ADF&G BSAI Crab Fishery Data Overview

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Observer program overview

- Program started in 1988 for BBRKC
- Monitor compliance of sex and size regulations
- Collect data for inseason management
- Observer coverage in snow crab fishery began in 1990
- 1999 BOF granted ADF&G authority and responsibility to deploy observers on any vessel participating in BSAI crab fisheries

Crab observer duties

- Species composition sampling using 1 of 2 methods: measure-pot OR count-pot sampling
- Monitor regulatory compliance of fishing operations
- Interview captains for fishing effort, catch, location information
- Report vessel and observer activities back to the ADF&G observer office
- Additional data collection tasks: tissue sample collection, egg clutch data, morphometric data, tagging efforts, etc.
- Sample retained catch at landing (AIGKC, C/P)

Three Primary Data Sources

1. Retained Catch Sampling

2. Edited Fish Tickets

3. Pot-lift Sampling

All data is collected, edited, and maintained by ADF&G Westward Region staff in conjunction with ADF&G Dockside Sampling and Crab Observer Programs

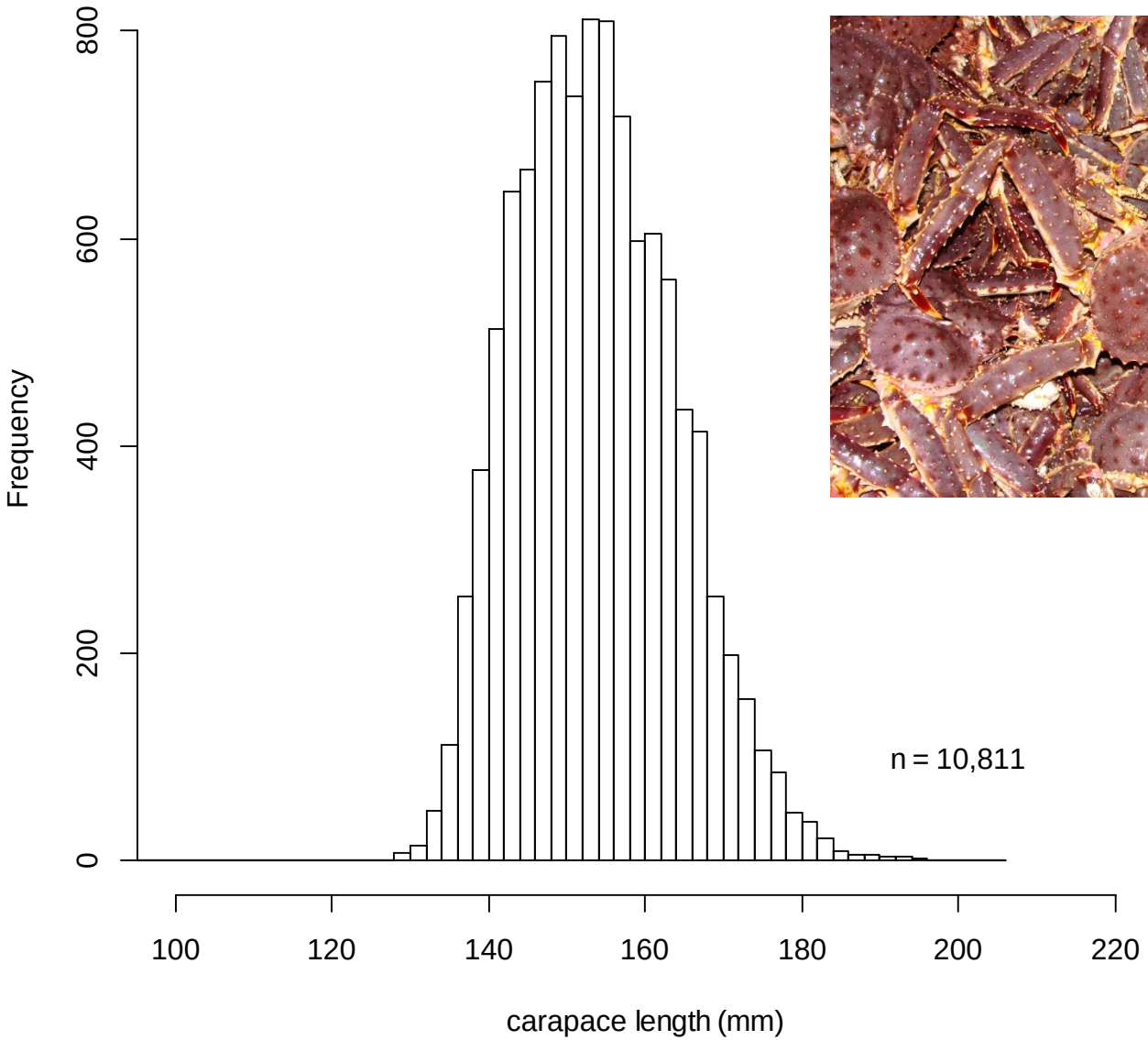
Retained Catch Sampling

Performed by ADF&G dockside samplers and onboard crab observers during delivery to processors

Includes:

- Size-composition sampling
- Estimation of average weight
- Assessing deadloss

2016/17 BBRKC Delivered Catch



Edited Fish Ticket Data

Commercial fish tickets issued by processors for each delivery

Edited by ADF&G Dutch Harbor staff based on information recorded by dockside samplers and onboard observers during “confidential interviews”

Apportion catch (numbers and weight) and effort (pot lifts) to ADF&G statistical areas by “vessel trip”

Confidential Interview Summary Form

Vessel Name	Interview/Summary Date (mm-dd-yy)	Processor Name, Port
RUSTY ANCHOR	04-01-19	BROAD BAY SFDS, DIT

Captain Name	Interviewer Name	Obs. ID[a]	SF Sample	SF Date (mm-dd-yy)
BART SIMPSON	SALLY SAMPLER		(Y) N	04-01-19

Fishery Code	Reg. Area	Species[b] Code	ADF&G Number	Interviewer Type[c]	Trip/Week Start Date (mm-dd-yy)	Trip/Week Finish Date (mm-dd-yy)	Days Fished	Packet[a] Number
0B19		923	99999	4	03-14-19	04-01-19	11	

Interview Conducted? (Y) N | DFL Obtained? (Y) N | DFL Used? (Y) N

Trip/Week Summary

Statistical Area	Total Crab	Total Pots Lifted
695301	6660	38
705300	75480	388
715232	39960	158
705232	51060	329
715231	48840	189
Totals	222 000	1102

Weight Tally

Date (mm-dd-yy)	No. Crab	Pounds
04-01-19	1044	4802
04-01-19	996	4482
04-01-19	1103	4853
Totals	3143	14137
Avg. Weight	4.5	

Offload Deadloss (lb. crab)

Live, Legal, Not Purchased:	0
All Other, Live or Dead:	450
Total Deadloss (lb. crab):	450

Total No. Lost Pots:	2
Total No. Rail-dumped Pots:	14

Personal Use (lb. crab):	15

Partial Deliveries

Partial Delivery: Y (N)	
Delivery Sequence: (Primary) Secondary	

Comments:	Landing Report ID[d]:

a Observer and fish ticket administrator use only
b Use the following crab species codes (in parentheses): red king *P. camtschaticus* (921), blue king *P. platypus* (922), golden king *L. aequispinus* (923), scarlet king *L. couesi* (924), Tanner *C. bairdi* (931), snow *C. opilio* (932), grooved Tanner *C. tanneri* (933), triangle Tanner *C. angulatus* (934), Dungeness *M. magister* (910), hair crab *E. isenbeckii* (940), and any *Paralomis* species
c 1 = observer: catcher-only vessel; 2 = observer: catcher-processor; 3 = observer: floating processor; 4 = dockside sampler
d Fish ticket administrator use only

ALASKA DEPARTMENT OF FISH & GAME
EDITED ELECTRONIC CRAB FISH TICKET

DO NOT WRITE IN THIS SPACE
E16 99999

Statistical Area WorkSheet

Stat. Area	%	Pot Lifts	Stat. Area	%	Pot Lifts
695301	4	38	705232	34	359
705300	35	368	715231	13	145
715232	14	181			

Agency Statistical Area WorkSheet

695301	3	38	705232	23	329
705300	44	388	715231	22	189
715232	18	158			

F/V Rusty Anchor
ID: 99999
K91O 99999C 1601M
SIMPSON BART
✓ Mag Stripe Read

Crew Size 8 | Mgmt Pgm IFQ
Observers onboard 0 | ID

Port of Landing or off-shore operation type: DUT Dutch Harbor/ Unalaska
Type of Gear used: 91 Pot

F9999 Broad Bay Seafoods
Date Fishing Began (Gear in Water) 03/14/2019
Date Landed 04/01/2019

PARTIAL DELIVERY:
☐ Partial Delivery
✓ Last Landing for Trip
☐ Multiple IFQ Permits

or:

ES	STAT AREA	DEL COND	SCALE WEIGHT	NUM	POT LIFTS	DISP	SIZE & GRADE	SCD WEIGHT	$	AMOUNT
king		01 Whole	220,000	48,889		60 Sold		220,000	4.40	968,000
king		01 Whole	2000	444		79 Deadloss				
						Total:		220,000		$968,000

ATTEST THAT THESE FISH WERE CAUGHT IN COMPLIANCE WITH ADF&G REGULATIONS.
ber's Signature
ved by Date
Report ID: 3339999 CFEC Serial Number: 123456

ADF&G USE	
Interview	X
Observer	
Logbook	X

K91O 99999C 1601C SIMPSON BART 2019-04-01 13:41:19 E16 999999 Final Report Submitted

Summary ADF&G fish-ticket data for 2016/17 BBRKC fishery.

2016-17 BBRKC by Stat Area-IFQ&CDQ - TR16

Stat Area	Vessels	Landings	Live Number	Live Pounds	Deadloss Number	Deadloss Pounds	Effort (sum)	CPUE	Ave. Weight	Price/lb.
615630	CONFIDENTIAL									
625600	18	35	73,637	476,338	416	2,666	1,965	37.69	6.47	9.04
625630	14	24	54,807	363,539	145	955	1,041	52.79	6.63	9.04
635530	8	11	929	6,378	1	9	229	4.06	6.87	9.04
635600	59	129	658,525	4,439,427	3,017	20,243	16,888	39.17	6.74	9.01
635630	39	85	225,594	1,517,086	1,178	7,890	5,834	38.87	6.72	9.01
635700	CONFIDENTIAL									
645530	5	7	1,091	7,626	1	5	159	6.87	6.99	9.04
645600	34	68	225,728	1,563,810	1,347	9,136	6,216	36.59	6.93	9.01
645630	15	21	6,417	43,995	26	175	591	10.90	6.86	9.02
645700	3	3	205	1,367	5	31	45	4.67	6.66	9.00
655600	CONFIDENTIAL									
655630										
Grand Total	63	148	1,247,829	8,425,581	6,138	41,120	33,126	37.87	6.75	9.02

Blue areas blocking stat area data that had less than 3 vessels.

Pot-lift Sampling

Performed at sea by ADF&G crab observers

3-10 pot daily quota, depending on fishery and vessel type

Distributed over day's hauled pot strings, "randomly" within strings

Two sampling protocols: count-pot and measure-pot

Pot-lift Sampling

Count-pot sampling includes:

- Pot location, depth, soak time and gear type
- Counts of all commercially important crab species by sex, legal status and retention status
  - Female, male sublegal, male legal retained, male legal not-retained

Measure-pot sampling additionally includes recording size, shell condition, female maturity and clutch condition and other biological information for each crab

Pot-lift Sampling

Measure-pot sampling is default protocol

Count-pot sampling used along with measure-pot sampling in *Chionoecetes* crab fisheries due to large pot counts, which can exceed 1,000

Crab observer daily pot quotas

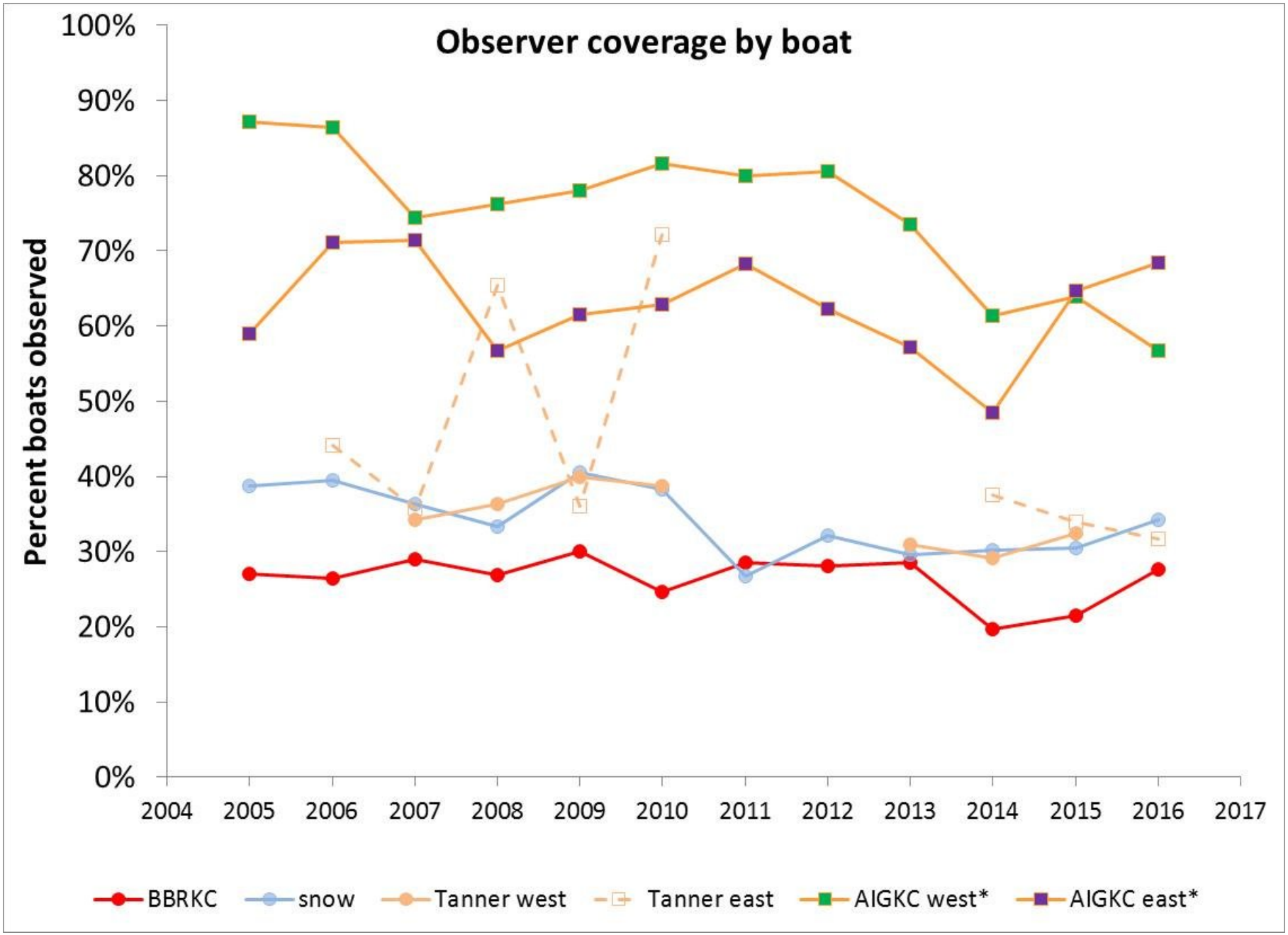
Fishery	Catcher-vessel		Catcher-processor	
	Measure	Count	Measure	Count
Eastern Aleutian Islands golden king [1]	7	0	4	0
Western Aleutian Islands golden king [2]	7	0	4	0
Bristol Bay red king	7	0	4	0
Eastern Bering Sea Tanner (*C. bairdi*)[3]	3	3	2	2
Western Bering Sea Tanner (*C. bairdi*) [4]	3	3	2	2
Bering Sea snow (*C. opilio*)	1	3	1	2
St. Matthew Island blue king	10	0	7	0
Pribilof golden king	10	0		

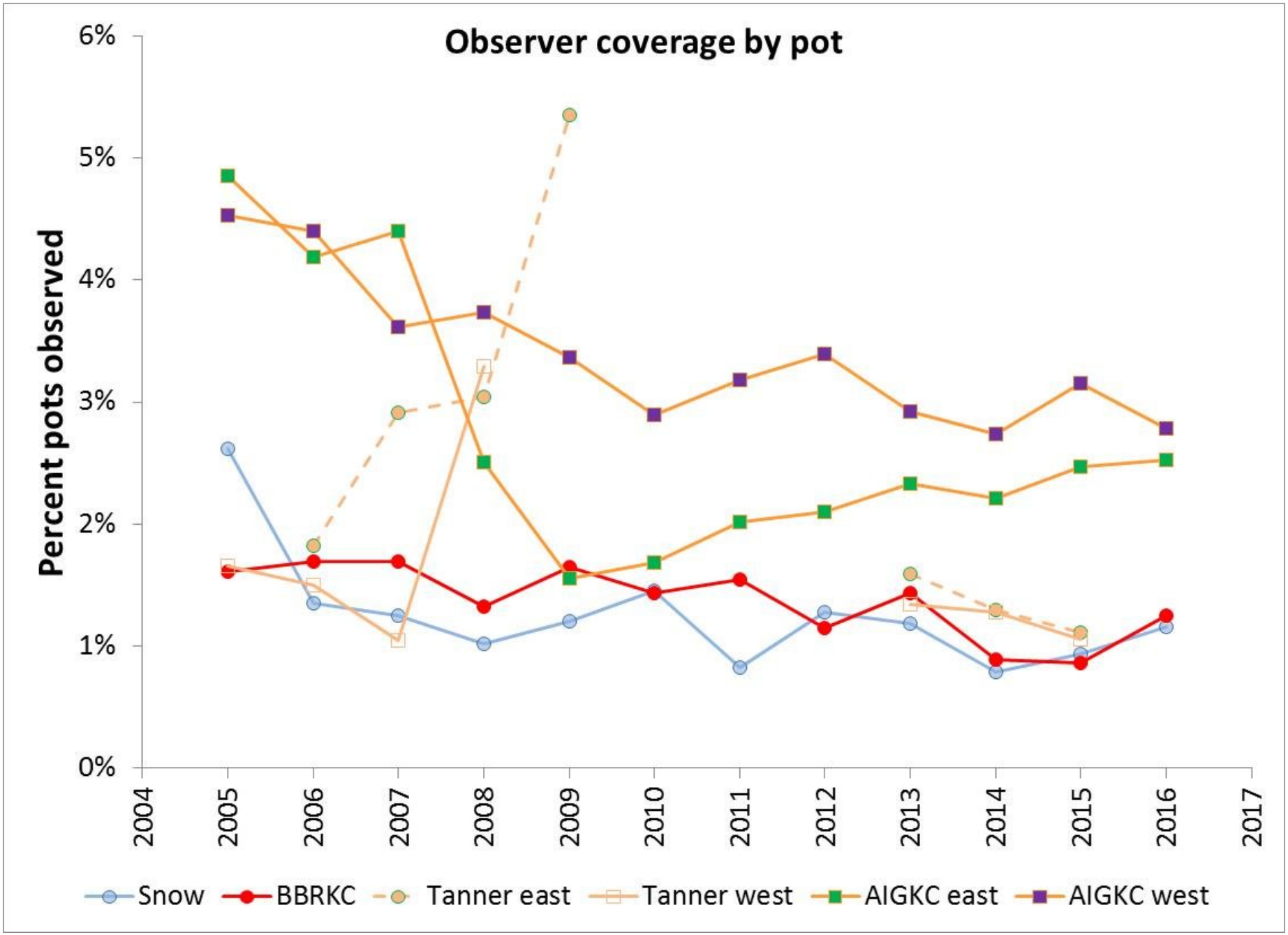
Mandatory catcher-vessel coverage requirements in FMP BSAI commercial crab fisheries, per 5 AAC 39.645. All vessels processing crab must carry observers.

Fishery	Coverage
Bering Sea snow crab	30-100% (a)
Bristol Bay red king crab	20% (a)
Bering Sea Tanner crab	30-100% (a)
Pribilof District red king crab	100%
Pribilof District blue king crab	100%
Saint Matthew Island blue king crab	100%
Norton Sound red king crab	Discretionary
Aleutian Islands golden king crab	50% (b)
Pribilof District golden king crab	100%
Adak red king crab	100%

[a] Vessels required to carry observers are randomly selected.

[b] All catcher vessels must carry an observer during harvest of 50% of total landed catch weight in each three-month trimester of nine-month season Aug 1 – Oct 31; Nov 1 – Jan 31; Feb 1 – April 30.


Observer coverage by boat
Percent boats observed
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
BBRKC
snow
Tanner west
Tanner east
AIGKC west*
AIGKC east*


Observer coverage by pot
Percent pots observed
6%
5%
4%
3%
2%
1%
0%
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Snow
BBRKC
Tanner east
Tanner west
AIGKC east
AIGKC west

Simple bycatch expansion =

Data source:

Observer pot CPUE → count pots OR measure pots, depending on desired sex/size/SC category

x

total fishery effort → Fish tickets

x

mean crab weight → Measure pot size comps, L-W regression

Caveats

THINGS HAVE CHANGED OVER THE YEARS

THINGS CONTINUE TO CHANGE

VIEW LEGAL MALE RETENTION PROPORTIONS WITH SKEPTICISM

USE HISTORICAL DATA AT YOUR OWN RISK

SAMPLED POTS ARE NOT A SIMPLE RANDOM SAMPLE

SAMPLED POTS ARE NOT A SIMPLE RANDOM SAMPLE

Pot-lift sampling typically involves a two-stage cluster sample:

- Stage 1: sample n of N vessels
- Stage 2: independently sample m_i of M_i pots within each stage-1 sampled vessel i

THIS MATTERS!

Example

Estimation of 2016/17 BBRKC retained crab CPUE based on 16 of 63 participating vessels observed with approximately 1.2% of all pots sampled

Let $\{ c_{ij} \}$ denote the $m = \sum_{?} ?_{?}$ sample-pot catches and M= $\sum_{?} ?_{?}$ the total effort (number of pots fished) by all N = 63 vessels, which is "known' from fish-ticket data

The simple expansion estimator $\hat{?}_{??} = \frac{?}{?} \sum_{?,?} ?_{??}$ is inappropriate for this design but will likely give a reasonable estimate; however, associated SE based on simple random sampling will likely exaggerate estimator precision

Example (cont.)

Two alternatives (ignoring stratification on days):

1. unbiased cluster estimator $\hat{Y}_{1} = \frac{M}{m}\sum_{i=1}^{m} y_i$
2. the ratio cluster estimator $\hat{Y}_{2} = \frac{\sum_{i=1}^{m} y_i}{\sum_{i=1}^{m} x_i} X$

The ratio estimator (2) does not require known M and can be expected to perform better than the unbiased estimator (1) when the relationship between vessel catch and effort is approximately linear through the origin and between-vessel effort (cluster size) varies significantly.

Example (cont.)

Results for 2016/17 BBRKC retained crab CPUE

Estimator	Estimate*	SE	SE/Estimate (%)	Design Effect
simple expansion	41.9	1.29	3.1	----
unbiased cluster	44.2	6.67	15.1	26.8
ratio cluster	42.2	3.09	7.3	5.8

* CPUE calculated from fish tickets = 38.0 crab/pot

Other Data Challenges

- Determining fishery effort
  - Incidental retention makes this difficult
  - Pressure by industry for 100% incidental retention
    - Difficult to untangle effort
- Evolution of data collection protocols
- Nuances in data recording: realities of BSAI fishing (e.g., weather, sea ice can affect fishing behavior or observer coverage)
- Stock assessment author specialty requests

Streamlining the fishery data exchange process

- Standardize SA author data needs and data format
  - Expanded abundance by 1 mm and shell condition?
  - Authors can then bin data to fit model needs
  - Authors calculate biomass from abundance estimates
- Host on AKFIN?

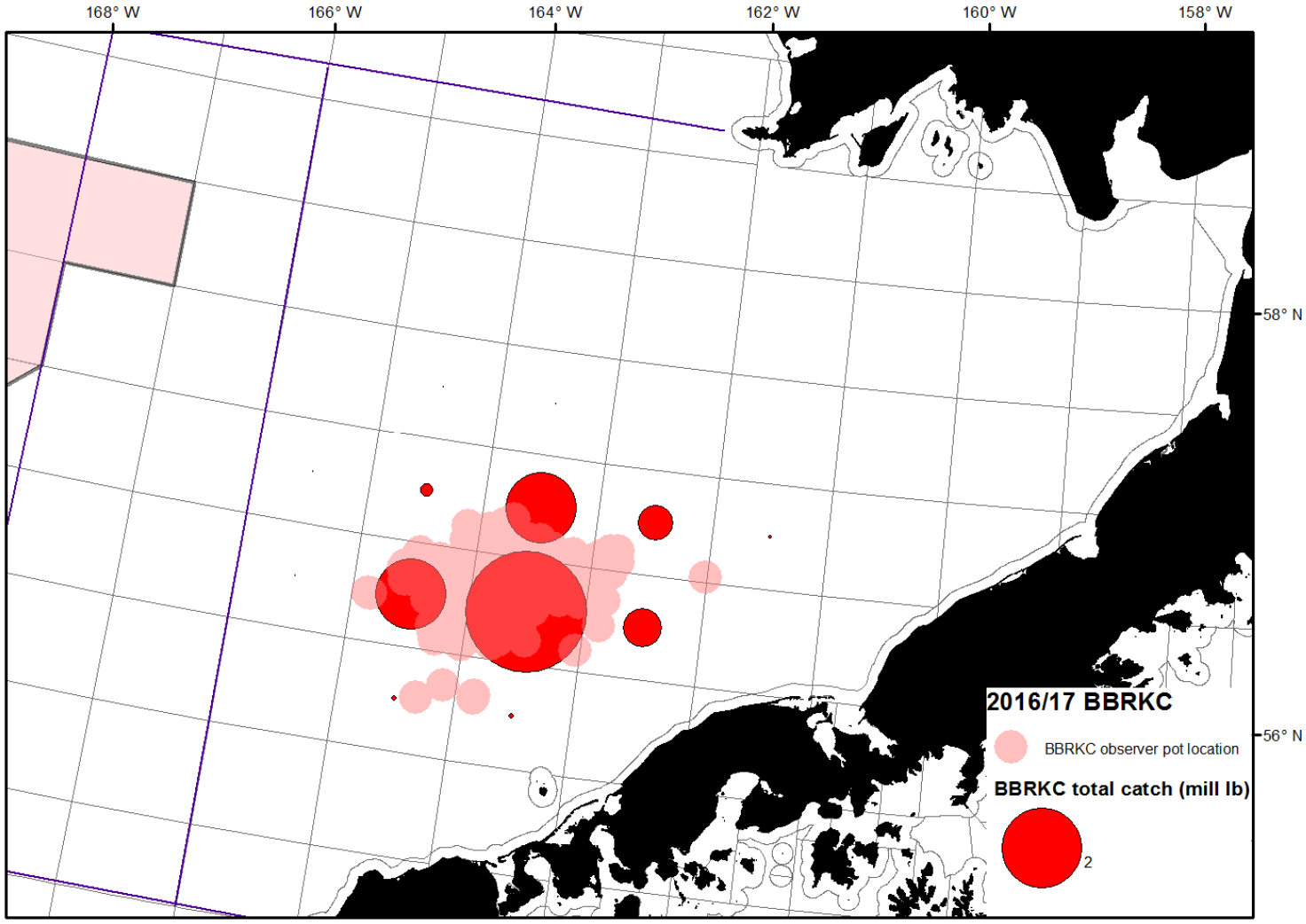
Further Information

2016 ADF&G crab observer training and deployment manual. Alaska Department of Fish and Game, Dutch Harbor.

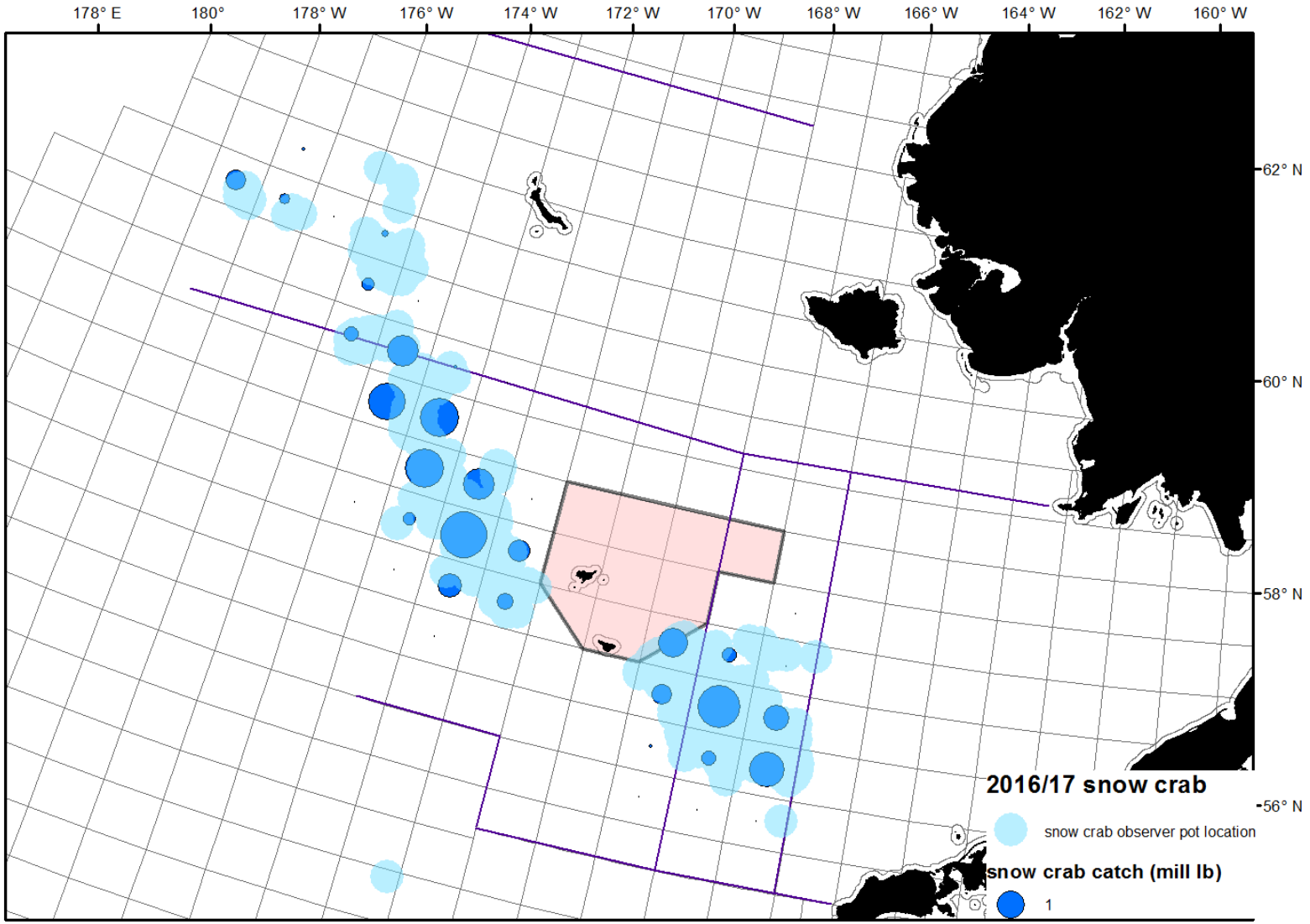
2016 ADF&G shellfish dockside sampling manual. Alaska Department of Fish and Game, Dutch Harbor.

2011/12 Annual Management Report for the Commercial and Subsistence Shellfish Fisheries of the Aleutian Islands, Bering Sea, and the Westward Region's Shellfish Observer Program. Alaska Department of Fish and Game, Dutch Harbor.

2016/17 BBRKC



2016/17 snow crab



2016/17 AIGKC