Figure 5-1. A Yupik whaling crew cruises in a skin boat at Pugughileq, Southwest Cape. (Photo by Chester Noongwook, 1998).
This paper discusses the organization and preliminary results of a joint effort in locally based ice and weather documentation, initiated by scholars and Native residents in two Yupik villages on St. Lawrence Island, in the northern Bering Sea. There is a growing interest across the science community in the ways indigenous arctic residents observe and document climate, sea ice, and weather phenomena in their daily life. There is also a mounting pressure on polar researchers to incorporate data and observations from northern residents into scientific models of global warming and arctic environmental change. Such local observations and monitoring practices are gradually gaining recognition as a valuable source of data for studies of arctic climate and ecosystem fluctuations. More efforts are needed, however, to ensure the next transition: from simple recognition to substantive partnerships built on data sharing and resource exchange.

Many efforts to promote such partnership will remain less than effective until the nature of the “other” knowledge, and the ways it is built and transmitted, is properly understood. A productive exchange between the two sets of observations can be feasible only when and if scholars learn more about how northern people watch their environment. Therefore, the collection and thorough examination of local observations, done by Native people themselves, and from their cultural perspective, is crucial for further progress. More and more researchers argue that only by this approach we may learn about the procedures, “matching” techniques, and limitations in efforts to bridge local expertise with the data used in scientific models of arctic climate change (Bielawski, 1996; Fox, 2000; Huntington, 2000a; 2000b; Huntington et al., 2001; McDonald et al., 1997; Riedlinger, 2001).

To test such a transition in a practical way, the U.S. Marine Mammal Commission (MMC) and the Yupik communities of Savoonga and Gambell on St. Lawrence Island, Alaska, agreed to run a pilot project to document local observations of sea ice conditions.
off St. Lawrence Island “the Yupik way.” This was a one-year effort (from fall 2000 to summer 2001) to document local knowledge about arctic weather and sea ice, following Native observations practices and making records in the Yupik language, with subsequent English translation. The project was named Watching Ice and Weather Our Way and it was supported by a small contract from the Marine Mammal Commission.

Although the main task of our joint venture was to create such a bilingual (Yupik-English) record of sea ice and weather monitoring (see earlier reports in Krupnik, 2000a; Krupnik and Huntington, 2001), many more materials have been produced during 2000–2001. These include a bilingual illustrated dictionary of Yupik sea ice terms; transcripts of interviews with St. Lawrence Island elders; historical accounts of former ice conditions off the island; comparative reviews of Native observation records and the data collected via satellite sea ice monitoring, etc. Most of these data are now assembled in an illustrated bilingual project report under preparation (Yupigestun Kellengake, 2002). This paper reviews the history of the project and its major activities. It also offers an anthropologist’s view on the relationships between scientists and Native experts, and between what are commonly called “academic” and “local” science. I believe that the lessons we learned are worth sharing as those relationships continued well beyond the original observation period.

How This Project Originated

The project Watching Ice and Weather Our Way originated as a joint initiative in addressing the issues of arctic climate change and in response to concerns that are now shared widely among polar scientists and arctic residents (cf. Ford, 2001). Both arctic scholars and Native subsistence users have, for years, been documenting changes to the arctic climate and natural environment. The key task of the project was to research the ways these two sets of records can be culturally “translated” and mutually “calibrated,” so that they become comparable sources of information to both constituencies.

The project originated from a recent interdisciplinary workshop, one of many similar initiatives aimed at bridging the scientific and Native perspectives on arctic climate change (see reviews in Huntington, 2000a; 2000b; Krupnik, 2000a). In November 1998, Caleb Pungowiyi, then the Head of the Eskimo Walrus Commission in Nome, wrote a letter to the U.S. Marine Mammal Commission (MMC) in Washington. The MMC, established under the Marine Mammal Protection Act of 1972, acts as an independent source for policy and program guidance to Congress and the Executive Branch on all issues affecting marine mammals. Pungowiyi’s letter pointed out that, despite all the attention being given to climate change studies, few scientists were taking seriously the observations of hunters and elders from Native communities. Pungowiyi, who was himself born in the Yupik village of Savoonga on St. Lawrence Island, argued that such observations clearly indicated significant recent shifts in the characteristics of sea ice, marine mammals, and other aspects of the arctic environment (see Huntington, 2000a:1; Pungowiyi, 2000).
In response to this letter, the commission organized a special workshop on scientific and indigenous observations of change in sea ice and the arctic environment, which took place in Girdwood, Alaska in February 2000. The three-day workshop brought together some fifty scholars and Native experts, including local hunters and environmental specialists from several Alaska communities. The ratio of scientists and indigenous experts was almost 50:50, and it represented a broad spectrum of northern communities, probably the largest ever at so many recent “arctic climate change” meetings. The background conference report (see Huntington, 2000b) included several papers authored by arctic scientists and Native experts, and featured their views on the ongoing shifts in polar sea ice ecosystems as the result of global warming.

During the workshop, Native elders and hunters shared their observations of the sightings of new or unusual wildlife species, of physical changes in the habitat, unusual timing of animal migration, and patterns of animal behavior due to changing ice and weather regimes (see summary in Krupnik, 2000b). In addition, a few focused and more substantial interviews were recorded after daily sessions (Krupnik, 2000b). From those statements, comments, and interviews it became obvious that people in many Alaskan communities clearly saw changes in weather, ice, and marine biota taking place, particularly in recent years.

It also became clear to many participants that bridging local and scientific observations of sea ice and environmental change requires special and diligent efforts. It cannot be achieved via usual round-table discussions that hardly go beyond general summaries, occasional statements by Native participants, or anecdotal “dipping” into Native expertise. Long-term documentation of arctic climate and sea ice change by Native residents themselves should be created that can be shared and analyzed on a comparative basis. The workshop endorsed activities to assist Native people in building such records. It also encouraged the participants to seek projects aimed specifically at documenting the ways Alaska Natives observe and communicate sea ice and weather conditions in terms and language(s) of their own (Huntington, 2000b: 7–8).

Two workshop participants from St. Lawrence Island, Alaska, Conrad Oozeva from Gambell and George Noongwook from Savoonga, agreed to explore the possibility of launching observations of sea ice and weather conditions in their respective communities. It was agreed that such observations should be carried out by local monitors and recorded in the Yupik language. This would follow a more traditional way of ice and weather monitoring and would use all the terms and realities that are important in Yupik subsistence activities and worldview. The Yupik text would then be accompanied by a parallel English translation, so that scientists and other Alaska Natives (particularly, younger students) could use observations from two villages for a broader comparative perspective on changes in the Bering Sea/Western Arctic region.

The MMC agreed to support such a pilot documentation project on St. Lawrence Island, from the arrival of new sea ice in the fall of 2000 until break-up in early summer of 2001. By the summer of 2000, a blueprint was prepared for a much larger
program in sea ice and weather observations in several Alaska Native communities in the Northern Bering Sea region. It was argued that small teams of local observers that included one or two senior hunters and elders, with younger assistants, should be set up to record their observations during the winter season of 2000–2001 or in 2001–2002. Each village team would decide for itself how to record its ice and weather monitoring, based upon local conditions, cultural tradition, and community’s annual subsistence cycle. Preference should be given to recording in Native languages, either Yupik or Iñupiaq (with the subsequent English translation), so that the observers could use all the terms and words important in Native culture. When observations were recorded in English, special efforts would be made to include as many Native terms as possible—terms used by hunters and elders as they monitor the ice and weather in the course of daily subsistence activities.

Thus, the effort was deliberately set up to avoid any preliminary scientific “framing” of Native observation. We never expected people to check their home thermometers and barometers or to produce their village “weather reports.” Too often, efforts to record indigenous ecological knowledge eventually devolve into a process in which Native participants are pressed to follow standard formats for local ice and weather monitoring, to use daily observation sheets prepared by scientists, to draw charts, maps, and other forms typical of scholarly research. In our project, the goal was to create a record that the observers could share easily with their parents or with other village elders. We wanted it to be done in the way that “one used to report ice and weather as a young person in the old days,” in order to document the cultural specifics of Native observation, to the greatest extent possible.

We sought, however, to get a comparable result for each community: a body of written data organized as a village journal made of short daily (or weekly) entries. Such bilingual village ice and weather journals would be illustrated by drawings and sketches produced by community members to show specific local ice and weather phenomena. Younger people, particularly future Native students, could then use such bilingual village journals as educational materials, in order to learn or remember how elders watched the ice and weather as their fathers once taught them to do. Having elders and experienced hunters as observers would guarantee that the comparable sets of village data and age-based knowledge of ice and weather would be recorded.

We viewed our project Watching Ice and Weather Our Way as contributing to broader discussions of arctic climate and ice change through properly collected local observations done by the northern residents themselves and from their cultural perspective. In considering such materials as the project’s critical input, we hoped to frame our study as much as a heritage and cultural preservation effort on behalf of participating communities as an exercise in scholarly data collection for further research. This approach helped us recruit many highly dedicated team members and generated enthusiastic local support. Our project participants expressed it strongly in their own words:
This project is so important, because we have thought many times about documenting our knowledge about ice and sea ourselves but we did not know how to get it started. This is very important for our children and grandchildren, and for all our next generations, so that they would know what we used to do from our fathers and forefathers. I got all my knowledge from watching after my grandfather Nunguk and after many other experiences with people of my early days. So, when these words are written down, they will keep on going for a long time for younger people, as long as this book will last. (Chester Noongwook, Savoonga, 2001)

All I wanted was to pass to our young people what I learned from way back to the present time and what were some changes in our way of life. As I see it, we haven’t changed spiritually and we still respect our ancestral people. It would be good to have to pass our culture from their time to our time and to feel the same, like they had. Our way of life is something that has to be learned specially, like nowadays people get their knowledge in writing and reading at school. (Conrad Oozeva, Gambell, 2001)

When I met with Igor Krupnik in December 2000 and he invited me to joint the Yupik sea-ice observation project, I told him that I am busy and that I have to take advice from my father Nelson Alowa (Qagaqu), who was sick at that time. When I told my father about this project, he said that many young people of today do not know some ice and weather conditions. Now it may be helpful to put it in written form, so they would be able to read it. “Think about your nephew and your sons, your future grandchildren”, my late father said. I said to him that women were not allowed to be involved in men’s gathering of data and in hunting trips. He just laughed and said, “I am glad you remember that but also remember, how many times I took you out hunting. This sure will help others if it is put in written words, so more young adult hunters will know what terms were used in the earlier years.” (Christina Alowa, Savoonga, 2001)

In October 2000, Conrad Oozeva started his weather and ice documentation “the Yupik way” in the village of Gambell on St. Lawrence Island. In December 2000, I traveled to the second island community, Savoonga, where George Noongwook—another Girdwood workshop participant and the Vice-President of the Alaskan Eskimo Whaling Commission—agreed to supervise local ice and weather documentation. After reviewing the proposal, the Savoonga Whaling Captains Association endorsed the project (Figure 5-2). Chester Noongwook, one of Savoonga’s most respected whaling captains and weather experts, volunteered to do the observations and to make daily documentation of ice and weather conditions in his native Yupik language. On December 8, 2001, I put down Chester’s first daily weather story in English (see
Appendix 1); shortly thereafter, Christina Alowa, a former Yupik language school-teacher, agreed to assist in recording Chester’s notes in Yupik and to help translate them into English.

Setting the Framework

To fulfill its tasks, the project was set up to document ice and weather conditions for at least one full “sea ice year,” from the fall arrival of slush ice until the next summer breakup. The observation record was to be organized as a series of regular entries so that it could be later matched with daily and weekly weather reports, sea ice satellite images and charts, and other forms of scientific data. The project also sought to document local terminology for specific ice and weather phenomena used in each community and to explore local information about past ice and weather events that is stored in language and cultural materials, proceedings of elders’ conferences, and other sources. Unfortunately, we did not succeed in generating funds for the bigger effort aimed at covering several communities; so our study was eventually limited to the two villages of Gambell and Savoonga, both on St. Lawrence Island. This pilot project in 2000–2001 was funded by the MMC, with additional assistance offered by some other agencies (see Acknowledgements).

Figure 5-2. Members of the Savoonga Association of Whaling Captains discuss the proposal of sea ice observations “the Yupik way” (photo by Igor Krupnik, December 2000).
St. Lawrence Island is located in the northern Bering Sea, less than 160 miles (250 km) south of the Bering Strait. It is the largest island in the Bering Sea and the one with the highest Native population, both historically and at present (see Hughes, 1984). Despite its position about two hundred miles (320 kilometers) below the Arctic Circle, between 63°00' and 63°38' N, this is fully an arctic environment of the treeless tundra, with the sea covered by sea ice for several months of the year. The island officially became a part of the U.S. territory in 1867, although both of its present-day communities—Gambell at the northwestern tip (Figure 5-3) and Savoonga near its northeastern tip (Figure 5-4)—are situated closer to the Asian than to the North American shore. Barely forty miles of water separate Gambell from the nearby Chukchi Peninsula, Russia, and the tops of the Asian mainland mountains are visible from the village on clear day. The two existing communities have an almost equal population of about 650. Local residents, with the exception of a handful of contract schoolteachers, are mostly Native Yupik Eskimo. They call their villages Sivuqaq and Sivungaq respectively, and name themselves Sivuqaghmiit, when speaking in their Yupik language. The official town names, Gambell (given in 1899 to honor its first white missionary-teacher who drowned in 1898) and Savoonga, are commonly preferred when talking and writing in English.

Both towns have similar economic profiles. Most local residents depend upon year-round subsistence hunting (primarily for walruses, whales, and seals), fishing and plant gathering in summer, and various outside sources of cash, including sales of carved and excavated prehistoric ivory. The two communities are closely related by blood, common history, shared language, and extensive family ties.

Despite their geographic proximity, winter conditions in Gambell and Savoonga are quite different. Savoonga is wide open to the north, from where winds and currents bring floating ice that eventually consolidates into a solid ice cover that commonly stays from December until June. Gambell is located at a rocky cape that is exposed to winds from several directions and that produces turbulent conditions in the sea as the currents mix off the cape. Although sea ice arrives here roughly at the same time as in Savoonga (and often earlier), it never becomes as solid and stable because of strong currents and winds. Breakups, ice leads, and patches of open water are the most common phenomena in Gambell throughout the winter; and spring breakup takes place here at least a month or two earlier than in Savoonga. Native elders can talk for hours about the differences in sea ice conditions in two communities located barely 40 miles (66 km) apart:

Gambell currents, to my thinking, are way much stronger than our currents here, because they go from both sides. Their cape is so different than the place we have here. Here, our currents are much weaker and the wind pushes the ice much stronger to the land, pressures it. Gambell ice is smoother, because there is always some open water there to the west and southwest. Between Gambell and all along northern shore it is very heavy packed ice in winter. So, our ice is
Figure 5-3. Gambell, St. Lawrence Island (May 1999; Photo by Igor Krupnik).

Figure 5-4. Savoonga, St. Lawrence Island (May 1999; Photo by Igor Krupnik).
indeed very different than in Gambell. We do not have that many terms and our terms are often different. This ice here is piled up real high; it makes high ridges along the shore. By the time this ice is chipped out from here in spring, it always moves eastward from here, uusqayaak (Chester Noongwook, October 2001).

The ice and weather observations in Gambell were started, as mentioned, in October 2000 by Conrad Ooozeva (his personal Yupik name is Akulki). Born in 1925, he is deeply respected for his expertise in local ice conditions and in traditional Yupik ice terminology. In the 1980s, he compiled a list of some ninety Yupik terms for the various types of sea ice and ice formations, which is included as a part of Yupik language cultural curriculum at both Gambell and Savoonga village high schools (Yupik Language, 1989). He also was a whaling captain of some twenty-five years, and he hunted on sea ice for more than sixty years of his life. Conrad’s wife, Elinor Oozeva (Miqaghaq), came as his natural partner in documenting his observations in both Yupik and English. Jennifer Apatiki of Gambell typed both the Yupik and English texts. Conrad’s observations were done as weekly, or were bimonthly “block-stories” that he taped in Yupik. Unfortunately, the recordings after late February 2001 have been lost or, at least, were not transcribed.

In Savoonga, the team of Chester Noongwook (Tapghaghmii, born 1933) and Christina Alowa (Sunqaanga), chose to make their observation records on a regular, almost daily basis. The observations were started on December 9, 2000 and ended with the total disintegration of sea ice off Savoonga on June 12, 2001. The six-month record has two substantial gaps: from mid-December 2000 to early January 2001 (because of the passing away of Nelson Alowa, Christina’s father) and from mid-April to early-May 2001, when Chester, together with other adult men of Savoonga, was at the village spring whaling camp at Pugughileq, near Southwest Cape. Despite these two gaps, the Savoonga record of some seventy pages may be one of the largest original handwritten texts in the St. Lawrence Island Yupik language. During the later portion of spring observations, Christina started to make pencil sketches and drawings to illustrate Chester’s daily ice and weather stories. The Savoonga team was later joined by a local ivory carver and artist, Vadin Yenan (Saywenga, born in Chaplino, Siberia), who made several dozen pencil drawings to illustrate various forms of sea ice. George Noongwook (Mangtaaquili) did style editing and translated the Yupik record into English during the fall and winter of 2001 and 2002, while Valerie Noongwook (Kisighmii) typed the Yupik and English versions of the Savoonga observations. Further editing was done by Igor Krupnik in October 2001 and by Henry Huntington, in November 2001.

Since the Savoonga and Gambell teams followed different patterns of documentation, their records of ice and weather conditions during winter 2000–2001 are quite distinct and cannot be compared on a daily basis. However, both Chester Noongwook and Conrad Ooozeva prepared an extensive summary of their observation records—a general review of the unique winter of 2000–2001. I recorded Chester’s overview in
English, whereas Conrad put his summary in writing, also in English, himself. Several months of observations produced an unprecedented set of data: literally, dozens of pages of records in Yupik (with English translation). These daily or weekly entries are full of Native terms, detailed explanations of ice patterns, references to rapid shifts in ice and weather conditions, migrations of marine mammals, and local hunting activities. These records by two experienced local elders were later reviewed by Lewis Shapiro, a Bering Sea ice specialist from the University of Alaska Fairbanks (see below).

**Winter of 2000–2001: What Did We Learn from One-Year Observations**

The winter of 2000–2001 was unusual on St. Lawrence Island and in the northern Bering Sea area in general. Local people have long reported a delay in fall sea ice formation, which now commonly occurs in early December—instead of late October or November as in the “old days.” This past winter, however, was indeed very special. The sea ice was not firmly established until mid-late December; then it broke up in late January and February. In the 1940s and 1950s, solid winter ice covered the entire northern Bering Sea for months, from St. Lawrence Island all the way to Nome and the Bering Strait. In recent years, this solid ice is often broken by leads, ice cracks, and patches of open water, even in the middle of winter, as our observers record:

![Figure 5-5. An aerial view of Gambell, February 2001. The shore is ice-free from both sides of Cape Sivukak (Photo by Igor Krupnik).](image-url)
The first sea ice that I noticed [i.e., that left a deep impression] was when going on a single-engine airplane. [It was] on my first trip to Nome, on April 25, 1943. We flew from Gambell toward King Island. From the end of the Island to the north and northeast, right up to Nome, there was just solid ice all over. There were but a few breaks—not open leads but just lines across the ice in between the mainland and the island.

This I believe, maybe at that time it was always like that, because back then we had more fair weather and cold weather. Today—as Caleb [Pungowiyi] told us about his trip to Nome from the island when he looked down—it was all broken ice everywhere, all the way to Nome. And nowadays it is most often like that (Conrad Oozeva, 2001).

When I flew over the same route in February 2001, there was open water with scattered ice floes all the way from St. Lawrence Island to Nome. In the middle of the arctic winter, Nome’s waterfront was ice free and Gambell had no shore-fast ice whatsoever, from both the northern and western side of the cape (Figure 5-5). In Savoonga, large areas of open water were clearly visible across the narrow patch of the shore ice (Figure 5-6). According to the sea ice chart produced by the National Ice Center for
February 23, 2001 (Figure 5-7), the edge of heavy winter pack ice (0.9-1.0 cover) was positioned some 60 miles north of St. Lawrence Island or at least 300 miles (500 km) further north than its usual position at this time of the year (Figures 5-8). In fact, to the south of St. Lawrence Island, the Bering Sea was essentially ice free (Figure 5-7).

Although the sea ice eventually returned to stay until late spring, this was indeed a special year to remember, as both our key observers recalled:

Warming also made the difference, because the warm air kept coming. This is the third time in my memory that this happened, but it is also the longest time of all I remember. It is quite usual, as I said, that we have warm weather on the island for 2-3 days in midwinter; even some snow thawing may start, but the ground is still frozen. This past winter, it was really very long period of warming and one in February that made all this difference. It is quite normal to have warming waves in December, even in January, but not in February (Conrad Oozeva, October 2001).

Last winter’s snow (of 2000–2001) was so high I thought it was the second highest snow on my memory. At some places, we had up to fifteen feet of snow, particularly near the houses. The other time we had that much snow was about twenty-five years ago. … Because some of the houses were buried with snow and snow drifts almost half way to the roof height.

As it was snowing heavily, the water was wide open in November and most of the month of December. We had some little sea ice in late November and early December—mostly mixed ice: siku, kagimlegh, umestaghaq, unenghelnguk. But then we got wide-open water once again for most of December, and it lasted for couple of weeks or more. This is the second time on my life when this hap-
pened, because usually we have a solid, ice-covered Bering Sea at this time (mid-late December). This past December (2000), the water was wide open, and as far as I could see, there was a bluish color (on the sky) to the northwest to west, toward Gambell. It indicated open water over Gambell and even further than Gambell. Straight north and northeast from here, the entire area was whitish in the sky—this indicates some ice in the sea but very, very far away.

... Then, the second ice came in at the very late part of December. The walruses were very close to this ice, so the hunting was much better than years before. We even saw a few bowheads off the village, but we did not try to follow them, because it was already heavy ice. The ice was almost similar to the first one—good ice. People could walk on this ice.

Then in the mid-part January, we got wide-open water again. The shore here was almost free—just the gravel and the sand, no ice. We did not get the fast-shore ice until about our third wintering (ice coming) in February; so, there was no ice near the shore. The ice moved up north as far as one could see. If the weather is clear, I often go up to the mountains to look for the ice, usually, once or twice a month in winter. That past January, I also went to the mountains twice but could not see anything in the sea, except for few whitish spots, glares (qupaq). That indicated that the ice was very far away from shore.

It was mostly southerly winds, also southeast and southwest, for a couple of months in winter, moving back and forth, back and forth. This last February, open water lasted for a couple of weeks or even longer. This is my first time I remember the sea that way. It might have been some open leads here and there, some openings, cracks. But normally we have closed ice at this time.

Finally, the Bering Sea was covered with winter ice for the third time after mid-February. This was already good winter ice. Late February, March, and even early April were quite normal here, compared to usual years (Chester Noongwook, October 2001).

Although the ice returned in late February and the winter resumed until at least late April, the unusual course of events triggered a chain of impacts upon arctic wildlife, particularly on marine mammals. In his summary of winter 2000–2001, Chester Noongwook reported that:

In the last week of March we started to move to our (spring whaling) camps at Pugughileq, at the Southwest Cape. This was our normal time. When we came there, there was no shore-fast ice and not much of other ice. Just open water on the southern side (of St. Lawrence Island). I think, it was because of these big waves from south, we call them ughqaghtaaq. We usually have some shore-
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fast ice in there; so, this year was different compared to years before. Otherwise, it was like a usual first half of April: normally cold, some snow, very windy, with southerly and northerly winds.

The bowheads were there and there were many of them, as usual. But it was very hard to get to them because of the weather. Weather was always a problem: windy all the time, high waves, young ice forming on the water, like sallēk [thin young ice]. I think it was because there was too much open water—we could see the packed sea-ice but it was too far away. For a good whaling weather (in spring) we need a fast-shore ice for about a mile or less. ... So, this past spring was not very good for whaling. We were at the camp for about a month, maybe a little longer. ... In that spring, we got two whales on open water: one very close to the whaling camp, about five or six miles and we got the second whale well far off, about thirty miles from the camp. Not very good hunting because of weather, but nothing very special. The whales were also like in a normal year, but they were sounding all the time. Maybe, they were disturbed by the noise of the snowmobiles over the open water.

... When we came back to Savoonga from the camp in mid-May, it was ice and open water here. The fast-shore ice was broken up in early May or mid-May—about a week or even two weeks earlier than usual. I guess it was because of so much open water around. This open water in spring is the main thing that affects the ice. Spring walrus hunting here lasted much shorter, because the ice moved up north very quickly. Hunters had to go much further to get the walruses in late May, and then they just stopped going, because the ice was so far away. We continued our ice observations here until mid-June (June 12), but the ice was already gone here, the sea was wide open, as far as one could see.

The same thing happened in Gambell, where, because of the early spring break-up, spring hunting season for walruses was much shorter than usual:

After that, we started walrus hunting, in early and mid-May. Mostly in the southern area off Gambell, where there was open water. ... There was still snow on the ground in the village, but it already started to melt down. The ice was moving up north. It opened up about mid-May, and then it cleared up around Gambell, both on the northern and western side. This happened because of very strong winds from the south in May. Even the shore ice on the northern side was broken away and gone far away, as far as you can see. But we could still see the edge of the ice from the top of the Gambell Mountain. When the wind calmed down, several boats went hunting up north towards the ice for walruses and maklaks (bearded seals). They had to travel some twenty miles to get to the ice front in mid-May; then more and more as the ice moved further north. By late May there was almost no ice around. It would be possible to travel to Sibe-
ria in mid-May—we would have no problem to get there at this time (Conrad Oozeva, October 2001).

Chester Noongwook also acknowledged that during the spring and summer months of 2001, far fewer gray and minke whales were observed off St. Lawrence Island than are usually seen. On the other hand, there were numerous reports of an unusually high number of polar bears seen on the island in spring and summer time. They were obviously left behind by the fast retreat of sea ice and had to survive on local food resources until the next winter.

The unusual winter of 2000–2001 offered a stunning model of what the ice conditions off St. Lawrence Island may look like if the current warming trend continues. It also presented a good illustration of the potential impacts on the Native economy and annual subsistence cycle. Here, the consequences were far less dramatic than one might expect from the ice charts that showed heavy winter ice pushed some three hundred miles farther north than usual, with open water all around St. Lawrence Island in the middle of the arctic winter. Native spring whaling in 2001 was only moderately successful (Gambell and Savoonga got two spring bowhead whales each) and far fewer walruses were killed in May and June of 2001 than during the last several years. As a result, by fall 2001 both villages experienced a shortage of walrus meat and very little frozen mangtak (whale skin with blubber) was left to last until the next spring hunting season of 2002. However, this shortage was quickly ended, when, due to much lighter ice conditions, two more bowhead whales were killed off Savoonga and Gambell, each in late November and December 2001. The Gambell whale was a particular novelty, as no fall bowhead whaling ever took place in Gambell in the memory of today’s elders. Thus, the changed ice and weather situation obviously puts pressure on the established round of annual subsistence activities and its overall productivity. But it also offers some new resource opportunities, which Native residents are quick to exploit.

Yupik Ice and Weather “Watch”: Some General Remarks

This section reviews some individual comments by the project participants and other local elders and let the voices of the Yupik people be fully heard. By no means does it intend to be a summary of Yupik environmental expertise (“traditional ecological knowledge”) related to the sea ice and weather patterns. For more extensive and eloquent representation of how the Yupik people themselves perceive and discuss their environmental knowledge the reader is directed to the published contributions of the Girdwood workshop (Noongwook, 2000; Pungowiyi, 2000; see also Krupnik, 2000b); transcripts of the proceedings of local Elders’ Conferences (EHP, 1982), and to published collections of oral stories from St. Lawrence Island (Akuzilleput Igaqullghet, 2000; Sivuqam Nangaghnegha 1985-89; Silook, 1976). Several earlier studies of sea-ice and weather-related knowledge in other Inuit communities across the Arctic offer valuable comparative data (see Freeman, 1984; Lowenstein, 1981; McDonald et al., 1997; Nakashima, 1993; Nelson, 1967; 1981; Riewe, 1991).
Another purpose of this section is to offer an anthropologist’s perspective on how knowledge about ice and weather is collected, transmitted, and regarded by members of the Yupik society and how Yupik monitoring for sea ice and weather is organized. This is, again, not a comprehensive list of the basic features of “indigenous ecological knowledge,” but rather some more obvious observations on the nature of “other science” that come from our project.

Experience with sea ice and climate conditions is accumulated through generations of observation and daily encounters with the moving ice, storms, currents, and rapid weather changes. It is held in very high esteem in northern communities, such as Savoonga and Gambell. Elders commonly refer proudly to the “traditions of our ancestors,” whereas the younger people express the same feeling in more modern terms:

Sivuqaq, they call it St. Lawrence Island, since it is our home, we know about its ice and its movements. We have this knowledge about the ice that was taught by our ancestors. Our ancestors studied all about life here. They were always studying on things like that. So, they knew what to expect, and it always was right. Some years it can be different, so it was put in their minds like it was written (Frank Oktokiyuk, EHP, 1982: EC-GA-82-072-T#3)

We have our Native versions of knowledge about all these wind and ice patterns, and it has been passed down through the generations. And people, like Conrad [Oozeva], they have lived with this knowledge all their life. I mean they have knowledge on everything that pertains to the ecosystem, to the iceberg change, to the resources, and marine biology. I guess we have our own versions, in terms of understanding the comprehensiveness of our environment and all the necessary terminology. For every conceivable condition of snow and ice pattern, which is either annual or through generations. And we have stories of all these changes based upon comparative experiences and observations (John Waghiyi, February 2000).

Watching ice and weather is a critical task for every arctic community and the key factor that guarantees its prosperity and survival. This is why it is the most common pursuit and still one of the most respected duties of all men, particularly of the elderly people. It is a lifelong and a twenty-four-hour passion, since there is always someone in the community checking weather, sea, and ice at any given moment. In a critical time—when men go out hunting, during the spring whaling season, or when the weather is shifting rapidly—several people spend hours scanning the horizon and discussing signals (indicators) related to the status of weather and ice. It used to be this way always, as people remember, and it is still a common practice in both communities:

That high land, Aatnequisq, at the point northwest of Gambell [village], belongs to the elderly men. When all the men are out hunting, the elderly men
used to get out early morning and go there to watch. They would watch closely
for the hunting men. The ice can move away so dangerously; so, they watch for
that, when the ice just gets there. They call this early ice *akitaaghhaak* (Steven
Aningayou, February 1982, EHP: EC-GA-82-71-T2)

I took my grandchildren down to school (about 9 a.m.) and I looked for water
and ice near the school site at the shore—whether there is any open water out
there (far at sea). I could tell it because there was some dark(ness) in the sky
far over there; that dark sky is over open water. I stayed at the store for some
time to get information from other people, who were there earlier in the
morning. We always have a few people of my age gathering at the store, the
side that faces the water and the beach—they just stay there for some time,
watch the weather and ice, and talk (Chester Noongwook, February 19, 2001).

However, beyond these general attitudes, several specific factors are to be consid-
ered. *First*, whereas many people are knowledgeable and almost everyone is watching
ice and weather, some are reportedly better than others. Both our senior observers,
Conrad Oozeva and Chester Noongwook, are deeply respected for their special knowl-
dge and weather forecasting skills. This is, again, a well-established pattern, as such
experts are well remembered, their names praised through the generations, as seen
from the following story:

Clarence Irrigoo: Who was an elderly man at Pugughileq, my father and others
often told about?

Frank Oktokiyuk: Gugwiingen. Gugwiingen, our “weather bureau.”

Clarence Irrigoo: He knew it (weather) better than weather bureau does. They
would even be asking him about the weather, when they want to know. He
would just look around from his house door way up at the sky and tell the oth-
ers to wait a while and not (to) go on hunting trips. He would say, “It may not
turn out.” And they would just obey, or did as he said. And sure enough, it soon
would not be fit for hunting.

And other times, when other men thought (it was) not good, he would say, “All
right, see if you can get out now; it may be all right.” By knowing, see, he knew
it all from watching (February 1982, EHP: 82-072-T#3).

*Second*, the most remarkable feature of the Yupik watch of weather and sea ice con-
ditions is that it is primarily wind- and ocean current-oriented—unlike the scientific
(that is, instrumental) observation, which is first and foremost focused on changes in
temperature and atmospheric pressure. Temperature is indeed of low importance to
Native observers, unless it shifts rapidly or is highly unusual for the season, and
The Earth is Faster Now

atmospheric pressure has no special meaning in Yupik terminology. Atmospheric pressure did not become a factor until weekly and daily weather reports started to be transmitted over the radio on a regular basis. Nowadays, many people, particularly the elders and active hunters, have indoor barometers, which they duly watch. Nevertheless, there was no reference to atmospheric pressure (or its change) in any record made by our Savoonga and Gambell observation teams.

Instead, Yupik hunters use an extremely sophisticated system of wind terminology that identifies some ten or twelve types of winds by specific direction and other features. Each wind is known to bring a certain type of weather, snow, or ice movement. By identifying or referring to the wind, an observer can make a quick judgment of the situation and even make a basic forecast of upcoming conditions. Chester Noongwook started his record of observations in Savoonga (and my first orientation in the Yupik patterns of weather watch) by listing the most common winds in his native village:

We have several winds here in Savoonga: Aywa (Aywaapik) is a direct north wind from the sea. Nakaghya is northeasterly wind, it comes from Nome.
Kenvaq is a northwesterly wind; this is the old name, and we now call this wind Naayghiinaq (“that from Siberia”). There is also another northerly wind, Quutfaq, that can come from anywhere between northwest and northeast.
Asivaq is a direct east wind; Ikevag— south wind from the island to the sea; with another wind from inland, Ikevaghlluk, from southeast. We call the southwest wind Tapgham Ketaanganeng, because it comes from Tapghaaq, which is the place on the coast between Savoonga and Gambell. There is also west wind, Pakfalla, that comes from the sea.3

Conrad Oozeva produced a similar list of winds for Gambell, with the extensive characteristics of affiliated weather conditions (Yupik Language, 1989: 19–20; see Appendix 2). Very similar lists of winds, with assigned weather regimes, are known to the Yupik hunters in nearby Siberia (Krupnik, 2001: 398–402; Vakhtin, 1988: 30). Similarly organized wind classifications are used in ice and weather prediction in many other Inuit communities across the Arctic (cf. Nelson, 1967: 41–53; 1981:7–10).

A reference to the wind is commonly the first and most important feature of the daily observation, and it typically leads to many conclusions:

In the morning look up at the clouds, if any, and observe 360 degrees—get the idea of wind direction, wind speed from observing the cloud conditions. From these observations you can determine where and how to travel, whether to go by boat or on land, or whether to stay because of weather. In windy but clear conditions, without the snow or other visibility restrictions, we tend to stay within the village boundaries or in close proximity of the village, even if we travel along the coast.
You could often determine the forecast for the next day from observing the high elevation clouds. Generally very nice conditions but could get windy if it is easterly (Chester Noongwook, December 2000).

It comes as no surprise that most weather records by Chester Noongwook and Conrad Oozeva, as well as many other documented stories by local hunters, commonly start by referring to the prevailing wind direction:

*February 15, 2001: Today’s Weather*

Today’s weather is still the same, with the wind from the southeast (*ikevaghlugmeng*) generally a little east of Mount Ateq; but there were some boats that went out hunting today. It has cleared up as the day progresses. It has been weeks since the wind has blown from the southerly direction (Chester Noongwook, February 2001).

The next crucial factor to pay attention to is the ocean current(s), the high tide-low tide cycle, and whether the sea is calm enough for people to go out hunting:

The wind direction (today) is northeast (*Nakahgya*), something between twenty and twenty-five knots. I can feel it by my face: I always measure the wind by face, because I used to be airline agent in Savoonga for many years.

The sea is rough, big waves. If this wind continues for two or three days, it will bring the ice on from the north. Regular sea ice that was blown out earlier by the south wind (*Ikevaq*). … This is a bad weather for hunting—not very bad but rather dangerous. Too rough to go in boat and the wind is too strong: it won’t bring killed animals ashore. The current is always moving eastward or northward, and in a few hours there’ll be low tide. (Chester Noongwook, February 19, 2001).

This combination of critical indicators creates a very solid pattern of weather monitoring, which consists of certain established steps or actions. In acknowledging Chester Noongwook’s effort to document these Yupik monitoring practices for the younger generations, I call it “Chester Noongwook’s Rules of Weather Observations”:

First thing: get out early in the morning, and check the wind and the sky conditions, whether the sky is cloudy, and also whether it is cold or warm in terms of your body feeling;

In the old days, we always used to go down to the seashore every morning—to check the ice and weather conditions at the water (sea level), how the current is moving, and where is the tide;

- Always talk to other people about weather and ice conditions, listen to other people’s mind to see whether it is good to go out hunting;
• Check for any change in wind and weather condition; we were told to watch out for weather all the time, either we are on the ice or on shore—every hour, every minute or listen to other boats what they are saying.

• Keep watching for any change in water, because of currents or clouds or waves—any sign of water change is very important.

• You can never make a good forecast for tomorrow if based upon today’s weather. Better go out and check it in the evening. Make a guess and check it next day: it is better to see whether it is correct or not (Chester Noongwook, 2001).

Third, the use of wind directions, associated with certain weather conditions as key designators, allows Yupik observers to collect and pass on information by highly meaningful environmental packages. A similar practice is recorded for the Inupiat hunters in Wainwright, northern Alaska (Nelson, 1967: 41-53). Hence, it is not the observation itself that makes an impression of Native knowledge being holistic, intuitive, and multifaceted but rather the whole cultural “package” that is associated with each specific ice and weather term it uses. This makes a critical difference from the scientific (i.e., instrumental) type of weather observation, which is based on following the temperature and pressure “curves,” and on recording their current trends. Unlike scientific weather monitoring, the Yupik watch is focused upon specific signs that signal shifts from one phenomenon, condition, or weather and ice regime to a different one that can be defined by a different term. This is the primary motivation for the use of and value in multiple specific terms for every combination of environmental conditions. The more words (and combinations) one knows, the more precise one’s observation and forecast can be. On the other hand, as the use of Yupik words for specific patterns of ice and weather by younger people declines and the Yupik terms are replaced by English words, with a different (and often much more simplistic) meaning, the hunter’s overall awareness of his environment fades away. This is why Yupik elders are very proud of, and so keen on passing on to the younger people, their extended Native terminology of ice and weather conditions.

Such culturally rich “environmental packages” are used to the extent possible, including the most general characteristic of the overall winter regime. The Yupik people on both St. Lawrence Island and the nearby coast of Siberia (cf. Krupnik, 2001: 396) use the terms “man-winter” (yuguluni uksughtuk) and “woman-winter” (aghnangyaq), to identify cold, heavy-ice winters and milder, lighter-ice winters, with periodic ice openings (polynyas) respectively. There is an early reference to such practice in the early 1900s (Moore, 1923: 340), and the terms are still in use today:

Yes, I heard people saying that in Gambell too: “woman-winter,” aghnangyaq. When the temperature is above 10˚F [in winter], I like it. Because you can tell
it even without seeing the thermometer. The sea between the ice looks black, no smoke, nothing. (Conrad Oozeva, 2000)

It goes without saying that the winter of 2000–2001 was a model “woman-winter,” according to the Yupik terminology, whereas the winter of 2001–2002 has been already named the “man-winter,” because of its much colder heavy-ice conditions (George Noongwook, personal communication). As this paper is written in January 2002, the heavy winter pack ice (with 0.9–1.0 cover) extends some three hundred miles (five hundred kilometers) to the south of St. Lawrence Island, or almost four hundred miles further south in the Bering Sea than it was in February 2001. This is almost as far south as in January 1975 and 1976, during the two coldest winters on record (Burns et al., 1981: 784; Cavalieri and Parkinson, 1987: 7,148–151; Parkinson and Cavalieri, 1989: 14,507; www.natice.noaa.gov/pub/west_arctic/bering_sea/bering_sea_west/2002).

Fourth, Native observers are also very keen to document unusual ice and weather patterns, but they have their own ways and means of memorizing and documenting such events. They look for certain and, often, very specific indicators that are meaningful to them, both culturally and individually. To a scientific observer, the resulting story may seem “intuitive” and even eclectic, but it is no less solid, since it is based on the very same practical indicators followed over many years. This is clearly reflected in both Conrad Oozeva’s and Chester Noongwook’s record of the highly unusual winter of 2000–2001:

Let me add what I remember in the past on the condition of the weather. First time it happened on my memory, I was a little boy. Maybe, it was in the mid-1930s, because the men like Wamquun, Mangtataqui, and my dad were still very active hunters. That year, we did have very much the same weather as we had this last year. This is the first time I remember this happening. This unusual weather lasted until the first week of January. Boat hunting was good when the weather would subside. All kinds of tepaq (this is various kind of seafood we collect on the beach) were washed ashore. Even the mamaghwaaqs (a kind of tepaq) were getting soft from moldering. On the west side, the sigughneq (the buildup of the slush ice by shore waves) was formed about fifteen feet high or more. Later that year the weather became quite normal.

The second time it happened in my life was in 1965. Again, in the month of January the weather became very warm. This is the second time I remember that happening. The Troutman Lake was originally frozen and the ice was thick enough. That time, we did not have an airfield, so the motorized airplanes landed on the ice on the lake. Then, somehow, it started raining. The ice around the lake melted on the edges. As it happened, there was one plane left on the lake that had been stranded for several days due to the weather. It was not suitable to fly. Finally, the weight of the airplane broke the thinning ice.
The airplane was halfway drowned in the water. The snow on the ground melted. There was no more snow elsewhere. Somehow, there was still the *tuvaq* (shore-fast ice) around Aqeftapak (the bay on the other side of the Mountain), although it was very watery. It seemed that the weather would not get cold again. ... And then it really got cold again (Conrad Oozeva, October 2001).

*Fifth*, despite a very popular perception that Native knowledge is generally intuitive and holistic, Yupik ice and weather watch is not scanning for every environmental signal possible. It is very well organized around a few key factors—such as wind, current or ice movement—and is focused first and foremost upon conditions for maritime hunting and the related behavior of critical game species. Therefore, Native experts usually have a very coherent—one may say, “fully scientific”—vision of the annual sequence of weather and ice regimes, the migration patterns of major marine mammals, and how these two cycles are related. This vision can be articulated by many details and arguments based on generational observations:

There is much difference in sea ice that I see during my lifetime. Every year the first ice we see is mostly of this iceberg type—the floating icebergs coming from the north, mainly from the month of September. The wind always starts blowing from the north, almost regularly. I think that same high wind makes the ocean flow, too.

And now we have more westerly winds. What I learned from my elderly people, as the days grow longer, the northwest throw [stream] gets stronger in between the island and the mainland of Siberia. But now with those more westerly winds we have more ice on the other side, the Anadyr side of the island, the ice is packed over there (Conrad Oozeva, February 2000).

The ice is coming here (to St. Lawrence Island) in the fall as long as the wind is blowing from the north for several weeks to a month. One way of wintering to start faster, the faster way for the ice to come in, is by a couple of weeks or so with the wind blowing northwest to west. So, when the wind suddenly moves to north-northeast, the ice comes faster here in the fall. I always think that our ice is coming here mostly from the Siberian shore.

It hits the island first at Gambell—so, they get the slush ice before us here, in Savoonga. The small icebergs, *kulusiit*, also come there first. These small icebergs start breaking off the polar ice some time in midsummer or early fall way up north, in the Arctic Ocean. And they start flowing down to come this way, straight down south. When the wind pushes it south, it comes straight here, to our island.
So long as the wind is from the north, the ice stabilizes for a number of days to a week to a month. If the northerly wind continues, the ice keeps going around the island along its western and eastern side—way down south. And it melts down there. We do not know how far south it goes, at least, I do not know. Our ancestors told us that this ice that goes down south starts melting up there.

In spring the current goes in an opposite direction and this southern ice gets melted and scattered around St. Lawrence Island. So, the remaining ice we have at Savoonga is the only (solid) ice we have here until spring and for the spring time. By the time it is scattered up, it has nothing to support it (from the sides) and the current pushes it up quickly and it melts much faster. This northern ice lasts longer at the northeastern section of the island until it gets melted (Chester Noongwook, October 2001).

It is popular these days to praise the power of Native knowledge on ice and climate change. I would argue that, nonetheless, Native concepts of the relationship between marine mammals, ice regimes, and currents are rather underestimated, since they represent fully developed scenarios and not just “generational observations”:

The walrus hits the island in the fall, when it comes down from the north with the ice moving south. I believe the routing of walruses stay from the very old days; they just follow. These big winter walruses, anleghaq, they stay here for the whole winter. I do not know why: maybe, it is a good feeding area for them or maybe they used to stay here in winter in the old days, before we had this village at Savoonga. …

So long as we have leads of open water early in winter, this is the best time for fall walrus hunting. In November or December this ice also comes with the bowheads. This is early winter here. Still, this weather and ice is not very good for bowhead whale hunting, though we recently got a whale in December right in front of Savoonga. But more often the whales hang near the northeastern section of the island, between here and Northeast Cape. Because a couple of time in the past we have seen bowheads passing in front of Savoonga. When it really opens up (a lead of free water along the shore) they travel from Northeast Cape all the way around to Gambell and then turn south, feeding down south of St. Lawrence Island in winter time. …

The current we have here moves almost around St. Lawrence Island; it is a clockwise current. Most of the animals we have here follow this clockwise movement around St. Lawrence Island. The bowhead whales do this in spring, when they move from the Southeast Cape to Pugughileq at the Southwest Cape to Gambell, and then through the strait between the island and Siberia. The walruses also follow this clockwise movement; this is why we have walruses always
after they have them in Gambell. Even the birds travel this way from west to east, but only in the morning. I have seen them so many times flying from the side of Gambell and further northeast. In the evening they come back and they travel counterclockwise, from here back to Gambell area. I do not know, why they do this (Chester Noongwook, October 2001).

**Sixth,** Yupik hunters—unlike climate and ice scientists—think generally in terms of alternating ice and weather regimes rather than some sort of “average” (or “normal”) condition interrupted by periodic oscillations or more unusual “extremes.” One of the established alternating conditions is the dichotomy between very cold “man-winters” and warmer “woman-winters.” The high tide-low tide currents, north wind-south wind as well as high ice-low ice, and other similar alterations are common or daily occurrences. This prevents people from relying upon a framework of abstract “normal” conditions that feature so prominently in western mind and the way our daily weather and temperature forecasts are delivered.

Unlike physical scientists, the more elderly and experienced Yupik hunters are generally quite reluctant to talk in terms of average meanings or to compare certain conditions with “normal” or to call something “abnormal,” even when the current ice and weather are clearly far from “normal” for this time of year. The observation record of both Chester Noongwook and Conrad Oozeva of the unusual winter of 2000–2001 is extremely reserved in its wording. Both men stressed repeatedly that they did not consider those conditions as “extremes,” since they have seen it before. This comes as no surprise, as people living in the highly variable arctic ecosystems are quite accustomed to dramatic shifts in their familiar environment. Nowhere in the Arctic is there such thing as a normal or “typical” condition; and it is even misleading to conceptualize the Arctic in such terms (Krupnik, 1993:156–158). Here nothing escapes the process of change, as game and birds, climate and ice, tundra and sea are in ceaseless motion. Therefore, by the time any arctic person approaches old age, he or she necessarily garners memories of numerous events in one’s personal environmental “history.” From this, I believe, derives the above-mentioned reservation and the sense of recurrent short- and medium-term environmental shifts.

**Yupigestun Kelengakellgha Sikumllu Eslamllu**

In October 2001, I traveled to St. Lawrence Island to meet with local team members and to prepare a full-size project report. After preliminary talks in Gambell, the team gathered in Savoonga, where we spent two weeks processing and checking observation records, filling the gaps in our data, and making additional interviews with local experts. The aim of this last effort was to transform the 2000–2001 ice- and weather-observation journals from two communities into a more thorough summary of local Yupik knowledge about sea ice, a sort of a “Yupik Sea Ice Sourcebook.”

This was probably the first time that a book about St. Lawrence Island was not only produced mainly by the islanders themselves, but was actually assembled and prepared
right on the island. We ended up with an illustrated PageMaker file on a laptop computer, accessible for demonstration and desk-printing, but not with the final book, which was to be produced later. Nevertheless, this was a tremendous experience and highly emotionally rewarding to observers, translators, and elders, who generously shared their knowledge. To all the people engaged in the Yupik sea ice observation project, it offered the first chance to see how their stories and records, personal drawings, and old photographs are making their way into a bilingual book soon to come back to their communities as the main outcome of our joint effort.

The volume called *Yupigestun Kelengakelghha Sikumllu Eslamllu. Watching Ice and Weather Our Way*, will be produced by five co-authors—Akulki⁴ (Conrad Oozeva), Tapghaghmii (Chester Noongwook), Mangtaaquli (George Noongwook), Sungqaanga (Christina Alowa), and Igor Krupnik, under the general editorship of Krupnik, George Noongwook, and Henry Huntington. It will be a bilingual and heavily illustrated large-size book of some 180 pages, comprising an introduction, five chapters (“parts”), and an extended conclusion. Part One, “Definitions of Marine Ice,” is a bilingual dictionary of some ninety Yupik ice terms prepared by Conrad Oozeva in the 1980s and incorporated to the Yupik Language Curriculum (1989) used at both island high schools since the late 1980s. For our volume, Chester Noongwook and Christina Alowa prepared an English translation of Conrad’s dictionary, while Vadim Yenan made pencil drawings of all the types of ice identified in the dictionary (Figures 5-9 and 5-10).

Part 2, “Ice and Weather Observations: Savoonga and Gambell,” features the full bilingual observation record of 2000–2001 for both communities, accompanied by Oozeva’s and Noongwook’s general summaries of the 2000–2001 ice year. Part 3, “Yupik Stories About Ice and Weather,” presents excerpts from earlier elders’ conferences and some life-stories about personal experiences with ice that were recorded in 2001. Part 4, “How We Learned About Ice and Weather,” is made of interviews with six of today’s Yupik elders from St. Lawrence Island about their own youth training in hunting on the ice and observing ice and weather conditions by following elders and ice experts of the 1920s and 1930s. The interviews were recorded in Gambell, Savoonga, and Nome during my visits in 2000 and 2001.

Part 5, “Old Stories, Recent Memories,” presents some historical records of former ice and weather conditions on St. Lawrence Island, with comments by today’s elders. Its core section offers records of weather and ice conditions in Gambell exactly 100 years ago, extracted from the journals (“log-books”) of local teachers and missionaries during the winters of 1898–99, 1899–1900, and 1900–01 (Doty, 1900; Lerrigo, 1901; 1902). Most of the daily entries in teachers’ log-books are rather short and, in a purely “western” pattern, they record primarily the temperature, snow or rainfall, and the wind direction, with a few local details (e.g.: “March 15, 1899: School. 30°, 32°: northeast wind, light; snowed until evening. A number of schoolboys were absent in canoes hunting”—Doty, 1900: 241).
Figure 5-9. Qenghuk, refrozen crashed ice. Pencil drawing by Vadim Yenan (October 2001)

Figure 5-10. Chester Noongwook and Vadim Yenan are working on drawings of the Yupik sea-ice terms (photo by Igor Krupnik, October 2001).
However, exact dates for almost two dozen important events during three annual winter ice-cycles (1898–99, 1899–00, 1900–01) can be extracted from teachers’ journals, such as the appearance of first sea ice in the fall, the freeze-up of the lake near Gambell, the formation of the solid winter ice and its breakup in spring, the beginning of spring whaling season, the arrival of first boat from Siberia in spring, the general opening of the coast around Gambell, and so on. There were obviously remarkable variations in winter conditions one hundred years ago—as much as there are today, including days with open water and fairly warm weather in the middle of winter (like on December 30, 1898; January 31 to February 3, 1899, with temperature above freezing; March 13 to 27; 1899; December 31, 1900 to January 2, 1901, with rain, above freezing, etc.). These old journals offer an intriguing comparative sample to the observation records of 2000–2001. They show clearly that even in the “good old days”—before any large human-induced changes in the Arctic and signs of global warming—the winters on St. Lawrence Island were often marked by bouts of snowstorms, warmer temperatures, and unexpected ice breakups, although these swings probably arrived with a different frequency and in a different time they do today.

We hope that when the book is completed, it will follow the pattern pioneered by an earlier volume on St. Lawrence Island Yupik heritage produced in cooperation with the local communities (Akuzilleput Igaqullghet, 2000). First, a few laser-printed copies will be produced in the spring 2002 for careful review by the volume contributors and other community members. Then, a more expanded print of several dozen copies can be released, so that the book can be distributed at school and within the communities as a Yupik curriculum and Native heritage material. With additional funding, we hope to have the book printed for other interested readers, to preserve the data of the Watching Ice and Weather project as a monument to the dedicated efforts of local people in sustaining their ecological expertise and ways of ice observations for the generations to come.

Matching Scientific and Local Knowledge—Lessons Learned

Through ages of adaptation, Native residents of the Arctic have built a comprehensive and elaborate stock of knowledge about their environment and have developed survival techniques to cope with the constantly changing arctic climate, sea ice, and weather conditions (Berkes, 1999; Krupnik, 1993; 2000b). In the “good old days,” there was no “bad weather” and success in hunting and availability of animals was always interpreted as a result of proper human behavior, of following established spiritual guidelines, rites, and beliefs. Today, however, the knowledge and legacy of the ancestors is not bestowed automatically upon everyone who is a Native or who lives on the coast or even is a sea-hunter. Whereas formerly people believed they shared the land and the sea with spirits, hunters of today speak increasingly in terms of “ecosystems,” animal “behavior,” contamination, and stock “health.” They are now used to checking the local radio for daily and weekly weather reports, and to using the sea ice
charts and long-term weather forecasts. Hence, the body of indigenous expertise about ice and climate is changing, and will not remain intact for an indefinite time.

The sea-ice observation journals, stories, and personal comments of elders and hunters from two closely related communities on St. Lawrence Island, Alaska, illustrate the enormous richness of what is commonly called “traditional ecological knowledge” (or “local knowledge”—see definitions in Berkes, 1999: 5–8). To the Yupik people of today, this knowledge is their special treasure, the best of their scholarship, and a pinnacle of many generations of experience and achievement in their harsh Bering Sea environment. To scientists, these papers and records offer an invaluable new vision on how changes in weather, sea ice, and marine life can be documented by “another form” of observation and expertise.

Of course, what has been recorded during the project is just the tip of the iceberg of what is actually known about sea ice and weather by the people of St. Lawrence Island. Unlike scientists, hunters are not bound in their observations by any defined “project time” and their stories do not refer to any specific research period. They are going on the ice almost every day, year after year; and they preserve their memories, listen to elders’ stories and share their observations with others. This is the body of knowledge that has been praised highly by many experienced anthropologists and natural scientists for years (e.g. Berkes, 1993; Freeman, 1984; Nakashima, 1993; Nelson, 1969; Riewe, 1991).

It is almost trivial these days—at least, on the part of scientists—to talk about “barriers” and “hurdles” to the ways Native or local knowledge can be matched with the data collected by the scientific community. Those obstacles most commonly listed arise from the presumption (which more often that not remains untested and never fully examined) that traditional knowledge is assumed to be intuitive, holistic, qualitative, and orally transmitted while the academic or scientific knowledge is primarily analytical, compartmentalized, quantitative, and literate (Eythorsson, 1993; Lalonde, 1993; Nadasdy, 1999). While there is some truth to these differences, Native elders and environmental experts can effectively operate with both types of knowledge, and they often do it more skillfully than polar scholars. This was clearly illustrated by the many statements, stories, and observations collected during this project and, particularly, by the two senior participants of our project, Conrad Oozeva and Chester Noongwook. I regard both our senior experts as true scholars and I respect them deeply. They fully demonstrate the very best qualities that are commonly associated with the scholarly mind: analytical perception, an inquisitive drive for continuous observation and recording, the eagerness to cross-check their data with other people’s views and references, and openness to what Conrad Oozeva called “your scientists’ usual question marks.”

It is not a different nature, but rather a different focus of scientific and “local” knowledge, that commonly keeps these two types of expertise looking in different directions. Modern scientific studies of environmental change are unmistakably time-focused, in that scientists are primarily looking for well-documented series or samples
of otherwise uniformly organized data, like annual or seasonal temperature and ice series, ice charts, satellite photographs, ice core samples, and others. This time focus allows scientists to operate with both the average and the extreme characteristics of the environment that are easily and thoroughly positioned in time and marked by fixed calendar dates or years. For scientists, such things are regarded as “statistically reliable.” Scientific knowledge of climate change is basically aimed at expanding the timing and reliability of the various sets of data, in order to build better explanatory models with which it can operate. The actual nature of those data may be of secondary importance.

Local knowledge, on the other hand, is first and foremost detail-focused, in that it prizes specific and very detailed information about the characteristics of the environment observed, including sea-ice and weather change. There is no issue of statistical reliability, and every personal observation is considered sound and equal, as long as it relates to the environment, which is familiar to the observer. The age of the observer is probably the closest equivalent to the scientific concept of “reliability,” as changes reported by elders are always considered more valid than those observed by younger people. But even among elderly experts there are people like Conrad Oozeva and Chester Noongwook—very much like some elders from the past, such as the renowned Gugwiingen, nicknamed “the weather bureau”—whose expertise of ice and weather is considered exceptional and is highly praised in the communities.

Nonetheless, as local knowledge documents in amazing detail the many possible facets of sea ice changes, as well as all exceptional weather phenomena, there is hardly an issue of precise timing of these events. Current stories and elders’ memories are not focused on absolute dating or on any source of precise timing. People may say that “such and such thing happened twice or three times in my lifetime,” but there is not a traditional practice to define exactly when it happened. Native observation of the environmental change does not have a dating method, unless queried specially. That is why many scientists have problems using records from local observations. To them, local knowledge contains too much data that is very hard to organize properly in a familiar standardized time series. The events or phenomena are usually reported with the excessive detail, but they are rarely dated in acceptable terms and, thus, are hard to compare with time series available through scientific records and/or instrumental observations.

There is also a problem of scale in comparing locally detailed Native observations and the more generalized scientific models based upon satellite images, multiyear observation records, and computer simulations (see also paper by David Norton, this volume). Lewis Shapiro, the polar ice specialist, who compared St. Lawrence Island observation records with contemporaneous scientifically organized sea ice data, notes that:

Clearly Chester (Noongwook) and the NIC folks [from the National Ice Center that produces summary ice charts for Worldwide Web distribution] are looking
at things on different scales. In fact, the thickness of the lines between different ice types on the (NIC) charts may scale to be comparable to the distance offshore that Chester could see standing on the beach. Also, I don’t have any idea of the size of the smallest area of a particular ice regime that the observers at the NIC would map independently. This creates some problems in making comparisons between the observations. If you want to see an example, go ... to the chart from the time that Chester indicates the ice was far offshore (on February 9, 2001).

However, in area “G” on the chart, the area off Savoonga is mapped as 0.7–0.9 ice covered. ... The remaining area of 0.1 to 0.3 is left for open water, but there is no information about how the ice and open water are distributed over the mapped area. The contradiction is obvious, but at the same time, they are probably both right. Chester certainly didn’t see any ice off Savoonga during this time, and the NIC observers, who made the chart, didn’t see a large enough area of open water to map it as a separate unit; so, they folded it into their unit “G.” That seems like a reasonable conclusion, but it would be nice to know how far Chester really could see (from the shore), and how finely the NIC folks discriminate their ice zones. (Lewis H. Shapiro, letter to Henry Huntington and Igor Krupnik, December 10, 2001).

Therefore, in order to be compatible, both types of observation must be substantially modified to accommodate each other’s specifics—in the same way that the data from social and natural sciences have to undergo certain accommodations to be used in an interdisciplinary or joint study. The same process takes place regularly in Native science, as experts from distant areas have to adjust the sets of observations from other communities, to be able to compare them with their own expertise and to benefit from other people’s knowledge.

One can also see from the observation records and, particularly, from the summary statements of project participants, that local environmental experts are often far more advanced in mastering the terms, data, and approaches developed by scientists than vice versa. There are very few polar scholars, who can distinguish and name at least a few Native definitions of sea ice (although there are some who have produced papers and books about Eskimo knowledge of ice). Today’s hunters, by contrast, can talk at length in purely scientific terms about the effects of global warming on sea ice and marine animals migrations well beyond their local areas of daily travelling and observation. Some elderly experts, like Conrad Oozeva and Chester Noongwook, have an extensive knowledge of major ice and current circulation cycles in the general northern Bering Sea-Bering Strait area, from the Pribilof Islands in the south and up to Barrow and the Chukchi Sea, in the north. This may be a unique blend of knowledge shared by today’s Native elders, from which polar scientists and younger generations of St. Lawrence Islanders could learn in both more traditional and in fairly modern terms:
People like Conrad [Oozeva]—he is a life-long observer, a living database. He is very articulate in his first language [Siberian Yupik]. He is very well versed in knowledge about how the [ocean] currents are flowing, and he knows how to get out when the ice is moving. He knows about the winds in the wintertime and about ice formations, and different weather patterns—he has his own equivalents for all these terms plus some sixty years of his personal knowledge. … Now, Conrad knows—and he is a living database—maybe thirty different conditions of ice and snow around our island. And I just talked about two different conditions: one is slush ice and the other is flowing sea icebergs. Conrad can give you many, many different variations, with their specific terminology from our Native culture (John Waghiyi, February 2000).

Despite certain reduction in shared ice and weather expertise lamented by the elders, the people of St. Lawrence Island will almost certainly maintain this body of local knowledge. As long as they keep listening to their elders and continue to go hunting and travelling on ice, this expertise will be sustained by practical needs and new experience. Unlike Native experts and practitioners, scientists learn and maintain their knowledge through “projects” and “research initiatives” (or by reading the results of other people’s studies). Therefore, the only way polar science can learn to be more open to local knowledge is by developing special research on just how to do this. This was the main purpose of our pilot project in documenting the sea ice and weather “the Yupik way” and of other similar projects presented in this volume. We believe that in both cases that initial goal has been achieved.

In order for the two types of science—developed by northern residents and scholars, respectively—to be compatible, a lot of further mutual adjustment is required. This approach differs from the perspective, which is popular among natural scientists and which looks for the ways to incorporate the data from indigenous observation into scientific research. To my mind, the gap is too big for an easy scanning from “other science” and it is obvious at every meeting that brings academic scholars and Native experts together.

Scientific knowledge about recent climate change in the Arctic has to become more specific, in order to interact productively with local expertise shared within the northern communities. It has to find ways to be projected from the more general (global?) models down to the regional and even to the individual village level. For local knowledge, on the other hand, a timing mechanism has to be created to make Native record of past and present events compatible with the time series used by academic scholars. This is a complicated enterprise, as each local community has to build a “beach-ridge chronology”5 of its own, one based upon its particular history, available documentary records, and memories shared by the most elderly experts.

To accomplish these and other goals, intensive new learning and the sharing of knowledge and data is required. Thus, future long-term efforts should be focused first
and foremost on charting the ways for mutual adjustment of the two types of knowledge about arctic environmental change.

**Conclusions**

To the polar science community, the study of Native practices in the observation of sea ice and weather conditions offers an opportunity to learn how a record of ice and climate change is accumulated and transmitted by “other” ways of knowledge, that is, by the shared expertise of northern residents. Physical scientists may be particularly interested in the potential observational and explanatory value of Native terminologies and databases on sea ice, like the one developed by the Yupik people of St. Lawrence Island. The ability to “read” through the records, both oral and written, of Native monitoring of sea ice and climate change is another obvious asset to the study of climate change. Social scientists, from their side, are to benefit from the increased awareness about the structure and functions of Native scholarship and from a better understanding of the role environmental knowledge plays in the complex social fabric of modern community life.

To the many ongoing impact assessment studies of arctic climate warming, such projects provide practical tests of collaboration between the two most involved groups of stakeholders, polar scientists and local residents. Such collaboration and mutual correction is critical at all stages of the impact assessment process, including observation, documentation, and analysis of the various signals of climate change. As scientists and northern residents alike experience rapid shifts in arctic weather and ice regimes, both constituencies express their concerns about the scope of potential change they may face in future. Climate scientists, in order to attract public attention to climate change issues, often respond by articulating some extreme scenarios under their computer-simulated models. Many such scenarios, like those featuring the 40% decrease in the volume of arctic sea ice over the next 20 years and the ice-free Arctic, with a complete disappearance of the permanent summer ice pack by the year 2050 (e.g., Vinnikov et al., 1999; Gough and Wolfe, 2001, etc.) may have dire or unprecedented consequences on Native residents. It is hard to say what practical worries about the future of the Arctic are shared by the science community; but their expression projects a message of extreme anxiety, to which a much more engaged Native political leadership responds with great alarm (Fenge, 2001; Ford, 2001; Whitehorse Declaration, 2001).

The response from the Native community, on the other hand, is a mixture of two clearly distinctive motifs. One is the message of confidence and endurance, based upon the legacy of survival in the ever-changing arctic environment and upon decades of personal experience by the elderly experts. Native elders are normally quite reserved and they rarely boast with confidence regarding the power of their expertise. Nonetheless, whenever they comment about the value of accumulated knowledge in addressing the climate change, they stress it eloquently:
This change (of winter ice and weather) is visible. Anleghaq [going out hunting at sea, particularly to the east—IK] has changed. When I was younger, there were these migrating walruses coming on the eastern side of Gambell first; and then they were going around the point, and headed south. That used to happen in November, first part of November. ... That did not happen like that anymore. Now they do like that for very short time in December, which is late. ... Something is changing—we noticed this.

[However] with the warmer weather, the animal behavior is still the same. They just migrate earlier. And during wintertime, despite all these changes of ice and weather, there is no effect on them. We can get more walruses in winter now, if it's a good weather for hunting. Because of that, I am not that much concerned.

I have lived through at least three periods [winters—IK] of exceptional warmth, including the latest one, but in between it was always like more or less normal winter. Still, I have a big question mark, like you scientists always have. It may get back to normal but it may not. If it does not change rapidly, it is not going to change our hunting and all the knowledge we have will be still valuable (Conrad Oozeva, 2001).

It is probably safe to say that changes are going to become a daily part of our lives. In light of more unstable weather conditions, I think that it would help if we can anticipate these changes based on observations and data collected by the scientific community and also observations by local hunters. Then we can make a collective prudent decision of where and when to concentrate our efforts in order to feed our souls, physical, and biological needs.

We cannot change nature, our past, and other people for that matter, but we can control our own thoughts and actions and participate in global efforts to cope with these global climate changes. That I think is the most empowering thing we can do as individuals (George Noongwook, 2000:24).

This motif of endurance (“resilience”), however, is often accompanied by the message of grave concern, as northern residents watch rapid shifts in their environment and struggle with explanations. Some of their statements clearly follow paradigms borrowed from the scientific discourse; others reflect their own monitoring of the habitat that has been familiar for decades:

I am concerned about this happening to our weather and these changes—the global warming, the erosion on our island. If it erodes more, the permafrost is melting, our island might get smaller. Hunting is different, too because of this changing weather and ice. And the animals are different because they are living along with the ice, like the bowheads, walruses, seals, polar bears, maklaks
[bearded seals]. They all come close to our island because of the ice. This year even minke and gray whales are fewer than before—I do not know, why.

To my knowledge, the whole globe is turning the other way. I had a strange vision at my camp last year, when I looked at the Big Dipper. It always used to be straight to the North Star. It looked like slightly off this past year. I was scared. It could have been my own sighting but I am concerned about it. And I am not trying to look that way anymore.

When we are building something, moving or mining, we are disturbing the permafrost and it is melting. The water is rising because of this, all these waves, erosion. That is why I am thinking about global warming. It could alter our way of life as well (Chester Noongwook, 2001).

Modern arctic ice and climate change studies can benefit tremendously via the contribution of properly collected local observations, done by Native people themselves and from their cultural perspective. As Native people are given a full chance (and appropriate means), to document how they observe weather and sea-ice in their own words, in the course of their daily lives, a whole set of new records will be available for a thorough and comparative examination. Then, and only after then, we may start thinking about how this knowledge can be matched with the data collected by scientists and used in scientific models, maps, and in the overall discussions of arctic climate and ice change in the course of recent global warming.

Acknowledgements
This is the first preliminary review of the project Watching Ice and Weather Our Way, to be followed by further accounts and, hopefully, by a bilingual volume to be prepared for the communities of Savoonga and Gambell, in cooperation with my research partners—Henry Huntington, the overall project director; and George Noongwook, Savoonga project coordinator. Henry’s role in preparing the many project documents and in offering advice and criticism on the draft of this paper should be specially acknowledged. The sea ice and weather observation in 2000–2001 was accomplished thanks to its endorsement by the communities of Savoonga and Gambell and to the financial support provided by the Marine Mammal Commission (Executive Director Robert Mattlin, Chairman John Reynolds). In my trips to St. Lawrence Island in 2000 and 2001, I also received substantial assistance from the Arctic Studies Center, Smithsonian Institution; the National Park Service, Western Arctic National Parklands office in Nome, Alaska; and the Eskimo Heritage Program of Kawerak, Inc. in Nome (Director Branson Tungiyan). My colleagues in arctic research, Fikret Berkes, Dyanna Jolly (Riedlinger), Gary Kofinas, Lewis H. Shapiro, and Carleton G. Ray, offered valuable comments that were received with gratitude. Finally, it was the greatest pleasure to work with the observation teams from the two Yupik
communities, particularly with our two senior experts, Conrad Oozeva and Chester Noongwook. Their dedication and sharing of expertise was the key contribution that made our joint venture in sea ice and weather observation “the Yupik way” and this paper as its first summary, possible.

Notes
1. This is the most extensive account so far of the project team activities in 2000–2001 (Igor Krupnik, principal investigator; Henry Huntington, project director; George Noongwook, local coordinator). See earlier reports in Krupnik, 2000a; Krupnik and Huntington, 2001.
2. The communities included Gambell, Savoonga, Mekoryuk, Unalakleet, Elim, Nome, Deering, Kotzebue, Kivalina, and Barrow in Alaska, plus Inuvik, in Canada’s Northwest Territories.
3. In Gambell, the basic names for the winds are the same but their meanings are slightly different, which is a common pattern among Inuit (Eskimo) groups throughout the Arctic (see Fortescue, 1988).
4. Following the pattern preferred by the volume contributors, the Yupik portions of the text go under the Yupik names of the authors, whereas English portions are under their documented English names.
5. This refers to the dating method developed by geologists and archaeologists, whereby events or objects of the past are dated by calibrating the series of beach ridges that have been built on shore by the sea surf through time. Scientists call it a “beach-ridge chronology”: the ridges closest to the sea are the latest to be built up and, thus, the youngest; and those farthest from the sea are the oldest ones, and so on.

References


Adopted by the Circumpolar Climate Change Summit, held in Whitehorse, Canada on March 19 to 21, 2001. *Silarjualiriniq* 7: 5.

Yupigestun kelengakellgha sikumllu esclemlhu: Watching ice and weather our way. In prep.


Appendix 1: Chester Noongwook’s Daily Weather Story, December 8, 2000

I usually go out every morning to check the weather, about 8 or 8:30 in the morning. I got up and went out of my house at about this time this morning, and I looked around, to see how the weather would be today. And it was going to be a good hunting day. Sky condition was very thin—just a few clouds here and there. I could even see the moon and the stars from the breaks in the clouds. The wind is going to be light and it is from the south (iqevagatawa). It is a good wind to go out hunting in boat.

Then I took my grandchildren down to school (about 9 a.m.) and I looked for water and ice near the school site at the shore—whether there is any open water out there (far at sea). I could tell it because there was some darkness in the sky far over there; that dark sky is over open water. I stayed at the store for some time to get information from other people, who were there earlier in the morning. We always have a few people of my age gathering at the store, the side that faces the water and the beach—they just stay there for some time, watch the weather and ice, and talk.

It was very slushy ice—we call it qenu. The ice from the bottom moving up and starting to make it a very slushy young ice. Many of us can see some scattered ice cakes. We call this ice sikupik: it can be one foot or two feet or even three feet high. This is what we were told by our fathers, ayemqutet or uughhutet—pieces formed from the main (polar) ice being blown out to the island by the northern wind. These ayemqutet are making scattered ice floes from the main ice formations. It is mostly wind not the current (that brings this kind of ice) and also the icebergs from the north. We call these icebergs kulusiit.

This ice now is not good—neither for foot (walking) nor for a boat, because it is very hard to travel by boat (at this type of mixed and slushy ice). And it breaks very easily under the foot. My grandfather always told me that we have to wait until somebody was starting to go out hunting. It is always better this way; that what he used to say.

In the afternoon it got much warmer and the ice was moved in by the current. We have to be very, very watchful for this type of ice (because it moves quickly). As long as the weather stays warm, the hunting won’t be very good for us. This is because of the new ice, qenu, slush ice. It is dangerous for travelling in boat—
it has to get frozen first. When colder weather comes in, it may solidify, so that we can walk over on foot.

The weather for tomorrow: from my guessing, so long as the wind is from the south (iqevaq) or whatever my barometer says, the condition of the sky, the weather might be better of than this one by tomorrow. But we never know for sure. My grandfather used to tell me that you would never tell the weather for tomorrow until you get up, go out, and check the weather yourself. We are just thirty-five miles from Gambell, but we do not even know how the weather is up there today.

I could see a little bit of moon through the sky now (in the evening) and so I can guess that the weather might be a little bit better tomorrow.

This time of year (early December) the walrus is usually going from west to east. We call this walrus angleghaq. They are mostly females mixed with few bulls and calves from this year or a year before. Early in the morning, when the weather is calm, we can hear walruses in the water making noise. Seals and maklaks (bearded seals) here are almost the same as walrus. My grandfather used to call it katawsaq’a—like, pouring out with the ice. Ice moves in here with all these animals. My brother killed a walrus today, so everybody in the village has some fresh meat. No seals, no maklaks so far.

The day before yesterday (December 6) we have seen two gray whales—angtughaq. We do not hunt them here until we are really pressed (by shortage of food). We still have a chance to see or hunt a bowhead (whale) nearby. Usually around Stolby Rocks, at the place called Kitnik. And later on they may come by and going westward, toward Gambell, and then all the way around the island to the Southwest Cape. So, we still hope, maybe we can get one (bowhead) this year—we already started looking for one now. From this day on and until late winter, we will be carrying (whaling) gear in our boats.
Appendix 2: “Anuqem Nakengutanga”—Wind Directions in Gambell, St. Lawrence Island
Compiled by Conrad Oozeva. Translated by Branson Tungiyan

Aywaapik (North) Pakfalla (West)
Nakaghya (Northeast) Naayghiina (Northwest)
Kiwavaq (East Northeast) Naayviinaq (South Southeast)
Asivaq (East) Saalghaghta (Unexpected Storm)
Ikevaghlluk (Southeast) Quutfaq (Northeast)
Ikevaq (South)
Tapgham (Southwest)
Ketanga

1. **Aywaapik (North).** The weather (with the wind coming) from the true north is good. Because the weather is always good from that direction, travelling anywhere during the wintertime is considered safe because it is clear. (With this northern wind) the weather is often clear in summer as well, even if there is some wind blowing.

2. **Nakaghya (Northeast).** The true direction for this wind is in between north (aywaapik) and east (asivaq). This wind direction often brings a lot of fog. The fog associated with this wind does not clear up quickly, but often has light winds without big swells in the sea.

3. **Kiwavaq (East Northeast).** When the wind is from east-northeast, it is often coming from the direction of the tip of the Gambell Mountain. This direction has a special rule that comes with it, in regards to going out onto the sea ice for hunting. The men are told not to go out for hunting on the ice because this direction comes with stronger winds.

4. **Asivaq (East).** This wind comes directly from the (Gambell) mountain, and it often comes with snow, and even blowing snow, when this wind continues to increase. There are strong downdrafts with this wind around here (in Gambell). On the other hand, the ice is taken out from that direction in winter (the shore opens up in Gambell for boat hunting). Also, if the winds are light, they tend to stay light.

5. **Ikevaghlluk (Southeast).** At wintertime, like this, the weather usually warms up; but it gets very stormy, with blowing snow and strong winds. Also, when the wind comes from that direction, it opens up ice leads in the southeast direction. The ice that has been brought by this wind from the south (ivagghutkak) can be often seen out here (right in front of Gambell, on the western side). When the wind is light, it tends to stay light; but when it is packing strong winds, it is always stormy and blowing snow. In the summertime, it is always wet and rainy, and windy.

6. **Ikevaq (South).** This wind comes from the south, from the southern mountains direction. With this wind in the summer time, the travel along the northern part of
the island and all around Gambell is usually good. The weather also warms up with the southern wind. But mostly in the springtime, it brings a lot of fog with it. Still, it is often (considered) a good weather because it does not have strong winds.

7. **Tapgham Ketanga (Southwest).** This wind also brings a lot of heavy fog because the fog is brought over from the warmer air [over the open sea], and when [it is] brought to the cooler air, it creates foggy conditions. And, it sometimes gets drizzle. It almost always gets foggy when the wind is from that direction. This weather does not have strong winds. Travel conditions (on the sea) are sometimes quite good, particularly along the northern part of the island.

8. **Pakfalla (West).** This wind comes from the true west direction. When the weather becomes of “the normal wind strength” (igiighta—is kind of hard to explain in English), it often clears up, although there might be some clouds. If the shore ice has gone out, this wind often brings it back to the shore. In this case, even though there have been a lot of ice around, the shifting of ice by the western wind causes the ice to ‘change places’ for a while. This wind also tends to bring strong gusts, especially in the fall if the snow begins to set in. Then, it often creates snow showers, but then it clears up. That is how it tends to be. In the summer time, the rains that come with this wind are pretty much the same as the snow showers are in the fall.

9. **Naayghiina (Northwest).** This wind direction comes directly from the Siberian Mountains (that is, across the strait between St. Lawrence Island and the Siberian mainland). We hardly ever get real strong winds from that direction (in Gambell), but if it gets windy, it gets windy. These west and northwest wind directions do not stay long; it usually changes to a different direction shortly. These winds are favorable (for hunting and travelling) and the weather tends to be clear. All these wind directions that I have just told, the winds can change quickly and it could get windy from another direction. So, now that we have begun to understand, if [big] storms go through close to us, and the winds shift to certain directions because of the low pressures, the winds can become very strong from that direction.

10. **Naayviinaq (South Southeast).** That south-southeast wind direction comes right in between Ikevaq (south) and Ikevaghlluk (southeast). It gets very windy as well, but the wind does not stay in that direction for long; it shifts either to the southeast or to the south. (Overall) it is very similar to the southeast wind, but it shifts direction much quicker. When this wind increases, it gets foggy, but it does not have much fog condition. Even though it gets foggy, the lower level at the ground tends to be clear. It could also be quite wet, because it can warm up (the temperature) in winter. This wind is just the same in summer, with wet weather conditions, like the drizzle.
11. *Saallghaghta (Unexpected storm from any direction).* These unexpected strong wind conditions could occur from any wind direction, and in the winter can become very whiteout (blizzard) conditions quickly. Also in the summer, it can be very wet. Mostly, when heavy dark clouds rise from the southern direction, the gale force winds will arrive from the northeast direction and it can get very stormy real fast. Unexpected blizzard conditions (may come) from the east, southeast, west, or from any wind direction. In most cases, the wind and weather condition that is called *saallghaghta* is like that.

* This is the only (though a very clear) indication that traditional Yupik knowledge of wind patterns is now influenced by more ‘scientific’ explanations of atmospheric circulation, driven by the high pressure-low pressure alterations.