Regional Operational Plan DF.#R.YY-XX

Statewide Weathervane Scallop Survey Operational Plan, 2016 through 2018

by

Quinn Smith, Ben Williams and Ryan Burt

2016

Alaska Department of Fish and Game **Division of Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. 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	use two-letter abbreviations (e.g., AK, WA)

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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The Regional Operational Plan Series was established in 2012 to archive and provide public access to operational plans for fisheries projects of the Divisions of Commercial Fisheries and Sport Fish, as per joint-divisional Operational Planning Policy. Documents in this series are planning documents that may contain raw data, preliminary data analyses and results, and describe operational aspects of fisheries projects that may not actually be implemented. All documents in this series are subject to a technical review process and receive varying degrees of regional, divisional, and biometric approval, but do not generally receive editorial review. Results from the implementation of the operational plan described in this series may be subsequently finalized and published in a different department reporting series or in the formal literature. Please contact the author if you have any questions regarding the information provided in this plan. Regional Operational Plans are available on the Internet at: http://www.adfg.alaska.gov/sf/publications/

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Signature Page

Project Title:	Statewide Weathervane Scallop surveys, 2016 through 2018.
Project leader(s):	*Quinn Smith, Fishery Biologist III* *Ben Williams, Fisheries Scientist I* *Ryan Burt, Fishery Biologist II*
Division, Region and Area	Commercial Fisheries, Regions I, II and IV
Project Nomenclature:	
Period Covered	2016 through 2018
Field Dates:	Typical field dates are in April and/or May
Plan Type:	Category II

Approval

Title	Name	Signature	Date
Project Co-leader	Quinn Smith		
Project Co-leader	Ryan Burt		
Project Biometrician	Ben Williams		
Research Coordinator	Chris Siddon		

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PURPOSE

The goal of the standardized weathervane scallop survey is to develop long-term fishery independent indices of relative abundance of weathervane scallops, *Patinopecten caurinus*, on scallop beds across the state of Alaska via a dredge survey for stock assessment decisions. Abundance estimates will be derived from area swept calculations. The Alaska commercial weathervane scallop fishery is managed jointly by the North Pacific Fishery Management Council (NPFMC) and the Alaska Department of Fish and Game (ADF&G) under a federal Fishery Management Plan (FMP). ADF&G management of the weathervane scallop fishery covers Alaska state and federal waters.

Key words: Weathervane scallops, *Patinopecten caurinus,* Alaska, biomass, abundance

BACKGROUND

Weathervane scallops, *Patinopecten caurinus,* are distributed in the northeast Pacific Ocean from Pt. Reyes, California north to the Pribilof Islands in the Bering Sea, and west to the Aleutian Islands, and occur from the intertidal to 300 m (Foster 1991). Scallops are a long-lived species, attaining ages between 20 and 28 years in Alaska waters (Hennick 1973; Bechtol et al. 2009). Densities that support commercial harvest typically occur between 45 and 130 m on discrete aggregations (or beds) (Kruse et al. 2005), and in a wide variety of habitats ranging from rock and gravel to silt and mud (Hennick 1973). Scallop beds are typically elongated or elliptical in shape and oriented in the direction of mean current flow (Kruse et al. 2000).

In Alaska, dredge based fishery-independent surveys have been restricted to Kayak Island and Cook Inlet areas. Initial surveys were conducted for Kamishak Bay and Kayak Island in 1984 and 1996, respectively (Hammarstrom and Merritt 1985, Bechtol et al. 2003), and have been conducted biennially since 1996 (Gustafson and Goldman 2012). These surveys have enabled the department to (1) delineate the primary scallop beds; (2) estimate scallop abundance and biomass within these beds; (3) define bed composition through age and shell height data; and (4) estimate bycatch rates of non-target species, particularly Tanner crab. Fishery managers have used the results of these surveys to set guideline harvest limits (GHLs) and manage the commercial scallop fishery in the Cook Inlet and Prince William Sound registration areas. All other management areas in the state are reliant on fishery-dependent data gathered from the statewide scallop observer program to inform management decisions (NPFMC 2015).

OBJECTIVES

The objectives of this study are:

Primary:

1. Estimate catch rates and abundance of scallops by survey area with a coefficient of variation (CV) $\leq 20\%$
2. Collection of biological data (e.g., shell height, meat weight, age) for estimation of growth, mortality, and biomass.

Secondary:

1. Record incidental catch (numbers and weight) of commercially important species and scallop predators

Tertiary:

1. Address particular area management concerns
2. Special short term projects

METHODS

Survey Area and Design

The spatial extent of scallop beds in areas of the state that have not previously been surveyed is unknown. For the purposes of this survey the spatial extent of scallop beds is defined by overlaying a grid of one nmi^2 cells over commercial catch locations from the 1996/97 to 2014/15 fishing seasons. Contiguous grid cells containing a cumulative round weight catch >2,000 lb. will be used to define individual beds. Thus, this survey is examining trends in the exploited population, though there may be additional areas with exploitable levels of biomass. Future goals include more definite mapping of scallop bed extent.

Surveys conducted for Kamishak Bay and Kayak Island sampled half of the grids within a given bed, however a reduced sampling rate must be used for larger beds (e.g., Shelikof) due to time and fiscal constraints. The percent difference in standard deviation of population estimates from Kamishak Bay and Kayak Island beds were simulated (1,000 iterations) to examine the effect of sampling rates of 20%, 30%, and 40% of the total bed All cells within a bed were considered independent (i.e., no spatial autocorrelation) for this analysis, though this assumption will be reexamined in the future. Based upon the results of this analysis, 30% of each bed is the target sample size. As bed-specific information is obtained, sampling effort will be revised as necessary to produce estimates with CV <20%.

Previous scallop surveys at Kayak Island and Cook Inlet used a systematic sampling design with two primary units (Bechtol 2003). This survey will maintain the same general structure however three primary units will be used, sampling every third unit . The initial primary unit to be sampled will be randomly selected.. Selection of which one nmi^2 cell to sample will start at the northwestern most square in each bed (random start in the first three cells) and cell selection will continue west to east successively, row by row. Once cells are selected for sampling, sampling can be done in any order.

Sample Collection

The vessel captain, in cooperation with field lead, will determine the specific haul location within each sample station based on the tide and sea state. Surveys will be conducted with a 2.4 m (8 ft) dredge with 10.2 cm (4.0 in) inside diameter rings. To facilitate retention of small scallops, the ring bag is fitted with a 3.8 cm (1.5 in) mesh liner. Dredge weight is approximately 816 kg (1,800 lb).

Vessels will tow the dredge at approximately 3.8 knots (7.0 kph), for 15 min to cover 0.9 nmi (1.7 km) at each surveyed grid. Cable scope (ratio of tow cable to bottom depth) of 3.5:1 will be used for all hauls. The speed and scope values were developed by the Northeast Fishery Science Center using an 8-foot dredge similar to that used in these surveys (NEFSC 2015). All hauls will be conducted along a depth contour to minimize variation in dredge performance.

For each haul, all columns on the Fishing Log for Alaska Scallops - Survey data form (Appendix 1) will be completed. Additionally, if the survey vessel has the capability to record tracks with location/time/depth, these files will be recorded to provide exact depth and location data.

Catch Sampling

Catch sampling priority will be structured by tiers as follows:

Tier I - Scallops
Tier II - Crab & Halibut bycatch
Tier III - Miscellaneous bycatch
Tier IV - Special projects

If necessary, tiers can be dropped from sampling to meet Tier I priority.

All electronic sampling devices will be calibrated prior to commencing sampling of each haul.

Live Scallops

Live scallops will be sorted into baskets by large (≥100mm shell height), and small (<100mm shell height) size classes using a measuring stick. These size classes were chosen as 100mm is the approximate size at which scallops are vulnerable to commercial fishing gear. The number and round weight of large and small scallops will be recorded. All measured scallops will be checked for shell damage and assigned the appropriate code (Appendix 3). All shucked scallops will be examined for presence or absence of weak meats (defined as when the scallop doesn't shuck cleanly, meat rips easily or slides off shell during shucking), mud blisters (% of surface area covered in 25% increments), gonad development, and shell boring worms (% of surface area covered in 25% increments).

Large Class Scallops

A two-stage random sample design will be implemented for shell height and age/weight measurement. In the first stage a random sample of 40 individuals will be collected and measured for shell height (mm). These data will be recorded on the Scallop Measurement and Damage Form (Appendix 3). In the second stage a random selection of 10 of the 40 selected individuals will be collected and measured for whole weight (g), meat weight (g), and shells will be retained for ageing. These data will be recorded on the Scallop Measurement and Weight Form (Appendix 4). This sample size is based on examinations of the CV from previous years Kayak Island and Cook Inlet survey data (survey area, bed, and year) of shell heights and shell

heights at age. If a scallop catch is lower than the target sample size, then all scallops will be measured for shell height, the second stage sampling protocol, outlined below, will remain in place.

The random sampling protocol will be as follows: After scallops are sorted into baskets by large and small size classes, counting will begin. While counting, every X^{th} scallop will be collected for shell height measurement, where X is a randomly generated number between 3 and 7. If the 40 scallop subsample is not collected by the time the all baskets of a size class are counted, subsample collection will continue from the first basket, again collecting every X^{th} scallop until the sample size is met. The same protocols will be used to select the second stage subsample.

All additional large scallops will be counted and weighed in aggregate, and the data recorded on the left side of the Scallop and Bycatch Sampling Form (Appendix 2).

Small Class Scallops
The sample design for small class scallops is the same for large size class with the exception that meat weight will not be recorded.

A coefficient of variation (CV) will be calculated for each survey area and year to guide future adjustments to sample size, with a target CV below 20%.

Size composition
Sampled length frequencies will be proportionally allocated to the total catch count for large and small scallops, respectively. Length at age will be determined for the smallest unit possible (e.g., Bed or District) depending on sample sizes, using the Von Bertalanffy growth equation (von Bertalanffy 1938; Beverton and Holt 1957) .

Clappers

In order to obtain estimates of natural mortality, all clappers (empty shells still connected at the umbo) will be counted and weighed and the data recorded near the bottom of the Scallop and Bycatch Sampling Form (Appendix 2).

Additionally, a random sample of 5 clappers will be collected from each haul and sampled for shell height and retained for future age determination. These data will be recorded on the Scallop Measurement and Weight Form (Appendix 3).

All clappers will be broken apart before being discarded overboard to eliminate the chance of the clapper being caught and sampled again in future hauls.

Empty Shells

All empty shells not connected at the umbo will be weighed in aggregate. These data will be recorded near the bottom of the Scallop and Bycatch Sampling Form (Appendix 2).

Bycatch Sampling

Pacific Halibut
Pacific halibut should be sampled quickly for fork length and condition (as defined in Appendix 5) and returned to the sea. It is not necessary to weigh any halibut - an estimated weight can be

determined using the halibut length to weight conversion formula (IPHC 2003). These data will be recorded on the Crab and Halibut Measurement Form (Appendix 5).

Commercial Bycatch & Scallop Predators

All other bycatch of commercially important species will be sorted to species or taxonomic group, counted and weighed in aggregate. If many individuals of a species or species group are caught (e.g. juvenile Tanner crab) then a representative subsample may be taken. Any bycatch of scallop predators (e.g. skates, octopus, pycnopodia) will be sorted to species or taxonomic group, counted and weighed. These data will be recorded on the right side of the Scallop and Bycatch Sampling Form (Appendix 2).

Ageing Protocol

Although shells for ageing will continue to be collected as mentioned above, there will be a moratorium on ageing scallops for the 2016/17 season until standard practices can be established.

Data Analysis

Scallop abundance will be estimated based upon area-swept calculations. Where scallop density d_i is calculated as:

$$d_i = \frac{c_i}{a_i},$$

where:

$$a_i = l_i \cdot dw \cdot Q,$$

and

$$\bar{d} = \frac{1}{s}\sum_{i=1}^{s} d_i.$$

Density variance is calculated as:

$$\hat{\sigma}_{\bar{d}}^2 = \frac{1}{s-1}\sum\left(d_i - \overline{d}\right)^2,$$

And confidence intervals calculated as:

$$c.i. = \pm t_{\propto=0.05,\ n=d.f.-1}\frac{\hat{\sigma}_{\bar{d}}}{\sqrt{s}}$$

where:

c_i = the catch of a species, either as abundance or weight, in sample haul *i*;

a_i = the nmi^2 sampled in haul *i*;

l_i = the nmi towed for sample haul *i*,

dw = the dredge width in nmi,

Q = dredge efficiency, and

s = the number of stations sampled.

An estimate of the surveyed population $\hat{N}$ will be calculated by expanding $\bar{d}$ over the defined bed area *A encompassing all grid cells* as:

$$\hat{N} = A\bar{d},$$

Variance of the surveyed population will be estimated (Seber 1982) by

$$\hat{\sigma}^2_{\hat{N}} = (S)^2 \frac{s^2}{s}\left(1 - \left(\frac{s}{S}\right)\right),$$

where:

$S = A/\bar{a}$

A preliminary *Q* of 0.83 calculated from the Kayak Island beds in 2004 (Gustafson and Goldman 2012) will be used until bed specific capture efficiencies are available.

Data Integrity

All collected data will be entered immediately after surveys conclude and will be managed and housed in a relational database available via intranet to ADF&G researchers and managers statewide.

Raw datasheets will be scanned with both digital copies and physical sheets archived.

Survey Logistics
2016

The 2016 scallop dredge surveys will cover beds in the Yakutat, Kayak Island, and Shelikof areas. In Yakutat and Kayak Island areas the Yakutat 1 (YAK1) bed will be surveyed as well as the bed that is bisected by the Registration Area E and Area D boundary at 144° W longitude (Figure 1). This bed has been partially surveyed in the past (as East Kayak 1), but the survey has only continued to the 144° W longitude border line once (in 2014). Since fishing has occurred east of the border since the 2009/10 season it is a high priority to survey the whole bed complex and determine if it is a single, or two separate beds. The West Kayak (WK1) bed will be surveyed as it would normally have been in its two year rotation. The Shelikof beds will be surveyed on the second trip of the survey (Figure 2). Shelikof 1 (KSH1) is the priority and Shelikof 2 (KSH2) will be sampled if time permits.

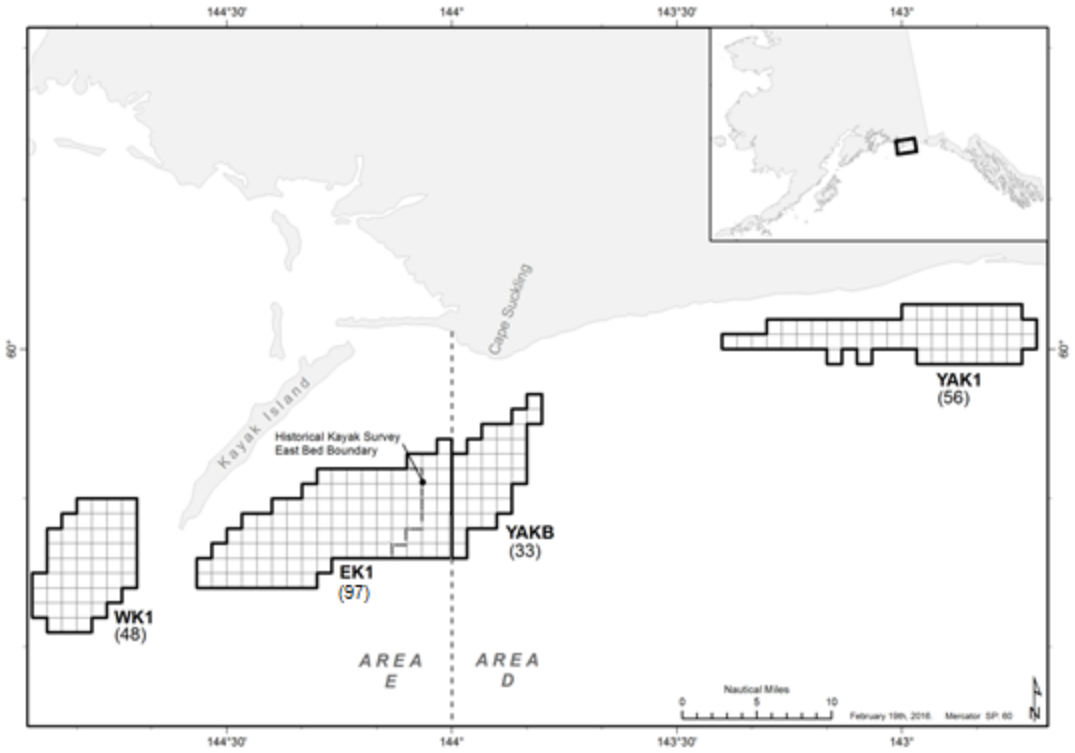

Figure 1.– Weathervane scallop survey sites in the north Yakutat and Kayak Island area. The 2016 survey priorities are the EK1 & YAKB complex, as well as the YAK1, and WK1 beds. Parentheses contain the number of stations in each bed.

2017

The 2017 survey will be conducted in the Shelikof area and survey KSH1 and KSH2 (Figure 2), though alternate beds may be selected based on statewide management concerns.

2018

The 2018 survey will be conducted in the Yakutat area and survey YAK2, YAK3, YAK4, and YAK5 (Figure 3), though alternate beds may be selected based on statewide management concerns.

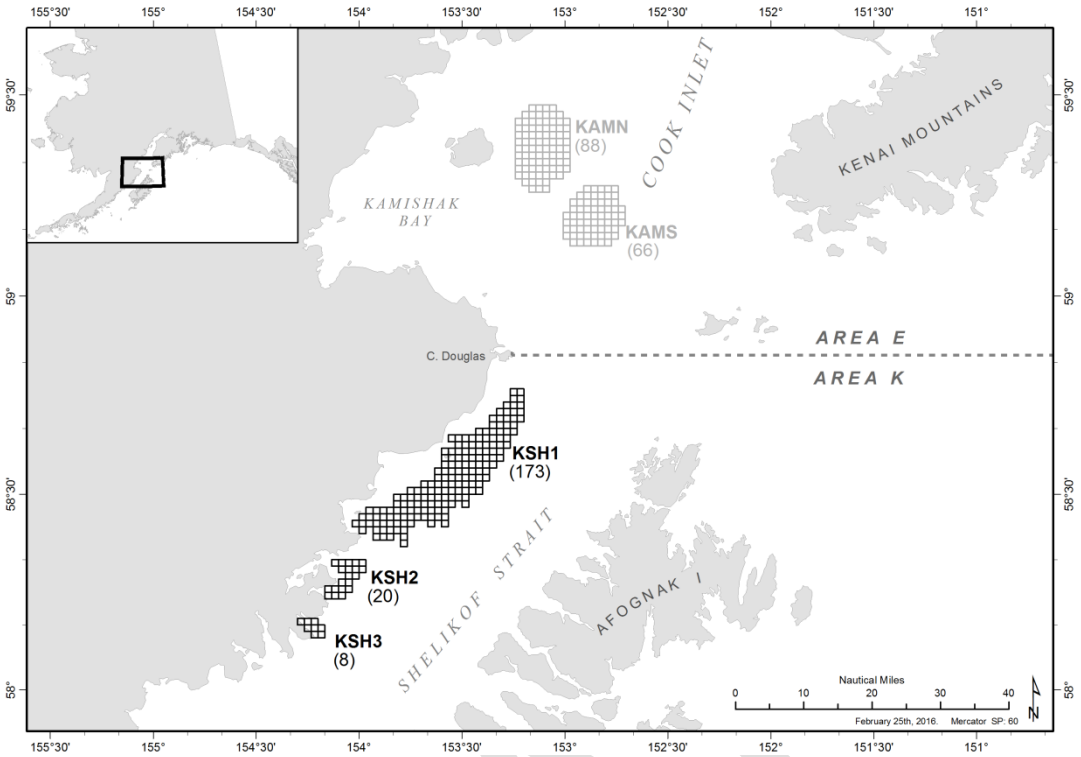

Figure 2.– Weathervane scallop survey sites in the Shelikof area. The 2016 survey priority is the KSH1 bed. The KSH2 bed will be surveyed if time permits. Parentheses contain the number of stations in each bed.

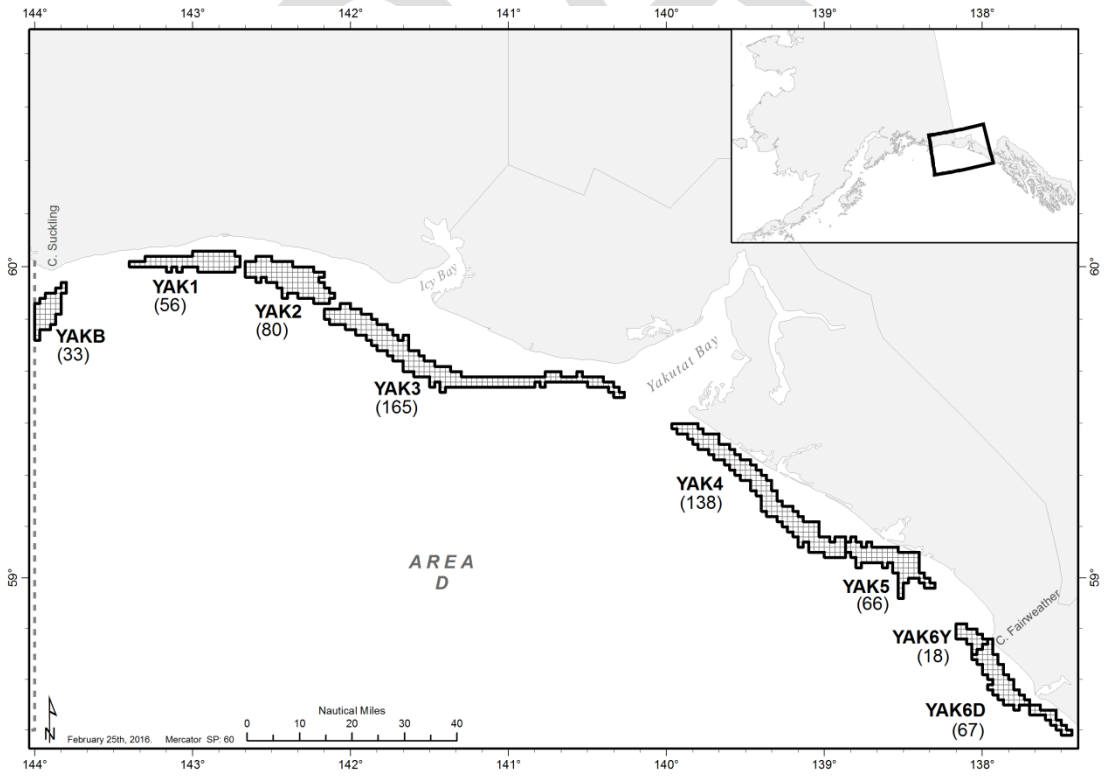

Figure 3.– Weathervane scallop survey sites in the Yakutat area. Parentheses contain the number of stations in each bed.

SCHEDULE AND DELIVERABLES

Time Frame	Activity
January-March	Field preparation and coordination with vessel captain
April	Sampling starts
May	Data entry and QA/QC
June 1st	Data analysis complete
June 1st	Draft results submitted to fishery managers
July-October	Age scallops*
December	Draft report for internal review
January	Report published and data sets archived

* If the program transitions to an age structured assessment timing of scallop ageing would need to be adjusted

RESPONSIBILITIES

Quinn Smith, Fishery Biologist III

Duties: Coordinate all aspects of the project. Assist biometrician with study design and Field Lead with scheduling. Provide support and advice to direct supervisors of the project personnel. Assist with field data collection as trip Field Lead or science staff.

Kenneth Goldman, Fishery Biologist III

Duties: Assist in project coordination. Act as lead for ADF&G vessel and staff scheduling. Assist with age verification methodologies.

Mike Byerly, Fishery Biologist II

Duties: Act as Field Lead for field data collection, including all aspects of equipment inventory, maintenance and preparation. Assist with survey scheduling. Act as liaison with state or contracted survey vessels. Assist with field data collection as trip Field Lead or science staff.

Ryan Burt, Fishery Biologist II

Duties: Assist with project planning of statewide scallop assessment program including coordination of survey and observer program data and database. Assist with field work as science staff.

Ben Williams, Fisheries Scientist I

Duties: Serve as project biometrician and provide input in sampling design and effort allocation. Provides procedures for calculation of estimates and standard errors. Assist with data analysis and report writing. Review operational plan and final report. Manage the project budget.

Josh Mumm, GIS Analyst II

Duties: Assist with spatial aspects of study design. Assist with field work as science staff. Assist in data analysis and report writing. Responsible for data coordination and entry of survey and laboratory ageing data.

Martin Schuster, Fishery Biologist I

Duties: Assist with field data collection as science staff. Assist with lab assessment of scallop shell ages, and dredge maintenance and repair as needed.

Joe Loboy, Fish and Wildlife Technician III

Duties: Responsible for dredge maintenance and repair.

Carla Milburn, Fisheries and Wildlife Technician III

Duties: Responsible for lab assessment of scallop shell ages.

Tom Sigurdsson, Fisheries and Wildlife Technician III

Duties: Assist with field data collection, and assist with lab assessment of scallop shell ages.

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APPENDICIES

Appendix 1.-Fishing Log for Alaska Scallops

Fishing Log For Alaska Scallops - Survey

Captain Name: _____ Survey Code: _____ ADF&G Number: _____

Vessel Name: _____ Management District: _____ Dredge Number: _____

Year: _____

HAUL NUMBER	BED CODE	STATION ID	SET DATE (mm-dd)	HAUL SETTING					AVG. HAUL SPEED (knots)	HAUL RETRIEVAL					SEA STATE	
				LATITUDE (N) (dd° mm.mm)	LONGITUDE (W) (ddd° mm.mm)	TIME HAUL BEGIN (0000-2359)	DEPTH (fathoms)	TOW CABLE OUT (fathoms)		LATITUDE (N) (dd° mm.mm)	LONGITUDE (W) (ddd° mm.mm)	TIME HAUL END (0000-2359)	DEPTH (fathoms)	GEAR PERF.	BEAUFORT SCALE	SWELL (feet)

MANAGEMENT DISTRICTS:

YAK = Yakutat; D16 = D16; EKI = East Kayak Island; WKI = West Kayak Island; KAM = Kamishak Bay; KNE = Kodiak Northeast; KSH = Kodiak Shelikof; KSEM = Kodiak Semidi Islands; KSE = Kodiak Southeast; KSW = Kodiak Southwest; UB = Unimak Bight; C = Central; WC = West Chignik; O = Dutch Harbor; R = Adak; Q = Bering Sea

GEAR PERFORMANCE:

1 = satisfactory - all dredges
2 = partially satisfactory - one dredge satisfactory, one unsatisfactory
5 = unsatisfactory - all dredges

Alaska Department of Fish and Game - Scallop Research- Fishing Log For Alaska Scallops - Survey (Rev. Feb. 24, 2016)

Appendix 2.-Scallop Catch and Bycatch Sampling Form

Scallop And Bycatch Sampling Form - Survey

Survey Code: _____ Haul Number: _____ Page: _____ of _____

Sampler(s) Name: _____ Set Date: _____ (mm-dd-yy) Dredge Sampled: Port Starboard

Dredge Width: _____ (feet) Dredge Ring Size: _____ (inches) Dredge Liner: Y N Liner Mesh Size: _____ (inches)

Large Weathervane Scallops (≥100mm SH)

Basket Number	Number	Round Weight (pounds)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Small Weathervane Scallops (<100mm SH)

Basket Number	Number	Round Weight (pounds)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Clappers and Empty Scallop Shells

	Condition	Number	Round Weight (pounds)
Clappers	3		
Empty Shells	3	~~~	

Condition: 3 = previously dead

Haul Composition

	Species Name	Species Code	Total Number	Total Weight (pounds)
1	Natural Debris (kelp, wood, rocks, etc.)	99999		
2	Man-made Debris (plastic, fishing gear, metal, etc.)	0		
3	unsorted catch and debris	99997		
4	empty gastropod (snail) shells	99994		
5	hairy triton (or Oregon triton)	72500		
6	sunflower sea star (Pycnopodia)	80160		
7	*Chionoecetes bairdi*	68560		
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

Alaska Department of Fish and Game - Scallop Research - Scallop and Bycatch Sampling Form - Survey (Rev. Feb. 24, 2016)

Appendix 3. Scallop Measurement and Damage Form

Scallop Measurement and Damage Form - Surveys

Survey Code: _____ Haul Number: _____ Page: _____ of _____

Sampler(s) Name: _____ Set Date: _____ (mm-dd-yy) Species Code: 74120

	Large Scallops (≥ 100mm SH)			Small Scallops (< 100mm SH)		
	SHELL HEIGHT (mm)	SHELL DAMAGE	COMMENTS	SHELL HEIGHT (mm)	SHELL DAMAGE	COMMENTS
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

SHELL DAMAGE:
0 = undamaged 3 = punctured 5 = crushed
1 = broken margin 4 = broken hinge 6 = previously damaged
2 = cracked

Alaska Department of Fish and Game - Scallop Research - Scallop Measurement and Damage Form - Survey (Rev. Feb. 24, 2016)

Appendix 4.- Scallop Measurement and Weight Form

Scallop Measurement and Weight Form - Survey

Survey Code: _____ Haul Number: _____ Page: _____ of _____

Sampler(s) Name: _____ Set Date: _____ (mm-dd-yy) Species Code: 74120

Scallop Size Class: Large (≥100mm SH) Small (<100mm SH)

	SHELL NUMBER	WHOLE WEIGHT (g)	SHELL DAMAGE	SHELL WORMS	SHELL HEIGHT (mm)	SEX	GONAD COND.	MUD BLISTER	SHELL COLLECT (1 = yes)	BAG NUMBER	MEAT COND.	MEAT WEIGHT (g)	CLAPPER (1 = yes)
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													

SHELL DAMAGE:
0 = undamaged
1 = broken margin
2 = cracked
3 = punctured
4 = broken hinge
5 = crushed
6 = previously damaged

SHELL WORMS:
0 = zero%
1 = 1% - 24%
2 = 25% - 49%
3 = 50% - 74%
4 = 75% - 100%

SEX:
0 = unknown
1 = male
2 = female
3 = hermaphrodite

GONAD CONDITION:
0 = immature
1 = empty
2 = initial recovery
3 = filling
4 = full
5 = cannot determine

MUD BLISTER:
0 = zero%
1 = 1% - 24%
2 = 25% - 49%
3 = 50% - 74%
4 = 75% - 100%

MEAT CONDITION:
0 = good
1 = weak

Alaska Department of Fish and Game - Scallop Research - Scallop Measurement and Weight Form - Survey (Rev. Feb. 24, 2016)

Appendix 5.-Crab and Halibut Measurement Form

Crab and Halibut Measurement Form - Survey

Survey Code: _____ Haul Number: _____ Page: _____ of _____

Sampler(s) Name: _____ Set Date: _____ (mm-dd-yy)

	SPECIES CODE	SEX	CARAPACE SIZE (mm) & FISH LENGTH (cm)	SHELL CONDITION	CONDITION
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

	SPECIES CODE	SEX	CARAPACE SIZE (mm) & FISH LENGTH (cm)	SHELL CONDITION	CONDITION
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					

SPECIES CODE:
68560 = Chionoecetes bairdi
68020 = Dungeness crab
69322 = red king crab
69323 = blue king crab
69400 = hair crab
10120 = Pacific halibut
68580 = Chionoecetes opilio
68590 = Chionoecetes hybrid
68541 = Chionoecetes sp. (mixed opilio and hybrid)

SEX:
0 = unknown
1 = male
2 = female
3 = hermaphrodite

SHELL CONDITION:
0 = premolt / molting
1 = soft / new pliable
2 = new
3 = old
4 = very old / very very old

CONDITION:
0 = uninjured
1 = fresh injury
2 = dead
3 = previously dead

Alaska Department of Fish and Game - Scallop Research - Crab and Halibut Measurement Form - Survey (Rev. Feb. 24, 2016)