Technical Paper No. 392

The Subsistence Harvest of Pacific Herring Spawn in Sitka Sound, Alaska, 2012

by

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and

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March 2014

Alaska Department of Fish and Game **Division of Subsistence**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly-accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly-accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
mnths (tables and figures)	first three letters (Jan,...,Dec)
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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TABLE OF CONTENTS

Page

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

LIST OF APPENDICES

Appendix **Page**

ABSTRACT

The subsistence fishery for the spawn of Pacific herring *Clupea pallasii* in Sitka Sound has been, and remains, important to Alaska residents. Alaska Department of Fish and Game (ADF&G) Division of Subsistence research on this subsistence fishery reveals that harvesting herring spawn is a specialized activity in which a relatively small number of community members harvest and distribute herring spawn widely. The giving and receiving of herring spawn products remains culturally important to Alaska residents. This report presents the results of the eleventh annual harvest survey conducted in Sitka in 2012. The survey generated data used to calculate estimates of the subsistence harvest of herring spawn on various substrates, including hemlock branches, kelp, and other seaweed in Sitka Sound. This report provides additional data and complements the Sitka Sound subsistence herring spawn harvest monitoring discussions found in *Sitka Sound Subsistence Herring Roe Fishery, 2002, 2003, and 2006*, by Mathew Brock and Michael F. Turek (2007) (ADF&G Division of Subsistence Technical Paper No. 327), *The Subsistence Harvest of Herring Spawn in Sitka, Alaska 2002–2010* by Holen et al. (2011) (ADF&G Division of Subsistence Technical Paper No. 343), and *The Subsistence Harvest of Herring Spawn in Sitka Sound, Alaska, 2011* by Lauren Sill and Terri Lemons (2012) (ADF&G Division of Subsistence Technical Paper No. 369).

Key words: Pacific herring, *Clupea pallasii*, herring spawn, subsistence fishing, harvest estimate, subsistence, Sitka, Sitka Tribe of Alaska.

INTRODUCTION

The spawn of Pacific herring *Clupea pallasii*, generally known as "herring eggs," is a traditional food for Native Americans throughout the Pacific Northwest and Southeast Alaska. Although herring spawn is consumed throughout this region, only a small number of people have the time, equipment, skills, and knowledge required to harvest it. Herring eggs from Sitka Sound have been shared throughout Southeast Alaska and beyond, as far north as Barrow and as far south as Hawaii (Schroeder and Kookesh 1990). This report presents findings of the eleventh annual project designed to document subsistence harvests of herring spawn in Sitka Sound. The report covers the 2012 spring fishery (see Holen et al. [2011] and Sill and Lemons [2012] for discussion of the previous study years).

Herring return annually to Sitka Sound in numbers that are not seen elsewhere in Southeast Alaska. The sheer abundance of herring and herring spawn, and the length of the spawning period, have set Sitka Sound apart from other areas in the state for this fishery. Herring harvesters have taken advantage of this unique harvest opportunity during both historical and contemporary periods (Schroeder and Kookesh 1990). In the 19th century, Sitka was a center for Tlingit from all over Southeast to harvest herring and herring spawn (Pierce 1972; Emmons 1991). In the 1860s, herring were so numerous around Sitka in February and March that the water became milky from eggs and milt and it was easy to catch herring with a rake (Tikhmenev 1978, 22). Herring spawn was traditionally exchanged for specialized foods, such as eulachon *Thaleichthys pacificus* oil and dried eulachon, berries, dried seaweed, and mountain goat *Oreamnos americanus* meat. It was also traded for raw materials and handicrafts.

The primary method of the contemporary harvest is to submerge branches of the Western hemlock *Tsuga heterophylla* in salt waters just outside the intertidal zone before spawning takes place. Herring spawn is collected on other substrates such as *Macrocystis* kelp, hair seaweed *Desmarestia* spp., and rockweed *Fucus* spp. (Schroeder and Kookesh 1990). The herring deposit their eggs on the branches of the hemlock or other substrate, which are then removed from the water. Historically, herring spawn was consumed either fresh or air-dried, or was packed in salt for later use and distribution. As freezers became more common in households in the 1940s and 1950s, freezing became the preferred method of preserving herring spawn.

At its February 1989 meeting, the Alaska Board of Fisheries (BOF) made a positive customary and traditional use determination for the harvest of herring spawn in Sitka Sound. In September 2001, the Sitka Tribe of Alaska (STA) met with representatives from the Alaska Department of Fish and Game (ADF&G) to discuss tribal members' difficulty in meeting their subsistence needs for herring spawn in Sitka Sound during the spring 2001 season. They cited the intensive commercial harvest of herring in the Middle, Crow, and Kasiana islands areas as affecting the subsistence users' ability to successfully harvest herring spawn on hemlock branches.

At the January 2002 BOF meeting, STA submitted an unsuccessful proposal requesting recognition of the geographically and historically important areas used for the subsistence herring spawn harvest. During this meeting the BOF also considered, but did not adopt, a permit program for the subsistence fishery. As a consequence of these proposals, the BOF requested that the ADF&G Division of Subsistence (the Division) work with STA to develop a harvest monitoring program based on in-person harvest surveys. The BOF made a determination that the amount reasonably necessary for subsistence[1] (ANS) was between 105,000 and 158,000 lb of herring spawn harvested from Section 13A and that portion of Section 13B that is north of the latitude of Aspid Cape (5 AAC 01.716 (b)). This finding was based upon the best harvest estimates of ADF&G, including a 1996 household harvest survey and a 1990 harvest estimate. In 2009, the BOF revised the ANS to 136,000–227,000 lb, based on the mean estimated harvest from 2002–

1. Pursuant to Alaska Statute 16.05.258, the Alaska Board of Fisheries and the Alaska Board of Game are charged with identifying the fish stocks and game populations that are customarily and traditionally taken or used for subsistence, and with determining the amount of the harvestable portion that is reasonably necessary for subsistence uses.

2008, as determined through the annual herring spawn harvest survey conducted by the Division and STA (see Holen et al. 2011). In the Sitka Sound area, state regulations allow the subsistence harvest of herring and herring spawn in sections 13A and 13B north of Aspid Cape on Baranof Island (5 AAC 01.716 (a) (7)) as well as the limited noncommercial exchange of subsistence-harvested herring spawn on kelp for customary trade (5 AAC 01.717).

Monitoring the subsistence harvest of herring spawn in Sitka Sound is an ongoing project. Division participation in the annual harvest monitoring program is supported by a reimbursable services agreement (RSA) from the Division of Commercial Fisheries to the Division as well as by the Division using core state general funds. The STA provides its own funding for the project, except for the harvest survey component of the research, which is supported by a cooperative agreement with ADF&G. The STA and the Division collaborate on survey design and data collection. The Division provides technical consultation and, when possible, field survey and interviewing support for the project. STA provides the Division with surveys and raw harvest data each year for analysis that applies the Division's standard statistical methods, which are explained below.

PROJECT OBJECTIVES

The primary goal of the harvest monitoring program is to document the subsistence harvest of herring spawn in Sitka Sound annually. The objectives of the project in 2012 were to:

1. Conduct in-person interviews with household members in Sitka and surrounding communities who were identified as likely harvesters of herring spawn from Sitka Sound for subsistence;
2. Produce estimates of the total pounds of herring spawn harvested on hemlock branches, *Macrocystis* kelp, hair seaweed *Desmarestia* spp., and "other" substrates; and,
3. Identify locations where herring spawn were harvested.

METHODS

Estimates of the subsistence herring spawn harvest in Sitka Sound have been produced for 2002–2011 by systematically identifying and surveying households that harvest herring spawn. This annual project is guided by the research principles outlined in the *Alaska Federation of Natives Guidelines for Research*[2] and by the National Science Foundation, Office of Polar Programs in its *Principles for the Conduct of Research in the Arctic*[3], as well as the Alaska confidentiality statute (AS 16.05.815). These principles stress community approval of research designs, informed consent, anonymity of study participants, community review of draft study findings, and the provision of study findings to each study community upon completion of the research.

Survey Plan and Implementation

STA and the Division met prior to the start of the 2012 subsistence herring spawn harvest to review the survey instrument, the methods for compiling the household list, and the methods for creating and validating conversion factors. The methods outlined in this section are a collaborative effort between the Division and STA. Division staff participated in the beginning of the herring spawn harvest in Sitka during April 2012 and collaborated with STA staff in updating the weight conversion factors. STA staff conducted the household survey. STA staff worked closely with Division staff during the entire process.

2. Alaska Federation of Natives. 2013. "Alaska Federation of Natives Guidelines for Research." Alaska Native Knowledge Network. Accessed February 25, 2014. http://www.ankn.uaf.edu/IKS/afnguide.html.
3. National Science Foundation Interagency Social Science Task Force. 2012. "Principles for the Conduct of Research in the Arctic." Accessed February 25, 2014. http://www.nsf.gov/od/opp/arctic/conduct.jsp.

Development of the Household Survey List

To meet Objective 1, STA updated the list of known and likely harvesters for the 2012 season. Using the 2011 household list as a starting point, new harvesters were added and known non-harvesters were removed, following the methods discussed below and enumerated in Holen et al. (2011). Outreach by STA and a chain referral method were employed to expand the list. Harvesting is a highly visible activity; therefore it was assumed that active harvesters would be aware of other harvesters. Based on the knowledge of active harvesters identified through STA outreach efforts, additional harvesters were added to the household list. The household list also included households from other communities who harvested herring spawn in Sitka Sound as identified through STA outreach efforts and knowledge of the surveyor and STA staff.

For this annual survey program, once added to the household list, an identified household remains on the list unless 1 of 3 situations occurs:

1. If the household is surveyed for 3 consecutive years and has not attempted to harvest within that time, it is removed, even if the household answers in the affirmative as to whether they plan to harvest in the future; or
2. If a household is unable to be contacted for 3 consecutive years, it is removed from the list; or,
3. If the household identifies that it no longer plans to harvest, it is removed from the list.

Once removed from the list, the household identification (ID) number is retired. Prior to the beginning of the 2012 herring spawn event, staff from STA and ADF&G reviewed the household master list to ensure these parameters were satisfied.

The Survey Instrument

Objectives 2 and 3 were addressed through the use of a household survey. The survey instrument was designed to collect information about:

1. Whether respondents harvested, attempted to harvest, used, received, or gave away herring spawn.
2. The amount of herring spawn harvested.
3. The kind of substrate used.
4. The amount of herring spawn respondents gave away locally or shipped out of Sitka and the communities with which they shared the harvest.
5. The location of respondents' harvests.
6. Survey respondents' qualitative assessments of the study year's herring spawn harvest.
7. Survey respondents' qualitative descriptions of their participation in the harvest.

There were no substantive changes to the survey instrument from the 2011 survey. A copy of the 2012 instrument can be found in Appendix A.

Survey Implementation

STA conducted the harvest survey in April, May, and June 2012, directly after the herring spawned. Using the 2011 household list as a base, STA created a list of 109 potential households for 2012. An interview was attempted for each household on the list; 75 households were successfully interviewed, 33 households were unable to be contacted, and 1 household chose not to participate in the survey. Local researcher Dan Williams conducted the surveys. After the survey was finished, completed surveys were sent to the Division for coding and analysis. Completed surveys were given a code (see Appendix B for

code book) based on user status: 1) individual harvester, 2) non-harvester, or 3) community-harvest boat. The latter code encompasses boats, such as STA's traditional foods boat, that harvest herring for community-wide distribution, whether in Sitka or another Southeast community. Community harvest data are treated as individual harvest data for the general analysis.

Update of the 2012 Conversion Factor

Prior to beginning the household survey, conversion factors to estimate the weight of herring spawn in common storage containers were created following the methods established in 2010. In April 2012, Division staff worked with STA to process 1,840 lb of herring spawn on hemlock branches and 439 lb of herring spawn on kelp. This was the first harvest of the season and was conducted using a boat owned and operated by STA. Prior to the beginning of the spawn, STA staff set 11 sets of hemlock branches in Sitka Sound. The locations of the sets were determined by STA staff based on active spawning conditions, their knowledge of herring spawn events, and their experience with the harvest (see Appendix C for a map of set locations). Four of these sets were harvested by STA and ADF&G staff and used for the conversion factor update.

Based on the plan devised by STA and the Division, the following steps were taken to measure weights in the field in 2012.

1. STA staff, accompanied by ADF&G researchers, checked all herring sets and pulled those that were ready.
2. Once the boat returned to the harbor after pulling a set, STA staff used a hanging scale connected to a hydraulic hoist attached to the dock to weigh the branches and remove them from the boat. While still on the deck of the boat, some of the branches were placed in a plastic fish tote of the type commonly used in commercial fisheries. Once full, the tote was lifted off the boat and weighed. Some branches were not placed in totes; these branches were tied up with rope, then weighed and removed from the boat.
3. STA staff recorded, by hand, the scaled gross weight (including the weight of the tote, if applicable).
4. STA staff then loaded the branches into a pickup truck for transfer to the processing site located in front of the STA Resources Protection Department office. The method of processing spawn depended on how the final product was to be stored. For storage in boxes or grocery bags, processors used pruning shears to remove the larger branches and the poorly covered branches. For storage in gallon- and quart-sized bags, the more rigid branches were discarded, leaving the softer branches and needles that would not tear the bags. The processed weight was the usable weight that could be stored for consumption in something as small as a quart-sized bag.
5. The processed spawn was placed in containers identified by STA as common containers used to store, move, and ship herring spawn. The container types reflected the units harvesters might be familiar with and able to report rather than having to estimate total pounds harvested for the survey. STA and Division researchers identified 25 lb and 50 lb wetlock boxes—a type of waxed cardboard box commonly used for shipping seafood—as well as plastic zip-top gallon- and quart-sized bags as the most common container types for herring spawn on hemlock branches. For herring spawn on kelp, researchers identified gallon zip-top bags and 5-gallon buckets as common container types.
    a. Each wetlock box from a herring set was placed in a plastic tote and weighed from a hanging scale. The gross weight of each tote was recorded by hand (weight of the plastic tote plus the weight of the wetlock box plus the weight of the spawn).
    b. Weights were taken for each box of processed spawn in order to understand variability between boxes. An average weight of each type of box was established. The net weights

of all boxes of spawn coming from the original unprocessed set were compared to understand the difference between the unprocessed and processed spawn.

c. During each processing event, some of the wetlock boxes did not get filled to the 100% mark. These box weights were included in the total weight calculations for the set, but not included in mean box weight calculations.

6. A few wetlock boxes from each set were taken into the STA offices and further processed for quart and gallon zip-top plastic bags. Weights of filled bags were measured by a desktop analog scale and recorded by hand.

    a. The weights of all zip-top bags coming from one wetlock box of spawn were compared to the weight of the wetlock box to understand the effect of additional processing.

    b. The weights of the bags were also taken independently for the purpose of developing an average weight for processed spawn for each bag size.

    c. During the processing, some of the plastic bags did not get filled to the 100% mark. These bags were included in the total weight calculations, but not included in mean bag weight calculations.

In all, 4 sets of branches were brought back to the harbor, and 2 of these sets were completely processed and weighed. The remaining 2 sets were weighed when brought off the boat, but only some of these 2 sets were processed into wetlock boxes and plastic bags. Since all of these 2 sets were not weighed before and after processing, the weights were only used for obtaining average weights of wetlock boxes and bags and were not included in overall processing weight comparisons.

DATA ANALYSIS

Division Information Management staff analyzed the data from the 2012 survey to produce estimates of the total harvest of herring spawn on all substrates. For 2012, the surveys were coded for data entry by Division staff in Douglas using the conversion factors that were determined as described above. Division staff also created codes for responses given to assessment questions (see Appendix C for 2012 codebook). Responses were coded following standardized conventions used by the Division. Division Information Management staff in Anchorage set up database structures within a Microsoft SQL Server[4] database. The database structures included rules, constraints, and referential integrity to ensure that data were entered completely and accurately. Data entry screens were developed in Microsoft Access and made available on a secure network. Daily incremental backups of the database occurred, and transaction logs were backed up hourly. Full backups of the database occurred twice weekly. This ensured that no more than 1 hour of data entry would be lost in the unlikely event of a catastrophic failure. All survey data were entered twice and reviewed so as to minimize data entry errors.

Once data were entered and quality-control checked using standardized procedures employed by Division Information Management staff, the information was processed using the Statistical Package for the Social Sciences (SPSS), Version 18. Initial processing included performing standardized logic checks of the data, which are often needed in complex datasets where rules, constraints, and referential integrity do not capture all the possible inconsistencies that may appear.

Data analysis also included review of raw data frequencies, cross tabulations, table generation, estimation of population parameters, and calculation of confidence intervals for the estimates. Missing information was dealt with in a manner appropriate to each situation, following such standardized practices as minimal value substitution or the use of an average response for similarly-characterized households

4. Product names are given because they are established standards for the State of Alaska, and for scientific completeness; they do not constitute an endorsement.

(mean replacement). Typically, missing data are an uncommon, randomly-occurring phenomenon in Division household surveys. In unusual cases, where a substantial amount of survey information is missing, the household survey is treated as a "non-response" and not included in community estimates. All adjustments were documented.

The Division applied the weighted means method (Cochran 1977) to generate harvest estimates for herring spawn from an interviewed sample of households drawn from a list of households known to harvest herring spawn in Sitka during the study year. In cases where a household was known to be an active harvester during one year, but the harvest was unknown that year, the mean household harvest of that year was used as an estimate of that household's actual harvest. Information Management staff used the following formula to generate these estimates:

$$H = N\left(\frac{\sum x}{n}\right) \tag{1}$$

Where

H = Total estimated harvest,

N = Total number of households identified,

n = Number of sampled households, and

x = household's reported harvest.

In this approach, the mean of the estimate remains the same as the sampled mean so percentages derived from sampled households can be applied to the entire household list. The principal assumption is that the group of households from the household list of likely harvesters that were unable to be surveyed in 2012 has (on average) the same harvest and use patterns as the households that were successfully contacted. Since the mean is the primary statistic used to develop the estimates, Information Management staff produced a 95% confidence interval (CI), represented as a percentage, to measure the relative precision of the mean. The CI can also be applied to the total estimated harvest to obtain a likely upper and lower range for the estimate. The following formula was applied to create the CI percentage:

$$CI\% = \frac{t_{\propto/2} \times \frac{s}{\sqrt{n}} \times \sqrt{1 - \frac{n}{N}}}{\bar{x}} \tag{2}$$

Where

s = sample standard deviation,

n = sampled households,

N = total households identified,

$t_{\alpha/2}$ = student's t statistic for alpha level ($\alpha = 0.05$) with n–1 degrees of freedom, and

$\bar{x}$ = mean harvest.

A small CI percentage indicates low variance in household harvest amounts and that the actual mean is very close to the sampled mean. A larger CI percentage would indicate that there is a larger variance between household harvest amounts and an increased likelihood that the actual mean differs, possibly substantially, from the sampled harvest mean. Confidence intervals for household surveys conducted in 1987 and 1996 as well as data from the annual monitoring program are presented in Table 1. Confidence intervals are not available for the 1983 harvest estimates (Table 1).

2012 RESULTS

All 3 project objectives were satisfied in 2012. Seventy-five of 109 households identified as potential harvesters of herring spawn were successfully interviewed. As provided in Table 1, an estimated 50 households attempted to harvest herring spawn, and 47 of those households were successful. This represents a slight decrease in the number of households that attempted to harvest in 2011 and is the second lowest estimated number of participating households since 2002.

The second objective of the project was to estimate the total subsistence harvest of herring spawn in Sitka Sound during 2012. Table 2 presents the total estimated harvest (115,799 lb) of herring spawn by harvester type and substrate. As has been seen in prior years of study, the vast majority of spawn was harvested by Sitka residents. Regardless of who harvested the spawn, by far the most common substrate for the harvest was hemlock branches (Figure 1). Ninety-five percent (110,454 lb) of reported harvests occurred on hemlock branches, while 5% was herring spawn on kelp or other substrate (5,344 lb). While still a small portion of the overall harvest, the 2012 spawn on kelp or other substrate harvest is much larger than has been documented in previous years.

The majority of the 2012 harvest was shared with the community of Sitka and beyond; this is a documented characteristic of the harvest common to every year of the project. Of the surveyed households that harvested herring spawn, 84% shared some of their harvest. It is usual for 80%–90% of harvesters to share their harvest in any given year. Because this survey only attempts to interview harvesters of herring spawn, it is not possible to obtain data for overall community use and sharing of herring spawn. However, some survey respondents who did not harvest any eggs still shared the eggs they received from others. Of the total amount of herring spawn that was harvested, only 7% was kept for use by the harvesting household; the remainder was given away. Of the more than 90% that was shared with others, almost three-quarters remained within Sitka and the remainder was shipped outside of Sitka (Figure 2). Spawn on hemlock branches composed most of the harvest kept for the harvester's personal use, by weight (about 70%), but that is largely because of the overall higher harvest amounts of spawn on branches. The majority of the spawn-on-branches harvest was shared, with only about 5% kept for personal use. In contrast, 46% of all the spawn on kelp harvested was kept for personal use; the rest was shared (Table 3). In 2012, herring spawn from Sitka Sound was shared with residents of the following communities in addition to Sitka: Anchorage, Angoon, Craig, Haines, Hoonah, Hydaburg, Juneau, Kake, Ketchikan, Klawock, Metlakatla, Wrangell, Yakutat, and Seattle. In addition, boats from Hoonah, Kake, and Metlakatla traveled to Sitka Sound to harvest herring spawn for those communities' residents.

The most common reason given for not attempting to harvest in 2012 was that the respondent was "working during the harvest." If the spawning event did not occur during a respondent's days off from work, it may not have been possible to incorporate harvesting activities with a work schedule. Other common reasons given were "lack of transportation/boat," "poor abundance," and "personal/health reasons" (Figure 3). In 2011, the most common reason for not attempting to harvest eggs was that the respondent had received eggs from family members. In 2012, only 3% of respondents listed receipt of eggs as a reason for not harvesting. When asked for a qualitative assessment of the harvest in 2012, almost half of the respondents (n=69) commented that the spawn was spotty, meaning that the distribution of spawn was uneven. Trees set in one area may have received a good deposition of spawn, while trees set in an adjacent area received little. The frequency of other comments offered on the survey is shown in Figure 4.

Table 1.–Estimated subsistence harvest of herring spawn in Sitka Sound, 1983–2012.

Year	Percentage of households attempting to harvest	Estimated number of households attempting to harvest	Percentage of households harvesting	Estimated number of households harvesting	Percentage of harvesting households giving away herring spawn	Estimated harvest, all substrates, pounds	95% confidence interval (±)	Range: low	Range: high
For the following 3 years, the data pertain to the entire population of Sitka, based on a random sample.									
1983	n/a	n/a	24%	586	n/a	42,000[a]	n/a	n/a	n/a
1987	n/a	n/a	9%	261	n/a	20,494[a]	91%	1,755	39,235
1996	16%	476	15%	464	n/a	127,174	72%	35,131	219,217
For the following 10 years, the data pertain to only those Sitka households identified as potential participants in the subsistence herring spawn fishery.									
2002	n/a	n/a	71%	77	95%	151,717	23%	116,701	186,734
2003	72%	117	71%	116	88%	278,799	19%	225,704	331,895
2004	61%	120	60%	118	93%	381,226	18%	312,224	450,229
2005	61%	111	52%	95	82%	79,064	9%	72,272	85,856
2006	58%	93	55%	88	91%	219,356	20%	176,484	262,228
2007	55%	92	48%	81	89%	87,211	22%	67,702	106,720
2008	45%	59	41%	54	73%	71,936	6%	67,764	76,108
2009	48%	91	48%	91	89%	213,712	9%	193,623	233,801
2010	30%	40	30%	40	85%	154,620	10%	139,872	169,367
2011	39%	57	35%	53	94%	83,443	5%	79,719	87,166
2012	45%	50	43%	47	84%	115,799	12%	102,332	129,265

Sources CSIS; Brock and Turek 2007; STA household surveys, as summarized in Gmelch and Gmelch 1985.

a. Harvest estimates for 1983 and 1987 are likely low due to the small size of the random sample, which might have failed to include high harvesting households that specialize in harvesting herring spawn.

n/a = data were not collected during the study year.

Table 2.–Subsistence harvest and use of herring spawn by community of residence, Sitka area, 2012.

Resource	Percentage of households					Estimated pounds harvested	Confidence interval		
	Used	Attempted	Harvested	Gave	Received	Total	CI%	Low	High
Sitka households (n=69)									
Herring spawn on kelp/other	n/a	n/a	27.5%	n/a	n/a	4,207.3	11.0%	3,742.9	4,671.8
Herring spawn on hemlock branches	n/a	n/a	29.0%	n/a	n/a	69,507.4	12.7%	60,691.1	78,323.8
Subtotal, herring spawn, all types	**82.6%**	**43.5%**	**40.6%**	**42.0%**	**78.3%**	**73,714.8**	12.0%	64,838.1	82,591.4
Other communities(n=5)									
Herring spawn on kelp/other	n/a	n/a	60.0%	n/a	n/a	692.9	3.6%	667.9	718.0
Herring spawn on hemlock branches	n/a	n/a	60.0%	n/a	n/a	37,225.6	6.6%	34,767.3	39,683.8
Subtotal, herring spawn, all types	**80.0%**	**60.0%**	**60.0%**	**60.0%**	**80.0%**	**37,918.5**	6.5%	35,452.8	40,384.2
Sitka Tribe of Alaska (n=1)									
Herring spawn on kelp/other	n/a	n/a	100.0%	n/a	n/a	444.0	0.0%	444.0	444.0
Herring spawn on hemlock branches	n/a	n/a	100.0%	n/a	n/a	3,721.5	0.0%	3,721.5	3,721.5
Subtotal, herring spawn, all types	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**0.0%**	**4,165.5**	0.0%	4,165.5	4,165.5
Total	**82.7%**	**45.3%**	**43.2%**	**44.0%**	**77.3%**	**115,798.7**	**11.6%**	**102,332.3**	**129,265.2**

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence household surveys, 2012.

Note n/a = not applicable.

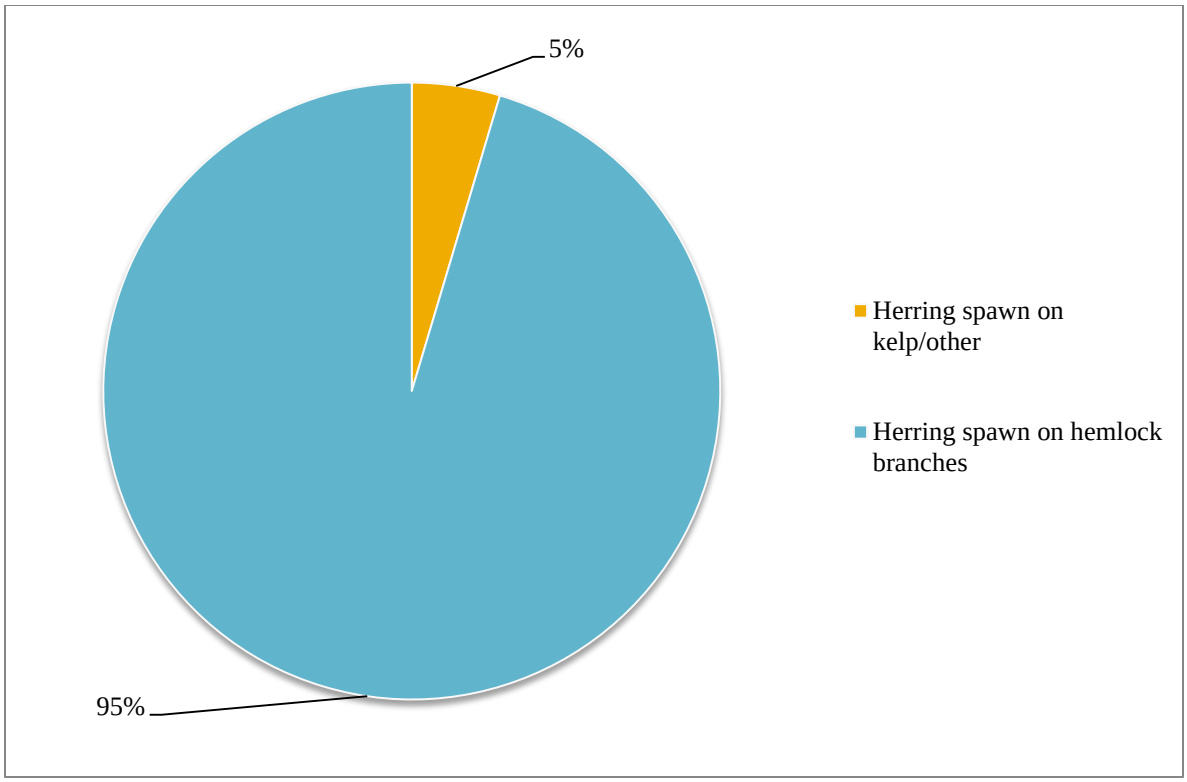

Figure 1.–Distribution of subsistence herring spawn harvest by substrate, Sitka area, 2012.

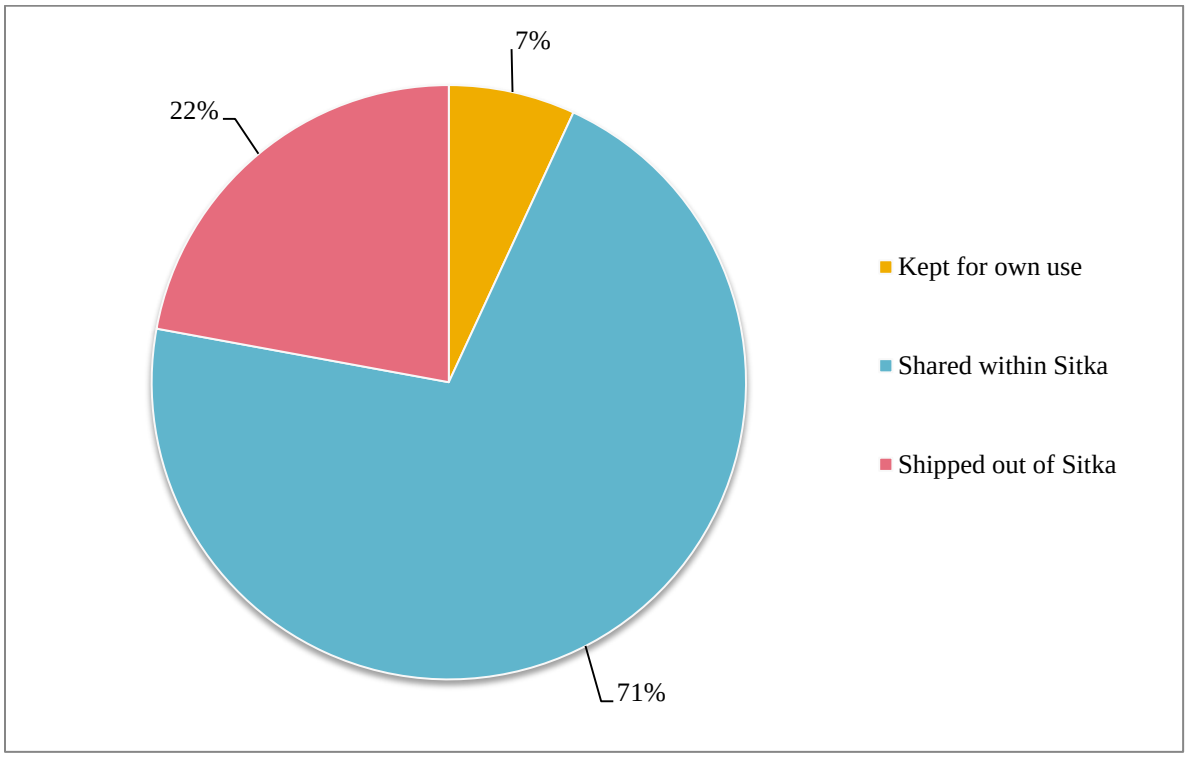

Figure 2.–Percentage of total subsistence harvested herring spawn that was shared, 2012.

Table 3.–Distribution of subsistence herring spawn harvest, Sitka area, 2012.

Resource	Reported harvest						
	Kept for own use		Shared within Sitka		Shipped out of Sitka		
	Pounds	Percentage of total harvest	Pounds	Percentage	Pounds	Percentage	Total pounds
Herring spawn on kelp/other	2435.8	45.6%	2,363.6	44.2%	544.9	10.2%	5,344.3
Herring spawn on hemlock branches	5,541.5	5.0%	79,850.1	72.3%	25,062.8	22.7%	110,454.4
Herring spawn, all types	**7,977.3**	**6.9%**	**82,213.7**	**71.0%**	**25,607.7**	**22.1%**	**115,798.7**

Sources STA and ADF&G Division of Subsistence household survey, 2012.

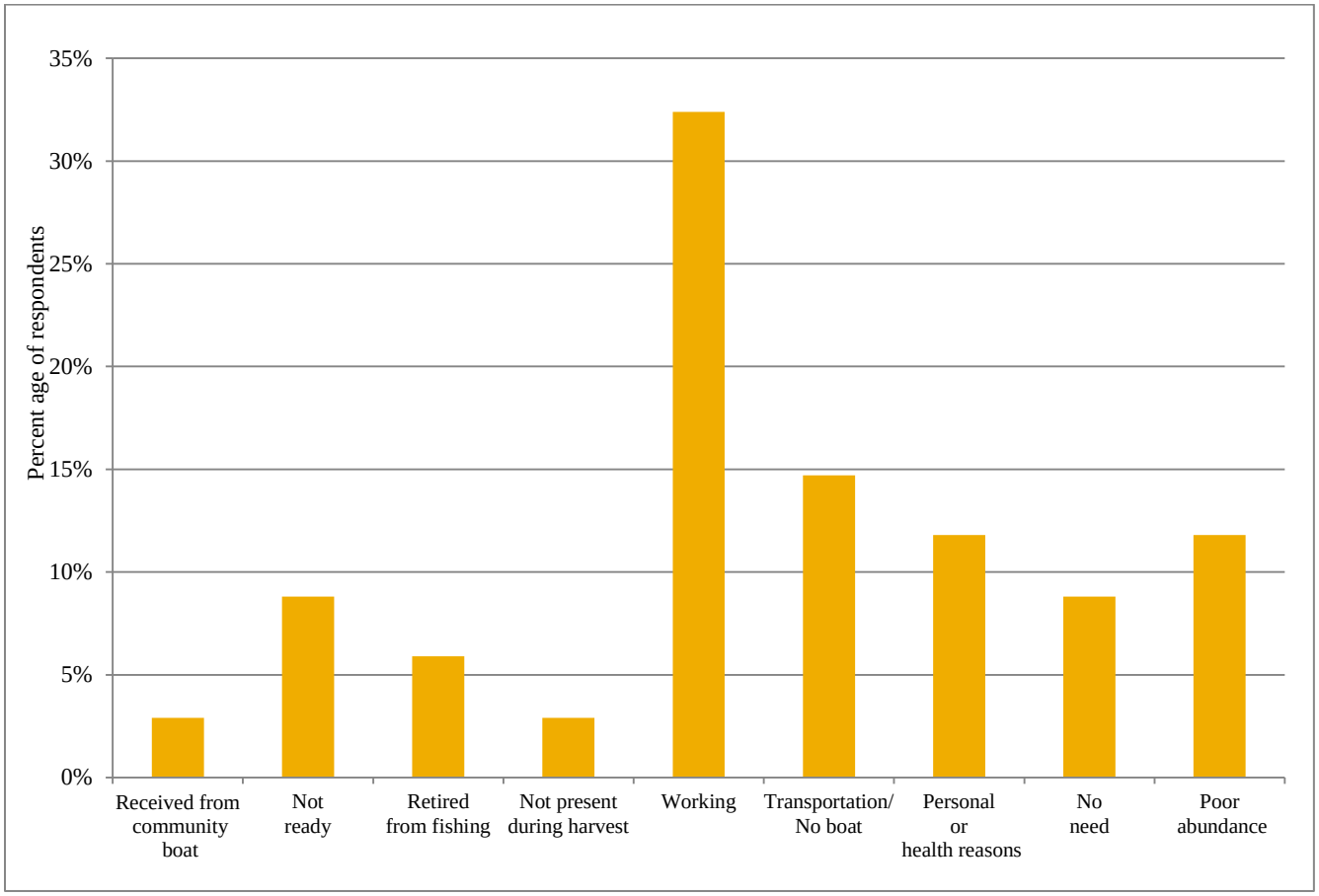

Figure 3.–Reported reasons households did not harvest herring spawn, Sitka area, 2012.

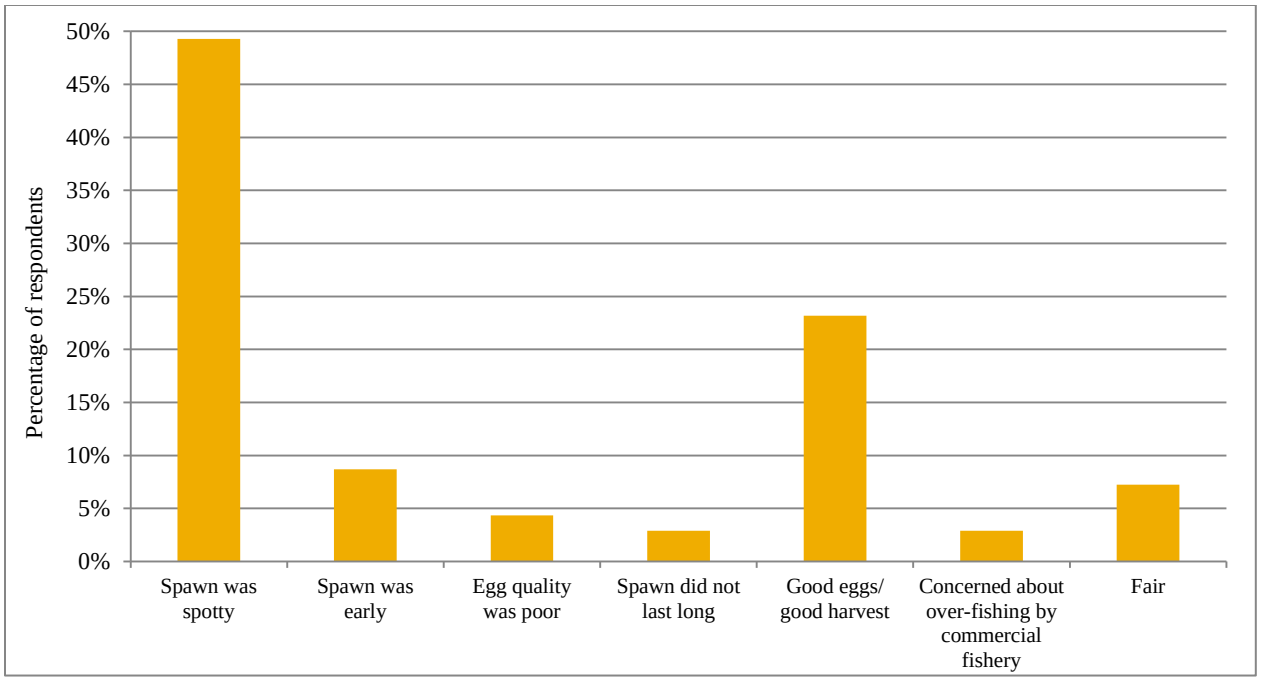

Figure 4.–Comments offered on the 2012 subsistence herring spawn harvest.

CONVERSION FACTORS

Researchers found that there was a slight decrease in weight between primarily processed (from tote to wetlock box) and secondarily processed (from box to bag) weights due to the removal of branches during processing. There was an average of 1.2% weight lost after primary processing (to wetlock boxes) and another 5.4%, on average, loss in weight during secondary processing (from wetlock to zip-top bags). This decrease has been factored into the conversion formula for 2012 (Table 4). Conversion factors were not calculated prior to 2010.

Table 4.–Conversion factors for 2010–2012.

	Estimated average weight (pounds)		
Container type, spawn on branches	**2012**	**2011**	**2010**
Sea Pro[a] large (50 lb) wetlock box	59.10 lb	53.27 lb	57.78 lb
Sea-Pro[a] small (25 lb) wetlock box	28.50 lb	24.88 lb	25.50 lb
Ziploc[a] gallon bag	4.43 lb	3.87 lb	4.07 lb
Ziploc[a] quart bag	1.38 lb	1.46 lb	1.42 lb
Container type, spawn on kelp			
Ziploc[a] gallon bag, kelp	3.65 lb	n/a	n/a
5-lb bucket, kelp	23.94 lb	n/a	n/a

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence household surveys, 2012. Sill and Lemons 2012.Holen et al. 2011

Note n/a = Conversion factors for spawn on kelp were not calculated for these years.

a. Product names are given because they are established standards for the State of Alaska, and for scientific completeness; they do not constitute an endorsement.

HARVEST LOCATIONS

The final project objective was to document where the herring spawn harvest took place. The aggregate locations of harvests by all survey respondents are shown in Figure 5. The majority of the harvests occurred in the core area of Sitka Sound. As can be seen more readily in Table 5, the most important locations include Crow/Gagarin islands (28.6%) and North Middle Island (22.2%). These harvest locations compare favorably to 2011, where North Middle and Crow/Gagarin islands were where the majority of harvesters made sets. The 2012 survey documented herring harvesting effort in locations not previously documented by this survey. A few respondents went north in search of herring eggs and set branches in the Magouns Island/Hayward Strait region, in Eastern and Promisla bays, and around the Siginaka Islands.

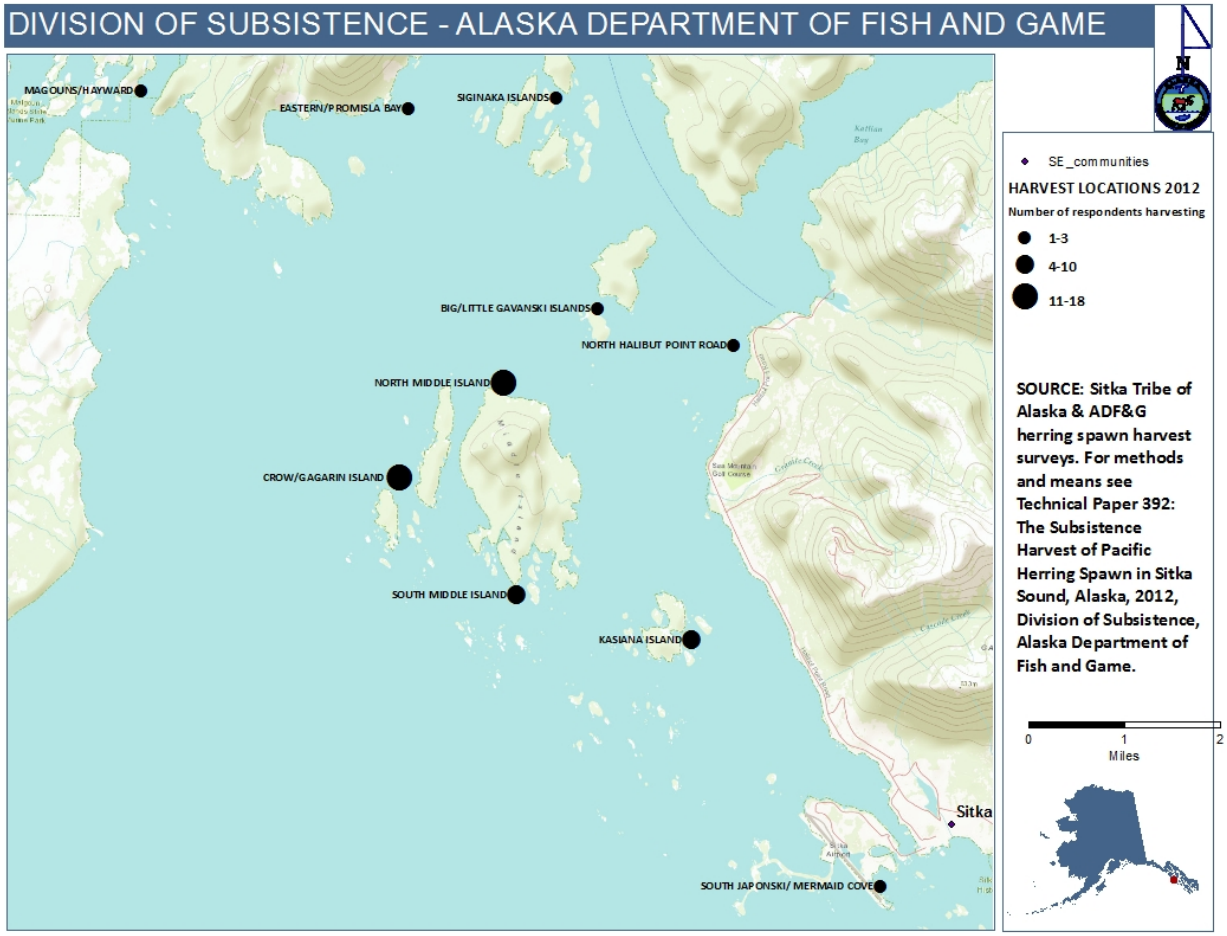

Figure 5.–Reported harvest locations, 2012.

Table 5.–Reported locations of subsistence herring spawn harvest, Sitka Sound, 2012.

Location	Number of households reporting use of locations	Percentage of harvesting households using location
Crow/Gagarin Islands	18	28.6%
North Middle Island	14	22.2%
Kasiana Islands group	10	15.9%
South Middle Island	8	12.7%
Big/Little Gavanski Islands	3	4.8%
Eastern/Promisla Bay	2	3.2%
North Halibut Point Road	2	3.2%
Magouns/Hayward	1	1.6%
Siginaka Islands	1	1.6%
South Japonski/Mermaid Cove	1	1.6%
Other	1	1.6%
Unknown location	2	3.2%

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence household surveys, 2012.

DISCUSSION

When looking at the harvests and participation documented over the course of this project (see Figure 6), what stands out the most is the downward trend in participation and harvest amounts over time. However, harvests show a great deal of annual variability and do not necessarily follow participation rates. For example, in 2012 there were fewer harvesters than in 2011, but a higher harvest. In 2010, there were even fewer households participating in the herring spawn harvest, but the estimated harvest was greater than that of 2012. The overall success of the community harvest (for these purposes this is defined by attainment of the minimum ANS; Figure 6) depends not only upon people making the effort to harvest herring spawn, but also on the opportunity for the harvest of quality spawn. Social, cultural, economic, and ecological factors all affect two key components—participation and opportunity.

Because project methods underwent a major revision in 2010, the focus of this discussion will be on study years 2010–2012; however, the same trends have been apparent since the inception of the project. The number of households harvesting spawn trends toward fewer households over time. The 2012 survey estimated the second lowest number of successful harvesters (though, interestingly, not the second lowest harvest). Even though there were fewer harvesters, herring spawn was still distributed throughout the community, throughout Southeast Alaska, and into other parts of the state and country. Approximately 93% of the harvest was shared with the majority going to Sitka residents. While the total pounds of spawn harvested and shared change from year to year, the overall picture has not changed much since 2010. These statistics, in part, speak to the skill and knowledge necessary to successfully harvest herring spawn. This pattern of a small number of households harvesting a unique resource and then distributing the resource is common in Alaska's subsistence economies (Wolfe et al. 2010). These "super-households" have the time, ability, knowledge, and equipment necessary to successfully harvest subsistence resources which are then shared throughout the community. As ecological changes have occurred, such as shorter spawn events, these skills and knowledge have become even more important because there is little time and limited resources for experimentation and adaptation.

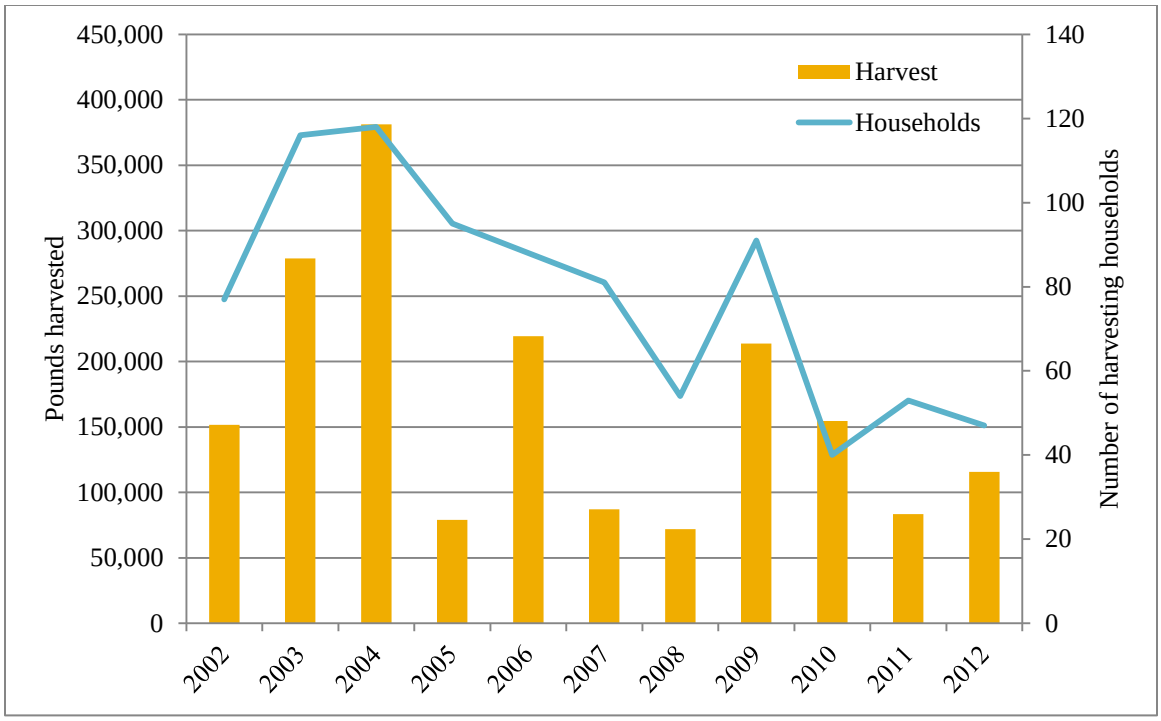

Figure 6.–Total pounds usable weight of herring harvested, number of harvesting households, and amount reasonably necessary for subsistence (ANS) of herring spawn on all substrates in Sitka Sound, 2002–2012.

As mentioned above, participation rates are not the only factor influencing harvest success. The other relevant factor to be considered can be termed "opportunity." The opportunity to participate is influenced by both socio-cultural factors and ecological factors. On the ecological side, there needs to be herring spawn available to harvest. A consistent spawn of some duration in one location is necessary. During in-depth interviews with herring harvesters, at public meetings, and in casual conversation, researchers have repeatedly heard about spawning events that lasted for weeks when the respondents were younger. More recent spawning events in the areas most heavily used by subsistence harvesters have lasted a much shorter length of time, with less multi-day deposition of spawn in any one area (Figure 7). In 2012, the number one comment on the season, voiced by almost half of the respondents, was that the spawn was spotty, meaning there were pockets of good spawn deposition, but not consistent areas of quality spawn. About 3 days of spawn in an area is commonly cited by harvesters as the minimum amount necessary for quality egg deposition and a good harvest. To investigate the connection between harvest success and multi-day spawn deposition, James Shewmake looked at mean spawning days in areas of Sitka Sound that have been used by subsistence harvesters.[5,6] Using regression analysis, he found that mean spawning days (from 2000–2012) in subsistence areas of Sitka Sound was a reasonably good predictor of harvest success until 2009 ($r^2=0.859$). After 2009, the correlation becomes less robust. However, from 2009 forward, looking at the same spawning data in the "preferred" subsistence areas—areas that are most conducive to subsistence fishing (good substrate, favorable prevailing winds and tides, distance from Sitka) and were highlighted during ethnographic interviews with herring harvesters—yielded another strong correlation

5. Shewmake, James W. II. 2013. "Spatial Resilience and the Incorporation of Traditional Ecological Knowledge in Mapping Sitka Herring". Thesis, Fairbanks: University of Alaska Fairbanks. Hereafter referred to as (Shewmake 2013).
6. Shewmake's research was conducted while he was a graduate intern with the Alaska Department of Fish and Game Division of Subsistence in 2011.

(r2=0.963). With few data points, this last regression is lacking in statistical significance, but shows a promising avenue to continue exploring.

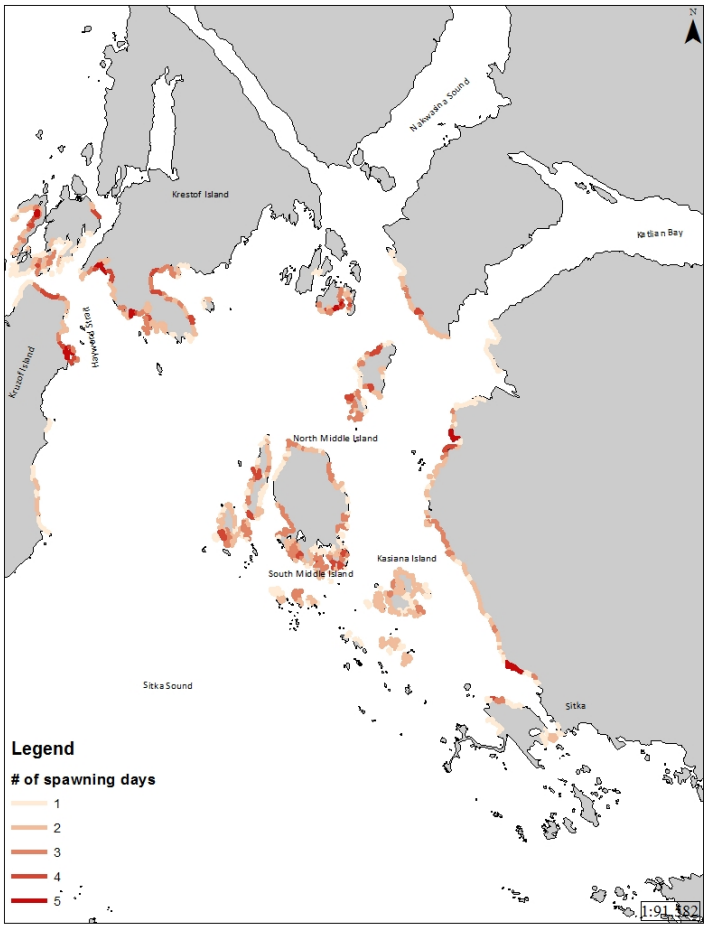

Figure 7.–Number of days of herring spawn deposition, Sitka Sound, 2012.

The socio-cultural aspects of opportunity are separate from the ecological. Assuming there is sufficient herring spawn, most fundamentally, to be a successful harvester requires that an individual can be physically present on the spawning grounds with the time available to prepare hemlock branches, set them, and in some cases, guard them against theft. Harvesters note that branches should not soak for more than 3 days or they become soft and the needles start to disintegrate, leading to a poor deposition on the branches. After the spawn individuals need to be able to haul in their sets, process the eggs, and preserve them.

In 2012 the most common reason given (by more than 30% of the respondents) for why the respondent did not participate in the fishery was "work." In 2011 and 2010, this reason was one of the top 2 given. The second most common reason given in 2012 was lack of transportation/boat, followed by personal or health reasons. The shorter available spawning period harvesters have spoken of may be exacerbating this issue. Most people do not have the ability to take a day off of work with no notice in order to capitalize on the spawn event. When the spawn lasts less than a week, the harvester does not have the flexibility to accommodate work schedules and other commitments. During the last 30 years, the spawn has begun as early as March 19 and as late as April 28. Some harvesters have a pretty good idea when the spawn is going to happen as the time gets closer, but there is no real predictability to allow for much prior planning. The second most common comment, a lack of transportation or boat, is a clear physical barrier to harvesting.

Bringing the 2 factors together, participation and opportunity, Shewmake (2013) investigated harvest success in terms of participation and opportunity. By graphing the relationship between household days in subsistence areas[7] (defined as the number of participating households multiplied by mean spawn days) and the total pounds of eggs harvested, he found that the relationship explained much of the variability in the total harvest at a statistically significant level ($p<0.001$). Declining participation is a concern, but declining opportunity is an equally valid concern when looking at overall harvest success in a season.

7. Shewmake (2013) defined subsistence areas through a participant mapping exercise. Areas that had historically been used for herring spawn harvests by key informants were identified and digitized. Additionally, the 19 areas identified on the annual harvest survey were included in the areas designated "subsistence areas."

CHANGES IN USE OF HERRING SPAWN

One of the limitations of this research project is that only herring egg harvesters are targeted. While that methodology allows for the collection of much useful information, it does not allow for an analysis of the wider use of herring eggs. The study had been able to document a decrease in the participation of the subsistence herring egg harvest, but there is no data available to speak to changes in overall use of the resource, either within Sitka or in other Southeast communities. The survey has shown that herring eggs continue to be widely shared and used throughout the state, but a broader survey looking specifically at the use and receipt of herring eggs from the general populace would be necessary to fully discuss changes in the use of herring eggs over time.

CONVERSION FACTORS

The effect of egg density on the success of the overall harvest is a relatively new avenue of investigation that researchers are beginning to explore. From Shewmake's (2013) work, it can be seen that the number of consecutive spawning days is important to overall success. More spawning days should lead to thicker egg deposition and heavier branches. One way the project is investigating egg density is through the creation of annual conversion factors. Assuming that the herring spawn processors are relatively consistent in how they process branches for packing containers during the conversion factor updates, the average weight of a wetlock box should vary annually with spawn density—less in years with low density and more in high-density years. In addition to allowing for a comparison across years, creating conversion factors each year gives researchers a more accurate estimate of herring egg harvests because individuals often report their harvest in number of boxes/bags.

As of yet, with only 3 data points, it is difficult to ascribe much significance to the annual variations in box weights. Looking at per capita harvests (total harvest divided by number of harvesters), 2011 was the lowest year, with a per capita harvest of 1,574 lb. The conversion factor for 2011 was also the lowest of the 3 years. Study year 2010 had a slightly higher per capita harvest than 2012 (3,865 lb and 3,619 lb, respectively), but a smaller conversion factor. More years of data will help clarify any connections between the 2 variables.

Subsistence harvesters say there is an ideal spawn density on hemlock branches where there is enough spawn on each branch to make hauling and processing the sets worthwhile, but the spawn is not so dense that the interior eggs do not cook properly during preparation. Years in which the spawn is sparse can result in less overall harvest. Harvesters may abandon some sets in the water because it is not worth the effort to bring in and process branches with sparse amounts of spawn. Branches that are harvested may be trimmed more heavily to retain only the portions with good deposition. The Division of Commercial Fisheries produces estimates of average egg deposition densities during yearly spawn deposition surveys. Egg deposition in 2012 dropped significantly from 2011 levels to below the average deposition (K. Hebert, Fishery Biologist IV, ADF&G, Douglas, personal communication). These ADF&G estimates have not been compared to subsistence harvesters' observations over time but such comparison is a line of inquiry worth pursuing in the future. It is hypothesized that there will be disparities between the 2 estimates because, like the length of the spawning event, a harvester's evaluation of spawn density will be based on a more limited geographic area than the spawn deposition surveys conducted by ADF&G. In general, additional work with spawn densities and weights of hemlock branches needs to be done to further understand the role spawn density plays in subsistence harvests.

LOCATION OF HARVESTS

The final aspect of the subsistence herring harvest that the project attempts to understand is the location of harvests. While the question concerning harvest locations has not been on the survey every year, from the years when this information was sought it is clear that there is a core area most harvesters use, but there is also year-to-year variability in all the locations used for the harvest. For example, in 2012 locations in northern Sitka Sound were documented for the first time. Looking at the map of spawning days (Figure

7), it is clear why some harvesters attempted to harvest in this area. There are a number of reasons for this pattern. Within limits, harvesters will go where the herring are spawning. Herring do not have site fidelity like salmon; therefore, where they spawn each year can change. Harvesters look for areas they feel are most likely to produce high-quality spawn based on factors such as geography, substrate, and protection from wind and waves. Some harvesters do not have access to a boat, so they need to harvest in locations accessible by the road system, regardless of where the herring are spawning. Skiffs and other small boats are commonly used by herring harvesters and wind and rough seas can make harvesting dangerous; therefore, protected areas are sought. Protected areas are also favored for their likelihood of high quality spawn since ocean surge can stir up sand on the seafloor, degrading the quality of the herring spawn. As Sitka has developed, and concerns for water quality have grown, harvesters have also tried to ensure that the area they harvest from is not negatively impacted by development. ADF&G documents the nautical miles of herring spawn observed in all of Sitka Sound each year. Because of the limitations in where quality subsistence harvests can occur, looking at the overall nautical miles of herring spawn in Sitka Sound does not give an accurate picture of the opportunity available to harvesters. A harvester's assessment of the length of the spawn and quality of the season is localized to areas that are accessible to that harvester and therefore may not be the same as the documented duration of the spawn.

SPAWN-ON-KELP FISHERY

In addition to further investigating the role of spawn deposition on weight conversion measurements, another aspect of the herring spawn fishery that researchers will continue to explore is the spawn-on-kelp fishery. While surveys are attempted with all harvesters of herring spawn, regardless of the substrate, herring spawn on branches accounts for the majority of the harvest and has therefore received the most attention. Often, the amounts of spawn on kelp documented by the survey have been less than that recorded on the permits (a permit is necessary to harvest spawn-on-kelp in Sitka Sound). In 2012, researchers concentrated additional effort on identifying and contacting spawn-on-kelp harvesters. The harvest survey estimated just more than 5,300 lb, while the permit data documented 2,075 lb. Part of this discrepancy is because the survey data are expanded to account for respondents that were unable to be surveyed whereas the permit data are unexpanded. Other sources of difference between the 2 estimates are unknown at this time.

CONCLUSION

Although participation in the subsistence harvest of herring spawn from Sitka Sound has dropped since the early 2000s, the harvest remains an important cultural activity for Southeast residents. Overall harvest amounts are influenced by the number of harvesters participating, but also the by the opportunity for quality spawn in accessible locations. The harvest of herring spawn continues to be shared extensively throughout Sitka, Southeast Alaska, and beyond. Concern for the resource over the changes experienced with the harvest is a consistent theme heard from harvesters. Future years of this project will continue to investigate the spawn-on-kelp harvest and comparisons with permit data for that fishery. In addition, the variations in spawn density and identifying accurate ways to track and correlate density with the harvest will be explored. Finally, a broader effort to look at overall use of herring eggs, not just the harvest effort, and changes over time, is needed but is beyond the scope of this project.

ACKNOWLEDGEMENTS

The ADF&G Division of Subsistence would like to thank the staff of the Sitka Tribe of Alaska for their hard work and dedication to this project; in particular we thank Jeff Feldpausch, Jessica Gill, and Dan Williams. The survey would not have been possible without their leadership and cooperation. We would like to thank the Sitka Tribe of Alaska Tribal Council and Herring Committee members for their dedication and support of the project. There are many subsistence harvesters and commercial fishers who contributed to the success of this project by taking the time to speak to researchers and we would like to take this opportunity to thank them as well.

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APPENDIX A: SITKA SOUND SUBSISTENCE HERRING EGG HARVEST SURVEY, 2012

Subsistence Herring Egg Harvest Survey 2012
Sitka Tribe of Alaska, and ADF&G Division of Subsistence

Community_____ Date _____ HHID _____

How many people lived in your household in 2012? _____ Interviewer _____

Is anyone in the HH enrolled in a tribe, and if so, which? _____

Please answer each question to the best of your knowledge. **ALL YOUR ANSWERS ARE CONFIDENTIAL AND WILL ONLY BE RECOGNIZED BY AN ASSIGNED RANDOM HOUSEHOLD SURVEY NUMBER**

HARVESTER QUESTIONS

1. Did you attempt to harvest eggs in 2012? _____ Yes _____ No

   If you answered **no** to **question 1**, why did you not attempt to harvest herring eggs in 2012?

   _____

   _____

   If you answered no to question 1, continue on to **Summary Questions**

2. Did you harvest herring eggs in 2012? _____ Yes _____ No

   If you answered **no** to **question 2**, why did you not harvest herring eggs in 2012?

   _____

   _____

   How do you feel the harvest went this year compared to previous harvests?

   _____

   _____

SUMMARY QUESTIONS

1. Did you receive herring eggs in 2012? _____ Yes _____ No
2. Did you give away herring eggs in 2012? _____ Yes _____ No
3. Were your subsistence herring egg needs met in 2012? _____ Yes _____ No
4. Do you plan on harvesting herring eggs in the future? _____ Yes _____ No
5. Do you have any additional comments about the 2012 subsistence herring egg harvest?

_____

_____

If you harvested herring eggs continue survey on next page. STOP - If you did not harvest. Thank you for your time and cooperation!

THANK YOU FOR YOUR TIME AND FOR HELPING WITH THIS PROJECT - GUNALCHEESH! HOWÁ!

This information will help Sitka Tribe of Alaska and the ADF&G protect subsistence uses of herring eggs.

Subsistence Herring Egg Harvest Survey 2012
Sitka Tribe of Alaska, and ADF&G Division of Subsistence

Interviewer_____ HHID_____

Please answer each question to the best of your knowledge. All your answers are confidential and will only be recognized by an assigned, random household survey number.

How much Herring Eggs **on Branches** did you harvest during **2012**? (i.e. Bags(Gallon, Quart), Boxes(size or weight), other)

How much did you harvest for personal use _____
How much did you give away in Sitka _____
How much did you ship out of Sitka _____

How much Herring Eggs **on Kelp/Other** did you harvest during **2012**? (i.e. Macrocystis, Hair Seaweed-Né, Other)

How much did you harvest for personal use _____
How much did you give away in Sitka _____
How much did you ship out of Sitka _____

If you shared herring eggs with others how many households did you share with?

Number of Households	Community

What size vessel(s) did you use to harvest herring eggs in 2012? _____

[**01=Skiff under 20'; 02=Pleasure cruiser 20'-24'; 03=Pleasure over 24'; 04=Commercial, 05=Other**]

GO TO NEXT PAGE TO COMPLETE SURVEY!!!!!!!!

THANK YOU FOR YOUR TIME AND FOR HELPING WITH THIS PROJECT - GUNALCHEESH! HOWÁ!

This information will help Sitka Tribe of Alaska and the ADF&G protect subsistence uses of herring eggs.

Where did you harvest your herring eggs in 2012 - set branches, harvest seaweed, macrocystis kelp**?**

	Location	# of Sets	# of Sets Harvested	Quality	Date Set/Pulled/Soak	Comments
1	Kasiana Islands Group					
2	North Middle Island					
3	South Middle Island					
4	Crow/Gagarin Islands					
5	Big/Little Gavanski Islands					
6	Siginaka Islands					
7	North Japonski/Whiting Harbor					
8	South Japonski/Mermaid Cove					
9	Causeway Islands					
10	South Halibut Point Road					
11	North Halibut Point Road					
12	Eastern/Promisla Bay					
13	Magouns/Hayward					
14	Katlian Bay					
15	Apple/Parker Group					
16	Crescent/Jamestown Bay					
17	Camp Coogan/Sandy Cove					
18	Aleutkina Bay/Leesofskia Bay					
19	Three Entrance Bay					
20	Redoubt/Kanaga Bay					
21	Goddard/Windy Pass/Dorothy Narrows					
22	Other:_____					

APPENDIX B: 2012 CODE BOOK

Subsistence Herring Egg Harvest Survey 2012

Herring Spawn User Status	Code
Individual Harvester	1
Non-Harvester	2
Community boat	3

1-a. If you did not attempt to harvest herring eggs in 2011, why didn't you?	Code
Harvester - no response necessary	Blank
Refused	-7
Missing (blank, but should not be & the reason is not clear)	-8
Unknown to respondent	-9
Not ready	1
Working during the harvest	2
Received from friends	3
Received from a community boat	4
Had eggs from last year	5
Elder	6
Personal or health issues	7
Not present during the harvest	8
Transportation/no boat	9

2-a. If you did not harvest herring eggs, why didn't you?	Code
Harvester - no response necessary	Blank
Refused	-7
Missing (blank, but should not be & the reason is not clear)	-8
Unknown to respondent	-9
Not ready	1
Working during the harvest	2
Received from a community boat	3
Elder	4
Personal or health issues	5
Not present during the harvest	6
Transportation/no boat	7
Had eggs from last year/no need	8
Too quick of spawn/poor abundance	9

2-b. How do you feel the harvest went this year compared to previous harvests?	Code
Refused	-8
Missing (blank, but should not be & the reason is not clear)	-9
Unknown to respondent	1
Better last year/poor abundance	2
Spawn was spotty	3
Spawn was early	4
Egg quality was poor	5
Spawn did not last long	6
Good eggs/good harvest	7
Concerned about over-fishing by commercial fishery	8
Fair	9
No hair kelp to harvest	10
Bad weather	11

5. Do you have any additional comments about the 2012 subsistence herring egg harvest?	Code

Refused	-7
Missing (blank, but should not be & the reason is not clear)	-8
Unknown to respondent	-9
Good harvest	1
Poor quality eggs	2
Spawn was spotty	3
Spawn did not last long	4
Concerned about the future of the resource	5
Concerned about the effect of the commercial fishery on the resource	6
Lot of male herring/few female herring	7
Better last year/poor abundance	8
Spawn came earlier than expected/had to be ready	9
kelp only harvest	10

APPENDIX C: LOCATION OF HARVESTS FOR 2012 CONVERSION FACTOR UPDATE

Location of sets A–K, set by STA for use in the conversion factor update of 2012 and for distribution to tribal members. Sets A, C, E, and F were harvested and used in the update.