional knowledge of nature, but of their language as well. Additionally, the Soviet government’s policy of eradicating shamanism, expressed in the physical extermination of shamans and a ban on transfer or use of their knowledge, removed the last “professional” keepers of traditional knowledge about nature. The current involvement of Natives in general social development has many positive results, but also a few negative ones. The involvement of most responsible adults in managing their communities, and providing them with food, technology, etc., reduces their chances to pass on their traditional knowledge, including knowledge of the use of currents.

2.7. Words, phrases and stories about currents

Only 31% of the interviewees were able to report on this issue. In most cases villagers had a difficulty answering it, saying that they did not remember anything, or did not speak their native language. We follow with some of the responses.

Eduard Ryphyrgin (Lavrentia): *The Chukchi name for current is **Tliaurghyn** – the current going north, we estimate its speed by comparing it to the speed of the boat, and we estimate the speed of movement. The speed of the ice down-current movement is about 5-6 km/hour.*

Yakov Etton (Lavrentia): *The Chukchi word for this current is **Tliaurghyn**. We go where this current is strong, where it creates an ice-edge. That's where we hunt.*

Nicolay Aratyrghin (Lorino): *Father told me how to hunt properly, how to fish, where and when to set my nets. He did not talk about currents specifically, but when we were hunting, I could not help learning what my elders did and that's how I remembered. I don't know the currents' names. There is Gulfstream, but that's not here. These days I receive a lot of information through internet.*

Nicolay Ettitegin (Lavrentia): *Pyssyssy is the Chukchi for Current.*

Vladimir Einycheivun (Lavrentia): *I cannot remember anything in Chukchi. There is the word **Passyssy**. It means current. High tide is **Ammat**, **Emytvyn** means receding waters. **Tliaurghyn** – breaking off of the ice edge, or the road made by the current.*

Once, a grey whale pulled a whaleboat away not far from Yandagay. That was in the summer. They found both the boat and the whale near Cape Dezhnev. It must have drifted there with the current. There are many stories of currents carrying boats off.

I always identify where the current goes to try and ride it when I travel by boat. The currents turn back between capes, so you keep the boat really close to the cape not to hit the tidal current. That's near Naukan. At Nunyamo we also used currents. We killed walrus and bearded seals in the water and the current washed them up on the shore. We were not concerned about losing the harvested animals. That's how currents were used for marine mammal harvest.

Evgeny Einycheivun (Lavrentia): ***Tliaurghyn** is the current that I described. Now the ice gets broken off all the time - we can see it. It did not use to be like that. We used to have a wide strip of shore-fast ice and hummocks in Lavrentia Bay, but not anymore. The same in Enurmino – all they get is crushed ice, no real ice. We ride over crushed ice all winter long. Or we get flat ice and no animals on it. It is dead. I don't know where it drifted from. Animals do not like such ice. I don't know much, the elders used to know things. Now you get on line and you learn everything.*

Evgeny Siv-Siv (Inchoun): *There is the name of the current that flows north – **Tliaurghyn**. I don't know any other names. We do not use our native tongue a lot these days. Young people know little of it. We were told about the ocean that we needed to respect it because it fed us. We had always known that we could get food from it, one only needed to know how and where to hunt or wait for a storm to wash things up on the shore.*

As can be seen from the quotes above, we have managed to identify four Chukchi names describing currents: *Passyssy* (or *Pyssyssy*) meaning current, *Ammat* – rising tide, *Emmytvyn* – ebbing tide, and *Tliaurghyn*. The latter term is somewhat ambiguous. It identifies either the north flowing current or the current that creates a pathway in ice (the ice-edge). Most probably, the word *Passyssy* denotes a current in general, while *Tliaurghyn* identifies a specific current or phenomenon when the ice breaks off from the edge and drifts northwards. Interestingly, most of the interviewees (4 people) remember this name, while only two of the

interviewees recalled the more general term of *Passyssy*. It's known that concrete words applicable to specific circumstances are in greater demand than abstract notions. Therefore the general term for current had less use than the specific term *Tliaurghyn* that people looked for when hunting marine mammals on the ice edge.

An Eskimo woman from Lavrentia, Elena Teplilyak, reported the Eskimo name for the current as *Maksak*. She also recalled the word *Namanok*, used to describe the sea when it is "like oil", meaning "still and smooth". This was good weather for going hunting.

Characteristically, it was only people over 35 and, mainly, those over 50 with marine mammal hunting experience that remembered the names of local currents in their native tongue. Young people could not name the currents because of the lack of knowledge of their native language (or they may have only elementary knowledge of it). People of the older generation confess that they are forgetting their language, especially words that they do not use in their everyday lives (Chukotka 1995). Obviously, one would need to consult with people aged 70 or older to get more detailed information about names of local currents, but there are few such people left in the villages, and communication with them is further hampered by their age and cultural barriers.

The following are several stories about the use of currents that were told by local residents.

Eduard Zdor (Neshkan): *I remember this about currents: we were fishing in the summer, and I saw an ice floe in late July with a polar bear on it. It was moving towards us. I have remembered it all my life.*

In winter the ice was usually stationary. There is also an island there that holds back the ice so it does not break off. In other words, we have special conditions, in which the influence of currents on ice is not pronounced.

Walrus are tied to ice, they rest on it. Since the current affects the ice it affects walrus indirectly.

Once a year somebody among the locals would be carried off into the sea, but that is mostly caused by the wind. We did have one occasion when a grey whale was washed ashore – that was clearly the current's doing.

They always said that the sea fed us and we needed to respect it, since it's a powerful force and one must understand it and know what to do. You must watch it and notice all changes, especially the wind.

Nicolay Etyne (Neshkan): *There are many stories of people being carried off. Every year someone gets carried off by the current. Last year it happened to Andrei Etavghe. He was chasing a bear. He killed it, but his sled got smashed. So he took that bear and skimmed it, and then he got to shore with that skin. He knew which way the ice would be drifting and he drifted*

with it for a week until he got to the shore. He did not have a GPS, he simply knew about natural signs and the direction of the current.

I don't remember any phrases describing the currents. I know the language, but I am forgetting it. People around me don't speak it.

We are beginning to encounter sharks and rays in our catches. We did not have that before. They caught a ray in Wankarem. We don't even have Chukchi names for these fishes, because we have never had them here in the past.

Andrei Ettuvye (Lorino): *I do not remember any phrases, but there probably were some. I remember when I was a little kid, we went whale hunting. We killed a grey whale far from the shore when the weather turned bad, and a storm began. We tied the whale to the boat and drifted with it eating muktuk. We cut it off its side, and we drifted for many hours this way. Our motor broke down. And when the storm died down, the team leader figured out our bearings, and we rowed our boat to shore.*

Igor Zdor (Lavrentia): *I do not speak Chukchi. My parents know it poorly, but my grandmother knew it well. I did not have enough time to learn from her. I remember few stories.*

When I was growing up we used many marine resources, and we ate traditional food. We collected weeds after a storm and we fished at high tide. We did not hunt whales then, but we did harvest seals and walruses. Whales could be washed ashore by storms. It happened three times in my memory, and people counted on that too.

Once, a helicopter carrying foodstuffs crashed into the sea not far from our village, and we knew that the next storm was going to wash up its cargo. That's exactly what happened. After storms people would usually look for something that would provide food for dogs – animal carcasses. You can locate them by seagull gatherings. People would also look for things that they could use (bottles or canisters and the like).

As you can see, the stories are mostly about using currents in emergency situations. Naturally, such cases are best remembered and often retold by different people, which helps retain them in memory. Most often people remember stories of someone being carried off by the sea while hunting or travelling. As a rule, the knowledge of currents and their effect on sea ice helps them return home safely. We have not been able to record a single myth or legend. All the stories represented real events, which were common in the hunters' lives and were also very important to them.

Conclusions

The following conclusions can be drawn from the information presented above:

1. Native people are aware of ocean and river currents in their areas, but in most cases have difficulties pointing them out on a map, probably, because of the fact that they learned the information from direct experience. When it comes to practice though, they

can orient themselves very well, and recognize and use local currents (river and lagoon), i.e. the ones that are important for their subsistence lifestyle.

2. Climatic changes including changes in the currents have been mentioned by 67% of the interviewed people in Lavrentia, 65% of Lorino interviewees, 50% of those in Inchoun, and 50% of Neshkan interviewees. The villagers speak about the warming of the sea in their areas, which has an effect on migrations of fish and marine mammals, the ice situation and, in the long run, their lives. They view the changes as negative since they destroy traditional understandings of marine mammal migrations timing and routes, affect the abundance of aquatic resources, and force the people to adapt to new conditions.
3. A majority of interviewees (92%) testify to the importance of currents in the lives of the Native people and their use during marine mammals harvest and ice or sea travels. Hunters point out close links between currents, ice cover and marine mammals – the knowledge of these things and the way they work is instrumental for a Native marine mammal hunter's subsistence. Hunters may use currents during animal harvest both directly (for example, so save energy when transporting harvested animals, or chasing a whale) and indirectly through the currents' effect on the ice situation. The use of motor boats has somewhat diminished the role of currents in hunters' lives, but the knowledge of natural phenomena remains very important for safe and successful hunting. One can speak of a certain shift in accents regarding the use of currents. If before they were essential for hunting or travelling, now they are regarded as a means to save time, effort or fuel.
4. The knowledge of currents has always been linked in the lives of the Natives with the knowledge of the ice situation and its properties. People may identify currents directly (visually, using a fishing line or other devices) or indirectly (by other natural signs) employing their knowledge of animal behavior. Most of interviewees (77%) know how currents affect sea ice and actively use that knowledge at present, or used it in their youth. They aver a close connection between the currents, the ice situation and subsistence, and mention the importance of their knowledge for successful and safe hunting.
5. Eighty one per cent of the interviewees believe marine mammals make use of currents in their lives, and quote examples of such use. Many speak of pinnipeds having a direct link to currents and using them (or the ice) for passive travel (drifting). They say that whales (especially such active predators as killer whales) and polar bears have an indirect association with currents through their prey. The knowledge of such animal-current associations is reflected in many omens and signs, when animal behavior allows people to make conclusions about the weather or the ice situation.
6. Over one half of all interviewees (69%) reported having received the knowledge of currents from their elders including (but not necessarily) their relatives. Most named the father as the main source of knowledge about currents. A partial loss of that

knowledge can be observed among young people, which appears to be part of a general process linked to the loss of the native language among other things.

7. Only 31% of interviewees could remember Native words associated with currents. Most said they could not remember anything on the subject or did not know their native tongue at all. Four Chukchi words describing currents have been identified: *Passyssy* (or *Pyssyssy*) – current, *Ammat* – incoming tide, *Emmytvyn* – ebbing tide and *Tliaurghyn*. The last term is somewhat ambiguous denoting either the current flowing north, or a pathway in ice made by the current, the breaking off of the ice-edge. Most probably, *Passyssy* is a general term for current as a directional flow of water while *Tliaurghyn* is the name for a specific current or event when the ice edge gets torn off and carried northwards. The Eskimo name for the currents is *Muksuk*. There is also a condition, described by the term *Namanok*, when the sea turns oily, meaning “calm and still, and good for hunting”. Stories about currents are mainly recounting real life-threatening events when knowledge of currents saved people’s lives.

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Dennis Litovka, interviewer in Lorino and Lavrentia



Andrei Stepanov, artistic photographer, author of Chukotka landscape photos



Anatoly Kochnev, Manager of ChukotTINRO Marine Mammal Laboratory, animal photographer



Nicolay Ettitegin, born October 3, 1947 in Nunyamo. Retired. Lives in Lavrentia hunting whales, walrus and seals. Worked as reindeer herder and technician as a young man.



Arthur Nuteveket, born in 1969 in Inchoun, where he still lives. Marine mammal hunter.



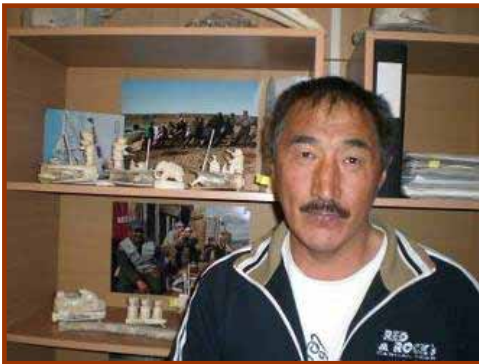
Eduard Ryphyrin. Born August 11, 1963, in Lavrentia. Lives in Lorino where he works as team leader in a marine mammal hunting community.



Gennady Inankuyaz, born November 15, 1958, in the village of Lorino, where he still lives. He is a hunter and chairman of the Chukotka Traditional Marine Mammal Hunters Association.



Vladimir Einycheivun, born January 9, 1960, in the village of Nunyamo. Lives in Lavrentia where he heads the Daurkin community. Comes from a line of marine mammal hunters.



Alexey Ottoy, born in 1960 in the village of Acconee. Lives in Lorion heading a marine mammal hunting community.

The following individuals were interviewed as part of this project. In Inchoun: Arthur Nuteveket, Sergey Pucheneut, Evgeny Siv-Siv; in Lavrentia: Oleg Dobriev, Evgeny Einycheivun, Vladimir Einycheivun, Nicolay Ettitegin, German Gheukay, Igor Zdor; in Lorino: Nicolay Aratyrgin, Yakov Etton, Andrei Ettuvye, Gennady Inankuyaz, Anatoly Napayuk, Alexey Ottoy, Vladimir Piny, Eduard Ryphrghin; and in Neshkan: Nikolai Etyne and Eduard Zdor.

Literature

V.V. Golobtseva, *Wind patterns and traditional knowledge about them in Uelen, Chukotka - Rational land use and environmental safety*. Collection of works of the Chukotka Research Center, Far Eastern Division of the Russian Academy of Sciences, Issue 12, Magadan, 2008.

Report on Socioeconomic Situation of Chukotka Natives; Anadyr, 2012, 14 pages.

Marine Mammal Laboratory Report; Anadyr, 2011, 156 pages.

L.N. Khakhovskaya, *Adaptation of Natives in the Magadan Region in the 20th century// Adaptation of Peoples and Cultures to Natural, Social and Technical Transformations*. Executive Editor: A. P. Derevyanko, A.B. Kudelin, V. A. Tishkov; History and Philology Division of the RAS – M.: Russian Political Encyclopedia, 2010, pp.319-327.

Chukotka: Nature and Economy – Summary. Moscow. Art-Litex Publishers, 1995. 367 pages.

Ocean Currents in the Bering Strait Region of Alaska

(and other marine features)

Numbers on this map correlate to descriptions found in the associated Map Guide. The ocean currents and other marine features on this map were documented in collaboration with local experts from three Alaskan communities.

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