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A Resilient Subsistence Salmon Fishery in Southwest Alaska

A Case Study of Fish Camps in Nondalton

ABSTRACT Harvesting and processing salmon is a significant subsistence activity for the residents of Nondalton, a predominantly Dena'ina Athabaskan community in Southwest Alaska. The Nondalton fishery, as a resilient social-ecological system, has had to adapt to change in order to maintain continuity over time. This paper will explore adaptation in a resilient salmon fishery through an ethnographic research project that documents the socio-cultural, economic, and environmental circumstances of fishing, mainly sockeye salmon (*Oncorhynchus nerka*), in the Kvichak Watershed of Southwest Alaska.

KEYWORDS salmon, Alaska, Dena'ina Athabaskan, Bristol Bay, social-ecological systems, resilience, adaptation, Traditional Ecological Knowledge (TEK)

Introduction

Harvesting and processing salmon is a significant subsistence activity for the residents of Nondalton, a predominantly Dena'ina Athabaskan community in southwest Alaska. The Nondalton salmon fishery is a complex social-ecological system; a system that involves humans as part of the natural system. The fishermen in Nondalton must negotiate socio-cultural, economic, and environmental circumstances in order to continue summer fishing activities. The Nondalton fishery, as a resilient social-ecological system, has the ability to adapt to change and maintain continuity over time, while maintaining ecological, economic, and social sustainability (Berkes *et al.* 2003: 15). The fishermen have adapted fisheries technologies and harvest strategies so that the fishery is self-

managed and they meet their harvest goals, while ensuring the sustainability of the salmon resource.

This paper will explore adaptation in a resilient salmon fishery through an ethnographic research project that documents the socio-cultural, economic, and environmental circumstances of fishing, mainly sockeye salmon (*Oncorhynchus nerka*), in the Kvichak Watershed of Southwest Alaska (see Fig. 1).¹ This paper will focus only on one of the study communities, Nondalton.

Following a short summary of Nondalton and the fishery, as well as the study methods used in this project, the discussion will center on the major socio-cultural, economic, and environmental circumstances that the residents negotiate during subsistence salmon fishing activities. The residents' adaptation of an efficient fish technology, seining, will also be discussed. The goal of the project was to document information that could help researchers understand how the residents use their knowledge of salmon and the environment to make decisions about when to harvest, where to harvest, and how much to harvest. Much of this knowledge sharing occurs at fish camps.

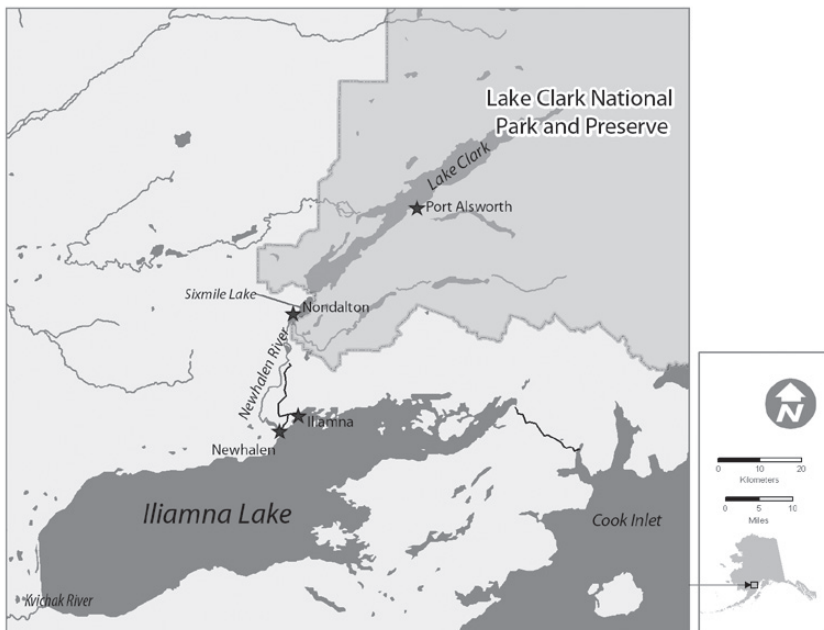


Fig. 1. Communities in Southwest Alaska that are part of the Kvichak Fish Camp Ethnographic Project. Map by Davin Holen.

The Community of Nondalton and the Kvichak Salmon

Nondalton is a predominantly Dena'ina Athabaskan community of 151 people (see Table 1). Alaska's Athabaskan people inhabit the sub-Arctic interior and many communities are situated on streams and rivers where large runs of salmon occur. Nondalton is located on the northern shore of Sixmile Lake, a small lake near the outlet of Lake Clark (Fig. 1). Sixmile Lake flows downstream into the Newhalen River, which flows into Iliamna Lake, Alaska's largest lake, which then empties into Bristol Bay through the Kvichak River. Kvichak River sockeye salmon returns are thought to be the largest in the world and the watershed acts as a nursery for Bristol Bay anadromous fish. The salmon resource is a major contributor to the area's subsistence economy. In Nondalton, salmon accounts for over 60 percent of the wild food harvest by the community in terms of pounds of usable weight (Fall *et al.* 2006). The majority of Nondalton residents spend most of the month of July fishing for sockeye salmon in Sixmile Lake.

The fish camps used by the Nondalton residents are located at the mouth of Sixmile Lake where it empties into the Newhalen River (see Fig. 1). Maps label this place "Fish Village." The residents simply call it "fish camp."

Table 1. Demographic characteristics of households in Nondalton Salmon harvest surveys, 2007 & 2008 study years.

Characteristics	2007	2008
Number of Households		
Total	36	39
Household Size		
Mean	3,62	3,9
Sample Population	94	124
% Sampled	72,22%	82,1%
Estimated Community Population	129,72	151
Age		
Mean	32,30	31
Alaska Native		
Estimated Households (Either Head)		
Number	34,50	38
Percentage	96,15%	96,9%
Estimated Population		
Number	110,40	132
Percentage	85,11%	87,1%

SOURCE: Alaska Department of Fish and Game, Division of Subsistence, Household Surveys, 2008 & 2009.

¹ Minimum household age of 0 indicates newborn in study year.

Study Methods

The principal social science research methods used in this project were participant observation, key respondent interviews, and in-person household surveys. (1) Participant observation was the primary method used. The research team helped the residents of each community to retrieve nets, process fish, or do other jobs as instructed by fishermen during the salmon harvest. The researchers experienced the fishery firsthand, making observations while asking questions. The researchers were present throughout the Nondalton subsistence sockeye salmon fishery in July 2007. (2) Key respondent interviews were conducted with knowledgeable fishermen in each of the study communities, with eight key respondent interviews conducted in Nondalton. The respondents were chosen by the researchers during participant observation. The researchers met to discuss potential respondents and decided on respondents that represented a wide range of ages and participation in the fishery. The researchers also used recommendations from local residents and community leaders. These post-season interviews occurred in October 2007. (3) Systematic household surveys were conducted to document demographic information and salmon harvests in Nondalton in February–March of both 2007 and 2008. In-person household surveys were conducted and there was an attempt to interview every household in the community (see Table 1 for sample size). In addition to recording the basic demographics of each household, as well as its amount of salmon harvested, the respondents were asked about gear types, harvest locations, and offered the opportunity to express their comments and concerns.

Adaptive Strategies for Negotiating Socio-cultural, Economic, and Environmental Circumstances Related to Subsistence Salmon Fishing

Every summer Nondalton families must make decisions about salmon fishing, including when to harvest, where to harvest, and how much to harvest, while taking into account socio-cultural, economic, and environmental circumstances. This discussion will present some circumstances that the residents must negotiate when making important decisions every summer.

There are two major socio-cultural factors, noted by both residents and resource managers, that could potentially affect the long-term resilience of the subsistence fishery: children and young adults are not actively participating in subsistence salmon fishing as they have in the past, and, since summer is often the time when seasonal employment is available, some residents miss the subsistence fishing season due to work obligations. During

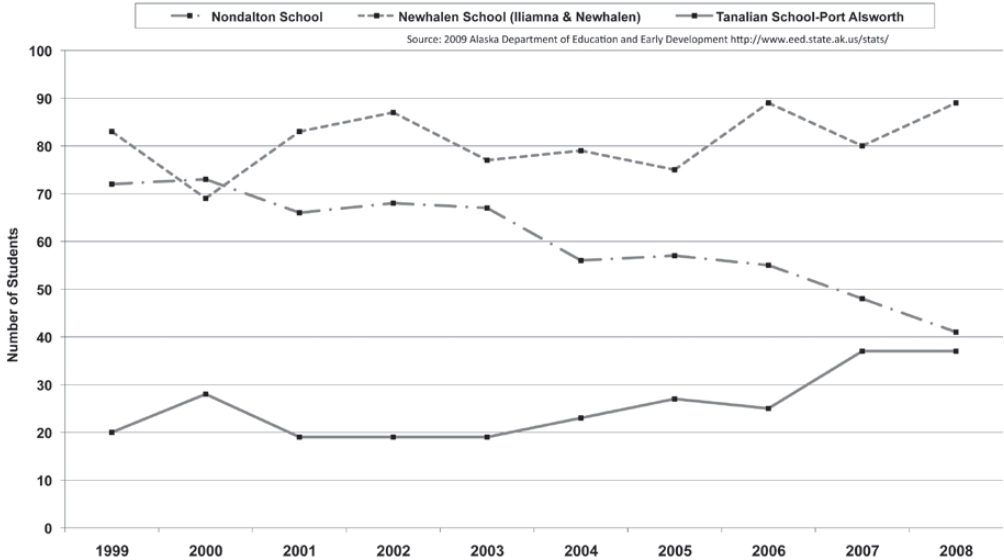
the summer school break youth participate in activities from work, various camps, and family visits to urban areas, to a range of other activities. The researchers found that although youths' free time is sometimes limited, some do participate in salmon fishing, as was observed during participant observation. The researchers visited each camp in Nondalton; many had children or young adults present. Children told the researchers that they do enjoy going to the fish camps. In Nondalton, the parents of one family said that it was their children who gave the impetus to travel early to the fish camp every summer. The entire family stays at the fish camp until the salmon harvest is finished; the father uses a boat to commute to the village every day to work.

But the researchers overall noted that there are fewer children at the fish camps each year. The ancestors of the Nondalton residents have been subsistence fishing in the area for about 1500 years (Kari in Townsend 1981; Kari & Fall 2003). In order for the fishery to continue a new generation must take over. A growing number of salmon fish camps are comprised of older couples or single adults. This is perhaps due in part to a gradual decline in the number of children in the community. Fig. 2 illustrates a gradual decline in the number of children enrolled in school in Nondalton over the past 10 years, based on records from the Lake and Peninsula School District. This data supports local observations that there are fewer children in the community, and therefore fewer children attending the fish camps each summer. This trend in school enrollment in Nondalton has been occurring for some time, according to the Lake and Peninsula School District, although school enrollment in the neighboring communities of Iliamna and Newhalen is flat, and in Port Alsworth school enrollment has been steadily increasing.

Fishing time may also be limited due to work obligations for adults and teenagers. Many residents have part time jobs or summer seasonal jobs. These types of jobs include commercial fishing in Bristol Bay, fighting fires in the interior of Alaska, or construction work (Fall *et al.* 2006). However, the researchers noted that many residents of Nondalton do make an effort to spend at least some time every summer harvesting subsistence salmon as a family, even if this time is limited. In addition, even if some family members are working outside the community, those who are able to go to a fishing camp throughout the subsistence salmon harvest season often harvest enough fish to share with those who are unable to fish due to work obligations.

Financial factors play a large part in the decision-making process of Nondalton families. Salmon harvest goals are affected by two related factors: (1) the necessity of harvesting enough salmon to last until the following salmon season, and (2) the cost of fishing. The first factor means that

Fig. 2. School enrollment, preschool & K-12, 1999 to 2008 Nondalton compared to neighboring communities.



families have enough salmon to eat without buying the majority of their meat from a store, which may be very expensive in rural Alaska due mainly to freight costs. This economic factor is also related to environmental circumstances, such as fewer caribou (*Rangifer tarandus*) and moose (*Alces*

Table 2. Salmon harvest per capita, Nondalton, 2007 and 2008.

2007				2008				
	Total Salmon Harvest	Per capita Salmon Harvest	Pounds per capita ¹		Total Salmon Harvest	Per capita Salmon Harvest	Pounds per capita ¹	
Population	130	9 612	74	346,8	151	10 241	68	317,1

¹Conversion factor = 4.68 pounds usable weight

alces) in the area. In this study residents related that fewer caribou and moose in the area prompted them to set their salmon harvest goals a bit higher than in recent years.

To answer the question “Do residents in Nondalton have enough salmon to last throughout the winter?” the in-person harvest survey asked whether the household’s salmon harvest during the study year met its needs. During the 2007 fishery, 88.5 percent of Nondalton households related that their needs were met, and in 2008 (although the harvest was lower than in 2007 [see Table 2]), 90.6 percent said the harvest met their needs. Both during the

surveys and during the key respondent interviews, the Nondalton residents said that they had to adapt to environmental circumstances, namely the absence of moose and caribou, and as a result, they had set their salmon harvest goals higher. In recent years, moose and caribou have been scarce. Caribou, especially, have not been readily close for several years (Holen *et al.* 2005; Fall *et al.* 2006; Krieg *et al.* 2009). Hunting caribou takes a tremendous investment in time and money, not to mention faith: hunters must have faith that once they arrive at the caribou hunting grounds, the caribou will still be present. The residents often travel long distances by all-terrain vehicle (“four-wheeler”) or snow machine to areas where caribou have been seen. For example, Nondalton residents will travel to Lime Village, a 5-hour journey by snow machine directly north of the community, if they hear from their Lime Village kin relations that caribou are in the area. The residents thus must negotiate the expenditures of time and money with the possibility of harvesting a caribou. The residents say that moose have also been scarce in recent years; however, the residents say that they will not travel as far from home to look for a moose. After the recent increase in gasoline prices (Fig. 3), many residents said that it was “too costly” to travel to caribou hunting grounds or to search for a moose. As a result, households apparently focus their harvest efforts on salmon.



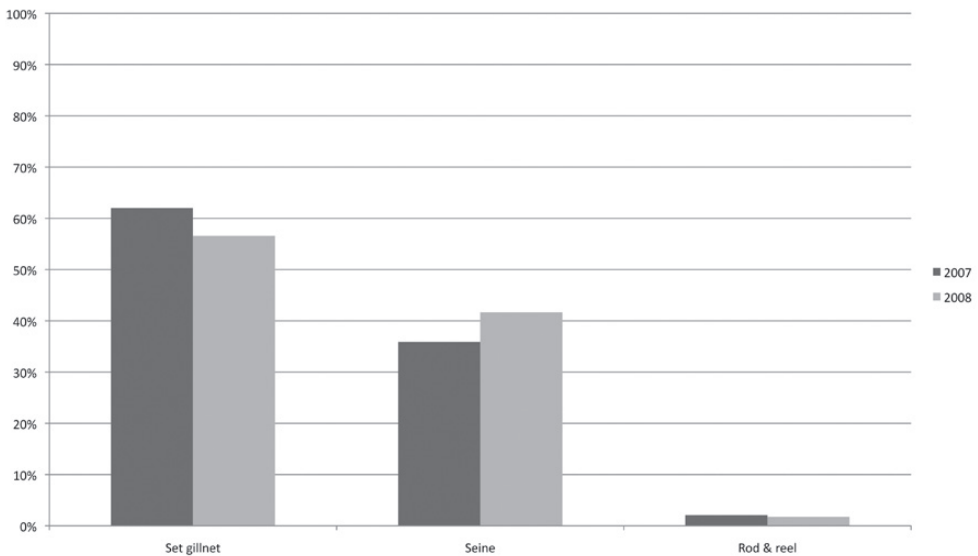
Fig. 3. Fuel price per gallon in US\$ at a station in neighboring Iliamna. Residents often travel the 18 miles by road to buy fuel at this station. Prices rose so quickly in 2007 that the dollar amount was often replaced. Photo: Theodore Krieg.

The second factor is the cost of fishing. Families need cash income in order to pay for boats, gasoline, fishing-nets, and the general upkeep of fish camps. Some households may have one or several adult family members who work full-time all the year round, and who receive little summer vacation time. Or, some family members may work long hours in the summer commercial fisheries in Bristol Bay or in wildfire control efforts. The summer months, besides being an important time for harvesting and processing a large part of the household's annual subsistence needs, are also the months when cash income opportunities are more numerous.

Families involved in commercial fishing in Bristol Bay usually miss the peak of the subsistence salmon fishery in their own communities. Due to the cost of shipping salmon to the village, few households in Nondalton retain a portion of their commercial catch for subsistence uses, as do many commercial fishermen who live nearer the fisheries. Nondalton residents also say that they prefer the taste of locally caught salmon and that they would rather subsistence fish the end of the salmon run in Nondalton after the commercial fishery has ended in Bristol Bay.

Having time to deal with shifts in seasonal salmon run timing and abundance is a factor that influences a household's achievement of harvest goals. Households that can set aside late June in order to prepare for fishing, all of July in order to fish and process salmon, and, if the salmon run is late,

Fig. 4. Salmon harvest by gear type, Nondalton.



sometimes early August in order to fish and process salmon, are able to meet their harvest goals. However, if a household is able to fish for only a short period of time, or only during weekends due to work obligations, which is common in neighboring Port Alsworth for example, it may not be able to reasonably meet its harvest goals. In addition, households are able to harvest only the amount that matches their mode of fish processing.

Environmental circumstances, such as inclement weather, may also be a major factor affecting a household's ability to adequately process salmon. The processing method observed in Nondalton, which includes hanging fish to dry out-of-doors prior to canning them, facilitates the processing of larger batches of salmon all at one time. This method, however, may not be the best method for a household with minimal time, especially if there is inclement weather. During inclement weather and extended periods of rain, more frequent and smaller batches of salmon had to be harvested and processed by sending freshly cut salmon directly to the smokehouse, in contrast to the methods employed during dry weather, in which larger harvests are slowly dried outdoors on numerous racks before placement into much smaller smokehouses. This salmon processing adaptation allows fishermen to meet their harvest goals. In addition, residents have also adapted to inclement weather by using a seine net, as discussed below, which provides selectivity in harvest amounts. Those who can spend more time in camp are able to wait for weather more conducive to seining, harvest smaller amounts of salmon, and then finish the processing of these small batches in the smokehouse. The summer of 2008, for example, was described by respondents as being wetter and colder than the summer of 2007 (the harvest was also smaller, as demonstrated in Table 2). However, as discussed above, most residents related that they were still able to meet their harvest goals. The residents had to spend more time at fish camp processing their salmon harvest in smaller batches. Even though the residents were also affected by weather in 2008, according to the salmon harvest survey, 90.6 percent of households were again able to meet their requirements. Extended kin networks in Nondalton ensured that residents who were unable to harvest enough salmon received from family members what they needed until the next year's salmon season. During the household harvest survey, 75 percent of households reported giving away salmon; the same percentage reported receiving salmon.

Seining

Seining for sockeye salmon may be considered an adaptive strategy for negotiating socio-cultural, economic, and environmental circumstances, as well as an adaptation of technology that has led to the resilience of the

Nondalton salmon fishery. As will be discussed later, it is also an example of a sustainably self-managed fishery. The results in this section are based on all three research methods listed in the methods section, above.

Briefly, the Nondalton residents use three methods for harvesting salmon in Sixmile Lake: gill nets, rod and reel, and seine nets (Fig. 4). Gill nets are still the most common method. A 10-fathom net is anchored to the shore, a buoy is attached to the far end, and this end anchored in the lake. As the fish migrate, they try to swim through the net. They cannot swim backward, so they are usually caught by their gills. Residents also use rod and reel to harvest sockeye salmon; however, this method is classified by resource managers as “sport fishing” and by most residents as recreation.

Seining, as a fishing method, is an example of adapting fishing gear to a particular environmental situation or context. Although illegal until 2007, a few families in Nondalton had participated in seining for over twenty years. According to many Nondalton residents interviewed for this project, seining is the best way to fish.

A gill net left overnight might catch too few fish or too many fish. In addition, the fish can be cut or bruised by the net mesh. The damaged sections of the fish must be removed before the fish are dried, or the fish will spoil. A seine net, with its smaller mesh size and thicker net material enables fishermen to take only what they need and minimizes damage to the fish. Fish are captured by the net, not caught in the net. In addition, fishermen can select which fish they would like and let the rest go. Fish that look ready to spawn, small fish, or fish that are thought to be extremely healthy “large breeders” are often released.

Although seining as a method was illegal in the Kvichak Watershed until 2007, when regulations were changed to allow its use, one family has used a seine net since 1985. Presently, this family has the only seine net in Nondalton. Respondents said that there used to be a second net, owned by the village, used as a cooperative community net. However, seine nets require frequent maintenance and their use extreme care. Because of the smaller mesh, the net captures more debris, and holes must be repaired often. Respondents said that no one took care of the community seine, so it fell into disrepair. The net owned by the family is well maintained. The family takes the net out to fish for and with other families who request help in harvesting salmon. This family said that the only difference between the time seining was illegal and now is that they can now use the seine during the day, instead of using it in stealth at night.

Seining is also a community activity, one that takes many people to ensure that it is done properly. Gill nets are stationary nets, requiring the labor



Fig. 5. Seining on Sixmile Lake, 2007. Photo: Davin Holen.

of only one or two people to set and then remove fish. Seining takes many people. In the cases observed by the researchers, no fewer than six people were involved (see Fig. 5). In the Nondalton community with its relatively small household size (see Table 1), this means that cooperation across more than one nuclear family is needed.

As observed by researchers, in order to harvest salmon with the seine net, one end is pulled into shore by a skiff and given to at least two people to hold. The boat driver then moves into the water accompanied by at least one other person whose job it is to make sure that the net is deployed smoothly. The fish are circled, and the net handed off to at least two additional people on shore. The number of people needed to deploy the net and the distance the net is deployed from shore depends on the number of fish present. In one case, the researchers observed that there were so many fish that the net was taken out only a few feet before the other end was returned to shore and handed off. One person at each end makes sure the lead lines, dragging on the bottom, stay on the bottom to ensure a complete capture of the fish. The second fisher at each end holds the top of the net above water. Both sides then pull the net to bring the fish close to shore (see Fig. 5). The boat

is stationed alongside the outside edge of the net and serves as a third anchor with a small portion of the net ideally caught by the oarlocks. Several people then step into the water, grab the thrashing salmon, and throw them into the boat. The fishermen holding the net at each end slowly pull the excess net toward shore in order to maintain a tight seal as the fish try to push outward to get away. During the activities observed by the researchers, the boat driver counted the fish as they were being loaded, and when the desired amount had been taken, the net was dropped to the bottom and the rest were released. If a salmon looked as if it was not going to swim away, it was added to the boat. In this way, accurate record keeping occurred, which ensured that no more fish were taken than could be processed.

Seining is an example of how residents use the best available technology, even though it was, until recently, illegal. The residents of Nondalton, even those that do not use a seine net, say that it is the best method for subsistence fishing because it ensures minimal waste.

Seining is also a method that necessitates considerable knowledge of the environment. The residents know the best location for using a seine net, taking into account such factors as fish behavior, changes in water levels, and changes in lake topography, or bathymetry. The Nondalton residents seem to prefer places where fish school, where a boat can be easily landed, and where the water is shallow enough for people to stand in. Annual changes in lake water levels must be accounted for. In 2007, for example, respondents said that the water levels were several feet below normal: their boat docks at the fish camps were dry. Reduced water levels and changing water flow also appear to affect the locations of fish schools. The residents must also adapt their harvest strategies based on bathymetry. The glaciers at the headwaters of the Kvichak watershed deposit silt into Lake Clark and Sixmile Lake. Residents say that the amount and composition of the silt have changed over the past 50 years because many glaciers have completely melted and no longer deposit silt into the streams. One resident who has fished a location for over 50 years noted that areas which used to have lots of grasses and weeds, in which fish schooled, are no longer present because the nutrient-rich silt has dissipated. Strong currents move silt deposits from year to year and thus the residents must adjust their fishing efforts based on these changing water levels and lake bathymetry.

Discussion

Observing fishing activity in Nondalton contributes insights about traditional ecological knowledge (TEK)—living knowledge based on the actions and activities of a group during their experiences and traditions of engaging the social and natural worlds (Usher 2000: 185). In the case of the Nondal-

ton fishery, there is a way to include TEK into a management strategy by requiring that local values and practices be included in management (Nadasdy 1999: 13). Both local fishermen and resource managers share the same goal: sustainable fishery. Seining supports sustainable fishery because the residents harvest only what they need and the seine nets do not damage the salmon. By self-managing the fishery, the fishermen ensure that the fishery is resilient and the resource remains sustainable.

Self-management is a strategy that manages resources with respect for the land and wildlife. According to Feit (1988: 74), self-management systems “are determined at the local level by reference to community-based systems of knowledge, values, and practices.” Self-management is presently not a recognized Alaska management practice; rather it is part of the local culture. The Nondalton residents use best practices to meet their harvest goals without taking more than can be processed by small family and kin related groups. Self-management decisions are made in a changing social and natural environment and the residents must continuously adapt. By negotiating these changes from year to year, residents are able to adapt their actions and decisions to ensure resilient fishery (Manseau *et al.* 2005: 153). Residents also reaffirm the importance of fishing in accordance with their cultural tradition and collective environmental knowledge.

Conclusion

The subsistence economy of Nondalton has changed over time, adapting to circumstances such as the varying abundance of salmon and the changes in weather, both of which affect the ability of fishermen to adequately process their harvest. Salmon fishing remains a large part of the harvest of wild foods in this predominantly Dena’ina Athabaskan community (Fall *et al.* 2006).

As in other parts of the Arctic, Nondalton youth have expressed frustration at being excluded from subsistence activities, during which they would learn the skills necessary to fully participate (Myers *et al.* 2005: 35). However, young adults with new families in Nondalton relate that as their children get older, they participate more each year in fish camps. Families, especially those with school-aged children, are important for the continuity and resilience of the Nondalton salmon fishery, and the community as a whole.

The seine is an example of an adaptation of technology that has supported self-management of, and therefore the sustainability of, the salmon resource. Cultural norms of right conduct in this predominantly indigenous community necessitate taking only what one needs and using all of the resource. As discussed above, effective seining requires considerable knowl-

edge of the environment and the resource. In this case TEK is crucial for the success of using this adapted technology for harvesting salmon.

The sockeye salmon fishery of Nondalton is a complex social-ecological system that is shaped by sociocultural, economic, and environmental circumstances where adaptation is necessary to maintain a resilient system. Some residents have adapted the technology for its efficiency and for its conformance with cultural norms of right conduct in taking only what is needed. Nondalton fishermen who are currently not using the seine relate in interviews that they are interested in adapting this technology. Summer subsistence salmon fishing allows residents from all parts of the community to participate in a continuing cultural activity and fosters a sense of belonging to the community.

NOTES

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