Technical Paper No. 486

The Subsistence Harvest of Pacific Herring Spawn in Sitka Sound, Alaska, 2021

by

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and

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December 2021

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

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the reports by the Division of Subsistence. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

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.)	$, ¢
months (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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December 2021

The Division of Subsistence Technical Paper series was established in 1979 and represents the most complete collection of information about customary and traditional uses of fish and wildlife resources in Alaska. The papers cover all regions of the state. Some papers were written in response to specific fish and game management issues. Others provide detailed, basic information on the subsistence uses of particular communities which pertain to a large number of scientific policy questions.

Technical Paper series reports are available through the Alaska Resources Library and Information Services (ARLIS), the Alaska State Library and on the Internet: http://www.adfg.alaska.gov/sf/publications/. This publication has undergone editorial and professional review.

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ABSTRACT

The subsistence fishery for the spawn of Pacific herring *Clupea pallasii* in Sitka Sound was historically, and remains, important to Alaska residents. Alaska Department of Fish and Game (ADF&G) Division of Subsistence research on the contemporary subsistence fishery reveals that harvesting herring spawn is a specialized activity in which a relatively small number of Southeast Alaska residents harvest and distribute herring spawn widely. Annual subsistence harvest monitoring surveys began in 2002 in response to concerns from subsistence harvesters that the commercial sac roe herring fishery was negatively affecting subsistence harvesting success. This report presents the results of the 20th annual harvest survey conducted in Sitka and neighboring communities in 2021. 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. The most recent 10-year average annual harvest (2011–2020) was 78,846 lb. In 2021, an estimated total of 46,950 lb of herring spawn was harvested; this level of harvest was more than double the estimated harvest of 2020 but still ranked among the lowest estimated harvests over the course of the project. Approximately 92% of the harvest was shared with other households within Sitka or in other communities in the state and beyond.

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

1. INTRODUCTION

The spawn of Pacific herring *Clupea pallasii*, generally known as "herring eggs," is a traditional food of great cultural importance for indigenous coastal communities throughout the Pacific Northwest and Southeast Alaska (Moss 2016). Herring spawn is consumed throughout this region, however only a small number of people have the time, equipment, skills, and knowledge required to harvest it. The harvest is then shared widely. This report presents findings of the 20th annual harvest assessment, which occurred in the spring of 2021, designed to document subsistence harvests of herring spawn in Sitka Sound (see Brock and Turek (2007), Holen et al. [2011], Sill and Lemons [2012; 2014a; 2014b; 2015; 2017; 2020; 2021] and Sill and Cunningham [2017; 2019; 2021] for discussion of the previous study years).

Pacific herring return annually to spawn in locations throughout Alaska and the Pacific Northwest, but the abundance of herring and herring spawn and the length of the spawning period has set Sitka Sound apart from these other areas (Schroeder and Kookesh 1990). 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 Alaska to harvest herring and herring spawn (Emmons 1991; Pierce 1972). 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. Recently, herring eggs from Sitka Sound have been documented as being shared throughout Southeast Alaska and beyond to as far north as Utqiaġvik (formerly Barrow) and Kotzebue and as far south as California (Sill and Cunningham 2017).

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 also collected on other substrates such as giant kelp *Macrocystis pyrifera*, 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 the Sitka area. State regulations in the Sitka Sound area 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). 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 sac roe fishery 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.[1] As a

1. Subsistence fisheries throughout the state of Alaska have varying requirements for harvest reporting: the majority do not require a permit. Based on salmon permit programs, permits can underestimate the actual harvest (Conitz 2010; Walker 2009). In addition, permit data decouple harvest from the broader context in which the resource is harvested. For example, permits do not document information about household demographics, sharing practices, or qualitative assessments about the harvests that

consequence of these proposals, the BOF requested that the ADF&G Division of Subsistence work with STA to develop a harvest monitoring program based on in-person harvest surveys. This method of data collection provides a way to increase community buy-in and participation in harvest reporting, build capacity within the community and STA, and provide consistent data. The BOF also made a determination that the amount reasonably necessary for subsistence[2] (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 available harvest data, including results from a 1996 household harvest survey[3] and a 1989 harvest estimate range (Schroeder and Kookesh 1990). At its 2009 meeting, the BOF revised the ANS to 136,000–227,000 lb, based on the mean estimated harvest from 2002–2008, as determined through the annual herring spawn harvest survey conducted by ADF&G and STA (Holen et al. 2011). Beginning in 2012, STA successfully proposed several closures to other fisheries in areas of Sitka Sound that have historically been used for the subsistence harvest of herring spawn (referred to as the "core" area) (see Appendix A). In 2012, a compromise version of an STA proposal was adopted by the BOF, resulting in a closure of approximately 10 square nautical miles of Sitka Sound to the commercial herring sac roe fishery. In 2015, the Federal Subsistence Board approved a proposal submitted by STA that closed approximately two square miles of federal waters around Makhnati Island (see Appendix A). In 2018, the BOF adopted Proposal 106, which expanded the state-closed waters in the District 13 commercial fishery by approximately 6.5 square nautical miles.

Monitoring the subsistence harvest of herring spawn in Sitka Sound is an ongoing project. ADF&G participation in the annual harvest monitoring program is partially supported by a reimbursable services agreement (RSA) from the Division of Commercial Fisheries to the Division of Subsistence as well as by the Division of Subsistence general funds. STA provides funding for the project and is also supported by a cooperative agreement with ADF&G. STA and ADF&G collaborate on survey design and data collection. ADF&G provides technical consultation and, when possible, field survey and interviewing support for the project and STA provides ADF&G with completed surveys.

PROJECT OBJECTIVES

The goal of the harvest monitoring program is to annually document the subsistence harvest of Pacific herring spawn through household surveys with all harvesters who participate in the fishery in Sitka Sound. The objectives of the project in 2021 were to:

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

METHODS

This annual project is guided by the research principles outlined in the *Alaska Federation of Natives Guidelines for Research*[4] and by the National Science Foundation, Office of Polar Programs in its

provide important explanatory context needed for sensitive allocation issues. A permit is required to subsistence harvest herring spawn on kelp in Southeast, but no other subsistence herring egg fisheries in the state require a permit.

2. 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.
3. The results from this study are published in the Community Subsistence Information System: http://www.adfg.alaska.gov/sb/CSIS/
4. Alaska Federation of Natives. "Alaska Federation of Natives Guidelines for Research." Alaska Native Knowledge Network. Accessed November 1, 2021. https://uaf.edu/ankn/indigenous-knowledge-syst/alaska-federation-of-nati/

Principles for Conducting Research in the Arctic[5], the *Ethical Principles for the Conduct of Research in the North* (Association of Canadian Universities for Northern Studies 2003), 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 the study community upon completion of the research.

Survey Plan and Implementation

The ongoing COVID-19 pandemic during the spring of 2021 prevented STA and ADF&G staff from meeting in person. Through email communications, phone calls, and videoconferences, staff reviewed and approved the survey instrument. A videoconference between STA and ADF&G staff took the place of in-person surveyor training. All surveyors had experience administering these surveys during previous project years. As closely as possible, the methods outlined in this section followed previous years' methods and are a collaborative effort between ADF&G and STA. STA staff conducted all surveys, and the majority were done telephonically.

Development of the Household Survey List

Prior to the start of the Pacific herring spawning season, STA staff update the previous year's survey list. Households that meet criteria for removal, which are outlined below (and provided in greater detail in Holen et al. [2011]), are removed from the survey list. Any new household planning to harvest that STA is aware of, usually through word-of-mouth, is added to the survey list at this time, but is not assigned a household identification (ID) number until they harvest eggs and are surveyed. Researchers have noted the declining number of households included in the survey universe; so, to ensure that researchers are reaching the majority of active harvesters, in 2021 STA staff implemented a more formal and robust outreach effort than had been done during previous project years. As part of these efforts, STA held a raffle for any harvesting household that participated in the survey. An announcement of the survey and the raffle was advertised online on the STA Facebook page and the STA website, printed in the Sitka Sentinel, and read on-air on the local radio station prior to and throughout the duration of the fishery (see Appendix B for a copy of the announcement). After updating the 2020 survey list, the initial 2021 list contained 48 households to be surveyed. Through STA outreach efforts, coupled with word-of-mouth and chain referrals, an additional 21 households were added to the survey list for a total of 69 households. Harvesting is a highly visible activity; therefore, it was assumed that active harvesters would be aware of other harvesters. The household list was not limited to Sitka residents; harvesting households from other communities, identified mainly through word-of-mouth and chain referrals, were also included.

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

1. If the household is surveyed for three consecutive years and has not attempted to harvest within that time, it is removed; or
2. If a household is unable to be contacted for three 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. Should a retired harvester become active again, the same household ID number would be re-assigned to the harvester.

5. National Science Foundation Interagency Arctic Research Policy Committee (IARPC). 2018. "Principles for Conducting Research in the Arctic." Accessed March 4, 2020. http://www.nsf.gov/geo/opp/arctic/conduct.jsp

The Survey Instrument

The primary method of data collection is the 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. Whether respondents harvested on their own or in collaboration with other households.
5. The amount of herring spawn respondents kept for their own use, gave away locally, or shipped out of Sitka, and the communities with which they shared the harvest.
6. The location of respondents' harvests.
7. Survey respondents' qualitative assessments of the study year's herring spawn harvest.
8. Survey respondents' qualitative descriptions of their participation in the harvest.

The 2021 survey remained the same as the 2020 survey, except for the addition of two questions about using publicly accessible online map tools. In 2020, ADF&G Division of Commercial Fisheries piloted the use of a mobile data collection app during 2020 aerial herring surveys and released an interactive mapper on the ADF&G website to allow users to view the data collected. In 2021, the mobile data collection app and maps were used again in Sitka Sound and regionwide. Since the maps were still under development, the department was seeking feedback regarding their use and utility. To assist in that effort, project researchers added several questions to the household survey to gauge the harvester's knowledge of and evaluation of the new maps. Responses were shared with Division of Commercial Fisheries staff for the next iteration of the mapping tool. A copy of the 2021 instrument can be found in Appendix C.

Survey Implementation

An interview was attempted for each of the 69 households on the survey list; 55 households were successfully interviewed and 14 households were unable to be contacted. STA staff conducted the majority of the surveys in May 2021 after the herring spawn activity ended and all surveys were complete by June 2021. Completed surveys were sent to ADF&G for coding and analysis (see Appendix D for code book). For analysis, surveys were grouped into two strata: individual harvester or community harvest boat. The latter stratum encompasses boats, such as STA's traditional foods boat or non-local individuals that harvest herring for community-wide distribution in Sitka or another Southeast Alaska community. These community boats are considered a "household" for the purposes of this report and are part of the 55 households interviewed. For survey methods, the skipper or owner of the boat is surveyed about the entire harvest brought in by that boat. Crew on board who are not part of the skipper's household that take home any of the boat's harvest are not considered harvesting households but as receivers of herring spawn. In 2021, STA was unable to use their own vessels to conduct their harvesting activities and instead the captains of two boats volunteered to harvest for the organization. For the purposes of data analysis, these efforts and harvests were recorded on one survey completed for STA.

Update of the 2021 Conversion Factors

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 (Holen et al. 2011). On April 7, April 9, April 12–14, and April 16, STA staff processed 1,200 lb of their harvest of herring spawn on hemlock branches to create conversion factors. This was a portion of the total egg on branches harvest of the season for STA and was conducted by the two volunteer boats mentioned previously. Prior to the beginning of the spawn and throughout the spawning period, these harvesters set hemlock branches

in Sitka Sound. The locations of the sets were determined by the harvesters based on active spawning conditions, their knowledge of herring spawn events, and past experience with the harvest.

Based on the plan devised by STA and ADF&G, the following steps were taken to measure weights in the field in 2021.

1. STA staff checked all herring sets and pulled those that were ready.
2. Once the boat returned to the harbor after pulling a set, STA staff offloaded the branches from the boat and 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 (usually anything larger than approximately one-half-inch in diameter) and the poorly covered branches. For storage in gallon-sized bags, the more rigid branches were discarded, leaving only the pliable branches and needles that would not tear the bags.
3. 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 on rather than having to estimate total pounds harvested for the survey. In 2021, containers used were 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.
    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.
4. A few wetlock boxes from each set were taken into the STA offices and further processed into quart- or gallon-sized zip-top plastic bags. Weights of filled bags were measured by a desktop digital scale and recorded by hand.
    a. 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.

DATA ANALYSIS

ADF&G Information Management staff analyzed the data from the 2021 survey to produce estimates of the total harvest of herring spawn on all substrates. For 2021, the surveys were coded for data entry by ADF&G staff in Douglas using the conversion factors that were determined as described above. ADF&G staff also created codes for responses given to assessment questions (see Appendix D for the 2021 code book). Responses were coded following standardized conventions used by ADF&G. ADF&G Information Management staff in Anchorage set up database structures within a Microsoft SQL Server[6] 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 one hour of

6. Product names are given because they are established standards for the State of Alaska or for scientific completeness; they do not constitute product endorsement.

data entry would be lost in the unlikely event of a catastrophic failure. All survey data were entered twice and reviewed to minimize data entry errors.

Once data were entered and quality-control checked using standardized procedures employed by ADF&G Information Management staff, the information was processed using the Statistical Package for the Social Sciences (SPSS), Version 20. 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 (mean replacement). Typically, missing data are an uncommon, randomly occurring phenomenon in ADF&G 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.

ADF&G 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. These households were further divided into groups, or strata: harvester and community boats. Valid responses for each group were used to develop averages for invalid or missing responses within the same group, and the same averages were extended to all uncontacted households in the group. 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. These totals were then summed to provide a community-wide estimate:

$$H = \sum_{k=1}^{K} N_k \left(\frac{\sum x_k}{n_k} \right) \quad (1)$$

Where

H = total estimated harvest,

N_k = total number of households identified for strata-group 'k',

n_k = number of sampled households in strata-group 'k',

x_k = reported harvest for household within strata group 'k',

k = strata group, and

K = total strata groups.

In this approach, each strata group is estimated separately and thus percentages are derived from the estimated values rather than samples. This assumes that the un-contacted households within each strata group are, on average, the same as those contacted and also that each strata group has different harvest patterns.

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:

$$CI\% = \frac{t_{\propto/2} \times \sqrt{\frac{1}{N}\sum_{k=1}^{K} N_k(N_k - n_k)\frac{s_k^2}{n_k}}}{H} \quad (2)$$

Where

s_k = sample standard deviation for strata group 'k',

n_k = sampled households for strata group 'k',

N_k = total households identified for strata group 'k',

N = total households identified in the community,

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

H = total estimated community harvest,

k = strata group, and

K = total strata groups.

A small CI percentage indicates low variance in household harvest amounts and that the actual mean is likely very close to the sampled mean. A larger CI percentage indicates 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.

DISSEMINATION OF SURVEY RESULTS

The written report is reviewed within ADF&G as well as by the Southeast Alaska Herring Conservation Alliance and STA. The final report, once published, is available on the ADF&G website. Hard copies are distributed to STA. The Southeast cycle of the BOF will occur in January of 2022; this report will be published and submitted to the board.

2. 2021 RESULTS

SAMPLE ACHIEVEMENT

As detailed in the methods, through STA's outreach efforts, 21 households were added to the survey list in 2021 compared to 2020, and three households were removed due to consecutive years of no participation, an inability for surveyors to contact the households, or deceased households. As a result, 69 households were identified as potential harvesters of herring spawn in 2021. Of these 69 households, 55 were interviewed (80%), including STA (whose harvest was conducted by volunteer vessels as discussed in the previous chapter) and four other community harvester boats (Table 1). The majority of Sitka households claimed tribal affiliation with the Sitka Tribe of Alaska (62%), but 28% of Sitka households had no tribal affiliation. All of the community harvester boats were affiliated with Southeast Alaska tribal organizations. Based on sampled households, an estimated 49 households attempted to harvest herring spawn in 2021 and 48 were successful (Table 2). Data from all years of the annual monitoring program, as well as household surveys conducted in 1983, 1987, and 1996, are presented in Table 2, including confidence intervals for the harvest estimates (excluding 1983, for which the confidence interval is not available).

HARVEST ESTIMATES

Households and community harvester boats harvested an estimated 46,950 lb of herring spawn on any substrate in Sitka Sound during 2021 (Table 2). Individual Sitka households, which composed the majority of the survey respondents, harvested slightly more than one-half (55%) of the total harvest (Table 3). The remainder of the harvest was conducted by individuals or groups harvesting herring eggs from Sitka Sound for general distribution to a community, including Sitka, Angoon, Juneau, and Hoonah. No boat was sponsored by Southeast Herring Conservation Alliance in 2021 for general community harvest.

Among the community boats, all boats harvested herring spawn on hemlock branches and 40% harvested spawn on kelp. Among the Sitka households, 60% harvested spawn on branches, 28% harvested spawn on kelp, and 14% harvested spawn on hair seaweed (Table 3). By weight, the majority of the herring egg harvest was on hemlock branches (95%; 44,854 lb), with a small portion on kelp (4%; 1,824 lb), and an even smaller portion on hair seaweed (1%; 272 lb) (Figure 1; Table 4).

Sharing of herring eggs continues to be an important aspect of the harvest. Every household surveyed that harvested herring eggs gave away some portion of their harvest (Table 2). Considering all of the herring eggs that were harvested on any substrate, 8% was kept for the harvesting household and the remainder was given away; 47% of the pounds harvested remained in Sitka and 45% was shipped outside of Sitka (Figure 2; Table 4). Table 4 presents greater detail on the harvest of herring eggs by substrate and by destination. Because of the overall larger amounts of herring spawn on branches harvested, that substrate composes the largest percentages of the estimated amounts kept for the harvesters' own use (88%), shared within Sitka (94%), or shipped outside of Sitka (98%). Approximately equal percentages of the herring spawn on hemlock branches were shared within Sitka and beyond Sitka (46% and 47%, respectively) with 7% retained for the harvesters' own use. In contrast, harvesters shared more of the spawn on kelp harvest with Sitka households (59%) than households outside of Sitka (21%) or kept for their own use (21%). Only 9% of the harvest of spawn on hair seaweed was shared outside of Sitka; harvesters distributed 61% of the harvest to Sitka households and kept 30% for their own use. Out of 32 harvesting households (including the community harvester boats) that indicated they usually harvest for other households, 28% indicated they usually harvest for six to 10 households, 22% harvest for two to five households, 19% harvest for more than 100 households, 13% harvest for 11 to 50 households, and 9% either harvest for one other household or 51 to 100 households (Table 5). In 2021, herring spawn from Sitka Sound was shared with residents of at least the following communities: Anchorage, Angoon, Bethel, Coffman Cove, Cordova, Fairbanks, Hoonah, Hydaburg, Juneau, Kake, Ketchikan, Klawock, Kotzebue, Metlakatla, Nome, Palmer, Sitka, Soldotna, Valdez, Wrangell, Yakutat, Utqiaġvik, as well as with communities in other states.

As follow-up to questions about harvest amounts, harvesting households were asked how their harvests compared to other years (a timeframe for comparison was not provided). Not all households responded to these follow-up questions. Approximately 65% of the 34 responding households thought that they harvested more herring eggs compared to other years and equal percentages (18%) reported harvesting the same as or less than other years (Table 6). Households that indicated a change in harvest (either more or less) were asked about the reasons for the change. Of the households that indicated harvesting more eggs, no single reason was given more frequently than others. Reasons provided included that it was a better year (30% of households), the household was a new harvester (30%), better management of the commercial fishery (25%), and the spawn was of good quality or was more available (20% of households each) (Table 7). Most households that harvested fewer eggs indicated that the resource was less available (83%) or the weather was poor (50%) (Table 8). Harvesting households were asked if they got enough herring spawn in 2021 for themselves as well as to share with others. In 2021, 87% of the 38 responding households reported that they got enough for themselves and enough to share with others (Table 9). This question differs from the one that asked if the household shared their harvest in that it specifically asks if the household had enough to share. Based on past surveys and discussions with harvesters, even in poor harvest years, people will share some amount of herring eggs with a core set of individuals; in better harvest years, more will be shared and with more people.

Not all potential harvesters contacted for this survey attempted to harvest herring eggs in 2021. Of the 13 households contacted who reported that they did not attempt to harvest eggs in 2021, the most common reason given was the household did not have a need to harvest (38%) (Figure 3). Following that, personal reasons, transportation issues, working during the harvest, and being out of town were reasons given by 25% or fewer of responding households.

Several more questions on the survey were included in order to understand certain characteristics of the harvest effort and to contextualize harvester activity. In many years, transportation issues—e.g., a lack of transportation, challenges in affording equipment repairs or fuel, or weather/distance concerns—factor into potential harvesters' decision making for whether or not to participate in the fishery and how they will participate. Survey respondents were asked the size of the vessel used during the fishery and whether they harvested with others. The latter question was asked to quantify how many households employ that strategy to share the costs of fuel, maintenance, and time. The question about the size of the vessel used provides information about potential limitations a harvester may have in terms of where to go, how many sets can be put out and the size of the set, among other considerations. In 2021, a plurality of harvesters (45%) used a vessel less than 20 feet in length, 40% used a vessel between 20 and 24 feet, 8% used a vessel longer than 24 feet, and 11% used a commercial vessel (Table 10). In 2021, 74% of responding households harvested with other families (Table 11).

Table 1. –Sampling characteristics for the 2021 herring spawn harvester survey.

Sampling characteristics	Sitka households	Community harvester boats
Herring spawn harvesting households		
Surveyed	50.0	5.0
Total	61.0	8.0
Percentage sampled	82.0%	62.5%
Population of herring spawn harvesting households		
Surveyed	167.4	23.8
Estimated total	204.2	38.0
Average household size	3.35	4.8
Tribal affiliation of sampled households[a]		
Sitka Tribe		
Number	31.0	1.0
Percentage	62.0%	20.0%
Other Southeast		
Number	4.0	4.0
Percentage	8.0%	80.0%
Other Alaska		
Number	0.0	0.0
Percentage	0.0%	0.0%
None		
Number	14.0	0.0
Percentage	28.0%	0.0%
Missing		
Number	2.0	0.0
Percentage	4.0%	0.0%

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021.

a. Percentages may not add to 100%. Households may have more than one tribal affiliation.

Table 2.–Estimated subsistence harvest of herring spawn in Sitka Sound, 1983, 1987, 1996, 2002–2021.

		Percentages based on surveyed households				Estimated values					
Year	Total number of surveyed households	Percentage of households attempting to harvest	Percentage of households harvesting	Percentage of harvesting households giving away herring spawn	Percentage of harvesting households receiving herring spawn	Estimated number of households attempting to harvest	Estimated number of households harvesting	Estimated harvest, all substrates, pounds	95% confidence interval (± %)	Range: low[b]	Range: high
For the following 3 years, the data pertain to the entire population of Sitka, based on a random sample.											
1983	139	n/a	24.0%	n/a	n/a	n/a	586	42,000[a]	n/a	n/a	n/a
1987	296	n/a	9.0%	n/a	n/a	n/a	261	20,494[a]	91%	1,755	39,235
1996	150	16.0%	15.0%	n/a	n/a	476	464	127,174	72%	35,131	219,217
For the following 20 years, the data pertain to only those Sitka households identified as potential participants in the subsistence herring spawn fishery.											
2002	86	n/a	71.0%	95.0%	40.0%	n/a	77	151,717	23%	116,701	186,734
2003	118	72.0%	71.0%	88.0%	30.0%	117	116	278,799	19%	225,704	331,895
2004	144	61.0%	60.0%	93.0%	17.0%	120	118	381,226	18%	312,224	450,229
2005	159	61.0%	52.0%	82.0%	13.0%	111	95	79,064	9%	72,272	85,856
2006	127	58.0%	55.0%	91.0%	27.0%	93	88	219,356	20%	176,484	262,228
2007	126	55.0%	48.0%	89.0%	43.0%	92	81	87,211	22%	67,702	106,720
2008	128	45.0%	41.0%	73.0%	52.0%	59	54	71,936	6%	67,764	76,108
2009	150	48.0%	48.0%	89.0%	79.0%	91	91	213,712	9%	193,623	233,801
2010	132	30.0%	30.0%	85.0%	12.5%	40	40	154,620	10%	139,872	169,367
2011	109	38.5%	35.4%	94.0%	35.0%	57	53	83,443	5%	79,719	87,166
2012	75	45.0%	43.2%	84.0%	88.0%	50	47	115,799	12%	102,332	129,265
2013	59	64.4%	62.7%	86.1%	27.7%	52	50	78,090	10%	70,075	86,106
2014	60	68.3%	67.8%	87.5%	31.7%	68	68	154,412	13%	135,054	173,769
2015	58	67.2%	65.5%	56.9%	17.2%	52	51	106,998	21%	84,664	129,333
2016	64	40.4%	37.2%	74.8%	0.0%	38	35	84,554	41%	50,028	119,079
2017	36	60.6%	49.8%	73.7%	0.0%	53	44	65,691	25%	49,268	82,114
2018	47	48.7%	36.2%	94.0%	5.8%	39	29	25,862	71%	17,914	44,148
2019	36	41.8%	39.0%	100.0%	14.2%	27	25	51,687	99%	26,447	102,764

-continued-

Table 2.–Page 2 of 2.

		Percentages based on surveyed households				Estimated values					
Year	Total number of surveyed households	Percentage of households attempting to harvest	Percentage of households harvesting	Percentage of harvesting households giving away herring spawn	Percentage of harvesting households receiving herring spawn	Estimated number of households attempting to harvest	Estimated number of households harvesting	Estimated harvest, all substrates, pounds	95% confidence interval (± %)	Range: low[b]	Range: high
2020	15	71.8%	63.1%	72.7%	41.0%	11	9	21,926	307%	8,051	89,128
2021	55	71.7%	69.9%	100.0%	12.4%	49	48	46,950	33%	35,856	58,045

Sources Sitka Tribe of Alaska household surveys, as summarized in Gmelch and Gmelch (1985) and Schroeder and Kookesh (1990); CSIS; Holen et al. (2011); Brock and Turek (2007); Sill and Lemons (2012; 2014a; 2014b; 2015; 2017; 2020; 2021); and Sill and Cunningham (2017; 2019; 2021).

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

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.

b. Confidence intervals falling below the reported harvest have been adjusted to the reported value.

Table 3.–Subsistence harvest of herring spawn by type of harvester and total estimated harvest, Sitka area, 2021.

	Percentage of potential participant households[a]		Estimated pounds harvested	Confidence interval		
Resource	Attempted	Harvested	Total	CI %	Low[b]	High
Sitka households (n=50)						
Herring spawn on hemlock branches	68.0%	60.0%	24,483.2	30.0%	20,068.2	31,836.1
Herring spawn on kelp	68.0%	28.0%	876.6	36.2%	718.5	1,194.0
Herring spawn on hair seaweed	68.0%	14.0%	272.1	50.3%	223.0	408.8
Subtotal, herring spawn, all types	*68.0%*	*66.0%*	*25,631.8*	*28.9%*	*21,009.7*	*33,033.4*
Community harvester boats (n=5)						
Herring spawn on hemlock branches	100.0%	100.0%	20,371.2	94.1%	12,732.0	39,536.6
Herring spawn on kelp	100.0%	40.0%	947.2	256.3%	592.0	3,374.4
Herring spawn on hair seaweed	100.0%	0.0%	0.0	0.0%	0.0	0.0
Subtotal, herring spawn, all types	*100.0%*	*100.0%*	*21,318.4*	*100.9%*	*13,324.0*	*42,823.2*
Total	**71.7%**	**69.9%**	**46,950.2**	**23.6%**	**35,855.6**	**58,044.8**

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021.

a. Based on the total number of surveyed households (n=55; community harvester boats are each treated as an individual household for the purpose of this analysis).

b. Confidence intervals falling below the reported harvest have been adjusted to the reported value.

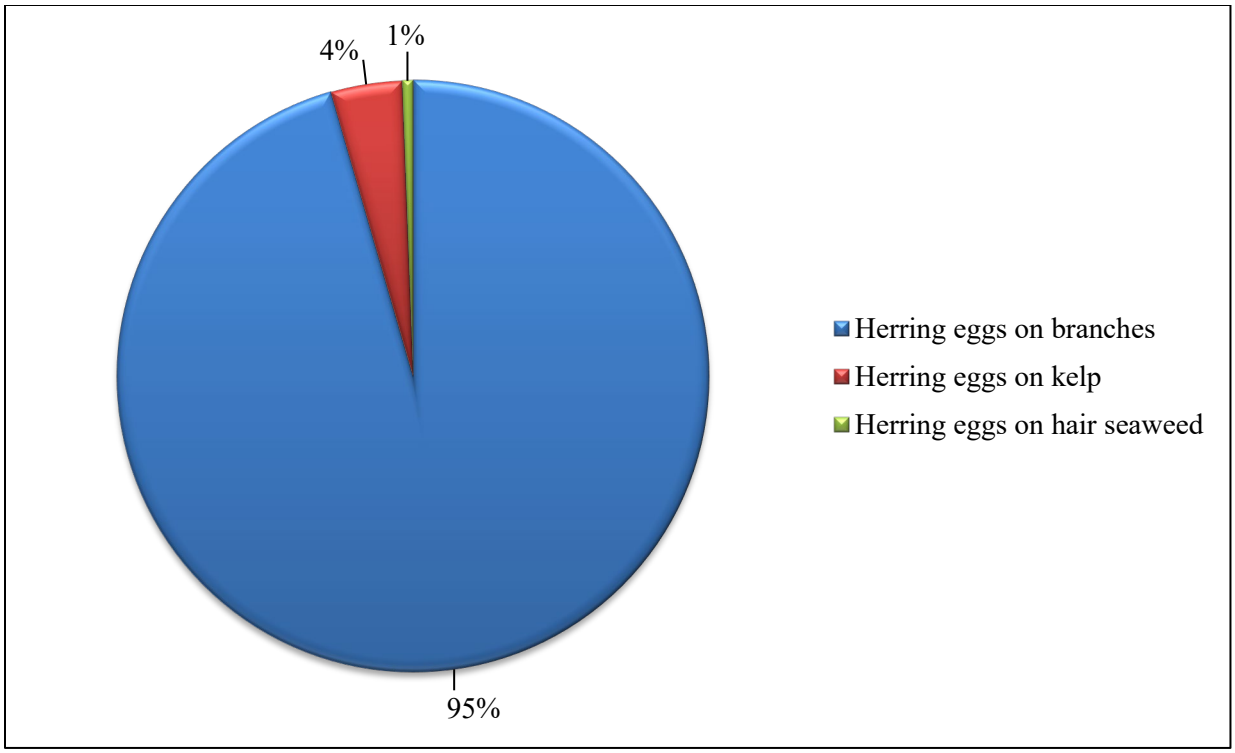

Figure 1.–Distribution of subsistence herring spawn harvest by substrate, Sitka area, 2021.

Table 4.–Distribution of subsistence herring spawn harvest, Sitka area, 2021.

Resource	Estimated harvest: *Kept for own use* Pounds	Percentage of substrate harvest	Percentage of kept harvest	Percentage of total harvest
Herring spawn on hemlock branches	3,178.3	7.1%	87.5%	6.8%
Herring spawn on kelp	374.8	20.6%	10.3%	0.8%
Herring spawn on hair seaweed	81.1	29.8%	2.2%	0.2%
Herring spawn–all types	***3,634.3***		***100.0%***	***7.7%***
	Shared within Sitka Pounds	Percentage of substrate harvest	Percentage of Sitka shared harvest	Percentage of total harvest
Herring spawn on hemlock branches	20,717.0	46.2%	94.4%	44.1%
Herring spawn on kelp	1,072.0	58.8%	4.9%	2.3%
Herring spawn on hair seaweed	166.5	61.2%	0.8%	0.4%
Herring spawn–all types	***21,955.5***		***100.0%***	***46.8%***
	Shared outside of Sitka Pounds	Percentage of substrate harvest	Percentage of harvest shared outside Sitka	Percentage of total harvest
Herring spawn on hemlock branches	20,959.1	46.7%	98.1%	44.6%
Herring spawn on kelp	377.0	20.7%	1.8%	0.8%
Herring spawn on hair seaweed	24.4	9.0%	0.1%	0.1%
Herring spawn–all types	***21,360.5***		***100.0%***	***45.5%***
	Total Pounds	Percentage of substrate harvest	Total percentage kept/shared[a]	Percentage of total harvest
Herring spawn on hemlock branches	44,854.4	100.0%	7.1% / 92.9%	95.5%
Herring spawn on kelp	1,823.8	100.0%	20.6% / 79.4%	3.9%
Herring spawn on hair seaweed	272.1	100.0%	29.8% / 70.2%	0.6%
Herring spawn–all types	**46,950.2**		**7.7% / 92.3%**	**100.0%**

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021.

Note Due to rounding considerations, total percentages may not appear to exactly sum 100%.

a. "Shared" includes herring spawn shared both within and outside Sitka.

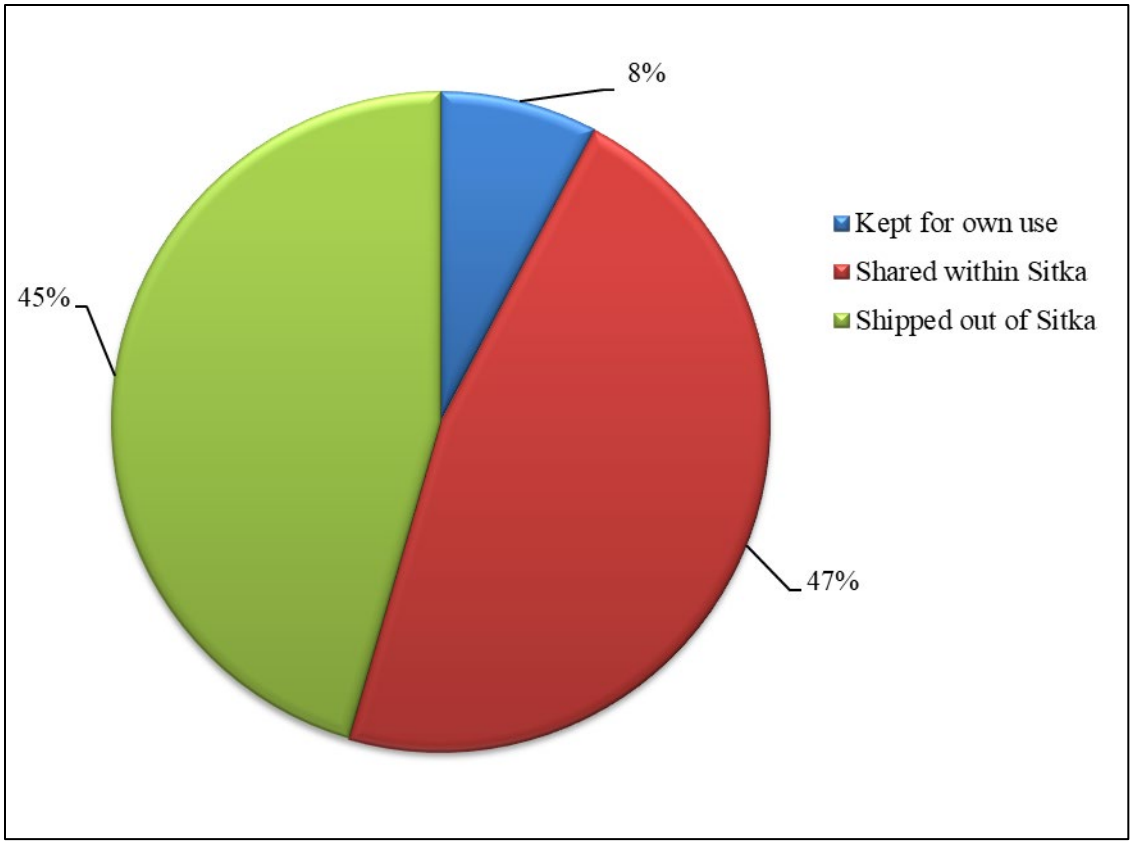

Figure 2.–Percentage of total Sitka Sound subsistence harvested herring spawn that was shared, 2021.

Table 5.–Number of households that harvesting households usually harvest for, Sitka area, 2021.

Number of households responding	Percentage of responding households					
	1	2–5	6–10	11–50	51–100	More than 100
32	9.4%	21.9%	28.1%	12.5%	9.4%	18.8%

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021.

Table 6.–Harvesting households' perception of herring spawn harvest compared to previous years, Sitka area, 2021.

Number of households responding	Percentage of responding households		
	Less	Same	More
34	17.6%	17.6%	64.7%

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021.

Table 7.–Reasons given by Sitka Sound harvesters for why their household harvests were more in 2021 than in other years.

Number of households responding	Percentage of responding households[a]						
	New harvester	Good quality spawn	More available	Fishery management	Better year	Other	Total
20	30.0%	20.0%	20.0%	25.0%	30.0%	10.0%	135.0%

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021.

a. Percentages may not add to 100%. Households may provide more than one response.

Table 8.–Reasons given by Sitka Sound harvesters for why their household harvests were less in 2021 than in other years.

Number of households responding	Percentage of responding households[a]			
	Resource less available	Weather	Other	Total
6	83.3%	50.0%	33.3%	166.7%

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021.

a. Percentages may not add to 100%. Households may provide more than one response.

Table 9.–Harvesting households' description of whether they got enough herring spawn to meet their households needs and their sharing needs, Sitka area, 2021.

For own household *(n=38)*		To share *(n=38)*	
Yes	No	Yes	No
86.8%	13.2%	86.8%	13.2%

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021.

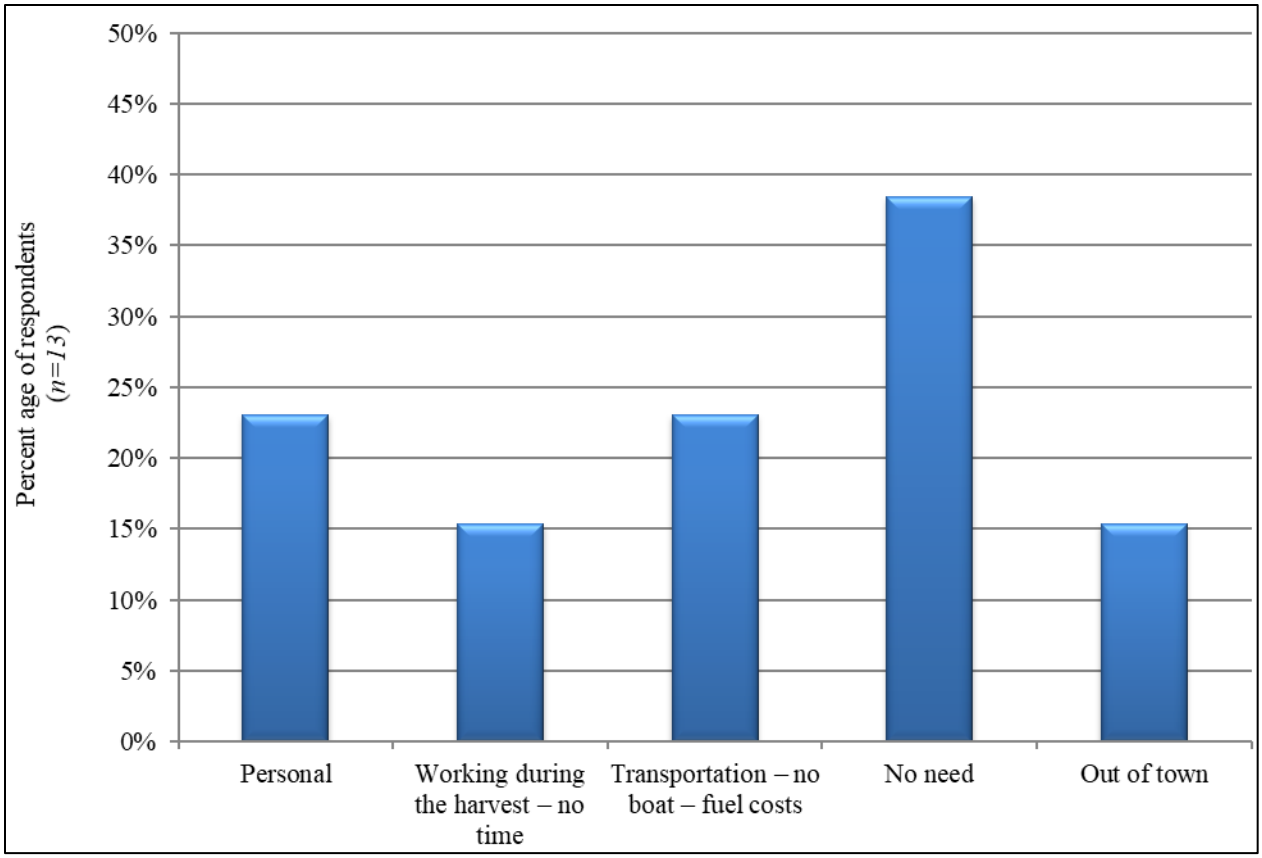

Figure 3.–Reported reasons households did not attempt to harvest herring spawn, Sitka area, 2021.

Table 10.–Size of vessel used to harvest herring spawn in Sitka Sound, 2021.

	Percentage of responding households[a]					
Number of households responding	Less than 20 feet	20–24 feet	More than 24 feet	Commercial vessel	Other	No boat used – harvested from shore
38	44.7%	39.5%	7.9%	10.5%	2.6%	0.0%

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021.
a. Percentages may not add to 100%. Households may provide more than one response.

Table 11.–Percent of households harvesting with other households, Sitka Sound, 2021.

Number of households responding	Percentage of responding households	
	Yes	No
38	73.7%	26.3%

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021.

Conversion Factors

During survey administration, surveyors ask respondents to estimate the processed weight of their harvests. Project staff assumed that experienced harvesters were knowledgeable about harvest weights through handling, packaging, and shipping herring spawn (Schroeder and Kookesh 1990). If respondents have difficulty estimating the weight of their harvests, they are asked for the volume, which can then be converted into pounds using a conversion factor. From 2002 through 2009, this factor was static and was based on the weight of an equivalent volume of water. Beginning in 2010, project staff developed a more rigorous method for gauging harvest weights based on weighing a portion of STA's harvest in commonly used containers. In any year, respondents provide the majority of the harvest weight in estimated pounds with small amounts being converted from volume to weight. Table 12 presents the conversion factors for 2010 through 2021. STA was unable to weigh the harvest in 2020 because of logistics complications caused by the COVID-19 pandemic, so the previous 5-year average of conversion factors was used. Conversion factors have been calculated every year for 50- and 25-lb wetlock boxes and gallon-sized zip-top bags; they have not been calculated for quart-sized zip-top bags or various container sizes of herring spawn on kelp every year. Generally, a small proportion of the total harvest weight derives from quart-sized bags or herring eggs on kelp or hair seaweed. In past project years, researchers documented 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. Since 2016, due to the unavailability of dock space at the winch, raw weights of branches off the boat could not be taken.

Table 12.–Conversion factors for 2010–2021.

Container type	Estimated average weight (pounds)											
	2021	2020[a]	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010
Spawn on branches												
Large (50 lb) wetlock box	50.35	54.5	53.9	57.1	51.9	55.5	54.0	48.9	53.0	59.1	53.3	57.8
Small (25 lb) wetlock box	26.89	25.5	28.0	24.1	24.8	25.2	25.6	24.7	22.8	28.5	24.9	25.5
Zip-top gallon bag	3.54	3.7	3.5	4.0	4.2	3.4	3.7	4.1	3.9	4.4	3.9	4.1
Zip-top quart bag	1.41	n/a	n/a	1.5	1.4	1.1	n/a	n/a	1.4	1.4	1.5	1.4
Spawn on kelp												
Zip-top gallon bag	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3.7	n/a	n/a
5-lb bucket	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	23.9	n/a	n/a
Small (25 lb) wetlock box	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	16.7	n/a	n/a	n/a

Sources Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021; Holen et al. (2011); Sill and Lemons (2012; 2014a; 2014b; 2015; 2017; 2020; 2021); and Sill and Cunningham (2017; 2019; 2021).

Note n/a indicates conversion factors were not calculated for these years.

a. The conversion factors for spawn on branches in 2020 reflect the previous 5-year average, 2015–2019.

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HARVEST LOCATIONS

The final project objective was to document where the herring spawn harvest took place. Table 13 and Figure 4 show the locations of harvest effort and reported harvest amounts. Note that not every surveyed household shared their harvest location data or the amounts harvested at each location. In 2021, surveyed households used multiple harvesting locations spread throughout the northern portion of Sitka Sound and the core area of islands just offshore from Sitka. Eighteen households traveled to the Eastern/Promisla bays area and Crow/Gagarin islands, eight went to South Middle Island, seven traveled to the Magoun Island/Hayward Strait area, and five each went to the Kasiana Islands group and North Middle Island. Less than five households reported traveling to the Siginaka Islands, Big/Little Gavanski Islands, and locations in southern Sitka Sound (Table 13). Harvest amounts generally corresponded with the percentage of households using a location.

Table 13.–Reported locations of subsistence herring spawn sets and harvest, Sitka Sound, 2021.

Location	Reported households using each location	Percentage of reporting households using each location[a]	Reported pounds harvested at each location
Eastern/Promisla Bay	18	26.1%	12,394
Crow/Gagarin Islands	18	26.1%	8,253
South Middle Island	8	11.6%	1,825
Magoons/Hayward	7	10.1%	1,050
Kasiana Islands Group	5	7.2%	625
North Middle Island	5	7.2%	125
Siginaka Islands	3	4.3%	450
Southern Sitka Sound	2	2.9%	50
Big/Little Gavanski Islands	2	2.9%	400
Other	1	1.4%	400

Source Sitka Tribe of Alaska and ADF&G Division of Subsistence, household surveys, 2021.

a. Percentages are based on the total number of locations reported by 36 harvesting households.

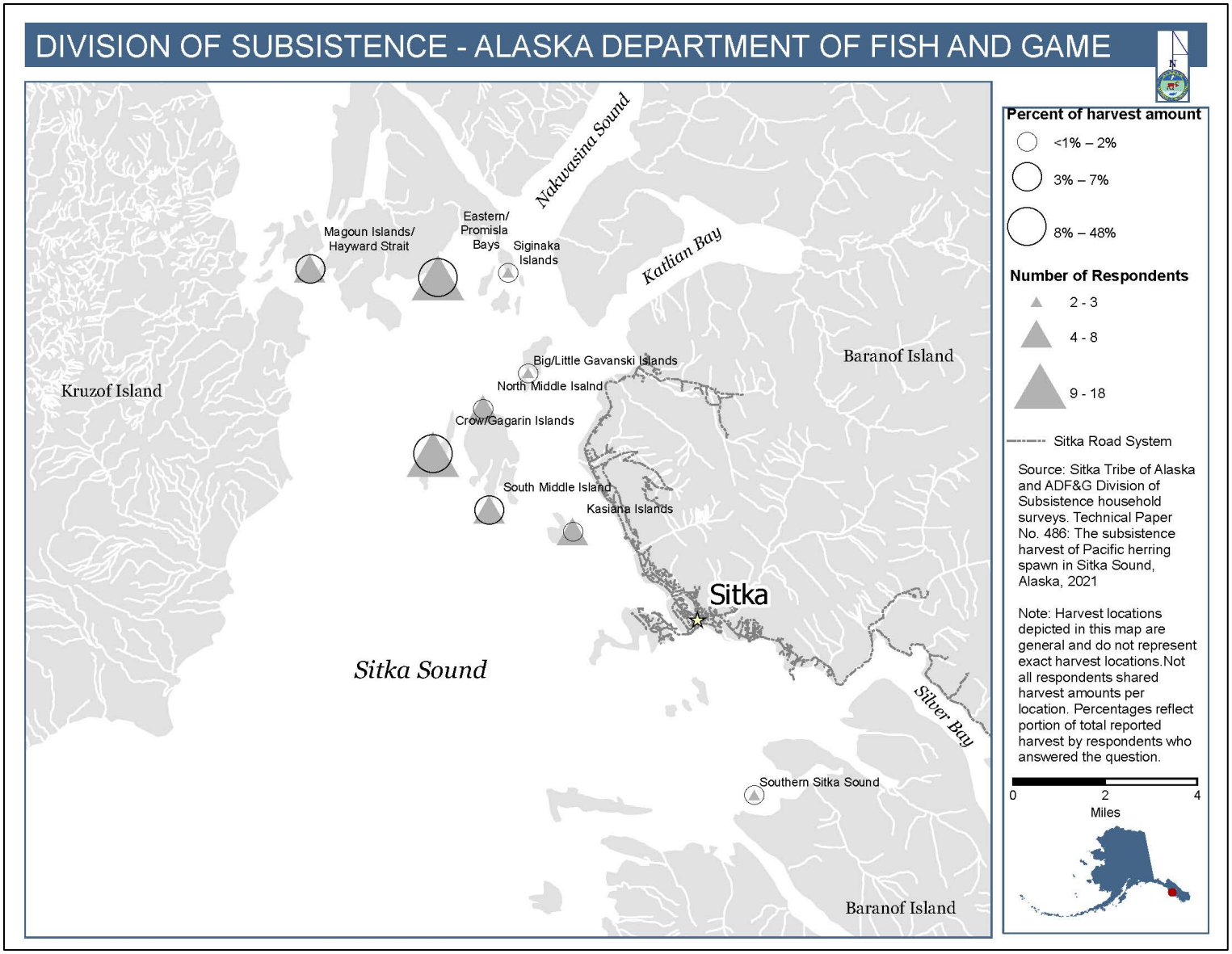

Figure 4.–Reported harvest locations and percent of harvest weight per location of herring spawn for subsistence use, 2021.

3. DISCUSSION

OVERVIEW OF 2021 STUDY YEAR

Many aspects of the 2021 subsistence herring egg fishing season appeared to be a return to patterns seen before the disruption of COVID-19 in 2020. While the 2021 fishing season again occurred in the midst of the global pandemic, much more was known about how the novel disease is transmitted and how individuals can best protect themselves. In comparison to 2020, when few households harvested together, nearly three-quarters of households reported harvesting together in 2021. Community boats that were mostly absent in 2020 returned in 2021. Despite these signs of returning to pre-pandemic fisheries, the 2021 harvest was still low compared to past years.

After several years of a declining sample, staff recognized the need to ensure that the 2021 survey sample was robust. As such, STA engaged in outreach activities to increase knowledge of the household survey effort in the community and among tribal members and to encourage participation in the survey by all harvesters. These efforts included a raffle drawing for survey participants and advertising on the STA Facebook page and website, the local newspaper, and the local radio station. As in past years, new households were added to the survey list through chain referrals and word-of-mouth, so it is not possible to quantify how many new harvesters were added to the survey universe specifically as a result of STA's outreach activities. However, more than 20 new households were added to the household list for the 2021 study year, a higher-than-normal amount. Additionally, STA staff thought that more respondents were prepared for the survey when they were contacted. Overall, more households were contacted in 2021 than in any of the previous five years of the project. With the increased number of households on the survey list and improved contact rates, a more rigorous estimate of the number of harvesters and of the total harvest in 2021 was possible than occurred in 2020.

2021 HARVEST YEAR CHARACTERISTICS

Over the course of this harvest monitoring program, several characteristics of the subsistence herring egg harvest have remained consistent, regardless of the overall magnitude of the harvest. The majority of harvesters share a portion of their harvest every year, and the harvest is widely shared, both in quantity and in geographic breadth. Harvesters usually focus their efforts on the islands just offshore Sitka, but when there is quality spawn elsewhere in the sound, some harvesters travel farther from town. The majority of the subsistence herring egg harvest is taken on hemlock branches, secondarily on kelp, with small amounts on hair seaweed. Conflicts with work schedules and receiving eggs from others are the main reasons that surveyed households do not attempt to harvest herring eggs. The 2021 harvest shared most of these characteristics. To further contextualize these 2021 patterns, the remainder of this section includes summaries or comparisons to previous harvest estimates and spawning event assessments presented in earlier reports (Brock and Turek 2007; Gmelch and Gmelch 1985; Holen et al. 2011; Schroeder and Kookesh 1990; Sill and Cunningham 2017; 2019; 2021; Sill and Lemons 2012; 2014a; 2014b; 2015; 2017; 2020; 2021).

Sharing of Herring Spawn

Sharing resources is a characteristic of subsistence economies. In specialized harvests, such as of herring eggs, where specific knowledge and skills and equipment are required for a successful harvest, sharing is even more profound. The pattern of a small number of households ("super-households") harvesting and then distributing a unique resource is common because these "super-households" have the time, ability, knowledge, and equipment necessary to successfully harvest (Wolfe et al. 2010). Specialized harvesters provide the resource, in this case herring eggs, to a much larger percentage of households. This is true of herring eggs in the community of Sitka, where an estimated 32% of households used herring eggs in 2013 but only 8% harvested them (Sill and Koster 2017a). Because Sitka remains one of the best places to harvest

herring eggs, harvesters send eggs well beyond Sitka households, reaching far throughout the state of Alaska.

In 2021, 100% of the surveyed households shared some of their harvest and the majority (92%) of the total harvest was shared, either with other Sitka households or with non-local households (Table 2; Figure 2). Because this project specifically targets only potential herring harvesters, inferences about overall use and sharing of herring eggs cannot be made from these results.[1] However, comprehensive household surveys in Sitka and elsewhere have shown that households share received resources, and it is likely that herring eggs are shared through multiple households. Additionally, comprehensive surveys recently administered in seven Southeast Alaska communities show herring eggs are widely used in these communities (Sill et al. 2017; Sill and Koster 2017a; 2017b; see further discussion to follow in section "Changes in Use of Herring Spawn"). Reviewing past project years, it is clear that the majority of the harvest is shared every year, regardless of how good of a harvest year it is, how many community boats are harvesting, or how many participants there are in the fishery. Since 2010, the percentage of the harvest that has been kept for the harvester's own use has ranged from 3% (in 2016) to 10% (in 2013). There is greater variability in where the harvest is shared: from 28% (2019) to 71% (2012) has been shared within Sitka and from 22% (2012) to 63% (2019) has been shared outside of Sitka. Through the survey, more than 40 communities have been documented as recipients of herring eggs. Because not every harvester is surveyed every year, and not all harvesters choose to share this information with the surveyors, these 40 communities are a minimum; it speaks to the importance of Sitka as a source of herring eggs for the entire state.

To further investigate the role of sharing in herring egg harvest patterns, survey respondents were asked whether they harvested enough herring eggs during the season. All surveyed households in 2021 responded that they had enough for their own needs, as well as enough to share. One caveat to these responses is that the survey was conducted shortly after the harvest and harvesters may not yet have been aware of unmet needs they would be asked to fulfill. Additionally, how needs are defined is subjective and can vary among households and between years. Surveyors have asked respondents this two-part question since 2019. Study year 2021 is the first year where both parts of the question received equal responses: 87% of households met both their needs for herring eggs to share and for their own use. In 2019 and 2020, more households met their needs for sharing than indicated the same for themselves, further illustrating the fundamental nature of sharing to this subsistence resource. In years with higher harvest levels, sharing patterns often expand so that more is shared with more people (Thornton 2019:109–110). Harvesting households in 2021 indicated that they usually harvest for six to 10 other households the most; only slightly less common was to harvest for two to five households (22%) or more than 100 households (19%).

In addition to harvesters who share their eggs with other households, community boats usually come to Sitka to harvest eggs for their communities. Sometimes, these are commercial boats that are already in Sitka Sound for the commercial sac roe fishery. In other cases, communities may sponsor a boat to help defray the expense of harvesting, and still other boats use personal connections with Sitka residents to facilitate their community harvest. From 2009–2019, the Southeast Herring Conservation Alliance (SHCA) sponsored a vessel (in some years more than one) to harvest herring eggs and distribute them within Sitka or more broadly throughout Southeast Alaska. This practice continued until 2019 when the boats were asked to stop fishing due to law enforcement investigations (Sill and Cunningham 2021:21) . In most years since 2010, the community harvester boats have been responsible for more than one-half of the total pounds of harvest estimated. In both 2020 and 2021, the harvest by individuals composed a greater proportion of the total harvest than community harvester boats, despite many more community boats being present and harvesting in 2021 than in 2020. In 2020, only STA's traditional foods program harvested herring eggs for

1. Thornton (2019) delves into the topic of the distribution of herring eggs from Sitka Sound through interviews with users and harvesters of herring spawn around Southeast Alaska and through the results of a temporary barter and trade survey module added to the household survey in 2018. He discusses different patterns of exchange of herring eggs, including sharing, barter, and trade.

general distribution. In 2021, community boats from the STA traditional foods program and at least Juneau, Hoonah, and Angoon traveled to Sitka Sound.

Harvest Participation and Success

Compared to the most recent 10-year average of 41 participants, the 2021 survey estimated a higher-than-average number of harvesters in Sitka Sound, and higher than the previous five years of surveys (Table 14). Creating a traditional catch per unit effort (CPUE) metric does not work for this fishery because of the variability in what constitutes a unit of effort (e.g., whether branches or trees are used, the size of tree or branch, the number used in a set). A similar, but less informative, metric is the harvest per fishery participant. Because this metric does not account for the variability in effort among harvesters, it cannot provide a complete picture of inter-annual variability within the subsistence herring spawn fishery. In 2021, harvesting households harvested less than in most years, both in total pounds and weight per harvester. In comparison to the total harvest and harvest per harvester averages for the most recent past 10 years, the 2021 averages were considerably smaller; the smaller harvest was despite the number of participants being higher than average. The 2021 harvest per harvester is on par with that estimated in 2018. It is possible that due to the focus by STA on reaching as many harvesting households as possible in 2021, the survey captured more new harvesters or small-scale harvesters that had been missed during previous years' surveys. It is also possible that long-standing harvesters harvested less than usual due to availability of the spawn to the harvester, perceived quality, demand, or ongoing pandemic-related factors. Changes in the harvest amounts of the community-based boats could also be a driver, given their usually significant contribution to the overall harvest. Without additional analysis into individual harvesting patterns over time, more in-depth discussion with harvesters than what occurs during the standard survey is necessary to contextualize this finding.

Harvester numbers vary from year to year due to a variety of reasons, including difficulty in finding time to participate, receiving herring eggs from others, or the cost of fuel or boat maintenance. One strategy to share the costs associated with harvesting is for harvesters to work together. In 2021, 74% of responding households (n=38) indicated that they harvested with at least one other household; this compares to 2020 when only 43% of responding households (n=7) harvested with others and 2019 when 92% of responding households (n=12) did so. In most years since 2010, working during the harvest or receiving eggs from someone else have been the two main reasons potential harvesters gave for not participating in the harvest. From 2017 through 2021, working during the harvest was not provided as a main reason; from 2017 through 2019 resource availability or the distance to the spawn were among the top reasons and in 2020 the pandemic was the main reason. In 2021, the most common reason given was that the household did not have a need for eggs because the household got eggs from someone else, followed by transportation challenges (either a lack of boat or motor or fuel costs) and personal reasons (Figure 3).

Among the many factors harvesters must consider, where the herring are spawning is an important one. Compared to recent years, herring spawned closer to town and in what would be considered the "core" area for harvest, as well as along the Kruzof Island shoreline and northern stretches of the sound. Despite this, the total estimated harvest remained low and well below the lower end of the ANS range (Figure 5). The unusual social conditions of spring 2020 that were likely responsible for the very low harvest in 2020 appeared to not be as influential in 2021. Although the pandemic continued through the spring of 2021, no one discussed COVID-19 as a factor in their harvesting (or not harvesting) in 2021 and many households harvested with others. Most harvesting households said that their harvest was better in 2021 than in recent years, with equal percentages saying it was the same or less. For those households that harvested less in 2021, the most common reason given was that the resource was less available and the weather. More reasons were given for why a household's harvest was more than recent years, with no single predominant reason. Approximately one-third of harvesters explained that they harvested more in 2021 because it was their first year of harvesting. The scale of harvest amounts is likely dissimilar between a harvester just beginning and an established harvester with existing relationships concerning the distribution of herring eggs. Survey

analyses do not currently examine responses to the less/same/more question in the context of individual harvest amount, or past amounts, but doing so could provide additional insight about the harvest year.

Table 14.–Estimated subsistence herring spawn harvests and number of harvesting households, Sitka Sound, 2002–2021.

Year	Estimated number of households harvesting[a]	Estimated harvest, all substrates, in pounds	Pounds per harvester
2002	77	151,717	1,970
2003	116	278,799	2,403
2004	118	381,226	3,231
2005	95	79,064	832
2006	88	219,356	2,493
2007	81	87,211	1,077
2008	54	71,936	1,332
2009	91	213,712	2,348
2010	40	154,620	3,866
2011	53	83,443	1,574
2012	47	115,799	2,464
2013	50	78,090	1,562
2014	68	154,412	2,283
2015	51	106,998	2,101
2016	35	84,554	2,441
2017	44	65,691	1,493
2018	29	25,862	906
2019	25	51,687	2,067
2020	9	21,926	2,315
2021	48	46,950	973
5-year average (2016–2020)	28	49,944	1,763
10-year average (2011–2020)	41	78,846	1,922
Historical average (2002–2020)	62	127,690	2,073

Sources Holen et al. (2011); Brock and Turek (2007); Sill and Lemons (2012; 2014a; 2014b; 2015; 2017; 2020; 2021); and Sill and Cunningham (2017; 2019; 2021).

a. The number includes community harvester boats, which are treated as an individual household for the purposes of this analysis.

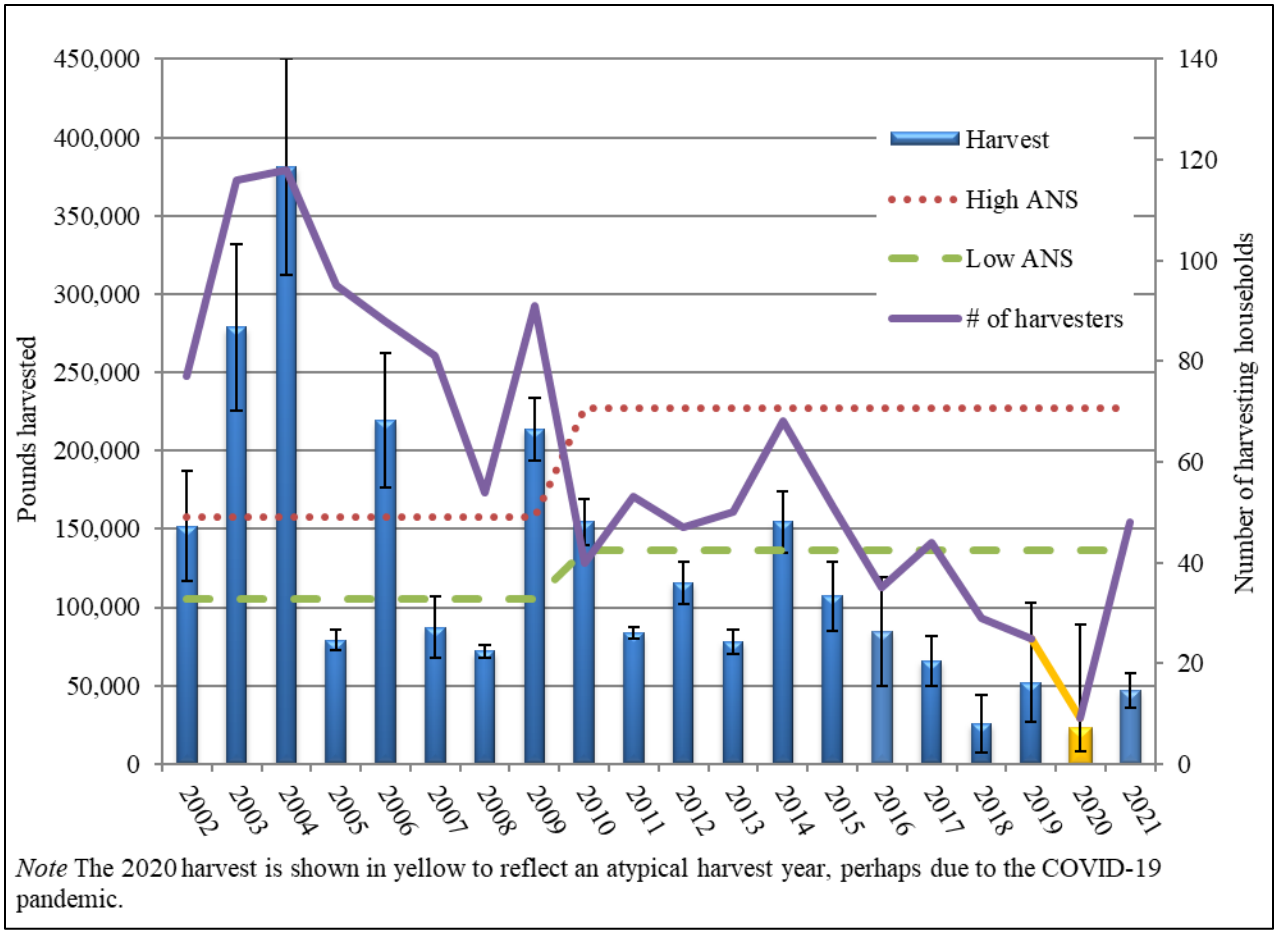

Figure 5.–Total pounds usable weight of herring spawn harvested, number of harvesting households, and amount reasonably necessary for subsistence (ANS) of herring spawn on all substrates in Sitka Sound, 2002–2021.

Delving further into the harvest success of any given year, it is clear that the amount of mature herring biomass returning to the sound does not have a direct correlation with harvest amounts (Figure 6). Some years with increased biomass estimates[2] were years with decreased harvests and vice versa. Since 2010, mature biomass estimates have been high compared to ADF&G estimates prior to 2010, but subsistence harvests show almost an inverse trend, with generally lower harvest estimates from 2010 to present than pre-2010 estimates. Shewmake (2013) argues that successful harvests in Sitka Sound are predicated on two groups of factors, broadly categorized as social opportunity and ecological opportunity. On the social side are issues like sufficient time, resources, knowledge, and skills to engage in harvesting activities. Within the ecological grouping the main factor is the quality of the eggs, which is influenced by timing, duration, location, and weather. There may be finer details within the run size composition, apart from total estimated mature biomass, that may correlate with subsistence harvests, but such investigations are beyond the scope of this project.

Good quality eggs cover the substrate several layers deep and lack impurities, such as sand. According to local respondents, the thickness of deposition is related to the number of days of the spawning activity, as well as other factors such as the size or density of the spawning school of herring (Shewmake 2013).

2. Sherrie Dressel, ADF&G Fisheries Scientist, email, May 21, 2021. Updated estimates to include 2021 were not available at the time of publication.

Shewmake (2013) found that mean consecutive spawning days in subsistence use areas of Sitka Sound can be a reasonably good predictor of harvest success (see also Sill and Lemons [2014a] for further discussion of the relationship between harvest success and multi-day spawning events).

The ADF&G Division of Commercial Fisheries documents total days of spawning activity and the number of miles of shoreline with active spawn but does not analyze how many days of spawning activity each section of shoreline receives.[3] Using the daily aerial mapped spawn coverage from the Division of Commercial Fisheries, the Division of Subsistence created a map[4] showing numbers of days of spawn activity throughout Sitka Sound (Figure 7). In 2021, ADF&G flew aerial surveys between March 9 and April 17 to document herring spawning activity. Between April 4 and April 17, a total of 102.3 nautical miles of spawn were recorded by ADF&G, which is higher than the 40-year average (1981–2020) of 59.1 nautical miles. Compared to recent years, in 2021 more days of multiple spawn deposition occurred in the subsistence "core" area, especially around Middle Island and Crow Pass. The majority of the Kruzof Island shoreline that received spawn deposition had multiple days documented, along with the Hayward Strait area and Middle and Kasiana islands. According to ADF&G herring egg deposition surveys,[5] egg deposition was very high throughout most of Sitka sound and exceptionally high along the Kruzof Island shoreline. A harvester's assessment of the length of the spawn and quality of the season is more likely localized to areas that are accessible to that harvester and therefore may not align with the ADF&G-documented duration or total coverage of the spawn. Harvester effort was documented throughout the core area islands as well as the more northern areas of the sound, including Hayward Strait and Eastern/Promisla bays. Harvester locations correspond to where spawning occurred for multiple days, with the exception of Kruzof Island. Some harvesters will set branches along Kruzof Island, but, with closer areas of quality spawn in 2021, none did.

It makes sense that the areas with more harvesters would produce more harvest weight, but that is not always the case, as was seen particularly in 2018 (Sill and Lemons 2020). As discussed above, harvest "effort" is difficult to compare within and between years, beyond the metric of number of households at any location, because there is no standard size of a subsistence herring egg "set." A set can vary dramatically between harvesters, based on the size of vessel, hydraulics on board, time available, and harvester intent. The harvest survey asks respondents how many sets are made and pulled in each area, but it does not ask the harvester to define a "set." Being able to track harvest per unit effort would likely give more insight into the effect of the spatial closures to commercial fishing in the core area since 2012. Without this scale of analysis, the closures do not seem to have had a clear or demonstrable effect on subsistence herring egg harvest totals. However, in approximately one-third of the years since the first closure went into effect, there has been unusual spawning activity generally bypassing the core area. With additional years of data, trends may become apparent.

3. Alaska Department of Fish and Game Division of Commercial Fisheries, "2021 Southeast Alaska Herring Summary," advisory announcement, May 28, 2021. Accessed October 14, 2021. http://www.adfg.alaska.gov/static/applications/dcfnewsrelease/1265317815.pdf
4. To create the map, the base shoreline was divided into segments of various lengths and the maximum number of days of spawn along any portion of that segment was calculated and attributed to the whole segment. Due to inclement weather, there were days during the spawn when surveys of the entire sound were not performed.
5. Alaska Department of Fish and Game Division of Commercial Fisheries, "Sitka Sound Herring Fishery Announcement," advisory announcement, April 30, 2021. Accessed October 14, 2021. http://www.adfg.alaska.gov/static/applications/dcfnewsrelease/1260289740.pdf

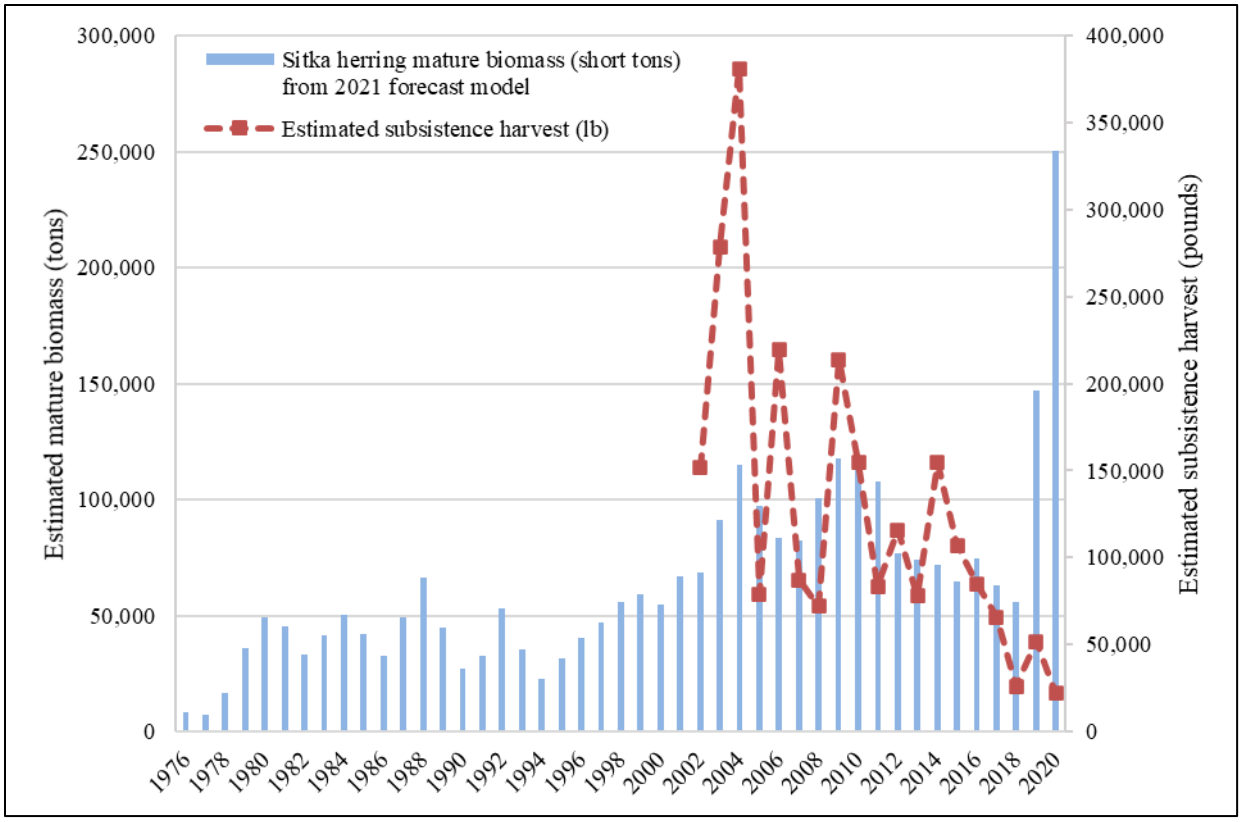

Figure 6.–Estimated mature biomass of Sitka Sound herring, 1976–2020 (based on the ADF&G 2020-forecast age-structured assessment model for Sitka Sound herring) and estimated subsistence harvest of herring eggs from Sitka Sound, 2002–2020.

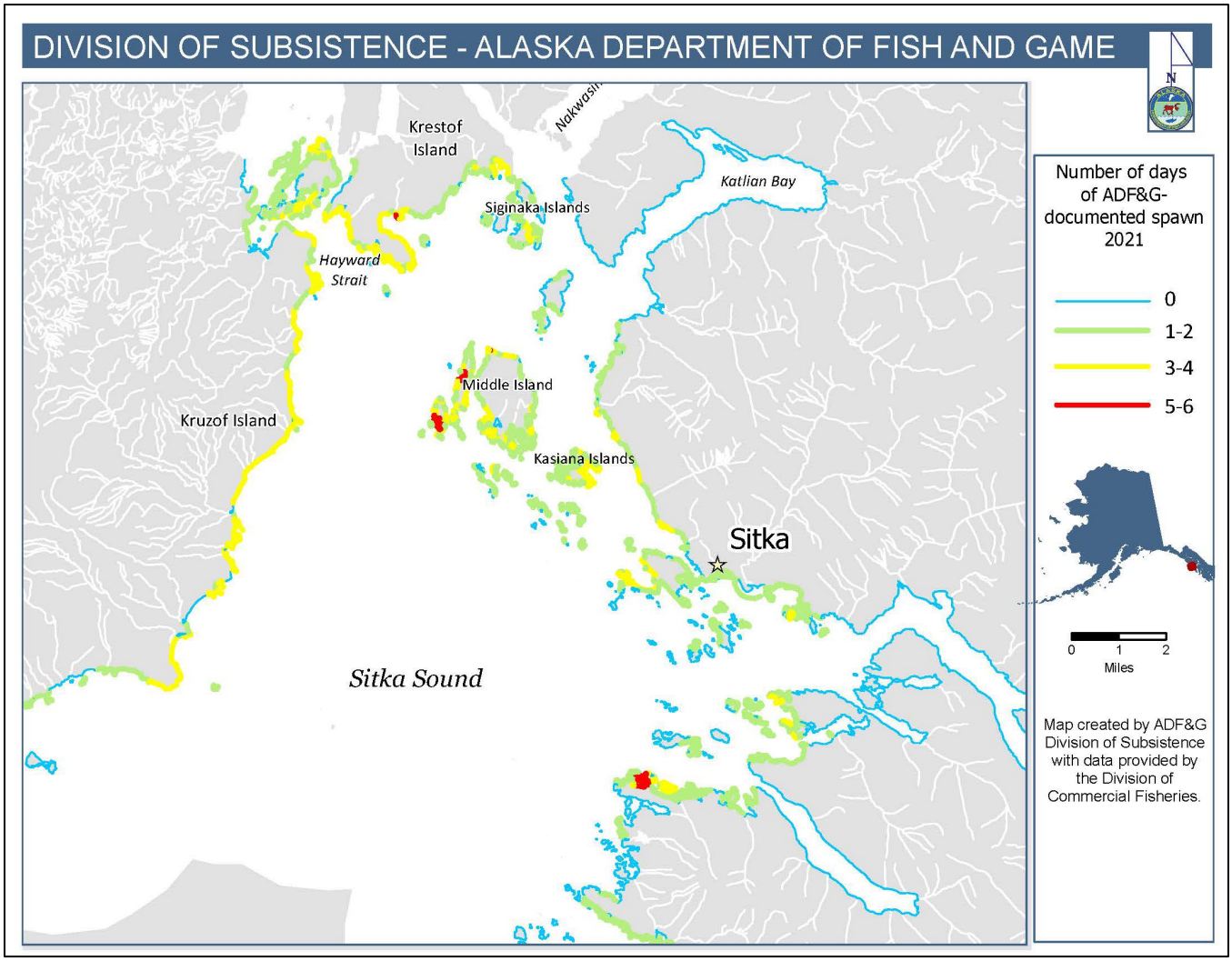

Figure 7.–Cumulative days of recorded herring spawn, Sitka Sound, 2021.[6]

6. Aerial or skiff surveys were conducted between April 4 and April 19, 2021. Note that no surveys were conducted on April 8, 16, and 18, due to inclement weather.

CHANGES IN USE OF HERRING SPAWN

As stated above, this research project targets herring egg harvesters, so it does not allow for analysis of the wider use of herring eggs within Sitka or other communities. The study has been able to document a general decrease in the participation of the subsistence herring egg harvest over the last 20 years, but there are few data available to speak to changes in overall use of the resource, either within Sitka or in other Southeast Alaska communities, or overall participation in the processing of herring eggs. In 2013, 2014, and 2016, several comprehensive subsistence harvest and use studies were conducted in Southeast Alaska communities. The use of herring eggs was documented in Hydaburg, Hoonah, Haines, Angoon, Sitka, and Yakutat; Whale Pass was surveyed, but no herring eggs were used in 2012 (Sill et al. 2017; Sill and Koster 2017b; 2017a). Sharing in all of these communities is widespread and varied: the percentage of households using herring eggs on hemlock branches ranged from 15% in Haines to 77% in Hydaburg, while the percentage of households harvesting eggs on hemlock branches was much lower, ranging from 0% in Angoon to 23% in Hydaburg (Figure 8). The majority of respondents indicated that the eggs they used or harvested came from Sitka, with the exception of Hydaburg residents who also harvested and used eggs from the Craig/Klawock area (Table 14); the Yakutat survey did not ask respondents to identify where herring eggs used and harvested came from, but some volunteered that herring eggs were shared or bartered for from Sitka and also harvested locally. In this limited sample of communities in Southeast Alaska, the use of herring eggs from Sitka Sound remains high, and patterns of sharing remain evident and of importance. 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.

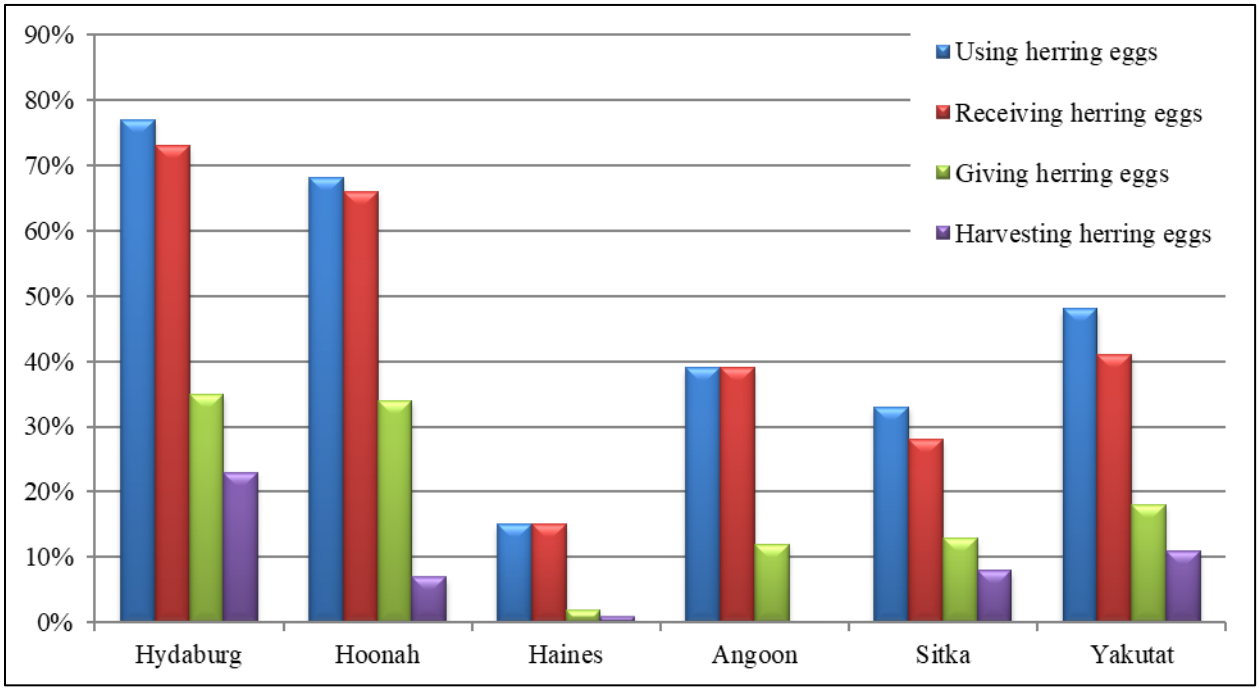

Figure 8.–Percentage of households using, receiving, giving, and harvesting herring eggs, Hydaburg, Hoonah, Haines, and Angoon 2012, Sitka 2013, and Yakutat 2015.

Table 15.–Locations where residents reported herring eggs were sourced, Angoon, Haines, Hoonah, Hydaburg, and Whale Pass, 2012.

	Valid responses									
	Angoon		Haines		Hoonah		Hydaburg		Whale Pass	
Source	No.	%	No.	%	No.	%	No.	%	No.	%
Craig	0	0.0%	0	0.0%	1	1.7%	21	51.2%	0	0.0%
Haines	0	0.0%	1	8.3%	0	0.0%	0	0.0%	0	0.0%
Hoonah	0	0.0%	0	0.0%	1	1.7%	0	0.0%	0	0.0%
Sitka	20	100.0%	11	91.7%	57	96.6%	20	48.8%	0	0.0%
Total	**20**	**100.0%**	**12**	**100.0%**	**59**	**100.0%**	**41**	**100.0%**	**0**	**0.0%**

Source ADF&G Division of Subsistence household surveys, 2013.

Note Includes only valid responses containing a named city; households were permitted to identify multiple sources.

CONVERSION FACTORS

Creating annual conversion factors is useful for two reasons.

1. Annual conversion factor summaries give researchers a more accurate estimate of herring egg harvests because individuals often report their harvest in number of boxes/bags, rather than total pounds harvested. With an average weight determined for storage containers for that year, researchers can convert the entire reported harvest into pounds with greater accuracy.
2. The other aspect of conversion factors is their potential insight into the effect of egg density on the success of the overall harvest. From Shewmake's (2013) work, according to local respondents, 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 can potentially investigate 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. However, other factors, such as seawater content of the set, may also affect the weights of the processed spawn. Until more work is done to identify other factors potentially affecting the weight of wetlock boxes of processed spawn, year-to-year variations in conversion factors cannot be taken as an accurate indicator of herring spawn densities.

LOCATION OF HARVESTS

The final aspect of the subsistence herring harvest that the project attempted to understand was the location of harvests. Harvest location data have been documented during every study year except for 2007 and 2008. According to these data, harvesters clearly use a core area, which is also where the frequency of herring spawn has usually been highest (Figure 9). From 2018 through 2020, there was a small amount of spawning activity within this area (Sill and Cunningham 2019; Sill and Lemons 2020; 2021). Spawning activity in 2021 was more similar to the years prior to 2017 with increased spawning activity in the core area. There is inter-annual variability in the locations used for the harvest within the broader core area; this variability occurs for several reasons. Within limits, harvesters will go where the herring are spawning (Figure 7). Herring do not exhibit site fidelity in spawn locations like salmon; therefore, the specific beaches and coves where they spawn each year can change. Harvesters look for areas they believe 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 become dangerous; therefore, protected areas are sought. Protected areas are also favored for their likelihood of high-quality spawn because ocean surge can stir up sand on the seafloor, thus degrading the quality of the harvest. 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 affected by development. In 2021, harvesters put more effort into the core area locations than they had in recent years, but still expended significant effort in the areas that have been most productive recently, including Eastern/Promisla bays area and Magoun Islands/Hayward Strait.

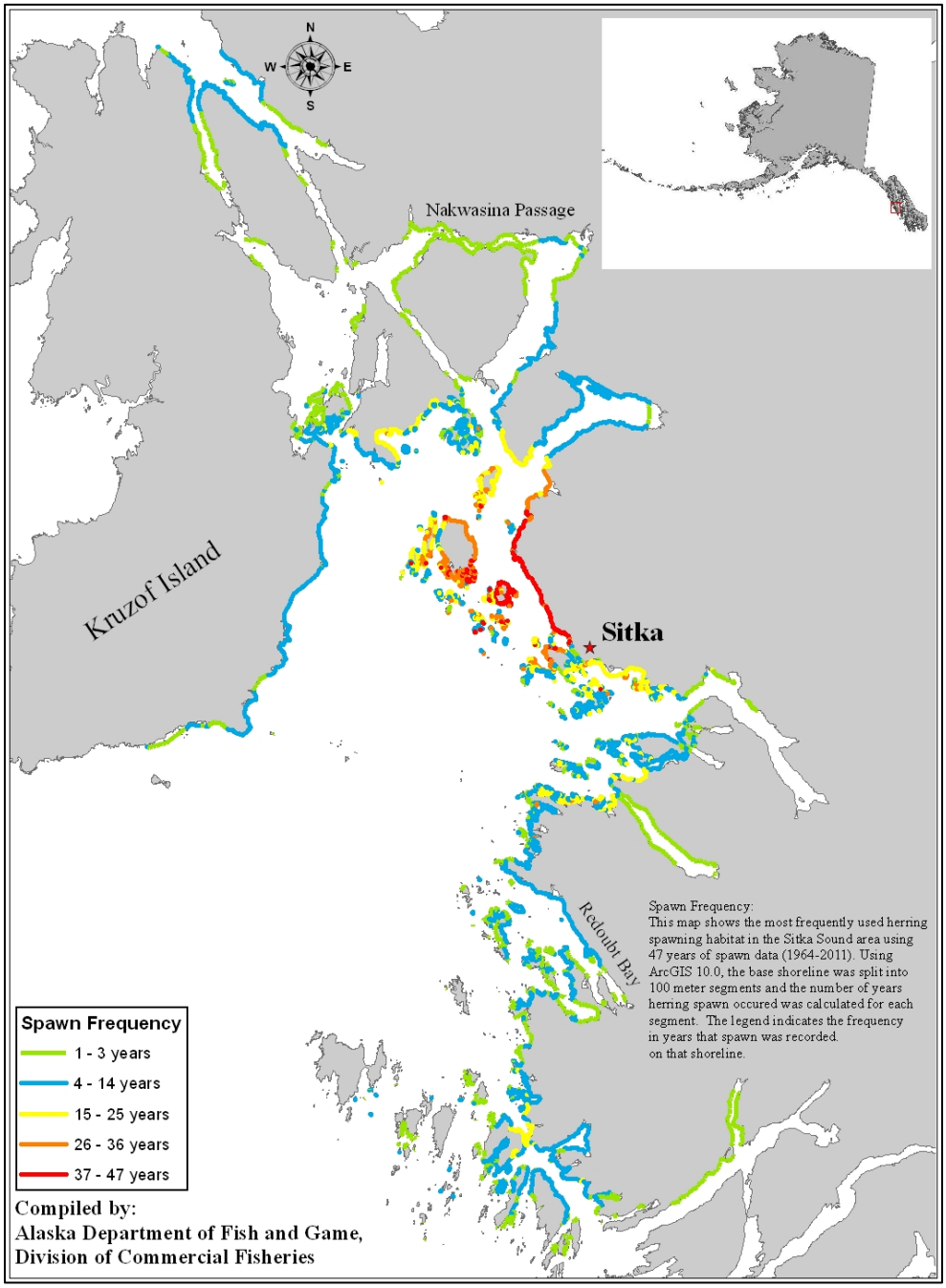

Figure 9.–Frequency of recorded spawn in Sitka Sound, 1964–2011.

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 they use to harvest, 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 those recorded on the permits (a permit is necessary to harvest spawn-on-kelp in Sitka Sound; a second permit may be issued, limiting a household harvest to 316 lb in total). Beginning in 2012 and continuing through 2015, researchers concentrated additional effort on identifying and contacting spawn-on-kelp harvesters. In 2021, the harvest survey estimated 1,824 lb of spawn on kelp were harvested (Table 4), while expanded permit data show a harvest of 2,948 lb, plus 2,500 lb harvested under a community harvest permit.[7] Additional efforts to identify and survey spawn-on-kelp harvesters is warranted since the survey effort is likely underestimating the spawn-on-kelp harvest recently. Additionally, further study of spawn-on-kelp harvesters to compare differences in participation, harvest, and uses to that of egg-on-branches harvesters would be useful. Because spawn-on-kelp harvesters already need to obtain a permit and report their harvest, they may feel they do not have to participate in the survey project. Comparisons of success rates and responses to annual changes in geographic spawn distribution between both sets of harvesters could also be investigated.

7. Data provided by ADF&G Division of Commercial Fisheries, Aaron Dupuis, Fishery Biologist, September 20, 2021.

4. CONCLUSION

Although participation in the subsistence harvest of herring spawn from Sitka Sound has generally dropped since the early 2000s, and more recently since 2014, harvesting and sharing eggs remain important cultural activities for Southeast Alaska residents. Local concerns for the subsistence harvest of herring eggs prompted this collaborative harvest monitoring program 20 years ago. Residents continue to express similar concerns, highlighted by the proposals submitted to the 2021 Southeast meeting of the BOF that echo proposals submitted within the last 20 years. Among others, there are proposals to reduce the harvest rate of herring in the commercial fishery; to implement a permit-based harvest reporting program for the subsistence fishery; and to reduce the area of waters closed to commercial sac roe herring harvest in Sitka Sound. Because of the participation of the subsistence community in the harvest monitoring program, the BOF has many years of consistent data about the nature of subsistence herring egg harvests to inform its decision-making process. There is no simple measure of whether Alaska residents are meeting their needs for herring spawn. One metric the BOF considers in determining whether reasonable opportunity to harvest herring spawn is being provided is the ANS, which has been achieved only once since 2010 (Figure 5). The reasons for the ANS not being achieved are likely multifaceted. Overall harvest amounts are influenced by the amount of harvest effort, but also by weather and the opportunity for quality spawn in accessible locations. The subsistence fishery in Sitka Sound is unique in terms of the importance of this one small geographic area to subsistence users throughout the state. Because of that, the herring spawn harvest continues to be shared by a small number of local harvesters extensively throughout Sitka, Southeast Alaska, and beyond. 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. Expanding on Shewmake (2013), correlations between harvester success and spawn duration by location could provide further insight into harvester success and perhaps provide a more useful metric for gauging subsistence harvest opportunity than total nautical miles of spawn. Finally, a broader effort to look at overall use of herring eggs beyond Sitka, and changes in harvest effort at the household level, would provide needed additional information to evaluate changes and trends documented through the harvest survey.

ACKNOWLEDGMENTS

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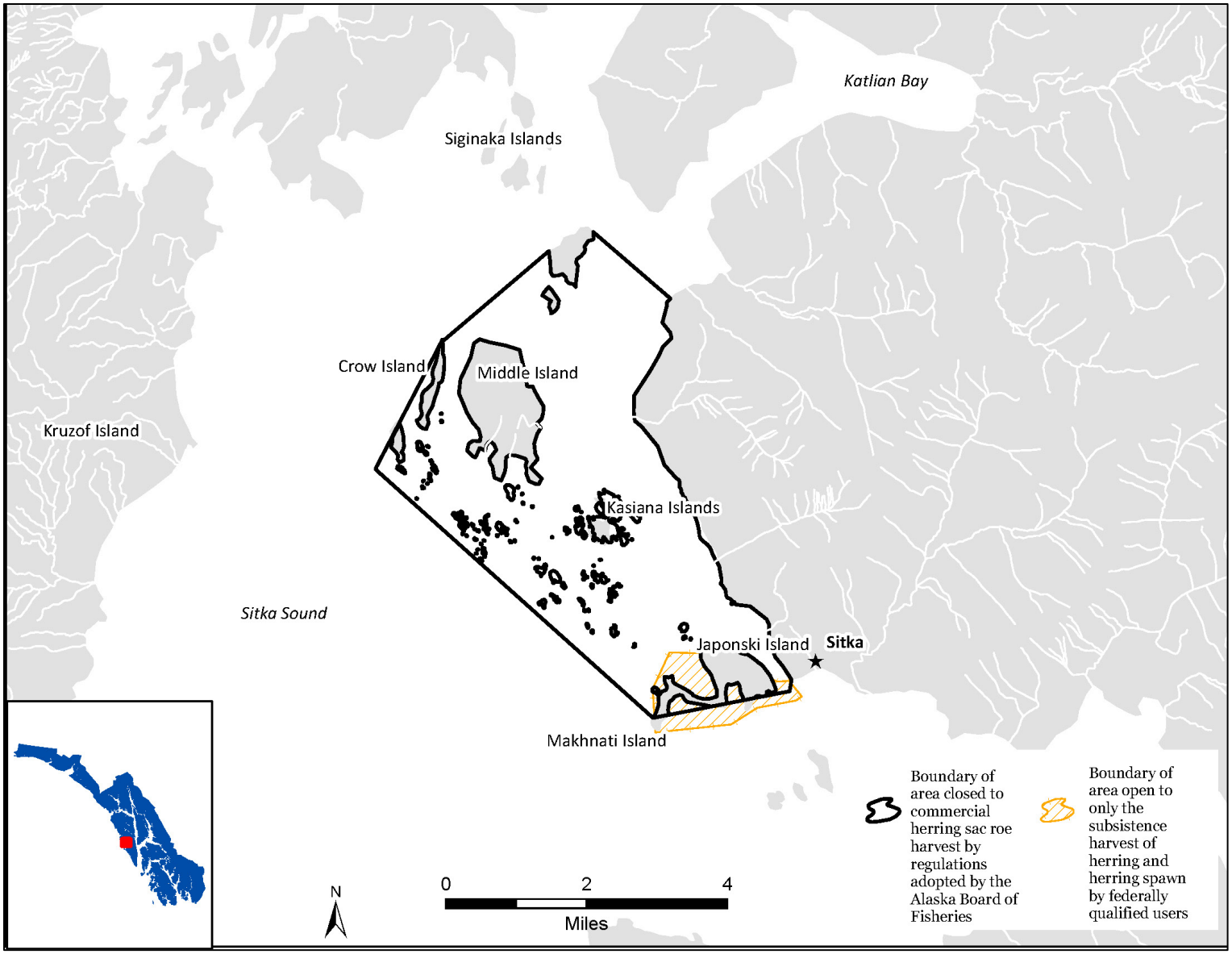
APPENDIX A: MAP OF AREAS OF SITKA SOUND WITH FISHING RESTRICTIONS



Appendix Figure A-1.–Waters of Sitka Sound with limitations on the harvest of herring and/or herring spawn.

APPENDIX B: 2021 SURVEY OUTREACH ADVERTISEMENT

STA Subsistence Herring Egg Harvester Survey

Since 2003 the Sitka Tribe of Alaska (STA) has been working with the Alaska Department of Fish and Game's Division of Subsistence to conduct the annual subsistence herring egg harvester survey. The survey collects quantitative and qualitative data to track harvesting and sharing trends, the volume and quality of the harvest, harvest locations, and determine if subsistence needs were met.

This year, harvesting households that participate in the 20 minute survey will be entered into a drawing for cash prizes of $50, $100, and $200. For more information or if you harvested herring eggs in 2021 and have not been contacted by STA to take the survey, please contact Helen Dangel at 747-7168 or helen.dangel@sitkatribe-nsn.gov or Jeff Feldpausch at 747-7469 or jeff.feldpausch@sitkatribe-nsn.gov.

APPENDIX C: SITKA SOUND SUBSISTENCE HERRING EGG HARVEST SURVEY, 2021

HERRING EGG SUBSISTENCE HARVEST SURVEY
SITKA, ALASKA
2021

This survey is used to estimate subsistence harvests of herring eggs from Sitka Sound and to describe community subsistence economies. We will publish a summary report which will be available to all households in your community. We share this information with the Sitka Tribe of Alaska, the Alaska Department of Fish and Game, the U.S. Fish and Wildlife Service and the National Park Service. We work with the Federal Regional Advisory Councils and with local Fish and Game Advisory Committees to better manage subsistence, and to implement federal and state subsistence priorities.

This project is guided by the research principles adopted by the Alaska Federation of Natives in 1993. We will NOT identify your household. We will NOT use this information for enforcement. Participation in this survey is voluntary. Even if you agree to be surveyed, you may stop at any time.

HOUSEHOLD ID:		
COMMUNITY ID:	Sitka	313
INTERVIEWER:		
INTERVIEW DATE:		
	DATA CODED BY:	
	DATA ENTERED BY:	
	SUPERVISOR:	

COOPERATING ORGANIZATIONS

RESOURCE PROTECTION DEPARTMENT
SITKA TRIBE OF ALASKA
429 KATLIAN STREET
SITKA, AK 99835

907-747-7168

DIVISION OF SUBSISTENCE
ALASKA DEPT OF FISH & GAME
802 3RD STREET
JUNEAU, AK 99801

907-465-3617

HARVESTS: HERRING EGGS

HOUSEHOLD ID

Do members of your household USUALLY harvest HERRING EGGS for subsistence? ..... Y N

In 2021...
...Did members of your household TRY TO HARVEST herring eggs? ..... Y N

If NO... why not? _____

How many people lived in your household in 2021? ..... ____

Is anyone in the household enrolled in a tribe? ..... Y N

If YES, which one? ..... _____

If the household did not attempt to harvest herring eggs, stop the survey here. If the household attempted to harvest, continue to next page.

Please estimate how many herring eggs ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED for subsistence use this year. INCLUDE herring eggs you gave away, ate fresh, lost to spoilage, or got by helping others. If fishing with others, report ONLY YOUR SHARE of the catch.

	IN 2021 DID MEMBERS OF YOUR HH...			IN 2021, HOW MANY {_____} DID YOUR HOUSEHOLD HARVEST...?			
	...HARVEST _____?	...GIVE _____?	...RECEIVE _____?	...FOR PERSONAL USE	...TO GIVE AWAY IN SITKA	...TO SHIP OUT OF SITKA	Units
	(circle)			*(amount used for each purpose)*			
Herring eggs on hemlock branches	Y N	Y N	Y N				LB
Herring Eggs							
Herring eggs on kelp	Y N	Y N	Y N				LB
Herring Eggs							
Herring eggs on hair seaweed {né}	Y N	Y N	Y N				LB
Herring Eggs							

These columns should include all the herring eggs harvested by members of this household in 2021.

If you shared with others, how many households did you share with?

COMMUNITY	

NOTES: _____

HARVESTS:

HOUSEHOLD ID

Where did you harvest your herring eggs in 2021 - set branches, harvest seaweed, macrocystis kelp?

	Location	# of sets... made	# of sets... harvested	Amount harvested	Quality (coverage, thickness)	Soak time	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	Magoons/Hayward						
14	Katlian Bay						
15	Apple/Parker Group						
16	Crescent/Jamestown Bay						
17	Southern Sitka Sound						
18	Other:						

LOCATION **SITKA: 313**

HARVESTS: HERRING EGGS **HOUSEHOLD ID** _____

ASSESSMENT: HERRING EGGS

What size vessel(s) did you use to harvest herring eggs in 2021?..... ____

In 2021...

Did your household get enough eggs for...

...your personal consumption?.....Y N

...to share or exchange with others?.....Y N

How do you feel your 2021 HARVEST was compared to other years?..... X L S M

If LESS or MORE, why was your harvest different?

_____

_____

_____

_____

If you HARVESTED LESS herring eggs in 2021, what was the last year you remember having a good harvest? _____

How many households do you typically harvest for?..... ____

Do you harvest with other households?..... Y N

NOTES: _____

Are you aware that ADF&G publishes daily maps of spawn observed during their aerial surveys?..... Y N

If yes, did you use those maps in 2021?..... Y N

Do you have any comments about the maps? _____

COMMENTS

DO YOU HAVE ANY QUESTIONS, COMMENTS, OR CONCERNS ABOUT THE 2021 SUBSISTENCE HERRING EGG HARVEST?

_____

_____

_____

_____

_____

_____

_____

OTHER FISH: 06 **SITKA: 313**

APPENDIX D: 2021 CODE BOOK

Subsistence Herring Egg Harvest Survey 2021

Herring Spawn User Status	Code
Individual Harvester	1
Community boat	2

Page 1: Harvests

If household did not try to harvest herring eggs in 2020, why not?	Code
Harvester - no response necessary	Blank
Personal	1
Working during the harvest/no time	2
boat/mechanical	3
no need	4
Out of town	5

If enrolled in a tribe, which one?	
Sitka Tribe of Alaska	1
Organized Village of Kake	2
Metlakatla Indian Community	3
Hoonah Indian Association	4
Hydaburg Cooperative Association	5
Angoon Community Association	6
Central Council of Tlingit and Haida Indian Tribes of Alaska	7
Ketchikan Indian Community	8
Yakutat Tlingit Tribe	9
Other AK	10

What size vessel did you use to harvest herring eggs?	Code
less than 20 feet	1
20-24 feet	2
over 24 foot pleasure cruiser	3
commercial vessel	4
other	5
no boat used - harvested from shore	6

Page 2: Assessments

If LESS HARVEST, why?

Non-harvester - no response necessary	Blank
resource availability	1
weather	2
other	3

If MORE HARVEST, why?

Non-harvester - no response necessary	Blank
new harvester	1
Good quality spawn	2
resource availability	3
Commercial fishery management	4
better year	5
other	6

Last good harvest year?

2020	1
2011-2019	2
2000-2010	3
1990s	4
1980s	5
1970s	6

How many households usually harvest for?

1	1
2-5	2
6-10	3
11-50	4
51-100	5
100+	6