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Editorial

Sustaining the marine ecosystem of the Pribilof Domain

Kudaliig̃in maqãxtakan txichin aguqangin
 Udaadan tanangin kugan Unangan anangin
 Ixaqangin lulalix matalix anãgãiing̃in matakun
 Aniqdun ngiin aqãgan ãnganin qulingiin akũ gumalgakũ.
 ...Kamgam Tukuu Adã Michael D. Lestenkof, 1999

The way of our beginning, our ancestors
 Our people's land and sea around here
 Believe in them and keep them going through time
 For the coming generations that we do not see yet, for their
 time here.

...from "The Right Way to Live as an Unangã"
 Very Reverend Archpriest Michael D. Lestenkof, 1999

"Keep them going through time for the coming generations..." requires sustaining regional ecosystem services (food, fuel and fibers, as well as spiritual, recreational, educational and other nonmaterial benefits to society) of the Pribilof Domain, those waters between and surrounding the Pribilof Islands. This necessitates changing perspectives and adopting management strategies supported by a greater knowledge base. Scientists have begun to realize the need to shift attitude from one of *taking* available natural resources (e.g., ecosystem services) to one of *receiving* Earth's services in a respectful way (Schumacher and Kendall, 1995; Hoopes, 2004). More recently, a synthesis of research from the Aleutian Islands suggests that science alone is not sufficient; management needs to expand to include input from a broad stakeholder community involving sectors of commercial and recreational fishing, subsistence, conservation, oil and gas development, tourism and others (Schumacher and Kruse, 2005). While local traditional knowledge has been accumulated over many generations, western scientific research is more limited, particularly with respect to regional ecosystem dynamics. To address such pressing issues as responses to climate change and increased human impacts, the research presented herein was undertaken to provide insight to key biophysical processes. The integration of all forms of knowledge (e.g., local traditional, western science, economics, legal, policy making) can provide the greatest potential of sustaining regional ecosystem services through effective management of direct and indirect human impacts and responses to ongoing climate change caused by anthropogenic and natural forcing.

Pribilof inhabitants have always had a close and intimate relationship with life on the islands and the surrounding sea. The modern people of the Pribilofs have lived there for 220 years, since

the islands were "discovered" by Gerasim Pribilof and other Russian fur traders in 1786–1787. In 1788, the Russian American Company populated the islands by enslaving and relocating Unangan (Aleuts) from Unalaska, Atka and Siberia to the Pribilofs to hunt fur seals (Fig. 1). One can only imagine how it must have felt for the nature-respecting Unangan to have to kill fur seals for reasons other than subsistence, i.e., the customary and traditional use of ecosystem services for direct or family consumption as food, shelter, clothing, tools or transportation. By 1834, Russian overseers realized the need to curtail the fur seal slaughter to preserve the resource, and they enacted restrictions to prevent hunting of females and hunting on land. An estimated 2.5 million seals were killed for their fur from 1786 to 1867 (Sims, 1906), when the United States purchased Alaska. The United States perpetuated the requirement that Pribilof Unangan kill fur seals, with most of the revenue destined for the private Alaska Commercial Company based in California and for the federal government. It was not until 1966 that the United States freed the Pribilof Unangan from virtual slavery (Corbett and Swibold, 2000; Koberstein, 2005a).

In 1869, the US Treasury was authorized to lease sealing privileges to outside commercial interests. Pelagic sealing (taking seals at sea) from about 1868 until 1909 by non-local hunters decimated the fur seal population. Many seals taken at sea were females, often pregnant. An accurate accounting of the number of seals taken at sea is nearly impossible, as many escaped wounded or were killed and sank. However, it is estimated that the Pribilof population reached a low of 216,000 animals in 1912 (NMML (National Marine Mammal Laboratory), 2007). The Alaska (including Bogoslof Island) population of northern fur seals increased to approximately 1.25 million by 1974 after the killing of females in the pelagic fur seal harvest was terminated in 1968. The population then began to decrease, with pup production declining at a rate of ~7% per year into the 1980s. By 1983 the total stock estimate was 877,000. The northern fur seal was designated as "depleted" under the Marine Mammal Protection Act in 1988, because population levels had declined to less than 50% of levels observed in the late 1950s (1.8 million animals). The estimated pup production in 2004 was below the 1919 level on St. Paul Island and below the 1916 level on St. George Island. The most recent estimate for the number of fur seals in the Eastern Pacific stock is ~722,000 (Angliss and Outlaw, 2007).

Today, ~680 people (2000 census; EcoTrust, 2005), many of them descendants of those early hunters, live on the two major Pribilof Islands, St. Paul and St. George. Residents subsist on halibut, fur seals, reindeer, birds, marine invertebrates, plants and berries. Their relationship with the sea continues. Over 100 local fishers



Fig. 1. *Fur-seal hunting*, acrylic on canvas, by Azat Minnekaev; reproduced with permission of the artist. In 1992, Minnekaev lived and worked in Alaska as a guest of the Aleut Corporation of St. Paul Island.

operate 30 locally owned vessels in a million-dollar halibut fishery. The islands provide the only sheltered harbors in 50,000 km² of rough ocean waters. The crab industry has sustained St. Paul. At its peak in the 1970s and 1980s (ADFG, 2001), the crab season boasted over 230 transient vessels, two floating processor plants permanently moored in St. Paul harbor, and more than 40 floating processors, freighters, and crab vessels all working within 5 km of the islands (A/PIA, 2004). Recently, the fur seal population and the halibut and crab fisheries have suffered, possibly due to the allowance of commercial trawling in the region. In 1994, the Pribilof Habitat Conservation Area, a no-trawl zone, was established to protect habitat of regional marine resources. However, fur seal, crab and halibut stocks have yet to recover (Koberstein, 2005b; Woodby et al., 2005; Angliss and Outlaw, 2007). The Unangan, despite being free for 40 years, still feel the influence of the federal government in ways that clash with their way of being.

According to Corbett and Swibold (2000):

Aleuts have become their own agents of assimilation and modernization through their participation in the fishing industry. This wave of acculturation has resulted in profound and rapid changes to the Pribilof culture. A local, cultural, and environmental movement has grown up to counteract the loss of Aleut identity, community cohesiveness, subsistence skills, and connection to the land and sea. In the process of cultural recovery, self-governance, self-reliance, and self-sufficiency are emerging in the community. Finally, the Unangan connection to the fur seal, severed by the collapse of the seal harvest and the disapproval of a Western, urban culture, is now being recovered by a young generation of Pribilovians.

This new generation is rediscovering the way of their ancestors: to be connected to the land and sea and to keep their resources, and their relationship to them, going through time.

Even considering recent downward trends in marine populations, the ecosystem of the Pribilof Domain is impressive in its abundance. Why all this marine bounty? The Pribilofs sit at the edge of the continental shelf with the shallower eastern Bering Sea shelf to the east and the deeper, nutrient-rich waters of the generally northwestward-flowing Bering Slope Current to the west. These waters are responsible for the islands' extraordinary biological wealth. Known as "the Galapagos of the North," the Pribilofs are home to some of the largest breeding colonies of marine birds and mammals in North America. Visitors come from around the world for the unique experiences available in the Pribilof Islands, including rare migratory seabird sightings, encounters with rookeries of nesting birds, and huge colonies of northern fur seals.

Throughout the last century, commercial whaling and fishing, pollution and introduced species have put severe stress on the Bering Sea and its islands. Species of marine mammals (northern fur seal), birds (black- and red-legged kittiwakes, common and thick-billed murres), and shellfish (king crab, snow crab, both Tanner and opillo) have experienced severe declines (with declarations of "overfished" and "closure"). Whole fisheries, such as the once lucrative king crab fishery, continue to be reduced. The reasons for these depletions are not all local. Global changes come to bear. For example, a consequence of increased green house gases in the atmosphere is that carbon dioxide in the world's oceans is increasing. Increased carbon dioxide causes a corresponding increase in ocean acidity (Orr et al., 2005), which results in coral bleaching, deleterious effects on shells of pteropods and other changes in plankton processes (Wingenter et al., 2007). The Bering Sea is not immune to this change.

More recently, the effects of a varying climate have brought significant change to the waters of the eastern Bering Sea (Macklin et al., 2002; Schumacher and Kruse, 2005). Nearly shelf-wide blooms of coccolithophores possibly have interfered with the

ability of some marine birds to find their prey. Seasonal sea ice that long ago routinely reached as far south as the Pribilofs appears to be receding northward and impacting ecosystem dynamics (Overland and Stabeno, 2004). The nature of the spring phytoplankton bloom, the timing of which is related to sea ice extent, is changing as a result of ice recession. The “cold pool”, also associated with sea-ice coverage, is diminishing, altering the thermal habitat for fish and shellfish and affecting their distribution.

Shepherding this marine ecosystem to ensure subsistence for Pribilof natives, commercial availability for fishers, and responsible development of tourism requires knowledge of what is in the ecosystem, how it works and responds to change, natural and anthropogenic, and the will to make strong decisions. This volume provides valuable baseline scientific information for the Pribilofs today. Content ranges from regional physical oceanography to discussion of nutrients and their fate, then travels up the trophic ladder from phytoplankton to zooplankton, fish and shellfish, seabirds and marine mammals. Many of the discussions relate recent changes in the ecosystem to processes that are likely brought about by climate variability.

What does it take to bring about the research needed to advance our understanding of this ecosystem? Glancing through the Acknowledgements section of each contribution to this journal gives an idea of the scope of support that was required to derive the information contained herein; an integration of support from many sources. Mentioned are no fewer than 20 separate organizations and 21 vessels. Some organizations provided support through more than one program, and several of the vessels made more than one voyage to the southeastern Bering Sea. What is not revealed in the Acknowledgments is the cooperation that occurred among the many scientists who contributed to this volume. It is exactly that cooperation that enables collection and synthesis of large amounts of data, and generation of coherent scientific hypotheses and truths from small bits of isolated information. And, it is these larger units of understanding that are necessary (but not sufficient) for wise management of the many human impacts so that ecosystem services that have perpetuated local people for countless years and contribute significantly to our national and global economies may continue. Such integrated strategies can help sustain this region's richness “going through time.”

December 5, 2007.

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