

**Historical and Contemporary Use and Effort of Subsistence Herring Eggs  
within the Makhnati Island Federal Waters**

Final Report for Study 08-651

Heather Meuret-Woody  
Sitka Tribe of Alaska  
456 Katlian Street  
Sitka, Alaska 99835

Benjamin Mann  
Sitka Tribe of Alaska  
456 Katlian Street  
Sitka, Alaska 99835

Thomas F. Thornton  
Environmental Change Institute  
School of Geography and the Environment  
University of Oxford  
South Parks Road  
Oxford, OX1 3QY, UK

and

Helen Dangel  
Sitka Tribe of Alaska  
456 Katlian Street  
Sitka, Alaska 99835

September 2010



## TABLE OF CONTENTS

TABLE OF CONTENTS.....	i
LIST OF TABLES.....	i
LIST OF FIGURES.....	ii
ABSTRACT.....	iii
INTRODUCTION.....	1
OBJECTIVES.....	4
METHODS.....	4
RESULTS.....	8
DISCUSSION.....	17
CONCLUSION.....	20
RECOMMENDATIONS.....	21
ACKNOWLEDGEMENTS.....	22
LITERATURE CITED.....	23
APPENDIX A.....	26
APPENDIX B.....	29
APPENDIX C.....	30
APPENDIX D.....	31
APPENDIX E.....	33
NON-DISCRIMINATION STATEMENT.....	34

## LIST OF TABLES

Table 1. Survey sample and participation summary.....	5
Table 2. List of interviewees.....	7
Table 3. Results of the Makhnati Supplemental Survey, 2008.....	10
Table 4. Results of the Makhnati Supplemental Survey, 2009.....	10
Table 5. Combined results for the 2008 and 2009 surveys, Makhnati Supplemental Survey. ....	11

## LIST OF FIGURES

Figure 1. Makhnati Island Federal Waters includes E.O. 8877 and E.O. 8216. ....	3
Figure 2. Herring eggs drying on racks in Sitka Indian Village. Japonski Island is in the background (year and photographer unknown). ....	9
Figure 3. Sitka and the Makhnati Islands federal waters area, 1932. Photo shows islands prior to development of the Causeway, Fort Rousseau, and the Sitka Naval Operation Base. In the center of the photo is the Navy coaling station and wireless station on Japonski Island (Photo supplied by The Photo Shop Studio). ....	12
Figure 4. Herring eggs on kelp and branches drying in Sitka. Photo by E.W. Merrill (ca. 1885–1904) (Alaska State Library - Historical Collections). ....	15
Figure 5. This photo was taken facing south with Japonski Island and smokehouses in foreground. The year of this photo is unknown (Photo supplied by The Photo Shop Studio). ....	19
Figure 6. 2007 herring spawn deposition survey relative magnitude of total egg counts on transect. Note the largest green dots which indicate higher spawn density per meter <sup>2</sup> occurred with the Makhnati Island federal waters (ADF&G 2007). ....	20
Figure 7. Location of the islands that are within the Makhnati Island federal waters (Fort Rousseau Causeway State Historical Park Management Plan, 2010, Alaska Department of Natural Resources). ....	27
Figure 8. Sitka and the Makhnati Island federal waters area, 1972. Photo shows islands after the development of the Causeway, Fort Rousseau, and the Sitka Naval Operation Base (Photo supplied by The Photo Shop Studio). ....	27

## ABSTRACT

### **Historical and Contemporary Use and Effort of Subsistence Herring Eggs within the Makhnati Island Federal Waters**

This study describes the historical and contemporary harvest and use of herring eggs (*Clupea pallasii*) from the Makhnati Island federal waters. Information was gathered through harvest surveys, a literature review, and key respondent interviews. It was already known that the majority of the harvest and use of herring eggs from Sitka Sound is by Alaska Natives. The Makhnati area was once used by many subsistence users, but today is not used as frequently due to the development of the area, and the ease of most subsistence herring egg gatherers to harvest in other areas. This report provides for a better understanding of the importance of the customary and traditional herring egg harvest overall, with a specific emphasis on Makhnati Island federal waters as an important historical and contemporary spawning habitat and harvest area.

Citation: Meuret-Woody, H., B. Mann, T.F. Thornton, and H. Dangel. 2010. Historical and contemporary use and effort of subsistence herring eggs within the Makhnati Island federal waters. Final report to the U.S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Resource Monitoring Program, Project No. OSM 08-651. Sitka Tribe of Alaska. Sitka, Alaska.



## INTRODUCTION

The community of Sitka is located on the east side of Baranof Island at the mouth of the Indian River in Southeast Alaska. Present-day Sitka is located at the site of an historical Sitka Tlingit settlement and fish, wildlife, and plant use area. *Sheet'ka Kwaan* is a name by which Native descendants and current residents are also known. Previous research by the Sitka Tribe of Alaska (STA) and others has described the traditional reliance of *Sheet'ka Kwaan* on wild resources. While salmon and other fish were the primary wild resources harvested for home use, herring eggs (*Clupea pallasii*), or *yaaw*<sup>1</sup> in Tlingit, were an important part of the seasonal round. While there has been non-Native participation in the herring egg fishery, non-Natives are not known to harvest in quantity or to participate as major suppliers of herring eggs to non-harvesting households (Schroeder and Kookesh 1990). Additionally, almost all herring egg harvesting, receiving, and distribution has been shown to be within the Alaska Native community.

Harvesting herring eggs had a central role in the seasonal round of *Sheet'ka Kwaan*. According to deLaguna (1990) in her description of a traditional Tlingit seasonal round, the annual cycle began in early spring and was a time for hunting and trapping bear, marten (*Martes americana*), mink (*Neovision vison*), and beaver (*Castor canadensis*), and harvesting halibut (*Hippoglossus stenolepis*). Low tidal flows in spring made it easier to gather shellfish and seaweed. Some hunted sea otter (*Enhydra lutris*) and seal, and gathered herring spawn. The first runs of Chinook salmon (*Oncorhynchus tshawytscha*) arrived in April and May. June to September was a time for catching and curing sockeye salmon (*Oncorhynchus nerka*), harvesting berries, and some hunted seal. In summer and other times of year, journeys were made to Yakutat and other communities to trade. In fall the last berries were picked and preserved, and hunting of deer (*Odocoileus hemionus sitkensis*) and bear occurred at a time when they were fattest. People were established at winter villages by December and winter activities including memorial “potlatching” (*ku.eex*) commenced. In addition to hunting and fishing, Tlingit devoted much energy to trade long before the arrival of Russian traders. Tlingit traded among themselves and with neighboring tribes. *Sheet'ka Kwaan* moved large quantities of herring eggs to Yakutat in order to trade them with the Alaskan and Canadian interior regions. Herring eggs were a substantial source of *Sheet'ka Kwaan* wealth and prestige. While herring were eaten, the roe was considered a delicacy (Brock and Turek 2007). After 1865, the use of Native trading networks in Southeast Alaska was gradually de-emphasized in favor of goods and merchandise brought in by American traders. “Currently the bulk of traded herring roe is transported from Sitka via commercial air carriers to people in other Alaskan communities and cities in the contiguous United States” (Brock and Turek 2007:2).

Pacific herring are of the *Clupeidae* family, the family of herrings, shads, and sardines, characterized by their large quantities and schooling behavior. Pacific herring range from Baja California north to the Beaufort Sea and south along the coast of Asia to Korea. In Sitka Sound, herring mature at 3-4 years old and annually migrate to coastal waters and consistently spawn on tidal and sub-tidal shores. Adult herring migrate in mid-March to spawn on 40-104 nautical miles of coastline in Sitka Sound (Davidson et al.

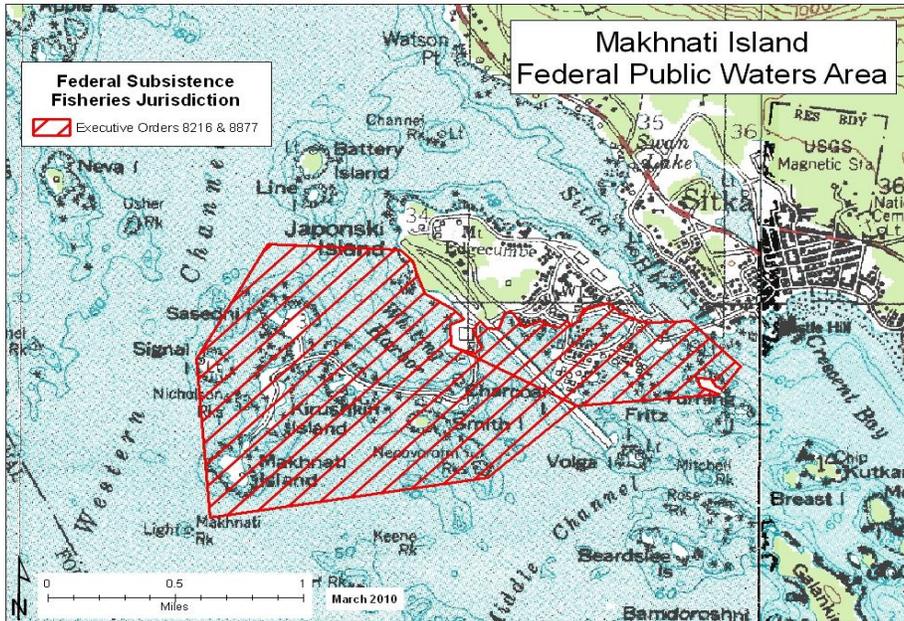
---

<sup>1</sup> Transcription of Tlingit words follows the system proposed by Naish and Story as closely as possible (Davis 1976).

2006). Spawning in Sitka Sound usually occurs in the third week of March and continues into mid-April, and sometimes can occur through May in some areas. Female herring relative fecundity is approximately 220 eggs per gram of total weight (Rabin and Barnhart 1977). Sitka Sound female herring lay 20,000-40,000 eggs. These eggs incubate in spawning areas for about 14 days before hatching as larvae in May and June. The planktonic herring larvae tend to drift to the northern end of Sitka Sound, which serves as a retention area (Haldorson and Collie 1990). Metamorphosis of the larval herring begins in June of that same year (Stokesbury et al. 2002). The herring then become nektonic and swim to favorable habitats where they are no longer at the mercy of the currents. In August, the young herring begin to form schools and aggregate at the heads of bays far from coastal waters (Brown et al. 2002, Stokesbury et al. 2000). These populations stay isolated in their respective nursery bays until June of their second year (Stokesbury et al. 2000). At that time this cohort of herring leaves the bays and joins adult schools (Stokesbury et al. 2000). Herring are an important part of the marine ecosystem, and as forage fish they are the staple source of food for many marine mammals, birds and fish. In Sitka Sound, herring is the food for many congregating sea lions (*Eumetopias jubatus*), humpback whales (*Megaptera novaeangliae*), and grey whales (*Eschrichtius robustus*).

Although herring eggs have been harvested for subsistence uses throughout the state in the past, Sitka Sound provides the largest and most reliable source of herring eggs in Alaska today. Despite an abundance of herring spawn being reported in Sitka Sound historically, the availability of subsistence herring eggs from Sitka Sound has fluctuated in recent years. In 2001, 2005, 2007, and 2008, subsistence herring egg harvesters were unable to meet their subsistence needs. At the Alaska Board of Fisheries meeting in January 2002 the board made a finding for the amount reasonably necessary for subsistence herring eggs in Sitka Sound: 105,000 to 158,000 lbs (5 AAC 01.716 (b)). In 2009, the amount reasonably necessary for subsistence was increased by the Board of Fisheries to 135,000 to 227,000 lbs, effective for the 2010 season (Gordon et al. 2010). Since 2002, Sitka Tribe of Alaska and the Alaska Department of Fish and Game (ADF&G) have conducted annual surveys of the subsistence harvest and use of herring eggs by residents of Sitka (Brock and Turek 2007, Turek and Ciccone *in prep*). Based on this work, the 2002 subsistence herring egg harvest was estimated at 152,000 lbs (76 tons), the 2003 harvest was estimated at 279,000 lbs (140 tons), the 2004 harvest was estimated at 293,000 lbs (147 tons), the 2005 harvest was estimated at 76,000 lbs (38 tons), and the 2006 harvest was estimated to be 219,000 lbs (110 tons). Unpublished data provided by ADF&G Subsistence Division estimates the 2007 and 2008 harvests at 87,211 lbs (44 tons) and 71,936 lbs (36 tons), respectively (Turek and Ciccone *in prep*). While these harvest levels have fluctuated, the surveys show that demand has remained constant, suggesting difficulties in accessing adequate supplies of eggs. Sitka Tribe of Alaska's 2004 Needs Assessment documented that herring eggs were the fourth highest used subsistence food (following sockeye salmon, halibut and deer) with 93% of Native households harvesting or consuming herring eggs (Sitka Tribe of Alaska 2005).

In 2006, the Federal Subsistence Board enacted regulations re-establishing federal subsistence jurisdiction over 800 acres of submerged lands in marine waters around Makhnati Island directly in front of Sitka (50 CFR §100.3(b) (5); 36 CFR §242.3(b) (5)) (see Figure 1). The Makhnati Island federal waters area lie within the traditional subsistence area of the tribal citizens of Sitka. (A more detailed description of the federalization of the Makhnati Island area is in Appendix A).



**Figure 1. Makhnati Island Federal Waters includes E.O. 8877 and E.O. 8216.**

In 2006, Sitka Tribe of Alaska and the Southeast Alaska Regional Advisory Council submitted proposals to close the waters to all non-subsistence users in order to protect the opportunity for subsistence users to harvest herring and herring eggs within Makhnati Island federal waters, and to protect and conserve the herring spawning habitat. In January 2007 the Federal Subsistence Board deferred action on the Council’s proposal and took no action on STA’s proposal, which had the same effect as rejecting it. In December 2007 the Federal Subsistence Board rejected the Council’s proposal. In 2008, STA submitted a proposal again to close the Makhnati Island area to the harvest of herring or herring spawn except by Federally qualified subsistence users, and in January 2009 the Federal Subsistence Board again deferred the proposal pending more research.

While the harvest of herring eggs occurs throughout Sitka Sound, this study specifically examines the Makhnati Island federal waters area in response to the history of regulatory change requests concerning this fishery, described above. Not only are the Makhnati Island area waters also federal public waters, and therefore within the jurisdiction of the Federal Subsistence Board, but additionally, they are the only place where people can gather herring eggs on *Macrocystis* kelp in close proximity to the city of Sitka. Finally, this report of findings provides for a better understanding of the importance of the herring egg harvest overall with a specific emphasis on Makhnati Island federal waters acting as an important historical and contemporary spawning harvest area.

For clarity, the common names, Tlingit names, and corresponding Latin names of resources associated with the subsistence herring fishery are noted below.

<b>Common name</b>	<b>Tlingit</b>	<b>Latin</b>
Pacific herring	<i>Yaaw</i>	<i>Clupea pallasii</i>
Hemlock	<i>Yan</i>	<i>Tsuga heterophylla</i>
<i>Macrocystis</i> kelp	<i>Daaw</i>	<i>Macrocystis integrifolia</i>
Hair kelp or seaweed	<i>Né</i>	<i>Desmarestia</i> sp.
Herring eggs on hemlock <sup>2</sup>	<i>Haaw</i>	

## **OBJECTIVES**

The primary objective of this project was to document and describe the customary and traditional herring egg harvest in the Makhnati Island federal waters, including harvest, effort, and customary and traditional practices. To achieve this objective, Sitka Tribe of Alaska completed two main tasks:

- (1) Gathering and analyzing contemporary information on the subsistence harvest and use of herring eggs in Makhnati Island federal waters; and
- (2) Gathering and analyzing historical information on subsistence harvest and use of herring eggs in Makhnati Island federal waters.

## **METHODS**

### **Survey of the Harvest and Use of Herring Eggs**

Beginning in 2002, Sitka Tribe and ADF&G developed a questionnaire to gather information concerning the harvest and use of herring eggs for subsistence in the Sitka Sound area. Since then, harvesters in Sitka have participated annually in a survey using the questionnaire. Harvesters were identified using “chain referral” methodology in order to include all households attempting to harvest herring eggs. Under this method, when surveyors learned of a household attempting to harvest herring eggs that was not on the survey list, the household was added to the list and contacted for an interview using the questionnaire. In order to collect information specific to the Makhnati Island federal waters, STA further developed questions to supplement the herring egg harvest questionnaire for the 2008 and 2009 study years. Questions were added to the annual survey to get at site specific locations of harvest and harvest effort in Makhnati Island federal waters. The Makhnati Supplemental Survey questionnaire was administered to 87 households in 2008 and 133 households in 2009 (see Table 1). Appendix B contains the supplemental questionnaire used in the 2008 survey.

---

<sup>2</sup> Herring eggs are generally referred to as *haaw*, *daaw*, or *né* depending on whether the substrate used for egg collection is hemlock branches, *Macrocystis* kelp, or hair kelp, respectively.

**Table 1. Survey sample and participation summary.**

Survey Year	Type of Sample	Number of Households		
		In Sampling Universe <sup>a</sup>	Participating in Sitka Sound Survey	Participating in Makhnati Supplemental Survey <sup>b</sup>
2008	Chain referral	131	129	87 (66%)
2009	Chain referral	196	150	133 (68%)

a. For each survey year, the list of harvesting households was updated by removing households that were known to have moved out of the community. Non-harvesting households were removed from the list after three years of no harvest activity.

b. Participated in supplemental survey by answering at least one of the survey questions.

Data was collected through a face-to-face household interviews where trained surveyors collected information on paper surveys on the harvest and use of herring for subsistence from the Makhnati Island federal waters. As mentioned previously, this was not an additional survey effort, but rather supplemental to the ongoing, annual survey effort. Persons to be interviewed were contacted and informed of the purpose of the project and potential use of the information, and participation in interviews by individuals was voluntary. Identities of participants were kept confidential in all presentation of findings, unless permission by written consent of the participant was obtained.

In addition to standard harvest questions asked on the regular survey (e.g., How many pounds of herring eggs did you get on branches? On *Macrocystis*? On *Né* - hair kelp? Did you share these eggs with anyone? Did you ship these eggs out of town?), supplemental questions were asked to get at harvest location (e.g., Did you use the Makhnati/Whiting Harbor area to collect herring eggs this year? Have you ever collected herring eggs in the Makhnati/Whiting Harbor area? Please mark on the map where you got herring eggs from in the Makhnati/Whiting Harbor area). The Supplemental Makhnati Survey was updated prior to the 2009 season as reflected in Appendix C. All data collected via interviews were entered in a standard survey form. Data were totaled using Survey Monkey™ (see <http://www.surveymonkey.com/>) and exported to Microsoft Excel. As indicated in the investigation plan, data were not extrapolated to account for un-interviewed households in the sample.

## Literature Review

Sitka Tribe of Alaska worked in coordination with Dr. Thomas Thornton of Portland State University who was working on recently-published research with a grant from the North Pacific Research Board to document the historical herring egg spawning and massing areas in Southeast Alaska and how those areas relate to historical subsistence and non-subsistence herring uses in Southeast Alaska (Thornton et al. 2010). This study used archaeological, historical, and environmental records as well as ethnographic interviews with contemporary local experts involved with herring fisheries. A key objective of Dr. Thornton's research is to understand changes in herring stocks, spawning and massing patterns, and uses

over long time scales, as complementary to more detailed recent records kept by ADF&G since 1964. In coordination with Dr. Thornton, Sitka Tribe of Alaska staff conducted a review of literature and other archival sources to collect information about the historical use of the Makhnati Island federal waters. Staff sought out published literature sources with references to herring egg harvest in Sitka Sound. In addition, staff researched unpublished interviews and other data located at the Sitka Tribe offices. All historical information was logged into a herring bibliography of published and unpublished documents.

### **Key Respondent Interviews**

Sitka Tribe of Alaska staff then conducted key respondent interviews to collect information about the historical use of the Makhnati Island federal waters. In coordination with Dr. Thornton, Sitka Tribe staff developed an interview tool for gathering data on historical subsistence herring egg fishery effort and harvest data (see Appendix D). Selection of key respondents was made from positive responses on the Makhnati Supplemental Survey and word of mouth. The investigation plan indicated 10 key respondents would be interviewed. However, it was decided to raise the target number so as to include respondents from more age groups and backgrounds. The goal of this change was to make sure the contemporary fishery was investigated as well as the fishery during earlier eras (see Table 2). Of the 33 people interviewed, 25 (74%) have harvested herring eggs in the past from the Makhnati Island federal waters, and of those, 11 (44%) indicated that they currently harvest herring eggs from the Makhnati Island federal waters. Helen Dangel, from Sitka Tribe of Alaska, and Dr. Thornton trained staff how to interview. Standard traditional ecological knowledge (TEK) methodology was used in developing the interview tool and conducting the interviews using methods from the Traditional Ecological Knowledge Handbook (Miraglia 1998). The interviews took place after the survey portion was over in July 2008. All interviews were audio recorded and interview participants were informed about the purpose of the interviews and asked to sign a consent-to-participate form (see Appendix E). Information collected from interviews was transcribed. Transcriptions were summarized and excerpted for this report.

**Table 2. List of interviewees.**

No.	Interviewee Age	Date	Location	Interview Duration
1	>80	July 22, 2008	Residence	1:05:28
2	69	July 22, 2008	Residence	1:05:28
3	NA	July 22, 2008	Office	0:46:39
4	NA	July 22, 2008	Office	0:46:39
5	52	July 24, 2008	Office	0:31:00
6	72	July 24, 2008	Office	0:31:29
7	38	July 24, 2008	Office	0:17:54
8	67	July 25, 2008	Telephone	0:14:59
9	70	July 25, 2008	Office	0:51:24
10	72	July 25, 2008	Office	0:09:12
11	NA	July 25, 2008	Office	0:04:24
12	79	July 25, 2008	Office	0:43:30
13	NA	July 25, 2008	Office	0:43:30
14	75	July 25, 2008	Office	0:43:30
15	66	July 25, 2008	Office	0:28:46
16	71	July 25, 2008	Office	0:42:58
17	42	July 28, 2008	Office	0:32:18
18	61	July 28, 2008	Office	0:26:24
19	43	July 29, 2008	Office	0:30:23
20	71	July 29, 2008	Hospital	0:30:49
21	43	July 29, 2008	Totem Park	0:22:08
22	55	July 29, 2008	Office	0:25:26
23	58	July 30, 2008	Office	0:32:07
24	82	July 30, 2008	Office	0:23:49
25	40	July 30, 2008	Office	0:06:56
26	64	July 30, 2008	Office	0:17:06
27	54	July 30, 2008	Office	0:18:29
28	61	July 30, 2008	Office	0:22:21
29	65	July 30, 2008	Telephone	0:24:55
30	53	July 31, 2008	Office	0:27:08
31	54	July 31, 2008	Office	0:27:08
32	54	July 31, 2008	Office	0:18:39
33	67	July 31, 2008	Office	0:31:52

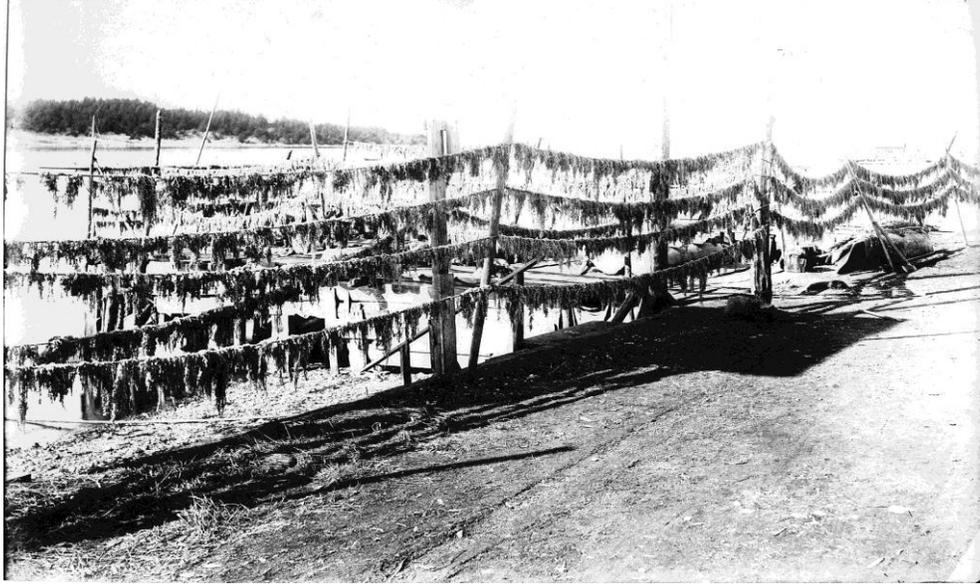
NA=not available

## RESULTS

### Overview of Customary and Traditional and Contemporary Use

The subsistence harvest of herring eggs in Sitka Sound is predominately focused on areas located close to town that are easily accessed by small boat. The customary and traditional herring egg harvest takes place in the spring during the herring spawn, usually in late March or early April. The harvest of herring eggs is done by anchoring hemlock tree boughs or entire trees in coastal bays and along beaches below the low tide line for herring to lay their eggs on. Harvesters place their trees in the water just before the herring begin to spawn. Once the spawn occurs, harvesters may move their trees or boughs to access the more heavily utilized spawning areas that can be delineated visually. Harvesters also harvest kelp that the herring lay their eggs on, both *Macrocystis* kelp and hair kelp.

Today the customary and traditional harvest of herring eggs from the Makhnati Island federal waters continues to be important to Sitkans, especially for those who cannot easily access areas beyond the Sitka road system. The federal waters are particularly important area to gather herring eggs on kelp, as kelp has historically been abundant, predictable, and of good quality in these waters, and it is the only place near town where people can harvest eggs on *Macrocystis* kelp and hair kelp. It is a part of the most productive subsistence areas. According to traditional ecological knowledge gathered in interviews for this project, herring have always spawned around these islands situated in front of Sitka. Traditionally people have also used this area to harvest herring eggs. Before the advent of motorized boats, canoes were used to set branches and haul eggs. The Makhnati Island federal waters area was also the site for drying eggs on racks and in trees with exposure to island breezes, the branches of which were cultivated to optimize their drying area and exposure. Families would dwell on or commute to the islands during herring spawning in order to see to the harvesting and processing of the eggs. Figure 2 offers a view of herring eggs drying on traditional racks.



**Figure 2. Herring eggs drying on racks in Sitka Indian Village. Japonski Island is in the background (year and photographer unknown).**

### **Results of Harvest Surveys**

One objective of the study was to gather and analyze contemporary information on the subsistence harvest of herring eggs from Makhnati Island federal waters by residents of Sitka. In 2008, STA staff designed a survey instrument, the Makhnati Supplemental Survey, that was supplemental to the herring egg harvest survey for all waters of Sitka Sound conducted annually by STA and reported by ADF&G (Brock and Turek 2007, Turek and Ciccone *in prep*).

In 2008, there were 131 households known to harvest herring spawn from Sitka Sound, 129 completed the Sitka Sound harvest survey, and 87 of those households participated in the Makhnati Supplemental Survey (see Table 3). The survey participants were asked the question, “In 2008, did you harvest or attempt to harvest herring eggs in this area?” five households responded yes and 82 responded no. Of the 78 households asked the question, “At any time in the past have you ever attempted to harvest in this area?” 15 households responded yes and 63 responded no. Of the 48 households asked “Do you know anyone else who has harvested/attempted to harvest in this area?” nine households responded yes and 39 responded no.

**Table 3. Results of the Makhnati Supplemental Survey, 2008.**

Question	Households Reporting (N=129)		Response				Question not asked HH
			Yes		No		
	HH	%	HH	%	HH	%	HH
In 2008, did you harvest or attempt to harvest herring eggs in this area?	87	67%	5	6%	82	94%	42
At any time in the past have you ever attempted to harvest in this area?	78	60%	15	19%	63	81%	51
Do you know anyone else who has harvested/attempted to harvest in this area?	48	37%	9	19%	39	81%	81

In 2009, 150 of 196 known harvesting households were interviewed regarding their use of Sitka Sound for herring egg harvesting, and 133 of those participated in the Makhnati Supplement Survey (see Table 4). Of the 131 asked the question “In 2009, did you harvest or attempt to harvest herring eggs in this area?” one responded yes and 130 responded no. Of the 133 asked “At any time in the past, have you ever attempted to harvest in this area?” eight responded yes and 125 responded no. Of the 131 asked the question “Do you know anyone else who has harvested/attempted to harvest in this area?” five households responded yes and 126 responded no. Combined survey data for both 2008 and 2009 are available in Table 5.

**Table 4. Results of the Makhnati Supplemental Survey, 2009.**

Question	Households Reporting (N=150)		Response				Question not asked HH
			Yes		No		
	HH	%	HH	%	HH	%	HH
In 2008, did you harvest or attempt to harvest herring eggs in this area?	131	87%	1	1%	130	99%	19
At any time in the past have you ever attempted to harvest in this area?	133	89%	8	6%	125	94%	17
Do you know anyone else who has harvested/attempted to harvest in this area?	131	87%	5	4%	126	96%	19

**Table 5. Combined results for the 2008 and 2009 surveys, Makhnati Supplemental Survey.**

Question	Households Reporting (N=279)		Response				Question not asked HH
			Yes		No		
	HH	%	HH	%	HH	%	HH
In 2008, did you harvest or attempt to harvest herring eggs in this area?	218	78%	6	3%	212	97%	61
At any time in the past have you ever attempted to harvest in this area?	211	76%	23	11%	188	89%	68
Do you know anyone else who has harvested/attempted to harvest in this area?	179	64%	14	8%	165	92%	100

In 2008, fishers reported harvesting 970 lbs of herring eggs from federal waters: 960 lbs on hemlock branches and 10 lbs on *Macrocystis* kelp. In 2009, one fisher attempted to harvest herring eggs on hemlock branches, but none were harvested.

It is important to note that when asked in 2008, “Under what circumstance do you use this area?” four households responded they used the area to harvest herring eggs on *Macrocystis* kelp, five responded that it is a traditional area, one responded that they have a small skiff and cannot get out very far, and three responded “other.” When asked in 2009, three households responded they used the area to harvest herring eggs on *Macrocystis* kelp, three responded that it is a traditional area, one responded that they have a small skiff and cannot get out very far, and one responded that they used this area because of bad weather.

The following graphic summarizes responses received when asked, for anytime in the past, “What did you harvest herring eggs on in the Makhnati Island federal waters area?”

Study Year	Number of households harvesting spawn on		
	Branches	<i>Macrocystis</i>	<i>Né</i>
2008	12	5	1
2009	5	5	1

There are limitations to interpreting the results of the Supplemental Makhnati Survey. The survey was not conducted with all harvesters who have utilized the area. In addition the area has not been used consistently since the mid twentieth century due to military security restrictions and other developments. Also, the 2008 response to the supplement survey was limited and inconsistent, probably because of survey “burn out” for both interviewers and interviewees (it followed the Sitka Sound herring egg harvest survey) and lack of familiarity with parts of the survey instrument and the total survey area on the part of interviewers. There may have been some confusion regarding which islands actually compose the

Makhnati Island federal waters. Despite being shown a map, the name “Makhnati Island” may signify different area boundaries to different users. Further, the historical interview questions did not hit at the heart of the issue—what is known specifically regarding historical use of the Makhnati Island federal waters for subsistence herring egg harvest. This may have occurred due to lack of clarity with the interview questions, and in some cases, a failure to follow-up with clarifying questions on the part of the interviewer.

### Results of Literature Review

The federal waters encompassing Makhnati Island were a center for subsistence harvesting activities prior to World War II (WWII). The myriad of islands surrounding present day Japonski Island often were referred to in Tlingit as *Aanya X'aat'x'i* (Little Islands in Front of Town) and are referenced in the phrase *Shee At'ika* (Islands on the Oceanside of Baranof), which is the basis for Sitka’s name today. Prior to WWII, the islands within the Makhnati Island federal waters were basically undeveloped save for fishing sites and boat haul-outs (see Figure 3). The building of the causeway connecting the islands was begun in 1939, and the islands were made off limits to the public until 1944. The islands are now collectively referred to as the Causeway Islands, or the Causeway.



**Figure 3. Sitka and the Makhnati Islands federal waters area, 1932. Photo shows islands prior to development of the Causeway, Fort Rousseau, and the Sitka Naval Operation Base. In the center of the photo is the Navy coaling station and wireless station on Japonski Island (Photo supplied by The Photo Shop Studio).**

Recent archaeological investigations date the oldest herring remains in Southeast Alaska human habitation sites at more than 8,000 years, though most date to the past 4,000 years BP (Thornton et al. 2010). Published literature regarding the herring egg fishery is limited and contains sparse information regarding specific subsistence harvest locations, such as the Makhnati Island area. Three ADF&G technical papers focus on the harvest and use of herring for subsistence: Schroeder and Kookesh (1990), Brock and Turek (2007), and Turek and Ciccone (*in prep*). *Sitka: Resource Use in a Small Alaskan City* by Gmelch and Gmelch (1983) also documents the subsistence herring egg harvest in Sitka. Also notable is Thornton et al.'s (2010) recently published research examining herring spawning areas within socio-economic systems. *The Tlingit Indians* by Emmons and de Laguna (1991) describe in detail herring ecology and Native egg harvests in Sitka.

The following is a review of the findings of these studies as they relate to the harvest and use of herring eggs from the federal waters of the Makhnati Island area. Significantly, the Causeway, particularly Whiting Harbor and parts of Japonski Island, contain beds of *Macrocystis* kelp, the easiest substrate from which to harvest herring eggs in a protected area closely adjacent and easily accessible to the city of Sitka.

In the lifetime of elders living in Sitka today, herring eggs were harvested at sites located as far north of Sitka as Nakwasina Sound and south to as far as Elovoi Island. Harvesting occurred on a number of substrata, but primarily three: hemlock branches placed in the water and existing beds of *Macrocystis* kelp and hair kelp.

Several factors affected where people went to harvest herring eggs. One factor was skill. A limited number of people have the skills and abilities necessary to successfully harvest large quantities of good-quality herring eggs. Second, there was weather, described by Turek and Ciccone (*in prep*:17) “large sea swells can make travel in a small skiff, setting branches, and harvesting herring spawn difficult if not dangerous.” As a consequence, fishers select protected waters and avoid traveling across open waters. Additionally, large ocean swells result in sand mixing with the spawn, making it inedible. Third, there was the substrate available upon which to harvest herring eggs. *Macrocystis* kelp seems to be preferred. This is because the eggs are collected off a natural-occurring substrate, only one trip is necessary, and fishers using this substrate harvest larger quantities of herring eggs. However, using this method requires knowing where kelp is found. Traditional *Macrocystis* kelp areas reported by harvesters in 1989 were found in the Causeway Islands area including Whiting Harbor and Japonski Island, Three Entrance Bay, and the southeastern corner of Kruzof Island (Schroeder and Kookesh 1990). When harvested, herring eggs on *Macrocystis* kelp are gathered in abundance compared to other substrata and the ability to transport and process the eggs is more of a limiting factor than regulatory limits<sup>3</sup> or difficulty harvesting.

It appears that *Macrocystis* kelp was harvested using similar methods as hair kelp. During large tides, it was gathered by hand or with a short rake. When the tide was higher, a long rake or a grapple was used. In 2009 it was reported that the most productive traditional subsistence areas include Middle, Crow, and Kasiana Islands, and kelp beds between Kasiana Island and Whiting Harbor (Turek and Ciccone *in prep*).

---

<sup>3</sup> Harvest of herring roe on *Macrocystis* kelp is regulated by permits issued by ADF&G.

## Results of Key Respondent Interviews

Respondents agreed that herring eggs not only are an important food source but also have cultural and traditional importance as well, as described in this excerpt taken from Thornton et al. (2010). Herring Rock, a prominent subject in *Sheet'ka Kwaan* oral history, was located at the site of the present-day city of Sitka, near to the federal waters of the Makhnati Island area. One story in this oral tradition is that of the Herring Maiden related here by John Nielsen:

[The stories] about the Herring Rock are very true . . . . We've known them for thousands of years. The Herring Maiden, she'd go down there when the tide would be coming up. She had real long hair. About that time the herring would start coming in. They'd mill around her hair and they'd start spawning in her hair. Then they found out after that, hey there's some food value in that. So they start gathering . . . on the hair kelp. And then we start setting branches too.

Eventually, Herring Rock (*Yaaw Teiyí*) was taken as a crest by the *Kiks.ádi* Clan,<sup>4</sup> and a name was given to commemorate the woman, *Yaaw Shaawu* (“Herring Woman,” or “Herring Maiden”) which is still carried today among clanswomen.

Donald “Duck” Didrickson adds further details about this sacred site:

It had three names you know; it's Didrickson Rock, after my Grandmother, Chris Didrickson. That's who owned the Herring House [*Kaxátjaa Hít*, or Flipping (Herring) House]. The reason they call it Didrickson Rock, everybody give up [on harvesting herring]. They couldn't get any herring spawn [there]. We set branches down there on the beach and all the herring come in. I figure it had the power to bring in the—see it had something to do with my people settling this area . . . . But Herring Rock . . . had the power to draw everything in, everything we wanted. The *guwakaan* and the *xoots*—deer and the bear—it's all there. In the river's our fish. Down here we had Herring Rock to draw everything in. Draw the herring and everything else: the salmon, the halibut, the seaweed, gumboots, everything. In the old days, that was our calendar. Herring spawned down there, you know spring is sprung. Yeah, Herring Rock been there over 10,000 years. And they always figured it had the power to attract the herring.

Herring Rock was literally blown-up (dynamited) to make room for a dock by what is now the Totem Square Hotel in downtown Sitka. Herring Rock is so important in the *Sheet'ka Kwaan* culture that a portion of it was saved and put on display in front of the *Sheet'ka Kwaan Naa Kahidi* (Sitka Tribe's community house). The remaining portion of Herring Rock is blessed each spring at the beginning of the herring spawning season. The original location of Herring Rock was adjacent to the Makhnati Island federal waters area and was directly impacted by the construction of the Causeway across the Makhnati

---

<sup>4</sup> See Thornton (2010) and Langdon (2006) for descriptions of the meaning and significance of the crest taken by the *Kiks.ádi* Clan in the context of subsistence uses.

Island chain. Thus the Makhnati Island federal waters area lies within the traditional core subsistence area of the *Sheet'ka Kwaaan*.

One key respondent who participated in the ADF&G aerial herring spawn survey during one study year stated that, “Gold Island and Sasedni Island had the most intense spawn I’ve ever seen.” Another key respondent stated, “Everybody goes for eggs on kelp in Whiting Harbor.” In addition, key respondents indicated that the islands were used for drying herring eggs on racks (see Figure 4). With the introduction of freezers (ca. 1950s) people modified their practice using the islands for drying herring eggs and instead stored the herring eggs in freezers.



**Figure 4. Herring eggs on kelp and branches drying in Sitka. Photo by E.W. Merrill (ca. 1885–1904) (Alaska State Library - Historical Collections).**

Key respondents also indicated historically the islands always had a big herring spawn that was easy to access. In more recent history, the herring spawn has been greatly affected by WWII military acquisition and development, the development and expansion of the runway and airport, the City of Sitka’s sewage outfall infrastructure located in Mermaid Cove, and the development of Sealing Cove Harbor. In addition, access to the islands via crossing the airport runway was restricted in the 1960s, which now restricts access to the Causeway Islands to boat only. Key respondents unanimously asserted that the herring spawn is not as dense as it was in the past, the herring spawns are shorter in duration, and the spawn has

diminished from historical areas, such as southern Sitka Sound. In addition several key respondents indicated that the timing of the commercial sac roe fishery has impacted the subsistence harvest of herring eggs as the two fisheries coincided with one another in the past; however, since the mid-1990s the commercial sac roe fishery occurs before the subsistence herring egg harvest.

The following is a list of sites within the Makhnati Island federal waters and their associated use mentioned in key respondent interviews:

**Makhnati Island**—Harvesting herring eggs on *Macrocystis* kelp, hair kelp, and hemlock branches; and harvesting black seaweed (*Porphyra* sp.), halibut from the hole between Makhnati Island and the navigational marker to the north, abalone (*Haliotis kamtschatkana*), alder trees (*Alnus rubra*), and salmon.

**Whiting Harbor**—Heavily used prior to WWII and airport construction for subsistence activities, including setting hemlock branches to harvest herring eggs and harvesting herring eggs on *Macrocystis* kelp, jigging for halibut, and harvesting abalone.

**Sasedni Island**—Harvesting herring eggs on hair kelp and harvesting black seaweed.

**Virublennoi Island**—Harvesting black seaweed, abalone, and octopus.

**Kirushkin Island**—Harvesting herring eggs on *Macrocystis* kelp.

**Mogilnoi Island**—Harvesting herring eggs on *Macrocystis* kelp and hemlock branches.

**Sealing Cove**—Setting hemlock branches to harvest herring eggs at entrance to harbor, jigging for bait herring from the footbridge (pre-1980s).

**Mermaid Cove**—Setting hemlock branches to harvest herring eggs and visiting gravesites.

**Nevski Island**—Picnic area and swimming hole prior to airport runway construction.

**John Brown Beach**—Harvesting abalone and herring eggs on *Macrocystis* kelp and visiting gravesites.

**Nepovorotini Rocks**—Harvesting abalone.

**Runway**—Harvesting gumboots along runway fill, harvesting octopus, and harvesting clams from beaches prior to airport runway construction.

**Causeway**—Harvesting abalone and octopus, harvesting gumboots along Causeway fill, and harvesting lingcod (*Ophiodon elongatus*) along south side of Causeway fill.

**Japonski Island**—Harvesting herring eggs on south side of island, harvesting alder trees and salmon, and harvesting the “best” Nagoon berries (*Rubus arcticus*) in all of Southeast Alaska.

**Aleutski Island**—Harvesting herring eggs on hemlock branches, *Macrocystis* kelp, and hair kelp; and harvesting alder trees.

In all, besides herring eggs, Sitka residents harvested chiton or gumboots, abalone, halibut, octopus, rock cod, lingcod, salmon, seal, sea otter, deer, and alder trees for smoking fish, as well as trapping small mammals. Key respondents said that before the addition of the Causeway that now connects the Makhnati Island group, deer would frequently swim from island to island during the late-fall to early-winter months and users would often watch for them in order to harvest deer from the water. Interviewees spoke of being able to access these areas when other harvesting areas could not be accessed due to weather. Camps were set up on the islands in order to render herring oil and seal oil. Herring egg and salmon drying racks were common (see Figure 4). One man spoke of his father keeping a chicken coop on the islands. Another spoke of his father farming potatoes while yet another recalled a fox farm. On Alice Island, there was a homestead and at least one individual from the *Kiks.ádi* Clan maintained strawberry, raspberry, and gooseberry patches. The most notable use of the area however, was the harvesting of herring eggs on kelp. Due to the ease of access prior to military occupation, and the rocky substrate (which is preferred over sand because sand makes the herring eggs unusable), the Makhnati Island federal waters area was a preferred herring egg harvest area for the community. However, from 1939 to 1944 the U.S. military occupation of the area prevented residents from being able to utilize the islands. In addition, the construction of the Rocky Gutierrez Airport on Japonksi Island was reported by interviewees to have covered and destroyed the most productive area for harvesting abalone and gumboots. The island itself, as described by one interviewee, was leveled and a mountain removed, eliminating productive hunting grounds.

Some harvesters considered some areas, especially in the vicinity of Whiting Harbor, Mermaid Cove and parts of the southeast side of the runway, off limits to harvest due to contamination by development, sewage outfall, and other effluent.

## DISCUSSION

Concerning the harvest and use of herring eggs from the federal waters specifically, it is clear that the area is and has been a preferred harvesting site for several reasons. First, it was reported that both hair kelp and especially *Macrocystis* kelp beds exist in the area, specifically along the northern edge of the Causeway in Whiting Harbor and along Japonski Island. Naturally occurring kelp is the preferred substrate upon which to harvest herring eggs, many fishers reported during research in the 1980s and 2000s (Schroeder and Kookesh 1990, Turek and Ciccone *in prep.*), as long as spawn are present. Harvesting eggs from these substrata allow fishers to make a single trip to harvest a large quantity of eggs, compared to hemlock branches which must be sunk and retrieved. However, kelp substrata are distributed unevenly in Sitka Sound, existing in only some areas. Second, kelp beds in the Causeway area lay in protected, nearshore waters. Thus, they are safer to get to and probably require less skill to harvest. Finally, the Causeway can be accessed even in inclement weather that prevents harvesting from areas other than the federal waters.

The Causeway area is probably not used by harvesters wanting to lay small beach sets of hemlock branches, for example. These harvesters do so from harvesting areas accessible by road. The Causeway area is used when taking larger harvest quantities to share within the community.

It has been reported that most of the eggs exported out of Sitka go by air freight and are *haaw* (herring eggs on hemlock) and that 40% to 50% of the total community harvest of herring eggs is exported (Schroeder and Kookesh 1990, Turek and Ciccone *in prep*).

Throughout the generations the Sitka Sound herring stock has been utilized as an important traditional and cultural food source. All key respondents interviewed stated that the herring spawn is not as dense as it was in the past, the herring spawns are shorter in duration, and the spawn has diminished from historical areas, and their ability to gather herring eggs has been greatly reduced since the inception of the sac roe fishery. In fact, subsistence harvest failures (when the total community harvest was estimated to be below ANS) occurred in 2001, 2005, 2007, and 2008 (Sitka Tribe of Alaska 2008) when significant numbers of users were unable to harvest sufficient herring eggs in Sitka Sound to meet their needs. The subsistence herring egg harvest seems to have suffered throughout all of Sitka Sound according to respondents.

The Makhnati Island federal waters area was an important and highly utilized area for subsistence gatherers historically. In fact the islands which occupy the Makhnati Island area were used for many types of cultural and subsistence activities. It is unclear if there were year round residents of the islands but interviewees indicated that there were cabins and smokehouses on some islands and many Sitka residents conducted some form of subsistence activities on them. A few of these cabins and smokehouses can be seen in Figure 5.

Other anthropogenic effects have also caused a decline in local subsistence resources inside of the Makhnati Island federal waters such as the City of Sitka's sewage outfall infrastructure in Mermaid Cove, and the development of Sealing Cove Harbor.

Thus, while the study clearly shows that the federal waters surrounding Makhnati Island are productive habitat for herring (ADF&G Sitka, Sitka Sound Historic Herring Spawn 1964–2009, on file) and accessible to Sitka residents, there are concerns about the sustainability and quality of the resources harvested there, as reported by the interviewees. These concerns appear to have constrained some Sitka residents from harvesting there, especially in the post WW II years, despite the area's proximity to town. A management and regulatory regime which focuses on improved habitat quality and productivity would provide increased opportunities for the customary and traditional harvest of key subsistence resources, including herring eggs for which Sitka residents have not always been able to meet their needs according to surveys since 2001.

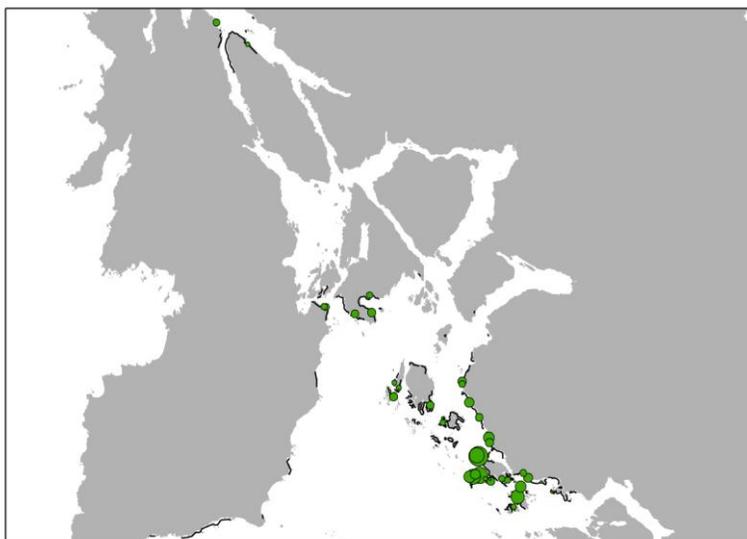


**Figure 5. This photo was taken facing south with Japonski Island and smokehouses in foreground. The year of this photo is unknown (Photo supplied by The Photo Shop Studio).**

The Makhnati Island waters were once used by many subsistence users, but today are not used as frequently due to the development of the area, and the ease most subsistence herring egg gatherers experience harvesting in other areas. Herring continue to spawn in these waters and continue to be used by a limited number of subsistence herring egg harvesters, as documented by the contemporary herring harvester survey conducted in 2008 and 2009. According to the results of the combined survey data, 3% of herring egg harvesters continue to use the Makhnati Island federal waters for subsistence herring egg gathering, while as many as 11% of herring egg harvesters have used the Makhnati Island federal waters for past subsistence herring egg gathering (see Table 5). Additionally, 8% of herring egg harvesters knew of other subsistence herring egg harvesters who have or currently use the Makhnati Island federal waters.

Also noted, the success of harvesting herring eggs in the Makhnati Island federal waters area in recent years depends on the distribution of herring spawn and weather conditions during the spawning event. For example, in 2007 the highest herring spawn density in Sitka Sound recorded by ADF&G occurred within the Makhnati Island federal waters area (see Figure 6). ADF&G observed 800,000–1,000,000 eggs per  $m^2$  in the Makhnati Island federal waters, over 47% above the average spawn density, while the average is 300,000-600,000 eggs per  $m^2$  (Pritchett 2008 Southeast Alaska Sac Roe Herring Stock Status Report handout 01/31/2008). If this report had included harvest survey data from 2007, we might find a higher percentage of subsistence herring egg harvesters using this area than in 2008 and 2009. In 2008, a

substantial portion of the biomass spawned on Kruzof Island (Gordon, D., ADF&G, personal communication 8/21/2009). However in 2009, a large majority of spawn occurred in the core traditional areas closer to town, e.g., Middle Island, Kasiana Island, and Makhnati Island federal waters. Also of note, in the 45 years that ADF&G has kept herring spawn records, herring have spawned 34 out of 45 years (76%) in Whiting Harbor, 36 out of 45 years (80%) on north Japonski Island, 22 out of 45 years (49%) in Mermaid Cove, 12 out of 45 years (27%) on the south side of the Causeway, and 11 out of 45 years (24%) on Makhnati Island (ADF&G, Sitka Sound Historic Herring Spawn 1964-2009). It seems that prior to its re-development as a military site and airport, the Makhnati Island federal waters were among the most consistent and favored subsistence harvest areas for herring and other fish, shellfish, marine plants, and game resources. Since the war, however, military and commercial development has made use of the site less consistent and less favored due to habitat and productivity changes, competing interests and concerns about habitat and resources quality, and limitations on access.



**Figure 6. 2007 herring spawn deposition survey relative magnitude of total egg counts on transect. Note the largest green dots which indicate higher spawn density per meter<sup>2</sup> occurred with the Makhnati Island federal waters (ADF&G 2007).**

## CONCLUSION

Nearly all of the survey participants suggested that the Makhnati Island federal waters were utilized by a large percentage of the Sitka community members before military occupation and the construction of the airport. Unfortunately the supplementary survey tool used to carry out this research was not able to reach all fishers in the community who have used the federal waters area.

The interview results regarding post-WWII use indicated that a much lower percentage of the Sitka community use these waters and islands due to access constraints, concerns about quality and productivity

of the resources, and other factors. After reviewing the interview transcripts, it seems clear that the interviewers may not have placed enough emphasis on the specific topic of *historical* use of Makhnati Island federal waters within the otherwise contemporary harvest survey; therefore, it is likely that fewer people indicated utilizing the Makhnati area than actually use it or have used it historically. At least five herring egg harvesters have attempted to collect herring eggs from these waters in the study years 2008 and 2009. Several respondents stated that whether they use the Makhnati Island federal waters to harvest herring eggs really depended on the herring spawning activity during the season. Respondents indicated that this may be due to the lack of quality spawn in locations where the spawn was harvestable within the Makhnati Island federal waters. Many folks interviewed perceive water quality issues within some areas of the Makhnati Island federal waters due to past military use, non-point source pollution from airport runoff, and the City of Sitka's sewage outfall located in Mermaid Cove.

## RECOMMENDATIONS

Several lines of investigation concerning herring in Sitka Sound have occurred simultaneously with the research described in this report. One is covered in the comprehensive report of herring ecology in Southeast Alaska by Thornton et al. (2010) that includes a section specifically on Sitka. This research had a strong ethnographic component; however, it also reports on the findings of biological investigations. Additionally, Meuret-Woody and Bickford (2009) investigated herring stock identification and production areas in Sitka Sound. With such a focus as currently exists on this resource, it is necessary to extend the recommendations for future research, and thus policy development, to include the results of these contemporary studies. Ideally, recommendations that include marine spatial planning should not be limited to bits of federal waters that may exist because of WWII, but rather be proposed on an ecosystemic scale; yet, in practice this may be how such planning evolves.

Recently-completed research (Meuret-Woody and Bickford 2009) indicated that Makhnati Island federal waters are a part of the most productive area for both adult and juvenile herring in Sitka Sound. This productive area was described as the "source habitat" where the bulk of the herring spawn occurs, and which also produces 90% of the Sitka Sound herring biomass. Other research (Thornton et al. 2010) validated and further described the reports of respondents in this study, that characteristics of herring spawning have changed in Sitka Sound and that the size, timing, and location of spawning events are different in the 2000s than in the historical period. Traditional ecological knowledge of the historical ecology of herring spawning was described and analyzed.

The primary recommendation based on the research conducted as part of the current study is that the annual herring egg harvest survey in which the Native community in Sitka participates include questions regarding the harvest location of each reported harvest of herring eggs, if it does not already, and that this harvest survey be fully funded each year by ADF&G. Another primary recommendation is that there be increased effort to monitor the overall herring population including impacts caused by the commercial sac roe fishery. It is further recommended that future investigations include a strong ethnographic component describing habitat, herring spawning conditions, and patterns of harvest; as well as including participation

by residents of Sitka. An interdisciplinary approach building on previous research is highly recommended.

As for conservation of herring spawn habitat, the Makhnati Island area would be ideal to protect herring spawning activities from commercial fishing impacts. Conservation measures taken now would help to secure future herring biomass, and ensure sustainability of harvestable surpluses. Herring exhibit a high level of stock complexity, with many spawning areas. Maintaining diverse spawning locations is important to conserving biodiversity and evolutionary or adaptive potential (Stephenson et al. 2001). Conservation of spawning habitat and minimizing disturbance in the pre-spawning holding areas are necessary for the conservation of herring stocks. Decisions affecting the integrity of spawning habitat are made routinely but it is not always clear whether decision makers are aware of the real value of spawning habitat (Pete 1991).

The Makhnati Island federal waters could also serve as a model experiment for how to monitor and restore critical source habitat which has lost productivity due to development or overfishing. Other important herring habitats, such as Auke Bay, have suffered similar fates, causing significant harm to local subsistence regimes and fish stocks. Makhnati Island federal waters could prove an important testing ground for building better ecosystem management regimes to support both human and non-human needs.

## **ACKNOWLEDGEMENTS**

The U.S. Fish and Wildlife Service, Office of Subsistence Management, provided \$69,185 in funding support of this project through the Fishery Resources Monitoring Program, under agreement (or contract) number 08-651. This report was submitted as the final report to U.S. Fish and Wildlife Service, Office of Subsistence Management, for project number 08-651. Our survey technicians were Dan Williams and James Craig. Our interviewers were Roby Littlefield and Emilie Springer. We'd like to thank the Sitka Tribe staff of Michelle Mahoney and Jessica Perkins, and Americorps volunteer David Pratt who assisted with data entry. Finally, thanks to Pippa Kenner at OSM for her guidance and support.

## LITERATURE CITED

- Alaska Department of Fish and Game. Sitka Sound historic herring spawn, 1964-2009.
- Brock, M. and M.F. Turek. 2007. Sitka Sound subsistence herring roe fishery, 2002, 2003, and 2006. Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 327. Juneau.
- Brown, E. D., J. Seitz, B.L. Norcross, and H.P. Huntington. 2002. Ecology of herring and other forage fish as recorded by resource users of Prince William Sound and the Outer Kenai Peninsula, Alaska. Alaska Fisheries Research Bulletin, 9(2), 75-101.
- Davidson, W., D. Gordon, W. Bergmann, P. Doherty, and K. Monagle. 2006. Southeast Alaska sac roe herring fishery. Alaska Department of Fish and Game. Fishery Management Report No. 06-07.
- Davis, Henry, and Associates. 1976. English Tlingit Dictionary. Sheldon Jackson College, Sitka, Alaska.
- De Laguna, F. 1990. Tlingit. W. Suttles, editor, in Northwest Coast, Handbook of North American Indians, Vol. 7. Smithsonian Institution Press. Washington, DC.
- Emmons, G.T. and F. de Laguna. 1991. The Tlingit Indians. American Museum of Natural History American anthropological papers, vol. 70. Seattle: University of Washington Press and the American Museum of Natural History.
- Gordon, D., W. Davidson, K. Monagle, T. Thynes, S. Walker. 2010. 2010 Southeast Alaska sac roe herring fishery management plan. Alaska Department of Fish and Game, Regional Information Report Series No. 1J10-03, Douglas, Alaska.
- Gmelch, G. and S.B. Gmelch. 1985. Resource use in a small Alaskan city – Sitka. Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 90, Juneau.
- Goldschmidt, W. R. and T. Haas. 1998. Haa Aani: Our Land. Tlingit and Haida land rights and use. University of Washington Press, Seattle and London; and Sealaska Heritage Foundation, Juneau.
- Haldorson, L. and J. Collie. 1990. Distribution of Pacific herring larvae in Sitka Sound. Proceeding from the International Herring Symposium. Anchorage, AK.
- Hart Crowser, Inc. 2002. Phase I site assessment report: The Causeway Islands. Office of the Deputy Under Secretary of Defense.
- Hunter, M. Sitka's WWII website: <http://www.sitkaww2.com/>
- Keres Consulting, Inc. 2003. Phase I site assessment report: Fort Rousseau, FUDS# F10AK035000. Office of the Deputy Under Secretary of Defense.

- Langdon, Steve J. 2006. Traditional Knowledge and Harvesting of Salmon by Huna and Hinyaa Tlingit. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Resource Monitoring Program, Final Report (Project No. 02-104), Anchorage, Alaska.
- Meuret-Woody, H. and N. Bickford. 2009. Identifying essential habitat (source vs. sink habitat) for Pacific herring (*Clupea pallasii*) in Sitka Sound using otolith microchemistry, *Exxon Valdez Oil Spill restoration project final report* (Restoration project 080834), Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage, Alaska.
- Miraglia, R.A. 1998. Traditional ecological knowledge handbook: A training manual and reference guide for designing, conducting, and participating in research projects using traditional ecological knowledge. Alaska Department of Fish and Game, Anchorage, Alaska.
- Pete, Mary C. 1991. Subsistence Herring Fishing in the Eastern Bering Sea Region: Nelson Island, Nunivak Island, and Kuskokwim Bay. Alaska Department of Fish and Game, Technical Paper No. 192.
- Pritchett, M. 2008. Southeast Alaska sac roe herring stock status report (handout 01/31/2008). Alaska Department of Fish and Game.
- Rabin, D.J. and R.A. Barnhart. 1977. Fecundity of Pacific herring, *Clupea harengus pallasii*, in Humboldt Bay. California Fish and Game 63(3): 193-196.
- Schroeder, R., and M. Kookesh. 1990. Subsistence Harvest of Herring Eggs in Sitka Sound. Alaska Department of Fish and Game technical report, 173.
- Sitka Tribe of Alaska. 2009. 2008 Annual report on management of customary and traditional herring harvest (unpublished ms. on file at Sitka Tribe of Alaska).
- Sitka Tribe of Alaska. 2008. 2007 Annual report on management of customary and traditional herring harvest (unpublished ms. on file at Sitka Tribe of Alaska).
- Sitka Tribe of Alaska. 2008. Makhnati Island interview and transcriptions: 1-34 (unpublished ms. on file at Sitka Tribe of Alaska).
- Sitka Tribe of Alaska. 2006. 2005 Annual report on management of customary and traditional herring harvest (unpublished ms. on file at Sitka Tribe of Alaska).
- Sitka Tribe of Alaska. 2005. 2004 Tribal needs assessment report (unpublished ms. on file at Sitka Tribe of Alaska).
- Sitka Tribe of Alaska. 2004. Phase I site assessment report, Mt. Edgecombe School and Sitka Naval Operations Base, FUDS No. F10AK0496. Prepared for the Office of the Deputy Under Secretary of Defense, (unpublished ms. on file at Sitka Tribe of Alaska).
- Stephenson, R.L., K.J. Clark, M.J. Power, F.J. Fife, and G.D. Melvin. 2001. Herring stock structure, stock discreteness, and biodiversity. Herring: Expectations for a New Millennium, Alaska Sea Grant College Program, AK-SG-01-04, 559-571.
- Stokesbury, K. D. E., J. Kirch, E.D. Brown, G.L. Thomas, and B.L. Norcross. 2000. Spatial distributions of Pacific herring, *Clupea pallasii*, and walleye pollock, *Theragra chalcogramma*,

- in Prince William Sound, Alaska. Fisheries Bulletin, 98, 400-409.
- Stokesbury, K. D. E., J. Kirsch, V. Patrick, and B.L. Norcross. 2002. Natural mortality estimates of juvenile Pacific herring (*Clupea pallasii*) in Prince William Sound, Alaska. Canadian Journal of Fisheries and Aquatic Sciences, 59, 416-423.
- Thornton, T.F., R.F. Schroeder, and R.G. Bosworth. 1990. Use of sockeye salmon at Sitkoh Bay, Alaska. Alaska Department of Fish and Game Division of Subsistence Technical Paper No. 174. Juneau.
- Thornton, T.F., V. Butler, F. Funk, M. Moss, J. Hebert, T. Elder. 2010. Herring synthesis: Documenting and modeling herring spawning areas within socio-ecological systems over time in the Southeastern Gulf of Alaska. North Pacific Research Board, Project 728.
- Turek, M.F., and V. Ciccone. (in preparation). The subsistence harvest of herring spawn in Sitka, Alaska 2002-2008. Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 343, Juneau.

## APPENDIX A

### Makhnati Island Federal Waters

The federal waters encompassing Makhnati Island were a center for subsistence harvesting activities prior to World War II. The myriad of islands surrounding present day Japonski Island often were referred to in Tlingit as *Aanya X'aat'x'i* (Little Islands in Front of Town) and are referenced in the phrase *Shee At'ika* (Islands on the Oceanside of Baranof) which is the basis for Sitka's name today.

Prior to World War II (WWII), the islands within the Makhnati Island federal waters were basically undeveloped, save for fishing sites and boat haul-outs. Japonski Island had been established as a naval reservation by an 1890 presidential proclamation. A U.S. Naval coaling station was operating on Japonski Island as early as 1902 (Phase I Site Assessment, FUDS No. F10AK0496). The islands were reassessed as part of Pacific military defense strategy in the 1930s and ultimately became part of the Sitka Causeway which formed Fort Rousseau during WWII from 1941-1944 (Keres Consulting, April 2003). The 810 acres of islands and marine waters that lie within the Makhnati Island federal waters area were removed from public domain and reserved for military use by Executive Order 8877, dated August 29, 1941, (Federal Register 09/03/1941, Vol. 6, No. 4504) and Executive Order 8216, dated July 25, 1939 (Federal Register 07/27/1939, Vol. 4, No. 3430). In 1939 Japonski Island became the Sitka Naval Operations Base; Charcoal, Alice and Harbor Islands became Fort Ray; and Makhnati, Mogilnoi, Kirushkin, Sasedni, Gold, Virublennoi, Reshimosti, and Nevski Islands were connected by an elaborate 8,100 ft rock causeway and bridges to form a landmass to support the United States Navy and Army installations (see Figure 7).

The islands are now collectively referred to as the Causeway Islands (Keres Consulting, April 2003). Nepovorotni and Nicholson Rocks and Signal, Aleutski, Smith, Stewart, Fruit, and Turning Islands are also included in the Makhnati Island federal waters. In 1946, the US Navy transferred several of the islands to the Alaska Native Service (ANS) for the development of public health and educational facilities, specifically a quarantine facility for a detrimental tuberculosis epidemic (Phase I Site Assessment, FUDS No. F10AK0496). In the 1970s and 1980s, most of the Naval Operations Base on Japonski Island was transferred to the State of Alaska for the construction of the airport (see Figure 8). Sitka's Village Corporation, Shee Atika, which is named for its Tlingit home village and its surrounding islands, took ownership of Alice and Charcoal Islands in 1980 as part of their entitlement under the Alaska Native Claims Settlement Act (Hartcrowser, March 27, 2002). The remaining islands were transferred to the State of Alaska. In 1986, the former Fort Rousseau site was designated a National Historic Landmark for its significance as the Navy's first air station in Alaska and its strategic importance during WWII (Keres Consulting, April 2003). In addition to its historic remains and values, the site also contained waste and contaminants from the military presence, which are still being monitored and cleaned-up by a local trail construction group. This contamination by the military is cited as a reason for avoiding the area by subsistence herring egg harvesters.



**Figure 7. Location of the islands that are within the Makhnati Island federal waters (Fort Rousseau Causeway State Historical Park Management Plan, 2010, Alaska Department of Natural Resources).**



**Figure 8. Sitka and the Makhnati Island federal waters area, 1972. Photo shows islands after the development of the Causeway, Fort Rousseau, and the Sitka Naval Operation Base (Photo supplied by The Photo Shop Studio).**

In April 2005, the Federal Subsistence Board requested a review by the U.S. Department of the Interior's Office of the Solicitor to determine whether a Federal interest presently exists in certain areas of southeastern Alaska. The specific areas were originally identified by the Sitka Tribe of Alaska and presented before the Southeast Alaska Subsistence Regional Advisory Council, who forwarded a request for review to the Federal Subsistence Board. In November 2005, the Office of the Solicitor responded that the Makhnati Island area withdrawal in Executive Order 8877 (August 29, 1941) was not rescinded until after statehood, and therefore the submerged land did not transfer to the State at statehood. Since this submerged land is not included in any other withdrawal, reservation, or administrative set aside, the marine submerged lands, including any filled lands owned by the United States, are under the administration of the Bureau of Land Management. Accordingly, the Solicitor's Office indicated that this area should be included within the jurisdiction of the Federal Subsistence Management Program (Federal Register 08/24/2006, Vol. 71, No. 164). This rule, which became effective September 25, 2006, inadvertently omitted 190 acres of the Makhnati Island Area which were withdrawn for use by the Federal Government in Executive Order 8216 (July 25, 1939). Executive Order 8216 was not rescinded until after statehood, so the submerged land did not transfer to the State at statehood. Since this submerged land is not included in any other withdrawal, reservation, or administrative set aside, the marine submerged lands, including any filled lands owned by the United States, are under the administration of the Bureau of Land Management and are included within the jurisdiction of the Federal Subsistence Management Program (Federal Register 07/17/2009, Vol. 74, No. 136).

## APPENDIX B

### STA Makhnati Supplemental Survey

The area around the causeway islands (Makhnati Island, Whiting Harbor) is under federal control. We are gathering information about the subsistence use of herring eggs in this federal area, which is important in the development of subsistence regulations.

1. In 2008, did you harvest or attempt to harvest herring eggs in this area? (w/ map) \_\_\_\_ Yes \_\_\_\_ No

1.b. If you harvested in **2008**, how many pounds of herring eggs did you get?

How many **pounds** of Herring eggs on **Branches** ?   
on **Macrocystis- Daaw** ?   
On **Hair Seaweed-Né** ?   
**Other** ?

2. At any time in the past, have you ever attempted to harvest in this area? \_\_\_\_ Yes \_\_\_\_ No

2.b. If so, when (list range of years, etc) \_\_\_\_\_  
\_\_\_\_\_

3. Were you successful in harvesting? \_\_\_\_ Yes \_\_\_\_ No

4. Do you know anyone else who has harvested/ attempted to harvest in this area? \_\_\_\_ Yes \_\_\_\_ No

If so, who (father, grandfather, friend) and when? \_\_\_\_\_  
\_\_\_\_\_

5. What did you harvest herring eggs on in this area?

- Branches  Né  
 Macrocystis  Other \_\_\_\_\_

6. Under what circumstance do you use this area?

- For Macrocystis  Bad weather  
 Small skiff, can't get far  Traditional area  
 Other \_\_\_\_\_

7. Could you please indicate on the map where in this area you have harvested or attempted to harvest herring eggs?

8. Comments about use of this area: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

*An attempt to harvest is defined as going out in a boat (1) with branches on board ready to set or (2) with the intent to harvest herring eggs on hair seaweed or macrocystis kelp.*

## APPENDIX C

### STA Makhnati Supplemental Survey

The area around the causeway islands (Makhnati Island, Whiting Harbor) is under federal control. We are gathering information about the subsistence use of herring eggs in this federal area, which is important in the development of subsistence regulations.

1. In 2009, did you harvest or attempt to harvest herring eggs in this area? (w/ map) \_\_\_\_ Yes \_\_\_\_ No

1.b. If you harvested in 2009, how many pounds of herring eggs did you get?

How many <b>pounds</b> of Herring eggs on <b>Branches</b> ?	
<b>on Macrocystis- Daaw</b> ?	
<b>On Hair Seaweed-Né</b> ?	
<b>Other</b> ?	

2. At any time in the past, have you ever attempted to harvest in this area? \_\_\_\_ Yes \_\_\_\_ No

2.b. If so, when (list range of years, etc) \_\_\_\_\_  
 \_\_\_\_\_

3. Were you successful in harvesting? \_\_\_\_ Yes \_\_\_\_ No

4. Do you know anyone else who has harvested/ attempted to harvest in this area? \_\_\_\_ Yes \_\_\_\_ No

If so, who (father, grandfather, friend) and when? \_\_\_\_\_  
 \_\_\_\_\_

5. What did you harvest herring eggs on in this area?

- |                                      |                                      |
|--------------------------------------|--------------------------------------|
| <input type="checkbox"/> Branches    | <input type="checkbox"/> Né          |
| <input type="checkbox"/> Macrocystis | <input type="checkbox"/> Other _____ |

6. Under what circumstance do you use this area?

- |   |   |
|---|---|
| <input type="checkbox"/> For Macrocystis            | <input type="checkbox"/> Bad weather      |
| <input type="checkbox"/> Small skiff, can't get far | <input type="checkbox"/> Traditional area |
| <input type="checkbox"/> Other _____                |   |

7. Could you please indicate on the map where in this area you have harvested or attempted to harvest herring eggs?

8. Comments about use of this area: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

*An attempt to harvest is defined as going out in a boat (1) with branches on board ready to set or (2) with the intent to harvest herring eggs on hair seaweed or macrocystis kelp.*

## APPENDIX D

### Makhnati Herring Egg Harvest Interview Guide

Date:

Location of Interview:

Interviewers present:

Consent form signed?

#### 1. Biographical Information:

Interviewee(s) present:

Age(s)

Hometown:

#### MAKHNATI AREA

2. In 2008, did you or your household use, harvest or receive herring eggs from the general Causeway area?
3. Did you harvest eggs there in 2008?
4. If you did NOT harvest eggs in Makhnati in 2008, but you did harvest eggs—where did you go?
5. Was 2008 a typical year for the herring egg collection? Why?
6. How have harvest areas changed over the time you've participated in subsistence harvest?
7. How does Makhnati area compare to other herring egg harvest sites? (Is it generally a preferred site? Why/ why not?)
8. What type of boat do you typically use to access these areas?
9. Who generally participates in the subsistence harvest (ask about: age range? Boat owners? People who are employed full-time?) Are there enough subsistence harvesters?

#### CHART QUESTIONS

10. Can you show me areas on this chart that are key harvest areas for roe on kelp or roe on branches?
11. WHY did you go to the specific areas (habitat, availability of kelp, avoiding tide/swell, etc.)?
12. Are there any other traditional or cultural dimensions (gravesites, hunting, berries) that are important to the Causeway area?

## CONCLUDING

13. How would you best define the subsistence product of herring eggs/how significant are these dimensions:
  - a. A nutritional necessity for the tribe?
  - b. An item necessary for barter/trade with other communities?
  - c. A culturally important item?
  
14. Do you have any thoughts about how the commercial harvest impacts opportunities for subsistence harvest?
  
15. Do you have any other comments about changes you've seen in the herring egg harvest over time?
  
16. Can you recommend any other herring egg harvester we should interview for this project?

**APPENDIX E**

**Sitka Tribe of Alaska  
Release of Information Form**

By signing this form, I authorize the Sitka Tribe of Alaska to utilize my traditional knowledge shared on audio tape for the protection and preservation of our Tlingit natural and cultural resources. This recording is a source of cultural intellectual knowledge.

The interview is being conducted for the Sitka Tribe's Makhnati Waters Herring Traditional Use project. The project is funded by the Federal Subsistence Board. The principle investigators for the project are Helen Dangel and Dr. Thomas Thornton.

I understand that the Sitka Tribe of Alaska will write a final report from this work and that my words may be transcribed and published in this report. I understand that anything and everything that I share during this interview will be properly credited to me and/or my clan as appropriate.

In order to reduce repeating interviews for information I've already given, Sitka Tribe may use information from this interview for future projects. I authorize Sitka Tribe to make public the data from my interview. My personal information will not be made public without my specific permission.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Clan

## **NON-DISCRIMINATION STATEMENT**

The Sitka Tribe of Alaska conducts all programs and activities free from discrimination on the basis of gender, color, race, religion, national origin, age, marital status, pregnancy, parenthood, or disability. If you believe that you have been discriminated against in any program, activity, or facility operated by Sitka Tribe of Alaska, please contact the Sitka Tribe of Alaska, General Manager, at 456 Katlian Street, Sitka, AK 99835.