

**NOAA**  
**FISHERIES**

Alaska Region

Alaska Fisheries Science Center



# BSAI Crab PSC Accounting

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# Brief History

- Historically PSC is calculated in numbers for a federal reporting area or special management area (e.g., COBLZ)
  - PSC management uses numbers at this resolution
  - Management not by crab-year
  - Management not by crab stock area
- 1991 – 2009 (June 30): PSC numbers from catch accounting and the blend database: numbers converted to weight using average weights (observer data)
  - Extrapolated weights/Extrapolated numbers by species - average calculated for the calendar year
  - Federal reporting area specific (not by stock area)- assessment authors assigned stock areas
  - Document provided to CPT in 2009
- 2009 (July 1)-Current: Extrapolated weights and stock area specific estimation
  - Haul-specific estimate of weight used in bycatch rate calculation- observer sampling hierarchy
  - Bycatch estimation is stock area specific
  - AKFIN (Dashboard or SQL)
- Minor change starting 2017 (Jan 1)- CAS process rather than AKFIN
  - Observer sample stratification updated
  - Still available through AKFIN



# What is CAS?

- Catch estimates for groundfish fisheries generated by the Alaska Regional Office
  - Retained groundfish catch
  - At-sea discards
    - Groundfish
    - Prohibited Species (e.g. halibut, crab, salmon)
    - Non-groundfish species (e.g. inverts, birds, etc.)
    - Crab Stock Area Estimates
- Designed for timely estimates to support effective in-season management
  - Enable fisheries to stay within annual catch limits set by Annual Harvest Specifications [http://www.alaskafisheries.noaa.gov/sustainablefisheries/specs13\\_14/](http://www.alaskafisheries.noaa.gov/sustainablefisheries/specs13_14/)
  - Support policy development, analysis, & stock assessment
  - Provided to stock assessment authors through AKFIN Answers (online “data mart”) or database link

Observer  
Data

Industry  
Reports

Vessel  
Tracking  
Data  
(VMS)

Permits  
Data



## Catch Accounting System

Total Catch Estimates: Retained Groundfish catch & At-sea discard estimates (groundfish, Prohibited Species, non-groundfish, Crab)



Catch  
Accounting  
Reports

Data  
Requests  
(Council,  
NMFS, public)

Alaska  
Fisheries  
Information  
Network  
(AKFIN)

Alaska  
Fisheries  
Science  
Center



Internal  
(inseason  
management)

Protected  
Web for  
fishery  
participants

Public Web  
Access  
(weekly  
reports)

<http://www.alaskafisheries.noaa.gov/sustainablefisheries/catchstats.htm>



NOAA FISHERIES

# Coverage (2017)

- Full Coverage- vessels that are required to have at least one observer onboard at all times.
  - HAL~ 43%
  - POT ~ 8%
  - NPT TRW ~ 78%
  - PTR TRW ~100%
- Partial Coverage- Annual Deployment Plan
  - HAL: ~ 57% (40% of total trips on zero coverage)
  - POT: ~ 92% partial (8% EM in 2017)
  - NPT TRW: 18%
  - PTR TRW: 0%

# Partial Coverage

- Annual Deployment Plan draft presented to Council in October, Finalized in December. NMFS makes decision with Council input
- Annual Review- annually review aspects of deployment plan (always a year lagged).
  - Includes a quantitative review of the sampling design, enforcement issues, budget, and some catch information is also provided. Released in June.
- Documents found at:
  - <https://alaskafisheries.noaa.gov/fisheries/observer-program>

# Partial Coverage

- Annual Deployment Plan (overall BSAI+GOA):
  - 2018 anticipated rates:
    - No Selection = 0% ;
    - EM = 30% ;
    - Trawl = 20%;
    - Hook-and-line = 17%;
    - Pot = 16%;
    - Tender trawl = 17%;
    - Tender pot = 17%
  - 2017 realized rates:
    - No Selection = 0%;
    - EM = 20.7%, but not all data was available so likely higher
    - Trawl = 20.7%;
    - Hook-and-line = 12%;
    - Pot = 7.2%
    - Tender Trawl = 18.8%
    - Tender Pot = 5.3%



# Current estimation processes

- Rate based estimation
  - Discard rates calculated from observed hauls or sets
  - Rates applied to total retained groundfish and halibut
  - No sex-specific or mortality estimation
- Rate calculation modified from the PSC estimation process. Main differences:
  - At-sea discard rates are specific to crab stock area
  - Estimates in weight not numbers
- Hierarchical: At-sea observer data used to derive the discard rates are as proximate as possible (in time and space) to the unobserved fishing "event" being estimated.

# Hierarchical Sampling

Random selection of trips

Selection determined by  
Observer Program (ADP)

Random sample of hauls

Selection using  
randomization tables

Random sample of the  
catch of each haul

Observer determines  
selection method

Random sample of individual fish

Observer determines selection method  
Rates specified by Program with input

## Sample Units

Gear  
Weight  
Volume

## Sample Designs

Systematic  
Random  
Simple Random  
Other Random  
Opportunistic  
Census

Stratification

Design

# Safety and Compliance Monitoring

## Catch Sampling

Strata

Trips

Hauls

Sample

Individual Fish

Observer Logbook Documentation  
Data Entry and Transmission

Fishery Interactions  
Marine Mammals  
Seabirds

Special Studies  
Cooperative Research  
EFPs

Salmon Monitoring  
Genetics Sampling

# Observer Annual Deployment Plan (ADP)

Year	Partial coverage category					Observer vessel selection pool	No selection pool Observer coverage not required
	Observer trip selection pool Observer coverage required on all randomly selected trips						
2018	Trawl: 20%	Trawl Tender: 17%	H&L: 17%	Pot: 16%	Tender Pot: 17%	Fixed gear EM trip selection pool: 30%	EM Innovation Research
2017	Trawl: 18% (20.7)	Trawl Tender: 14% (18.8)	H&L: 11% (12.0)	H&L Tender: 25% (0)	Pot: 4% (7.7)	Tender: 4% (5.3)	Voluntary EM Pre-implementation ~90 vessels
2016	Trawl: 28% (28.0)		H&L: 15% (15.0)		Pot: 15% (14.7)	n/a	Vessels <40' LOA and Jig gear
2015	Large Vessel: 24% (23.4) Trawl CVs, Small CPs, H&L/Pot CVs ≥ 57.5'		Small Vessel: 12% (11.2) H&L/Pot CVs >40' and <57.5'				n/a
2014	All Trawl CVs and H&L/Pot vessels ≥ 57.5': 16% (15.1)					H&L/Pot CVs >40' and <57.5': 12% (15.6)	Voluntary EM Pre-implementation 12 vessels
2013	All Trawl CVs and H&L/Pot vessels ≥ 57.5': 14.5% (14.8)					H&L/Pot CVs >40' and <57.5': 11% (10.6)	Vessels <40' LOA and Jig gear
Observer Program Restructure							
1990 - 2012 <sup>7</sup>	Regulatory Full ≥ 100%	Vessels self-selected coverage (i.e., choose when to take an observer) <ul style="list-style-type: none"> <li>• 30% of fishing days by gear/quarter and at least one trip per fishery.</li> <li>• CVs ≥ 60' and &lt; 125' LOA targeting groundfish</li> <li>• Other CPs and processing plants when not required 100%.</li> </ul>					

# Sampling on Fixed Gear Vessels

- Longline: 94% CV, 57% CP sets sampled/trip
  - CVs: 1,300 – 2,100 hooks/set
  - CPs: 10,000 – 30,000 hooks/set
- Pot: 88% CV, 52% CP sets sampled/trip
  - CVs: 51 – 87 pots/set
  - CPs: 23 – 60 pots/set
- Sampling occurs on-deck
  - Gear-based sample units
  - Identify to species & enumerate all catch
  - 3 samples / set, Typically > 30% of the gear
- Random selection of fish
  - Weight and length measurements
  - Biological samples
- Hooks per longline segment



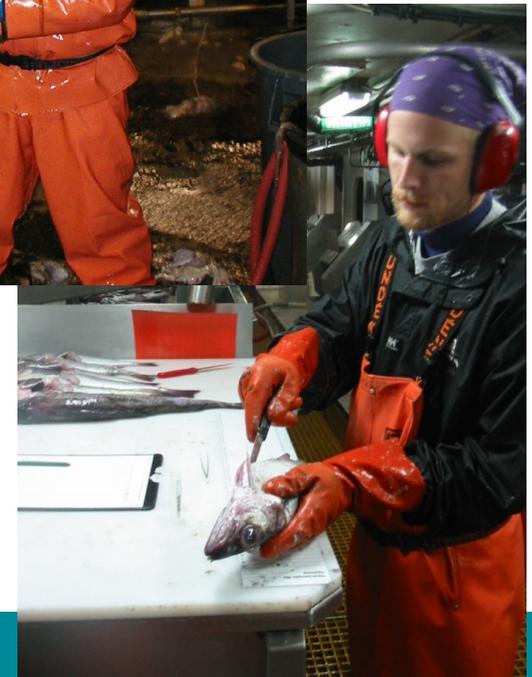
# Sampling on Trawl Catcher Vessels

- Pelagic: 95% hauls sampled/trip
  - 70 – 125 mt hauls
- Non-Pelagic: 91% hauls sampled/trip
  - 8 – 30 mt hauls
- Sampling occurs on-deck
  - Weight-based sample units
  - Identify to species & weigh all catch
  - Average 2-3 samples / haul
  - 1% (PTR) - 4% (NPT) of catch weight
- Random selection of fish
  - Weight and length measurements
  - Biological samples
- Total catch weight estimated
  - Codend volume, catch density measurements



# Sampling on Trawl Catcher Processors and Motherships

- Pelagic: 99.5% hauls sampled/trip
  - 35 – 140 mt hauls
- Non-Pelagic: 98.5% hauls sampled/trip
  - 5 – 50 mt hauls
- Sampling occurs in processing plant
  - Weight-based sample units
  - Identify to species & weigh all catch
  - Average 3 samples / haul
  - 28% (PTR), 2% (NPT) of catch weight
- Random selection of fish
  - Weight and length measurements
  - Biological samples
- Total catch weight over flowscale



# Additional Prohibited Crab Species Data Collections

Every individual prohibited species crab encountered in a species composition sample:

- Identify to species, count, weigh, determine sex, and check for the presence of eggs (females only)
- Measure using calipers
- Check for tagged crab

Crab Parts in samples:

- Identify whole crabs to species
  - Report number and weight
- Identify loose crab parts if possible
  - carapaces to species
  - legs to family



# Current estimation processes

- Sampling Strata = Observer Sampling Strata (2018 example)
  - Full, Hook and Line, Pot, Trawl, Tender Trawl, Tender Pot, EM
  - “zero” coverage combined with gear-specific sampling strata (e.g., hook and line <40 = hook and line).
  - EM (few trips in the BSAI)
  - Calendar Year
- Hierarchical Post Strata
  - Modification of PSC estimation process used for inseason monitoring-nightly updates based on new landings and at-sea observer information
  - Estimates at a “fishery” level e.g. gear, predominant retained species, processing sector
  - Species group specific (hybrids not a separate group).
    - Groups: BTCR, OTCR, RKCR, GKCR, BKCR

# Current estimation processes

- Estimated crab catch weight for hauls by expanding sample data  
Trawl Gear: Species proportion (kgs) from samples applied to total haul weight (ratio of means)

$$W_{\text{species}} = W_{\text{total}} \times \frac{w_{\text{species}}}{w_{\text{total}}}$$

Fixed Gear: Weight per gear (hooks or pots) from samples applied to total gear fished and expanded by mean weight per fish

$$W_{\text{species}} = W_{\text{gear}} \times \frac{w_{\text{species}}}{w_{\text{gear}}} \times \frac{\sum w_{\text{fish}}}{\# \text{ fish}}$$

- Estimated crab discard weight for haul by applying percent discard  
crab discard weight = %discard x crab weight

# Current estimation processes

## Rate based estimation- 'generic form'

- Estimated crab discards for fishery by applying discard ratio (observed hauls) to landings and estimated groundfish and non-PSC halibut

$$D_{crab} = \frac{\sum (L_{groundfish} + L_{non-PSC\ halibut}) \cdot R_{crab}}{\sum (L_{groundfish} + L_{non-PSC\ halibut})}$$

- Bycatch ratio for each crab species, post-strata, sampling strata

$$D_{bycatch} = \frac{\sum (L_{species} \cdot R_{bycatch})}{\sum (L_{species})}$$

# Current estimation processes

- Hierarchical Post Strata- always specific to crab species grouping
- Catch event post-strata = available observer information post-strata

Hierarchy	Vessel	Sector	Date	Area	Min Hauls	Gear
1) Trip	X	CP/CV/M	Trip	Crab Stock	1	X
2) 3-wk avg		CP/CV/M	Year/Week	ADFG	3	X
3) 3-month avg		CP/CV/M	Year/Week	ADFG	3	X
4) Yearly		CP/CV/M	Year	ADFG	3	X
5) Yearly			Year	Crab Stock Area	1	X
6) Yearly (no gear)			Year	Crab Stock Area	1	

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Cross sampling strata for #5 and #6

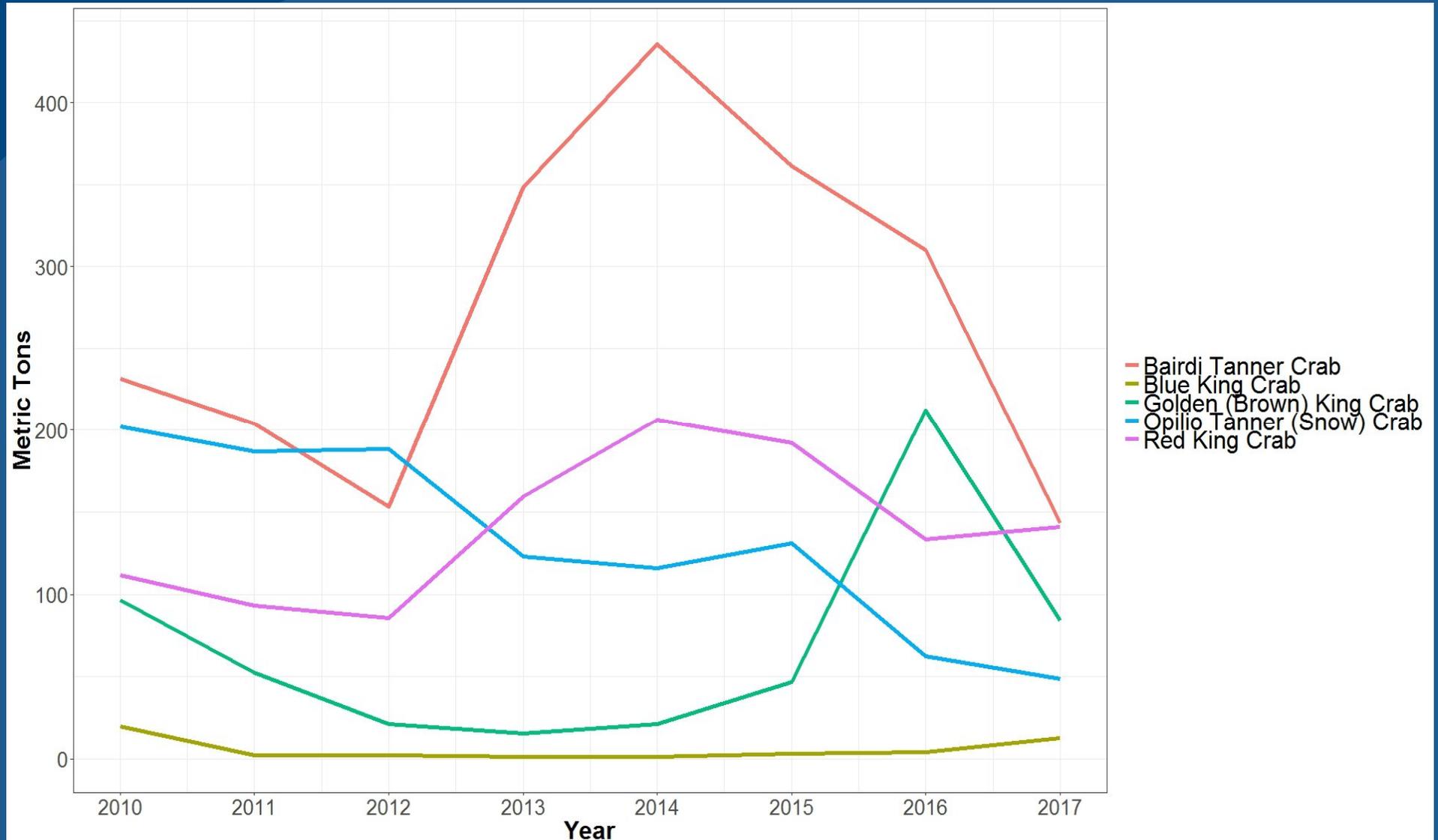
# Current estimation processes

Rate based estimation- 'generic form'

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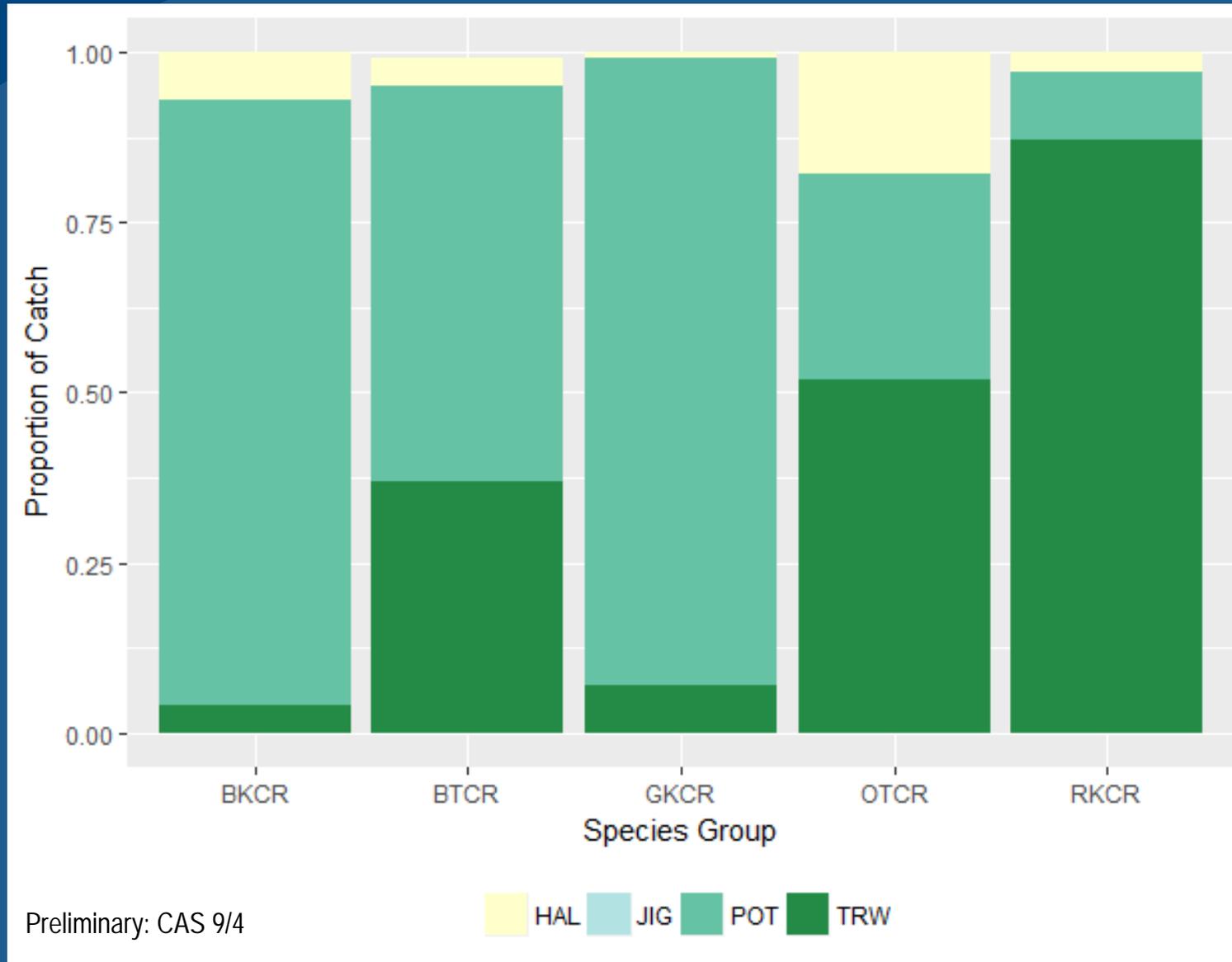
- Shoreside: Landing reports + CAS groundfish discard estimate = Total Groundfish & halibut
- CPs and Motherships= Total Groundfish and halibut estimated from at-sea observer information (sum of extrapolated haul estimates).
- Partial Coverage CPs (only a few of these)- from production information

# Total Crab Catch (no mortality applied)



AKFIN: 8/12/2018

# 2017/2018: Proportion weight by Gear (no mortality applied)



Preliminary: CAS 9/4



# 2017/2018 (Crab year post strata)

- Weight by post-strata type-2017 (all gear types)

Species	Trip	3 week	3 month	Year	Year (cross sampling strata)	Year (cross gear & samp. str)
BKCR	1.00	<0.01	<0.01	<0.01	<0.01	
BTCR	0.55	0.09	0.01	0.16	0.18	
GKCR	0.22	0.01	0.01	<0.01	0.76	<0.01
OTCR	0.79	0.08	0.01	0.07	0.06	
RKCR	0.94	<0.01	<0.01	0.05	0.02	

Preliminary: pulled from CAS 9/4

# 2017 (Crab year post strata)

- Weight by post-strata type-2017
- Pot Gear

Species	Trip	3 week	3 month	Year	Year (cross sampling strata)	Year Cross Gear
BKCR	1.00	NA	NA	NA	<0.01	NA
BTCR	0.24	0.16	0.02	0.28	0.30	NA
GKCR	0.13	0.01	0.01	<0.01	0.85	<0.01
OTCR	0.32	0.25	0.02	0.23	0.19	NA
RKCR	0.37	<0.01	<0.01	0.46	0.17	NA

Preliminary: pulled from CAS 9/4

# 2017 (Crab year post strata)

- Weight by post-strata type-2017

## Hook and Line

Species	Trip	3 week	3 month	Year	Year (cross sampling strata)
BKCR	0.98	0.01	0.01	NA	0.01
BTCR	0.97	0.01	0.01	<0.01	0.01
GKCR	0.51	0.01	0.09	0.06	0.32
OTCR	0.96	0.03	<0.01	<0.01	<0.01
RKCR	1.00	<0.01	<0.01	<0.01	<0.01

Preliminary: pulled from CAS 9/4

# AKFIN BI

- Estimates provided on AKFIN Dashboard
  - Discard rates applied at the fishing “event” level (e.g., landings, weekly).
  - No discard mortality applied
  - Summarized by crab-year/stock area and groundfish “fishery”.
  - Detailed .csv includes the post-strata information
  - Updated every Sunday

The screenshot displays the AKFIN BI Business Intelligence dashboard. The top navigation bar includes 'Business Intelligence', a search bar, and links for 'Advanced', 'Help', and 'Sign Out'. Below this is a 'Stock Assessment' header with navigation links like 'Home', 'Catalog', 'Favorites', 'Dashboards', 'New', 'Open', and 'Signed In As Jason Gas'. The main content area is titled 'Crab Bycatch Estimates' and contains a detailed report configuration panel on the left and a data table on the right.

**Report Criteria**

Fill out the following prompts and hit Apply to filter the report. Click Reset to clear the prompts and go back to the default values.

The crab year runs from July 1 to June 30 and is denoted using the earlier calendar year within the crab season (e.g., '2009' represents the 2009/2010 crab season). To return results for a single crab year, use the same year value in the range for the crab year filter (e.g., 'between 2009-2009' returns results for the 2009/2010 crab season; 'between 2009-2010' returns results for the 2009/2010 and 2010/2011 crab seasons).

Crab Year: Between 2009 - 2009

Fishery Name: Bristol Bay red king crab

Species Group Name: --Select Value--

PSCNQ Processing Sector: --Select Value--

Trip Target Name: --Select Value--

Agency Gear Code: --Select Value--

Buttons: Apply, Reset

**Crab Bycatch Estimates**

Crab bycatch estimates by area, based on an extrapolation of rates from observed hauls to the catch accounting data for 2009 and later, by crab year. Data for 2009 to 2016 calendar years are sourced from AKFIN. Data from the 2017 calendar year onward are sourced from NMFS Alaska Regional Office. Note: these estimates do not include handling mortality.

Time run: 9/4/2018 3:25:23 PM

Please see the [Documentation](#) tab for documentation on the crab bycatch estimate datasets.

Crab Year is between 2009 and 2009  
and Fishery Name is equal to Bristol Bay red king crab  
and Fishery Name is equal to Bristol Bay red king crab

Fishery Name	AFKIN Load Date	Detail	Record Count
Bristol Bay red king crab	04/11/2017		12,710

Note: Values associated with a Conf Flag value of 1, or a # Distinct Vessels fewer than or equal to 2 are considered confidential and should not be released to non-confidential data users or published.

Choose a Report: Summary by Fishery

Crab Year	Fishery Code	Fishery Name	Species Group Code	Species Group Name	Conf Flag	Estimate Num	Estimate Wt (kg crab)
2009	BBR	Bristol Bay red king crab	RKCR	Red King Crab	0	59,533.38	118,965.15

An Excel export will include formatted summary of choice, while the .csv export will include the detailed dataset.  
For large data downloads please export in .csv format (Data -> CSV Format).

[Refresh](#) - [Export](#)

# Past and ongoing work

## CAS methods documented:

Cahalan, J., J. Gasper, and J. Mondragon. 2014. Catch sampling and estimation in the federal groundfish fisheries off Alaska, 2015 edition. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-286, 46 p. Document available: <http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-286.pdf>

## Simulation studies:

Cahalan, J., J. Gasper, and J. Mondragon. 2015. Catch estimation in the federal trawl fisheries off Alaska: a simulation approach to compare the statistical properties of three trip-specific catch estimators. *Can. J. Fish. Aquat. Sci.* 72: 1024–1036 (2015) [dx.doi.org/10.1139/cjfas-2014-0347](https://doi.org/10.1139/cjfas-2014-0347)

Variance presentation (June 2016 SSC/Council): [https://www.npfmc.org/wp-content/PDFdocuments/conservation\\_issues/Observer/OACVarianceMay16.pdf](https://www.npfmc.org/wp-content/PDFdocuments/conservation_issues/Observer/OACVarianceMay16.pdf)

Estimation changes: Yearly rates defined by crab year rather than calendar year

Variance into production DB for groundfish/PSC early 2019

# Questions?



# Overwhelmed With Crab



# Overwhelmed With Crab

## Pot Vessels

- Collect a subset sample
  - 50 randomly selected individuals
    - Identify to species
    - Determine sex, count, weigh
  - Weigh all of the remaining crab
    - Identify to group if possible

## Trawl Gear

- NEVER subset sample for crab
  - End your sample
  - Identify to species
  - Determine sex, count, weigh all crab
- Reduce the size of your next sample

# Tagged Tanner Crab



## TAGGED TANNER CRAB

Western Bering Sea 2017/18

ATTENTION GROUND FISH OBSERVERS AND FISHERMEN



In 2017 the Alaska Department of Fish and Game tagged male Tanner crab near the Pribilof Islands using pop-up satellite tags and wraparound carapace tags. Information from tagged crab will be used to explore Tanner crab movement relative to fishery management boundaries. ADF&G asks fishermen and observers to please assist in our efforts to better understand Tanner crab migration in the Bering Sea.

Following guidelines below will earn the finder and vessel captain each a tag reward hat:

For satellite tags please perform the following:

- Remove entire tag setup by cutting pink tubing (of harness) where it crosses above abdominal flap
- Record sat tag number and harness number (locations pictured above)
- Record capture date and location (latitude and longitude)
- Save tag setup (sat tag with attached harness) and return with information

For wraparound tags please perform the following:

- Record tag number and/or take picture of tag number
- Return crab to water with tag intact
- Record capture date and location (latitude and longitude)

We would like to know about ALL tags found, even if there is no additional information available. Your assistance is invaluable to our efforts!



Please return information and sat tags to:

Rachel Alinsunurin  
Alaska Department of Fish & Game  
2315 Airport Beach Road  
Dutch Harbor, AK 99692  
(907) 581-1239

----- OR -----

Vicki Vanek  
Alaska Department of Fish & Game  
351 Research Ct.  
Kodiak, AK 99615  
(907) 486-1890



# Tagged King Crab



## TAGGED BLUE KING CRAB

### ST. MATTHEW ISLAND

#### ATTENTION GROUND FISH OBSERVERS



In 2015 and 2016, the Alaska Department of Fish and Game tagged male blue king crab in the St. Matthew Island area. Information from tagged crab will be used to determine their growth rate, time between molts, and seasonal migration and distribution patterns. ADF&G asks fishermen and observers to please assist in efforts to improve our understanding of St. Matthew blue king crab.

The following information recorded by an observer will earn the observer and finder each a tag reward hat:

- Tag number (or picture of tag number)
- Crab size (carapace length)
- Capture date and location (latitude and longitude)
- Capture depth (fathoms)



Please return crab to the water after recording tag number and size.

**We would like to know about ALL tags found, even if there is little or no crab information available.  
Your assistance is invaluable to our efforts!**



For distribution of tag rewards contact:

Rachel Alinsunurin  
Alaska Department of Fish & Game  
2315 Airport Beach Road  
Dutch Harbor, AK 99692

For questions on tagging project contact:

Vicki Vanek  
Alaska Department of Fish & Game  
351 Research Ct.  
Kodiak, AK 99615  
(907) 486-1890



Table 4-1. -- Number of vessels (V), total trips (N), observed trips (n), and percent of trips observed (%; with observer coverage) in 2017 in each FMP area (BSAI and GOA) by strata, gear type (hook and line (HAL), nonpelagic trawl (NPT), pot, pelagic trawl (PTR), and jig), and vessel length category (based on length overall, in feet) for the full and partial coverage category.

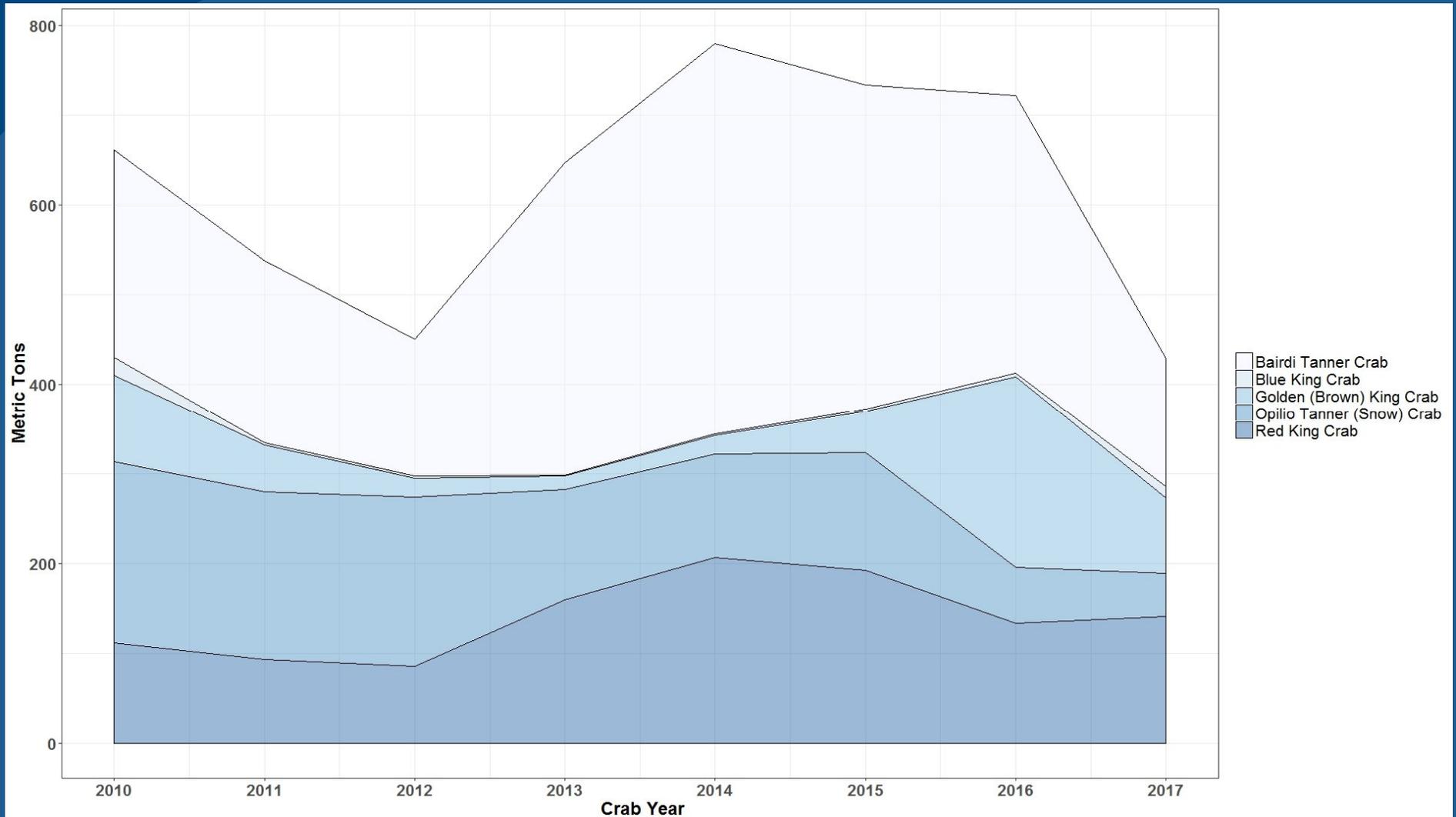
Area	Strata	Gear	Vessel length category											
			< 40'				40-57.4'				≥ 57.5'			
			V	N	n	%	V	N	n	%	V	N	n	%
BSAI	EM Voluntary	HAL					2	6	0	0.0	6	8	0	0.0
	EM Voluntary	POT									4	42	0	0.0
	FULL	HAL									28	326	326	100
	FULL	NPT									46	618	618	100
	FULL	POT									5	43	43	100
	FULL	PTR									93	2,173	2,173	100
	<i>HAL - No Tender</i>	HAL					23	138	19	13.8	31	99	10	10.1
	<i>POT - No Tender</i>	POT					2	37	4	10.8	49	425	28	6.6
	<i>POT - Tender</i>	POT					1	1	0	0.0	12	19	1	5.3
	<i>TRW - No Tender</i>	NPT									25	171	35	20.5
	<i>TRW - Tender</i>	NPT									1	1	0	0.0
	ZERO Coverage <sup>1</sup>	HAL	67	580	0	0.0								
	ZERO Coverage	JIG					1	4	0	0.0				
	BSAI Subtotal			67	580	0	0.0	26	186	23	12.4	242	3,925	3,234

Table 4-4. -- Observed catch (metric tons), total catch, and percent observed (%) of groundfish and halibut retained and discarded in the groundfish and halibut fisheries in 2017 in the Bering Sea/Aleutian Islands. Empty cells indicate that no catch occurred.

	CATCHER/PROCESSOR			MOTHERSHIP			CATCHER VESSEL		
	Observed	Total	%	Observed	Total	%	Observed	Total	%
<b>HOOK AND LINE</b>									
Retained	139,183	139,244	100%				222	2,271	10%
Discarded	29,359	29,375	100%				123	1,282	10%
<b>JIG</b>									
Retained							0	13	0%
Discarded									
<b>NON-PELAGIC TRAWL</b>									
Retained	323,323	323,323	100%	40,002	40,002	100%	16,934	30,685	55%
Discarded	20,015	20,015	100%	3,669	3,669	100%	630	1,284	49%
<b>POT</b>									
Retained	5,980	5,980	100%				1,547	25,591	6%
Discarded	209	209	100%				24	351	7%
<b>PELAGIC TRAWL</b>									
Retained	615,587	615,587	100%	119,145	119,145	100%	594,296	594,296	100%
Discarded	3,110	3,110	100%	163	163	100%	2,084	2,084	100%



# Total Crab Catch (no mortality applied)



AKFIN: 8/12/2018