2021/22 BSAI crab catch and fishery performance

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Crab Plan Team Meeting
September 12-16, 2022
Seattle, WA
Directed fishery observer coverage

Mandatory catcher-vessel coverage requirements, per **5 AAC 39.645**. All vessels processing crab must carry observers.

<table>
<thead>
<tr>
<th>Fishery</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bering Sea snow crab</td>
<td>30-100% (a)</td>
</tr>
<tr>
<td>Bristol Bay red king crab</td>
<td>20% (a)</td>
</tr>
<tr>
<td>Bering Sea Tanner crab</td>
<td>30-100% (a)</td>
</tr>
<tr>
<td>Pribilof District red king crab</td>
<td>100%</td>
</tr>
<tr>
<td>Pribilof District blue king crab</td>
<td>100%</td>
</tr>
<tr>
<td>Saint Matthew Island blue king crab</td>
<td>100%</td>
</tr>
<tr>
<td>Norton Sound red king crab</td>
<td>Discretionary</td>
</tr>
<tr>
<td>Aleutian Islands golden king crab</td>
<td>50% (b)</td>
</tr>
<tr>
<td>Pribilof District golden king crab</td>
<td>100%</td>
</tr>
<tr>
<td>Adak red king crab</td>
<td>100%</td>
</tr>
</tbody>
</table>

* Vessels required to carry observers are randomly selected.

* 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.

**2021/22** Generally status quo
Directed fishery observer coverage

Observer coverage by boat

Percent boats observed


BBRKC snow Tanner west Tanner east AIGKC west* AIGKC east*

*AIGKC calculated by trip because of trimester regulation
Directed fishery observer coverage

Observer coverage by pot

Percent pots observed

Snow BBRKC Tanner east Tanner west AIGKC east AIGKC west
Groundfish Vessels in Full Coverage vs Partial Coverage

**Full coverage vessels (1 or 2 observers 100% of the time)**
- Catcher/Processors (limited exceptions for non-trawl CPs)
- Motherships
- AFA Pollock catcher vessels delivering shoreside
- Non-Pollock BSAI trawl catcher vessels can opt for 100% coverage during all fishing

**Partial Coverage**
- Catcher Vessels fishing groundfish
- Catcher Vessels fishing IFQ/CDQ halibut/sablefish
- Non-trawl Catcher/Processors – They have to apply in advance

**No selection for observer coverage**
- Vessels using Electronic Monitoring (EM, 30% selection rate)
- 40 feet and under
- Jig Catcher Vessels
- No FFP (can only fish inside three miles)
- State Guideline Harvest Level fisheries
Partial Coverage Groundfish Observer Rates

- Prior to 2013 observer coverage for CVs >= 60 ft and <125 ft was based on 30% of fishing days by gear and quarter, >= 125 ft CVs and CPs were 100%
- 2013 observer program restructured
- In 2013 and 2014 partial observer coverage rates were the same for all gear types on vessels 57.5 feet and larger
  - 14.5% in 2013
  - 16% in 2014
- 2015 partial observer coverage rates were split by vessel size
  - 24% on vessels 57.5 feet and larger
  - 12% on vessels 40-57.5 feet

<table>
<thead>
<tr>
<th>Year</th>
<th>EM</th>
<th>Trawl</th>
<th>Tender Trawl</th>
<th>HAL</th>
<th>Tender HAL</th>
<th>Pot</th>
<th>Tender Pot</th>
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<tbody>
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<td>28%</td>
<td>NA</td>
<td>15%</td>
<td>NA</td>
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<td>2018</td>
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<td>17%</td>
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<tr>
<td>2019</td>
<td>30%</td>
<td>24%</td>
<td>27%</td>
<td>18%</td>
<td>NA</td>
<td>15%</td>
<td>16%</td>
</tr>
<tr>
<td>2020</td>
<td>30%</td>
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<td>2021</td>
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<td>NA</td>
<td>15%</td>
<td>NA</td>
<td>15%</td>
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<tr>
<td>2022</td>
<td>30%</td>
<td>30%</td>
<td>NA</td>
<td>19%</td>
<td>NA</td>
<td>17%</td>
<td>NA</td>
</tr>
</tbody>
</table>
Electronic Monitoring (EM) on Hook-and-Line and Pot Gear vs Trawl Gear

- **Hook-and-line and pot** (began in 2018)
  - EM for catch estimations
  - Cameras must be on for entire trip when selected
  - Discarding of some bycatch is allowed (no discarding of IR/IU species or rockfish)
  - All video is reviewed to identify and count discards
  - EM reviewers have a hard time identifying crab to species
    - Currently crab that are not identified to species do not count towards any stock species.

- **Pelagic trawl pollock** (began in 2020 with Exempted Fishing Permit)
  - EM for compliance monitoring
  - Cameras must be on 100% of the time
  - Operating under maximum retention (jellyfish and large animals like sharks can be discarded but must be reported on the landing report) All video is reviewed to monitor catch handling (i.e. ensure minimal discarding)
  - Observers at the dock monitor 100% of the offload and sample catch
  - All crab bycatch is weighed and counted at the dock
Incidental Crab Catch in Groundfish Fisheries

- All weights are in kilograms
- Mortality has been applied (50% for fixed gear and 80% for trawl gear)
- All weights are extrapolated from observer/EM data
- All weights came from AKFIN database
- Incidental catch data in this presentation are for the crab year (July 1 to June 30) except for Pribilof Island Golden king crab and Norton Sound red king crab which are a calendar year
- Fixed gear includes pot, hook-and-line, and jig
- Trawl gear includes non-pelagic and pelagic trawl
• Not much federal fixed gear fishing in this area.
• Not very much fixed gear observer coverage.
• Majority of 2021/22 bycatch occurred in July.
• In recent years A80 has been targeting both Atka mackerel and rockfish within the same trip.
• Most RKC is found while fishing in the summer months (June – August).
• “Other” species includes: Kamchatka flounder, Pacific cod, and pollock.
2021/22 Tanner W + snow crab directed fisheries

- Excludes stat areas with <3 vessels
- BBRKC cost recovery fishery
BBRKC

2021/22 fishery closed
Bristol Bay Red King Crab Harvest Strategy

1. Stock threshold for opening fishery:
   • 8.4-million mature-sized females (≥ 90 mm CL), and
   • 14.5-mill lb of effective spawning biomass (ESB)

2. Exploitation rate on mature-sized (≥120-mm CL) male abundance:
   • 10%, when ESB <34.75-mill lb
   • 12.5%, when ESB is between 34.75-mill lb and 55.0-mill lb
   • 15%, when ESB ≥55.0-mill lb

3. Harvest capped at 50% of legal male abundance
Millions of crab Mature Females

Area-swept 2021 model closure threshold

Upper 95% CI for model estimate below threshold

Millions of crab

- Area-swept
- 2021 model
- Closure threshold

2018 2019 2020 2021 2022
Mature Female Abundance Threshold

• Blunt tool meant to avoid recruitment overfishing

• **8.4 million MFA threshold**: estimated at 20% of equilibrium level of fertilized females from Ricker stock-recruitment curve ("Thompson's rule", Thompson 1990)
  
  • Defined as the minimum mature female abundance "that allows sufficient recruitment so that the stock can eventually reach a level that produces MSY" (1989 BSAI Crab FMP)

2021/22 Cost recovery fishery
- 38,465 lbs
- 6,230 crab
Observer data in CR fisheries

Proportion crab in observed pots vs Carapace length (mm) for 2006-2020 and 2021.
Cost recovery fisheries

CR retained catch

Mean CL (mm)
Bristol Bay Red King Crab Incidental Catch in Groundfish Fisheries

- In most years there is more RKC bycatch in the Pacific cod pot fisheries in the fall. Observers reported more females in pot gear than in trawl gear in the past eight years in BB: 72%-91% female in pot gear vs 20%-46% in trawl gear.

- Lower RKC rates during the 2020/21 crab year in the fixed gear sectors could be due to:
  - Lower observer coverage in the pot Pacific cod fishery in the fall of 2020 due to COVID (although there was EM data in this sector)
  - Lower Pacific cod TACs
  - Pacific cod pot fleet using more gear with crab excluders
• Rock sole and yellowfin sole are often targeted during the same fishing trip.
• “Other” species includes: Alaska plaice, arrowtooth flounder, Atka mackerel, Greenland turbot, Kamchatka flounder, other flatfish, Pacific cod, rockfish, and pollock.
• Red king crab savings subarea in Bristol Bay was closed to nonpelagic trawl in 2022.

Bycatch of BBRKC in trawl gear typically occurs throughout the crab year.
• In 2021/22 bycatch peaked in August during the yellowfin sole fishery due to high red king crab rates in the stock area.
• The majority of yellowfin sole harvest in the stock area occurred Feb-May when the crab rates were lower.
Rate of red king crab in pot gear in 2021 Calendar Year

2021 Red King Crab Rate (Pot Gear)
- less than .1 crab/mt
- .10 - .50 crab/mt
- .51 - 1.0 crab/mt
- 1.01 - 5.0 crab/mt
- 5.01 - 10 crab/mt
- Great than 10 crab/mt

Red King Crab Savings Area

Red King Crab Savings Subarea

Area T

Zone 1

NOAA FISHERIES

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Page 10
Rate of red king crab in trawl gear in 2021 Calendar Year
Snow crab
2021 retained catch CPUE lowest in rationalized time series
2021/22 snow crab retained catch

* Excludes stat areas with <3 vessels
2021/22
snow crab
CPUE

* Excludes stat areas with <3 vessels
Snow crab weighted mean centers of catch

Centroid latitude (degree N)

fish_year
- 1984 - 1990
- 1999 - 2005
- 2006 - 2013
- 2014 - 2021

2021/22 snow crab

Proportion of total harvest

snow

1/1/2022
1/8/2022
1/15/2022
1/22/2022
1/29/2022
2/5/2022
2/12/2022
2/19/2022
2/26/2022
3/5/2022
3/12/2022
3/19/2022
3/26/2022
4/2/2022
4/9/2022
4/16/2022
4/23/2022
4/30/2022
5/7/2022
5/14/2022
5/21/2022
~50% of harvest occurred ~Feb

Survey occurs in June+ July

~6 months between

Purple = 2022 survey abundance 4 inch males
Blue = 2021/22 fishery harvest
2021/22 Snow crab: observations from the fleet

• Captains reported much smaller areas of high CPUE fishing compared to 2020/21.

• Most of the season described by captains as “pothole fishing” where there were only small pockets of high CPUE fishing that didn’t hold up to setting gear back on.

• Heavy freezing spray conditions and significant sea ice coverage throughout most of the season made operating especially challenging.
Snow crab discard mortality rate

lb bycatch mortality per lb retained catch

- 0.302 in 2020
- 0.243 in a year before 2020
- 0.089 in 2005

Years: 2005 to 2020
Declining retained catch mean wts
Increasing proportion sub-4-inch crab
I.e., Retaining more small crab
Bering Sea Snow Crab Incidental Catch in Groundfish Fisheries

- Pot and hook-and-line Pacific cod fishing accounts for most BSS bycatch in the fixed gear category.
- Hook-and-line Pacific cod fishing is spread out throughout the stock area.
- Pot Pacific cod fishing is concentrated on the north side of Unimak Island to Port Moller.
• 2018/19 and 2019/20 increased BSS bycatch in the yellowfin fishery was due mainly to increased yellowfin sole fishing in the area above the Pribilof Islands.

• “Other” species includes: Alaska plaice, arrowtooth flounder, Atka mackerel, Greenland turbot, Kamchatka flounder, other flatfish, Pacific cod, rockfish, and pollock.

• Bycatch of BSS in trawl gear typically occurs throughout the crab year.
• In 2021/22 bycatch was highest in Feb/March during the yellowfin sole fishery.
• Rates are more consistent throughout the year.
• Majority of yellowfin/flathead harvest occurred Feb-May.
Tanner crab
2021/22 TAC East=0, **West=1.1 mil lb**

**Tanner crab retained catch**

- East and west combined

![Graph showing the Tanner crab retained catch over time, with a significant peak in 2015 and a lower value in 2020. The graph indicates a decrease in catch starting from around 2000, with a notable increase in 2015.](image-url)
2021/22
Tanner crab retained catch

* Excludes stat areas with <3 vessels
Retained catch CPUE

Tanner W

2021/22 CPUE approximated rationalized timeseries average, 40 crab/pot
2021/22 Tanner crab

Proportion total harvest

Tanner W

9/25/2021
10/9/2021
10/23/2021
11/6/2021
11/20/2021
12/4/2021
12/18/2021
1/1/2022
1/15/2022
1/29/2022
2/12/2022
2/26/2022
3/12/2022
3/26/2022
4/9/2022
4/23/2022
5/7/2022
5/21/2022
2021/22 WBT: observations from the fleet

• High CPUE fishing on new-shell crab along the 166° W long. boundary in the southeastern most part of the grounds. Some captains reported this area was the best Tanner fishing they had ever seen.

• Low CPUE fishing around the Pribilof Islands. Discouraging given that this is the traditional Tanner fishing grounds.

• No effort at all on the east side of the Pribilof Islands due to low CPUE seen in the previous two seasons.

• High concern about bottom trawl flatfish fisheries E/W of the Pribilof Islands impacting both Tanner crab numbers and habitat.

• Observation that the current high CPUE fishing areas in the southeasternmost portion of the grounds are areas that see relatively little bottom trawl effort.
Legal size: 4.4 inches
Preferred size: 5 inches

With small snow crab TAC, there was market for small Tanner crab in place of snow crab.

Most vessels retained down to smaller sizes than in the past.
Non-directed crab fisheries

Bycatch mortality (mill lbs)

- BBRKC
- snow crab

Years: 2004 to 2022
Eastern Bering Sea Tanner Crab Incidental Catch in Groundfish Fisheries (East of 166° W)

- Pacific cod fishing with pot gear accounts for most EBST bycatch in the fixed gear category.
- Pot Pacific cod fishing is concentrated on the north side of Unimak Island to Port Moller.
- Lower EBST rates during the 2020/21 crab year in the fixed gear sectors could be due to:
  - Lower observer coverage in the pot Pacific cod fishery in the fall of 2020 due to COVID (although there was EM data in this sector)
  - Lower Pacific cod TACs
  - Pacific cod pot fleet using more gear with crab excluders

<table>
<thead>
<tr>
<th>Year</th>
<th>Hook-and-line</th>
<th>Pot</th>
<th>Pelagic Trawl</th>
<th>Non-Pelagic Trawl</th>
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<tbody>
<tr>
<td>2012/13</td>
<td>3,353</td>
<td>17,995</td>
<td>101</td>
<td>35,065</td>
</tr>
<tr>
<td>2013/14</td>
<td>4,386</td>
<td>77,984</td>
<td>300</td>
<td>85,534</td>
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<tr>
<td>2014/15</td>
<td>4,765</td>
<td>112,137</td>
<td>6</td>
<td>80,252</td>
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<tr>
<td>2015/16</td>
<td>1,879</td>
<td>127,034</td>
<td>4</td>
<td>28,818</td>
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<tr>
<td>2016/17</td>
<td>2,377</td>
<td>71,494</td>
<td>54</td>
<td>59,675</td>
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<tr>
<td>2017/18</td>
<td>1,434</td>
<td>48,166</td>
<td>63</td>
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<td>2018/19</td>
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<td>2019/20</td>
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<td>2020/21</td>
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<td>8,547</td>
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<td>47,564</td>
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<td>13</td>
<td>23,531</td>
<td>4</td>
<td>43,565</td>
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</tbody>
</table>
The majority of bycatch in 2021/22 was from January to April and again from August to November.

“Other” species includes: Alaska plaice, arrowtooth flounder, Atka mackerel, flathead sole, Greenland turbot, Kamchatka flounder, other flatfish, Pacific cod, rockfish, sablefish, and pollock.

Bycatch of EBST in trawl gear typically occurs throughout the crab year.

In 2021/22 bycatch was highest Sept/Oct during the yellowfin sole fishery due to high Tanner crab rates in the stock area.

Majority of yellowfin harvest in stock area occurred April-May when the crab bycatch rates were lower.
WBST bycatch in fixed gear is mostly from hook-and-line and pot Pacific cod fisheries.

Pot catcher vessels do not fish for groundfish in the WBST stock area as much as in the EBST stock area which results in less fixed gear bycatch in the Western area than the Eastern area.
“Other” species includes: Alaska plaice, arrowtooth flounder, Atka mackerel, Greenland turbot, Kamchatka flounder, other flatfish, Pacific cod, rockfish, sablefish, and Pollock.

Bycatch of WBST in trawl gear typically occurs throughout the crab year.
In 2021/22 bycatch was highest Feb/March during the yellowfin sole fishery.
Rates are more consistent throughout the year.
Majority of yellowfin/flathead harvest in stock area occurred Feb-March
CPUE (legal males per pot)

WAG

2021/22 lowest CPUE in post-rationalization period

- Observer
- Retained catch

CPUE (legal males per pot)
2021/22 Harvest Spatial Distribution

2021/22 Aleutian Islands Golden King Crab Harvest (pounds)

- Daily Fishing Log (DFL) effort
  - 1 - 200,000
  - 200,001 - 400,000
  - 400,001 - 600,000
  - 600,001 - 800,000
2021/22 CPUE Spatial Distribution
2021/22 AIGKC

![Graph showing proportion of total harvest from EAG and WAG over time]

- Proportion total harvest
- EAG
- WAG

Directed AIGKC fishery bycatch mortality rate

lb bycatch mortality per lb retained

EAG
WAG
Eastern Aleutian Islands Golden King Crab Incidental Catch in Groundfish Fisheries (East of 174° W)

- The EAG stock area includes federal groundfish areas from the WGOA, BS, and AI.
- When there is no federal pot Pcod observer/EM coverage in the stock area the State pot vessels get an extrapolation rate based on all observed/EM groundfish targeted with pot gear in the stock area, including sablefish. This is typically the cause of the “spike” years.
The EAG stock area includes federal groundfish areas from the WGOA, BS, and AI. Amendment 80 is targeting a variety of species during the same trip in this stock area. “Other” species includes: Alaska plaice, arrowtooth flounder, Greenland turbot, other flatfish, Pacific cod, flathead sole, rock sole, yellowfin sole, sablefish, and pollock.
Western Aleutian Islands Golden King Crab Incidental Catch in Groundfish Fisheries (West of 174° W)

- Not much federal fixed gear fishing in this area.
- Not very much fixed gear observer coverage.
- When there is no federal pot Pcod observer/EM coverage in the stock area the State pot vessels get an extrapolation rate based on all observed/EM groundfish targeted with pot gear stock area, including sablefish. This is typically the cause of the “spike” years.
Most trawl bycatch accrues in the summer months.

“Other” species includes: Kamchatka flounder, Pacific cod, and pollock.
PIGKC
2021 Pribilof GKC

- Fishery conducted by calendar year
- 4 vessels participated in the 2021 fishery
  - GHL = 130,000 lb (59 t)
  - Harvest = 34,216 lb
Observer pot location during Bering Sea golden king crab fisheries from 1992-2021 (n=7,977).

Pots north of the Pribilof District northern boundary were fished during the Northern District – Saint Matthew island Section fishery.

~95% of all observer pots
67% of all historical catch

Proportion of historical catch by stat_area

67% of all historical catch
2021 PIGKC

Proportion total harvest

PIGKC

0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
• Most fixed gear GKC bycatch is from hook-and-line Pacific cod fishing.
Majority of bycatch occurred from June through August in 2021.

“Other” species includes: Alaska plaice, Atka mackerel, other flatfish, Pacific cod, rockfish, rock sole, yellowfin sole, sablefish, and pollock.
Other BSAI crab stocks
SMBKC: non-directed crab fishery bycatch
Saint Matthew Islands Blue King Crab Incidental Catch in Groundfish Fisheries

- Overfished stock.
- Very little trawling in this stock area due to trawl closure areas.
- Fixed gear trip targets in this area include halibut, Greenland turbot, sablefish, and Pacific cod.
- BKC is usually seen in the Pacific cod trip target for fixed gear (hook-and-line and pot).
Pribilof Islands Red King Crab Incidental Catch in Groundfish Fisheries

- Pot and trawl gear are prohibited in the Pribilof Islands Habitat Conservation Zone which is in place to protect blue king crab.
- Most fixed gear fishing in this area is with hook-and-line gear targeting Pacific cod.
In the 2020/21 crab year most of the RKC found in the “other” category were during trips with the Alaska Plaice target in March 2021.

“Other” species includes: Alaska plaice, arrowtooth flounder, Atka mackerel, Greenland turbot, Kamchatka flounder, other flatfish, Pacific cod, rockfish, and pollock.

Majority of 2021/22 bycatch was from yellowfin sole and flathead sole fishing in September.

“Other” species includes: Alaska plaice, arrowtooth flounder, Atka mackerel, Greenland turbot, Kamchatka flounder, other flatfish, Pacific cod, rockfish, and pollock.
Pot and trawl gear are prohibited in the Pribilof Islands Habitat Conservation Zone which is in place to protect blue king crab.

- Overfished stock.
- Overfishing occurred in the 2015/16 crab year.
- Most fixed gear fishing in this area is with hook-and-line gear targeting Pacific cod.
During the 2020/21 crab year, trawling occurred in the same areas as previous years but no BKC was reported by observers.

Majority of bycatch in 2021/22 crab year occurred in May in the yellowfin sole fishery.

“Other” species includes: Alaska plaice, arrowtooth flounder, Atka mackerel, Greenland turbot, Kamchatka flounder, other flatfish, Pacific cod, rockfish, and pollock.
Norton Sound Red King Crab Incidental Catch in Groundfish Fisheries

- 2009 – 2017: no RKC bycatch in NSRKC stock area
- In 2018: 8 kg of RKC bycatch (mortality applied)
- In 2019: 13 kg of RKC bycatch (mortality applied)
- In 2020 and 2021: less than 1 kg of RKC bycatch
Thank you

Photo courtesy of Sam Zmolek