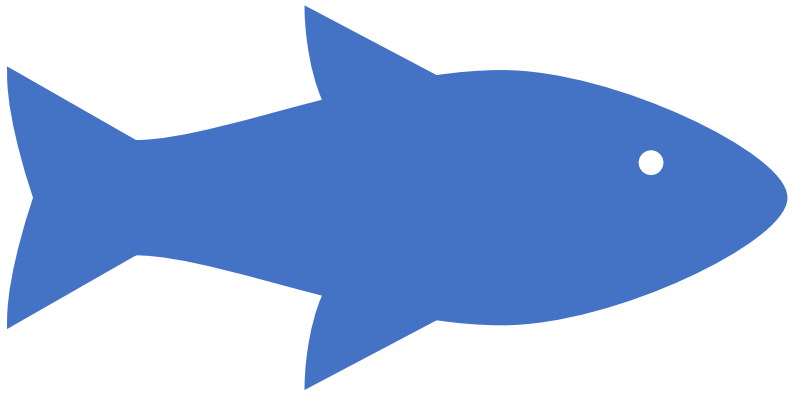


Bering Sea Aleutian Island and Gulf of Alaska cod assessment and management

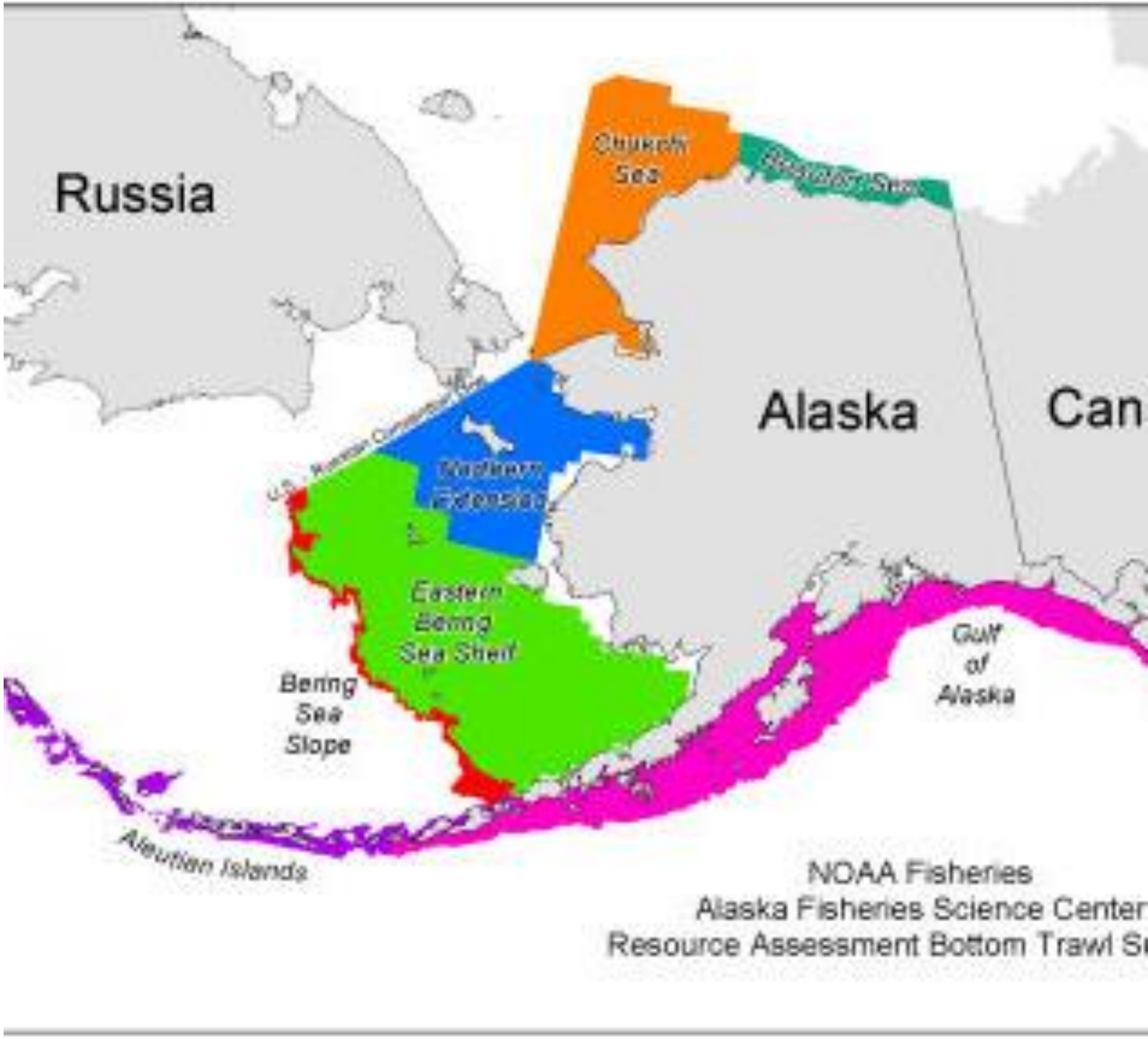
Diana Stram (NPFMC) and Josh Keaton (NMFS)

Joint Protocol Committee

October 13, 2022

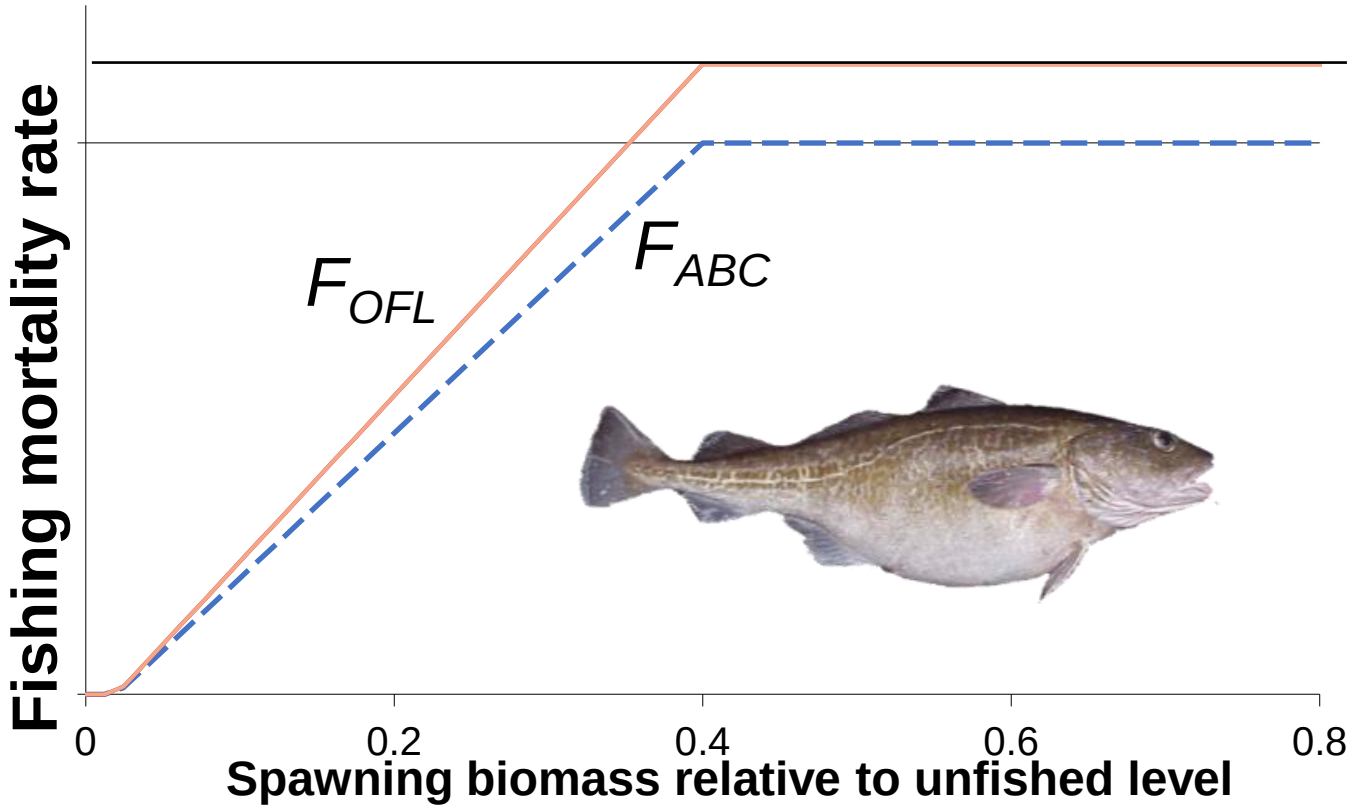
3 managed stocks

- Bering Sea
- Aleutian Islands
- Gulf of Alaska



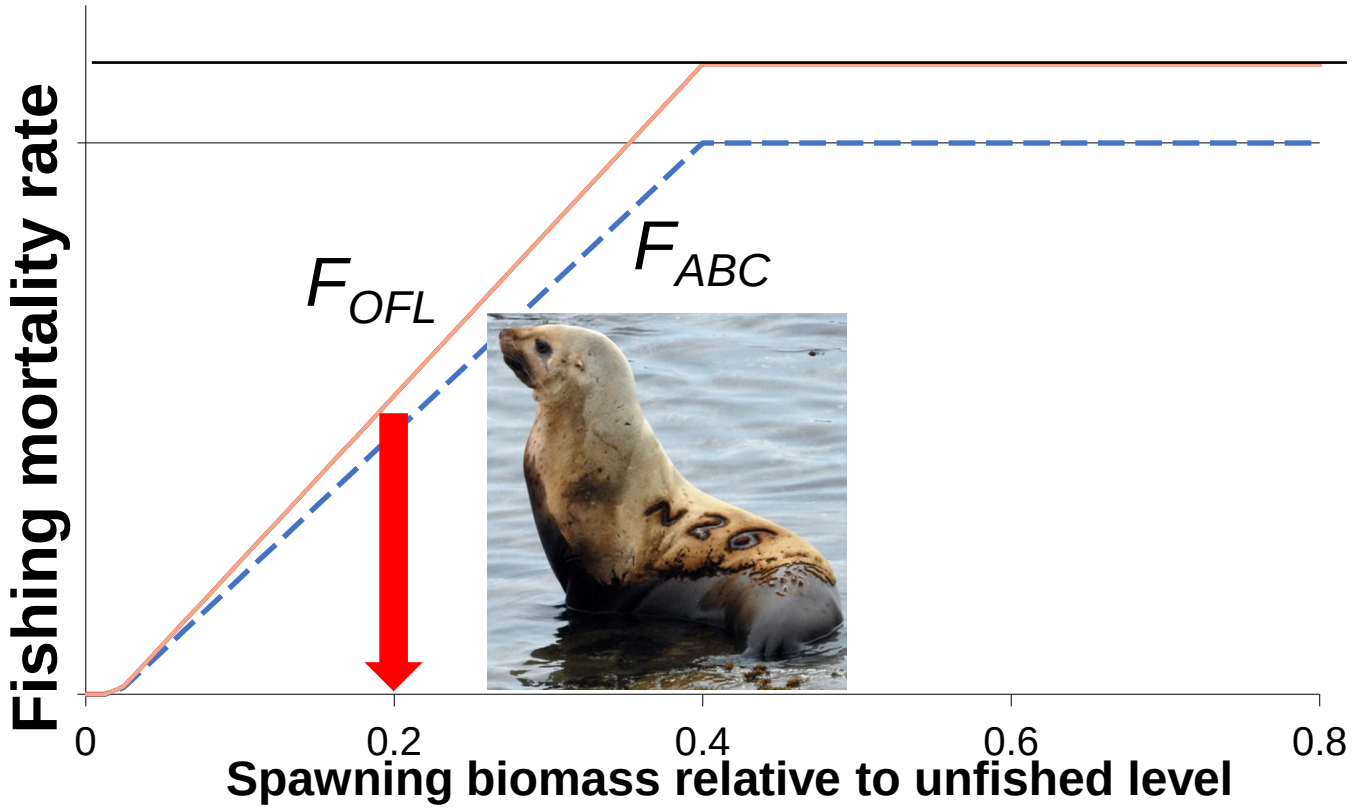
BSAI Pacific cod assessment

- Managed as a single unit stock from 1977-2013
  - Tagging studies show migration within and between EBS, AI, GOA
- Research indicated discrete stocks between EBS and AI (Canino et al., 2005, Cunningham et al. 2009, Canino et al, 2010, Spies 2012)
- 2014-on separate harvest specifications by area (EBS and AI)



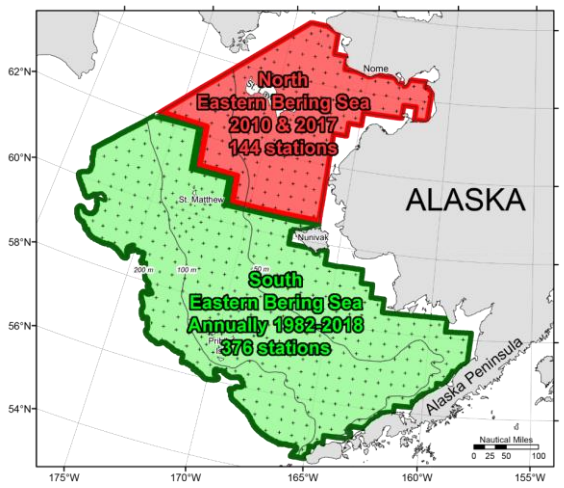
- Sloping control rule to set specifications.
- Control rule provides for automatic rebuilding below 40% of unfished level

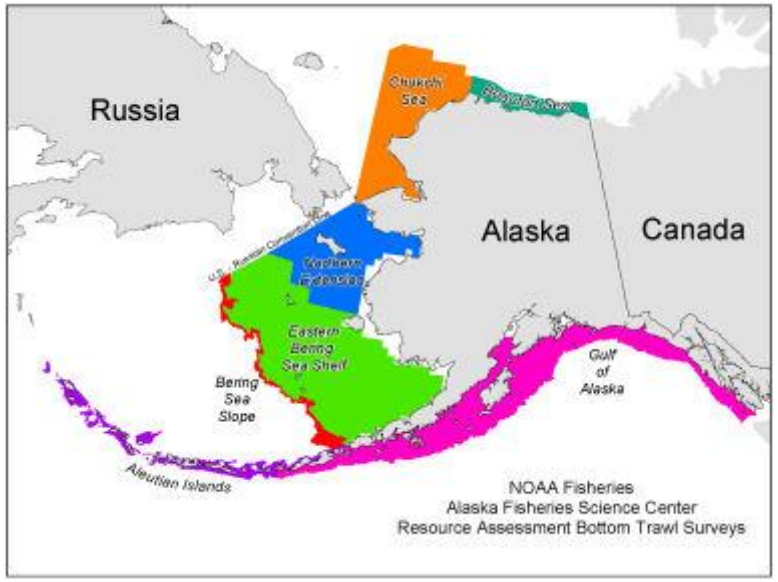
Control rule for cod



Directed fishery = 0 at ≤20% of unfished level

Control rule for cod, pollock and Atka mackerel

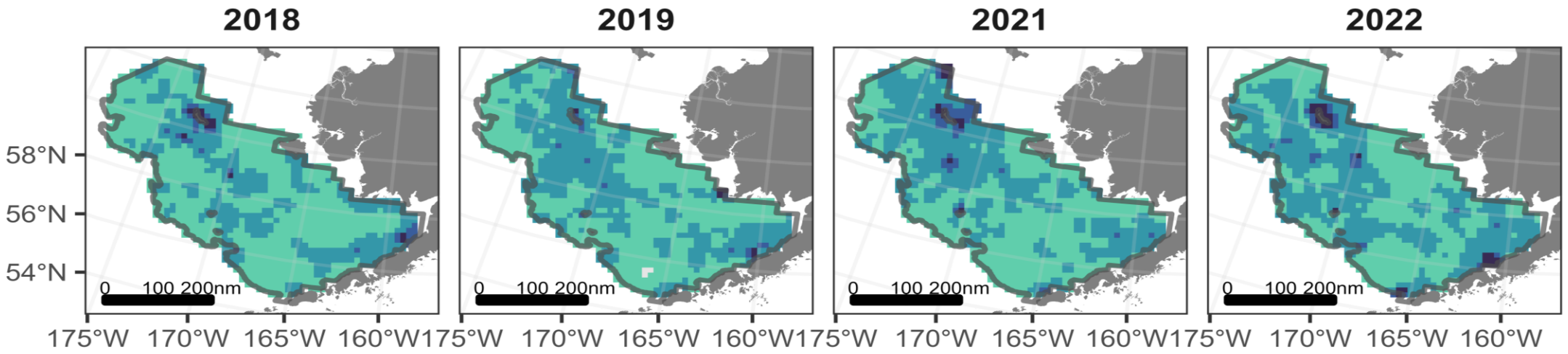




Bering Sea cod

- Beginning in 2022 ensemble model approach employed in assessment which includes information from both the EBS and NBS

Pacific Cod Distribution

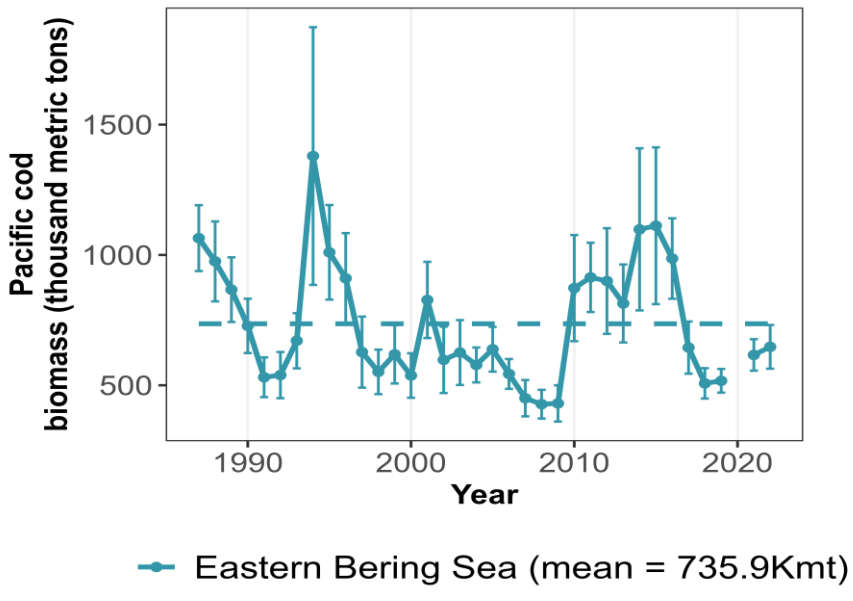


Pacific cod
relative biomass (kg/ha)

No catch >0–10 >10–30 >30–50 >50–150 >150–167

Eastern Bering Sea

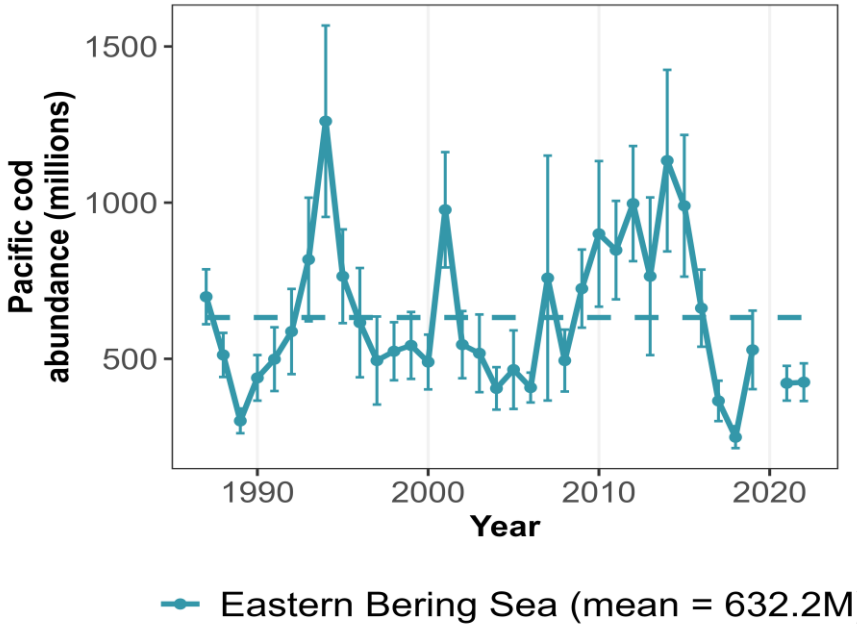
2022 Bering Sea survey



EBS Biomass
2022: 647 Kmt
2021: 616 Kmt
(5.03%)

EBS + NBS
2022: 801 Kmt
2021: 844 Kmt
(-5.1%)

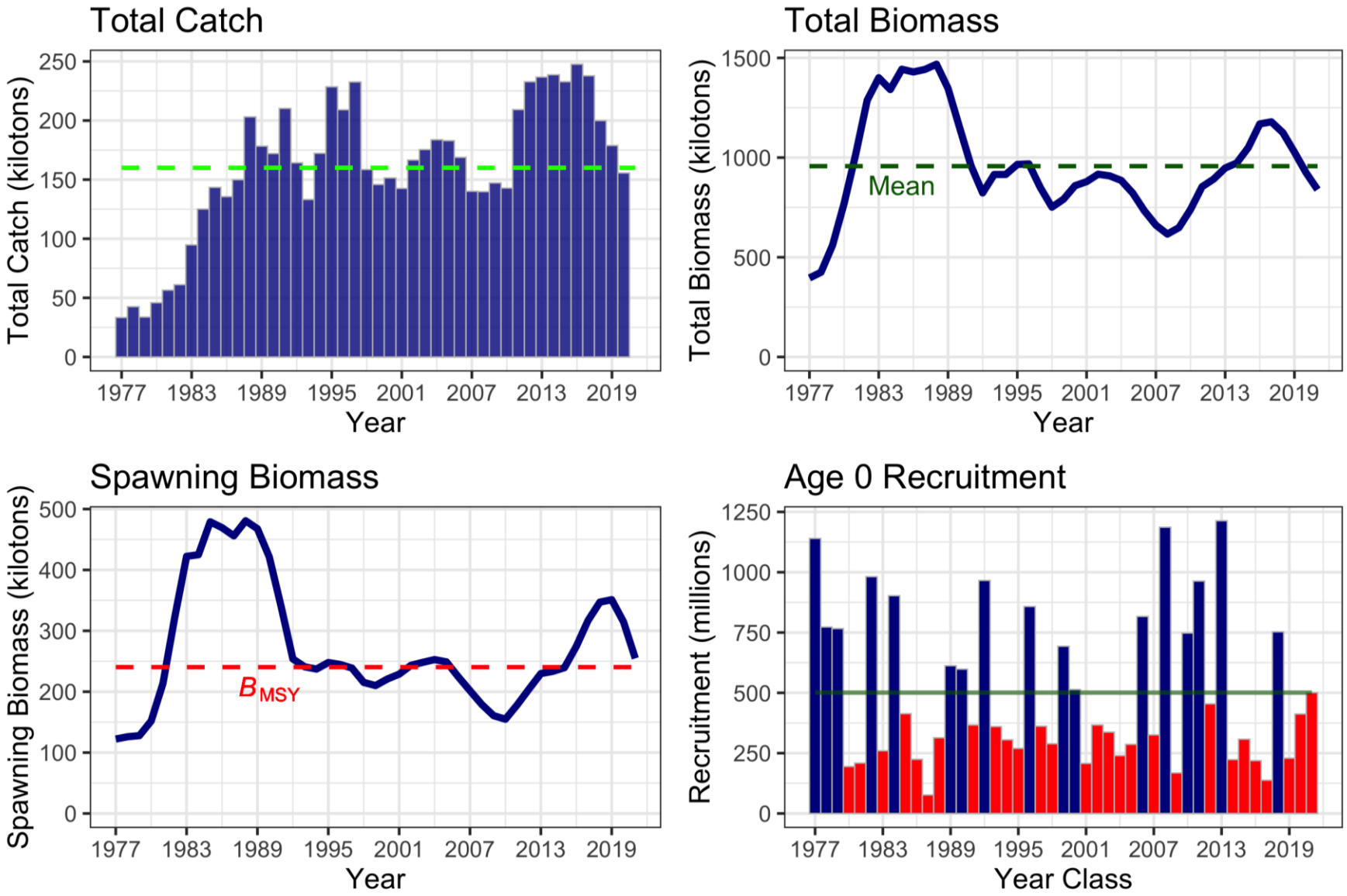
Biomass in millions MT



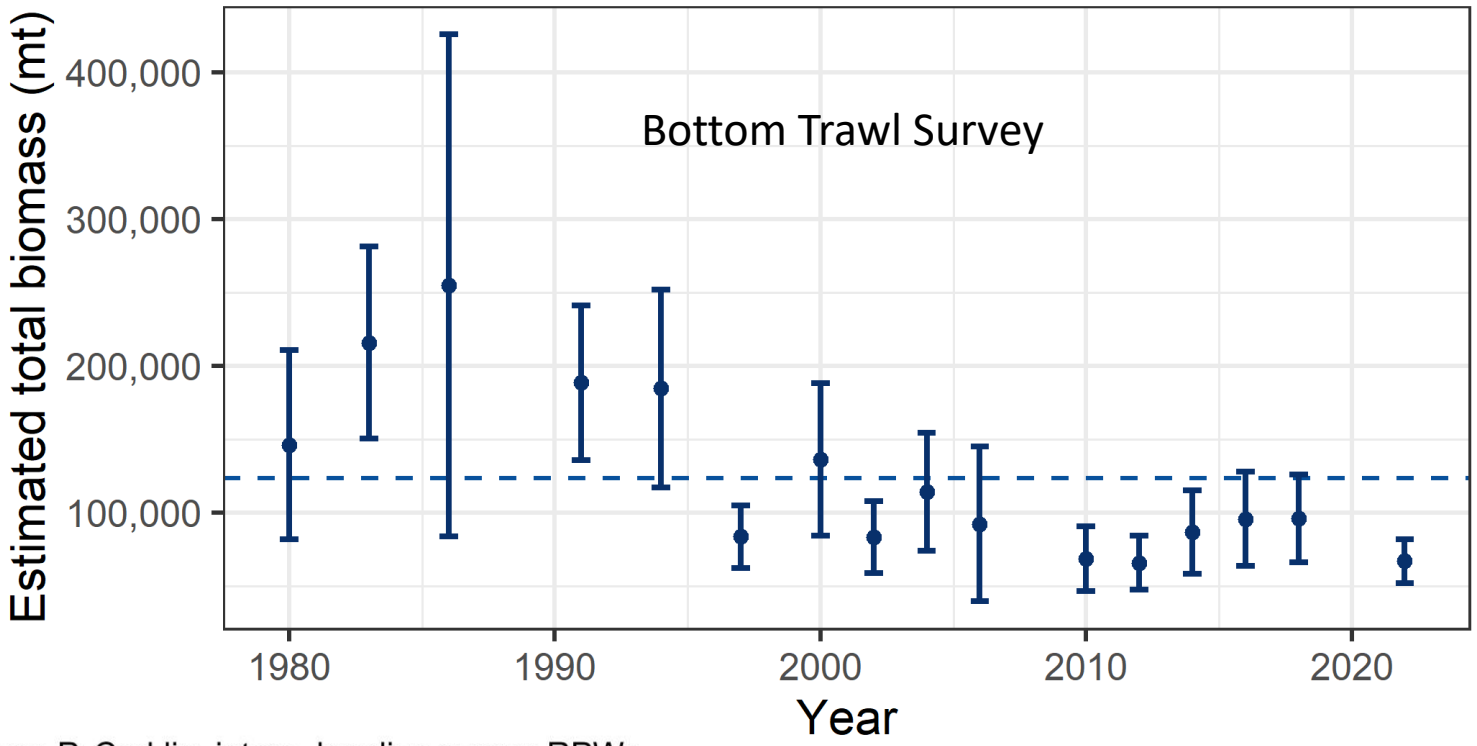
EBS Abundance
2022: 425 M
2021: 422 M
(1%)

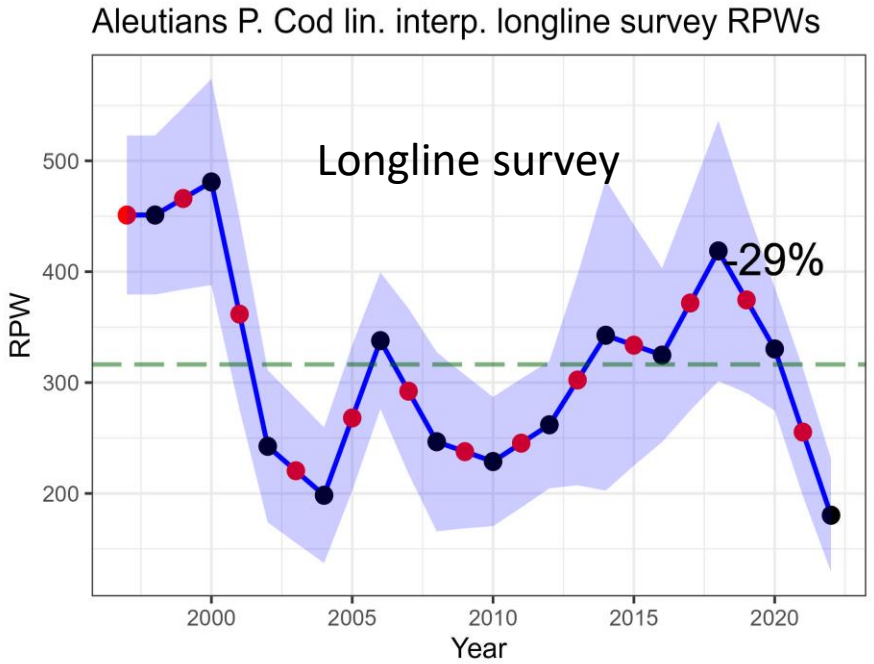
Abundance in billions of fish

EBS cod

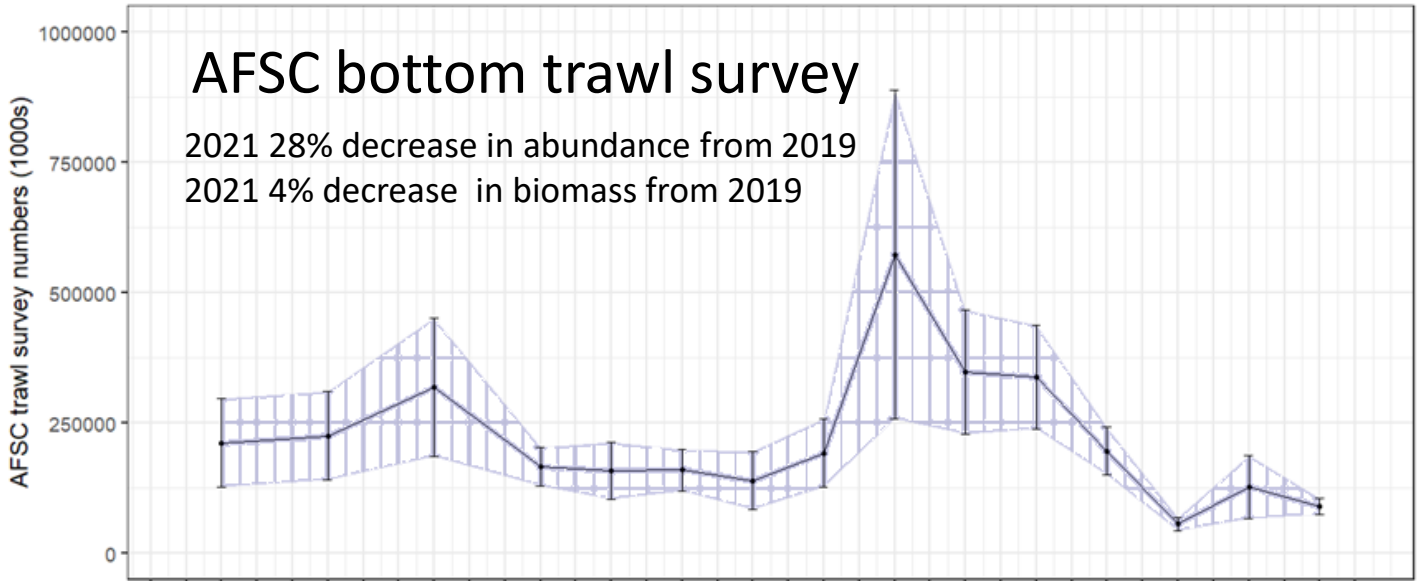

Total Catch
Total Catch (kilotons)
0
50
100
150
200
250
1977
1983
1989
1995
2001
2007
2013
2019
Year
Total Biomass
Total Biomass (kilotons)
0
500
1000
1500
Mean
1977
1983
1989
1995
2001
2007
2013
2019
Year
Spawning Biomass
Spawning Biomass (kilotons)
0
100
200
300
400
500
B_{MSY}
1977
1983
1989
1995
2001
2007
2013
2019
Year
Age 0 Recruitment
Recruitment (millions)
0
250
500
750
1000
1250
1977
1983
1989
1995
2001
2007
2013
2019
Year Class

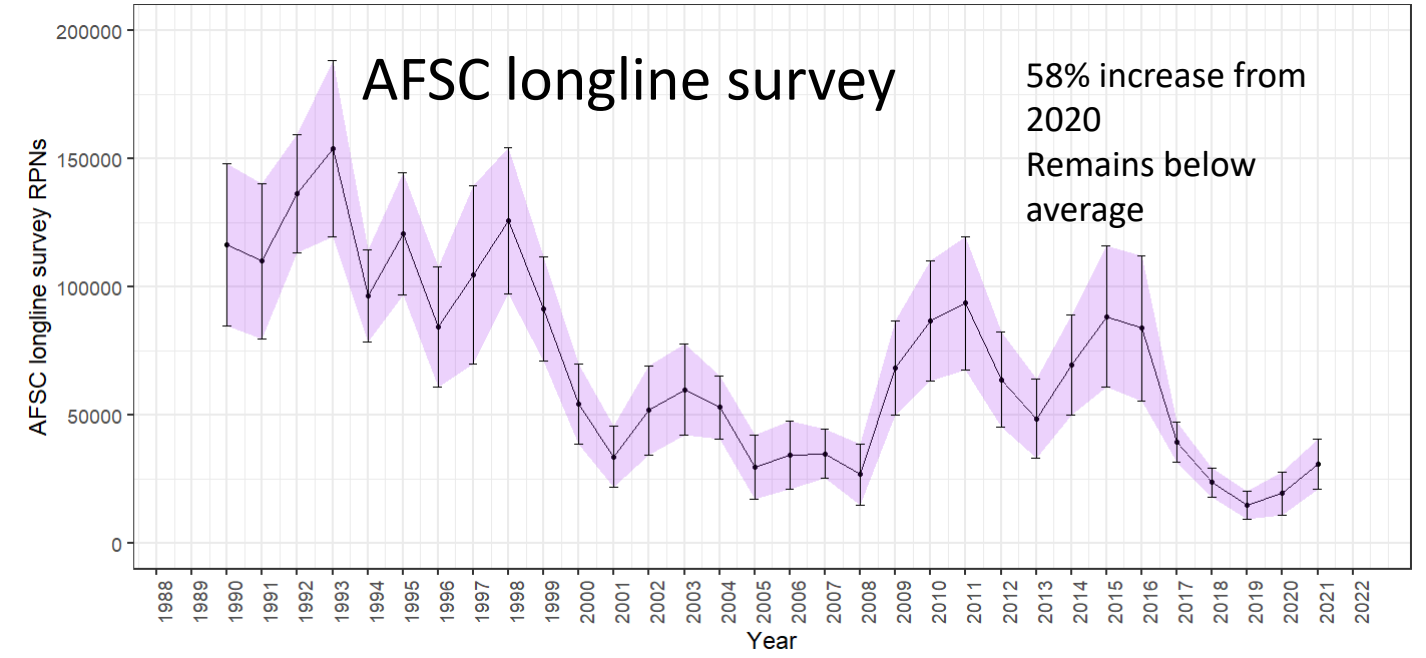
Aleutian Islands survey biomass



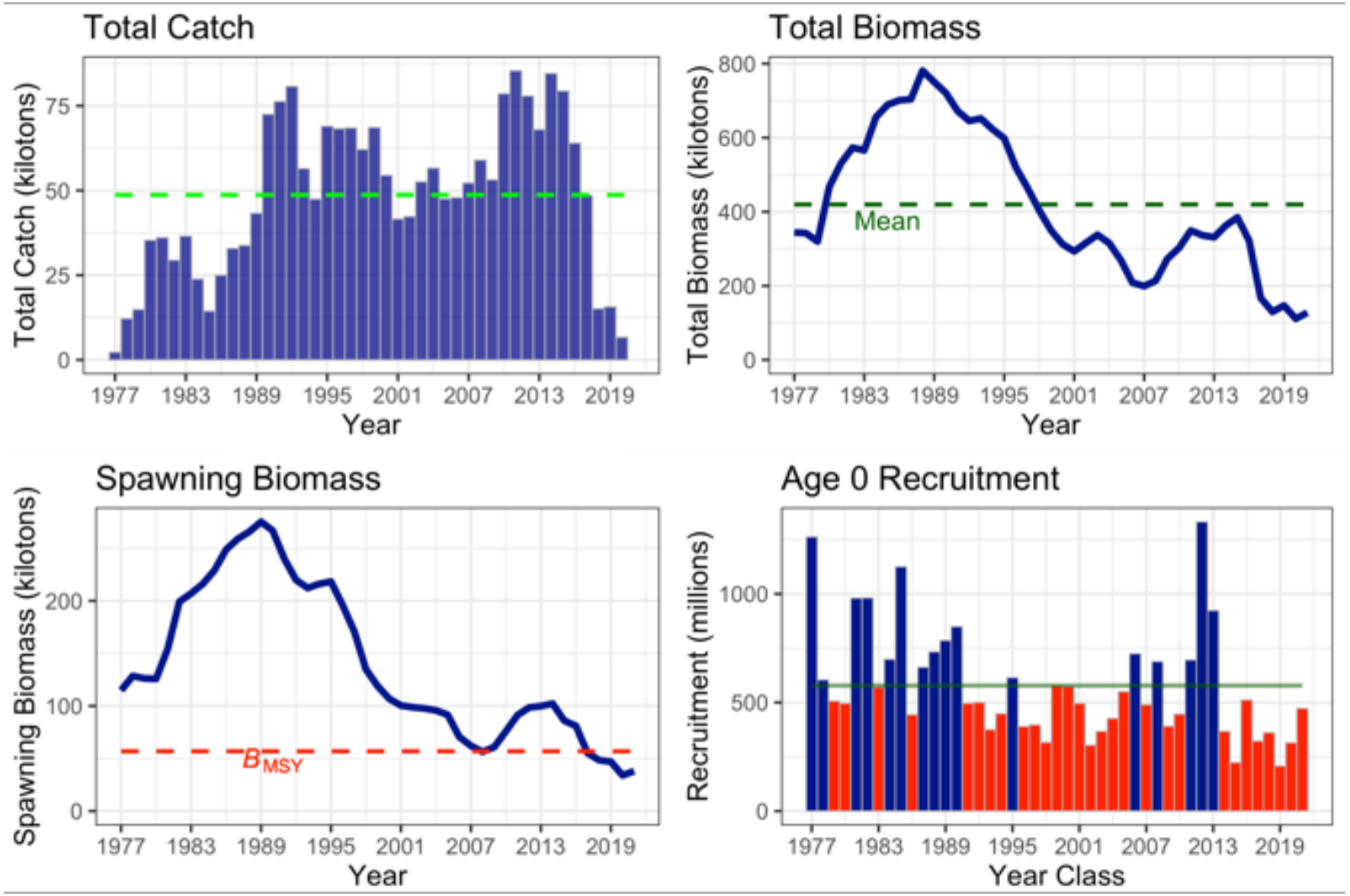


Gulf of Alaska cod





GOA cod assessment



Cod genomic studies of population structure

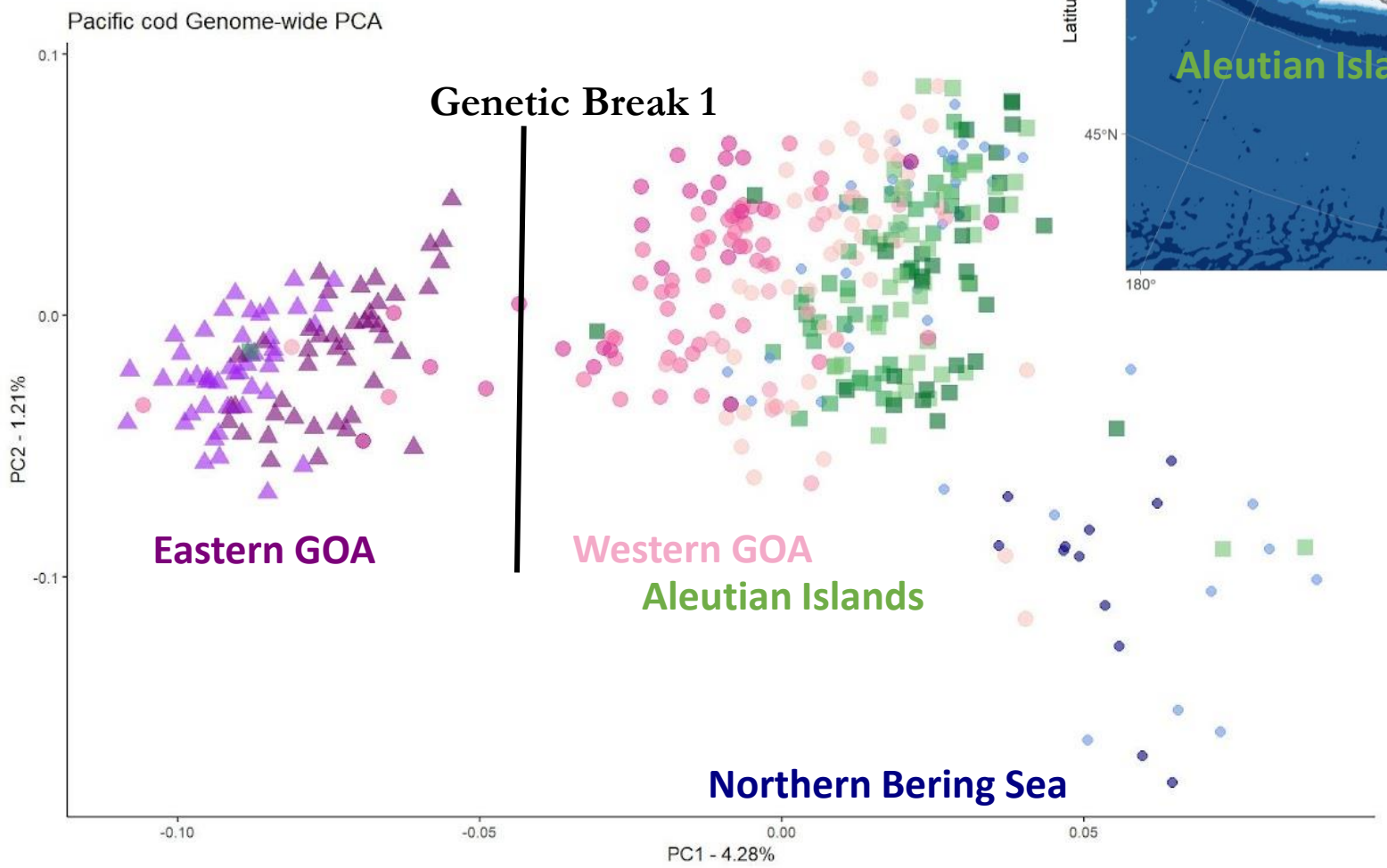
From Schall et al 2022 September Groundfish Plan Team presentation

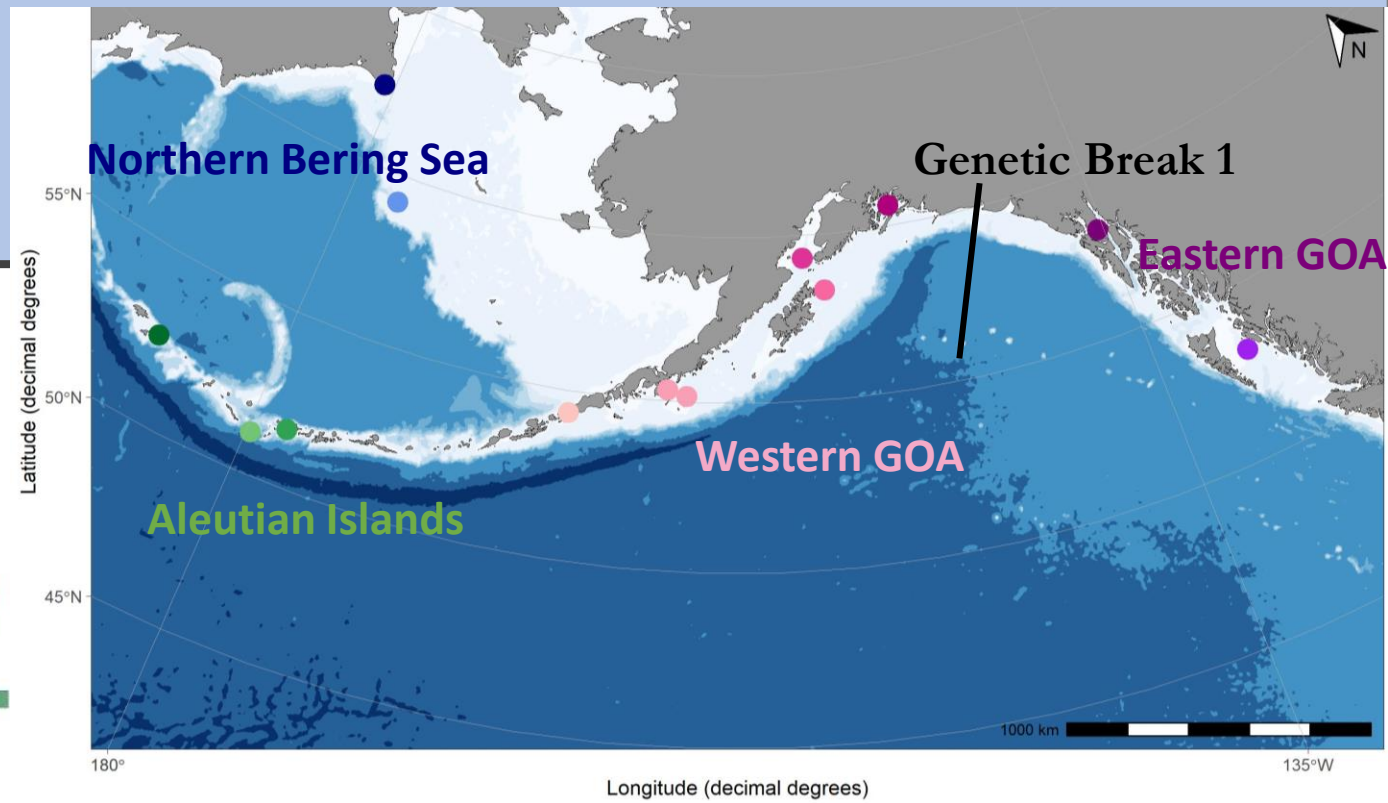
Whole genome sequencing

- developing a more complete suite of markers for classifying differentiation among BSAI and GOA spawning stocks

Whole genome sequencing

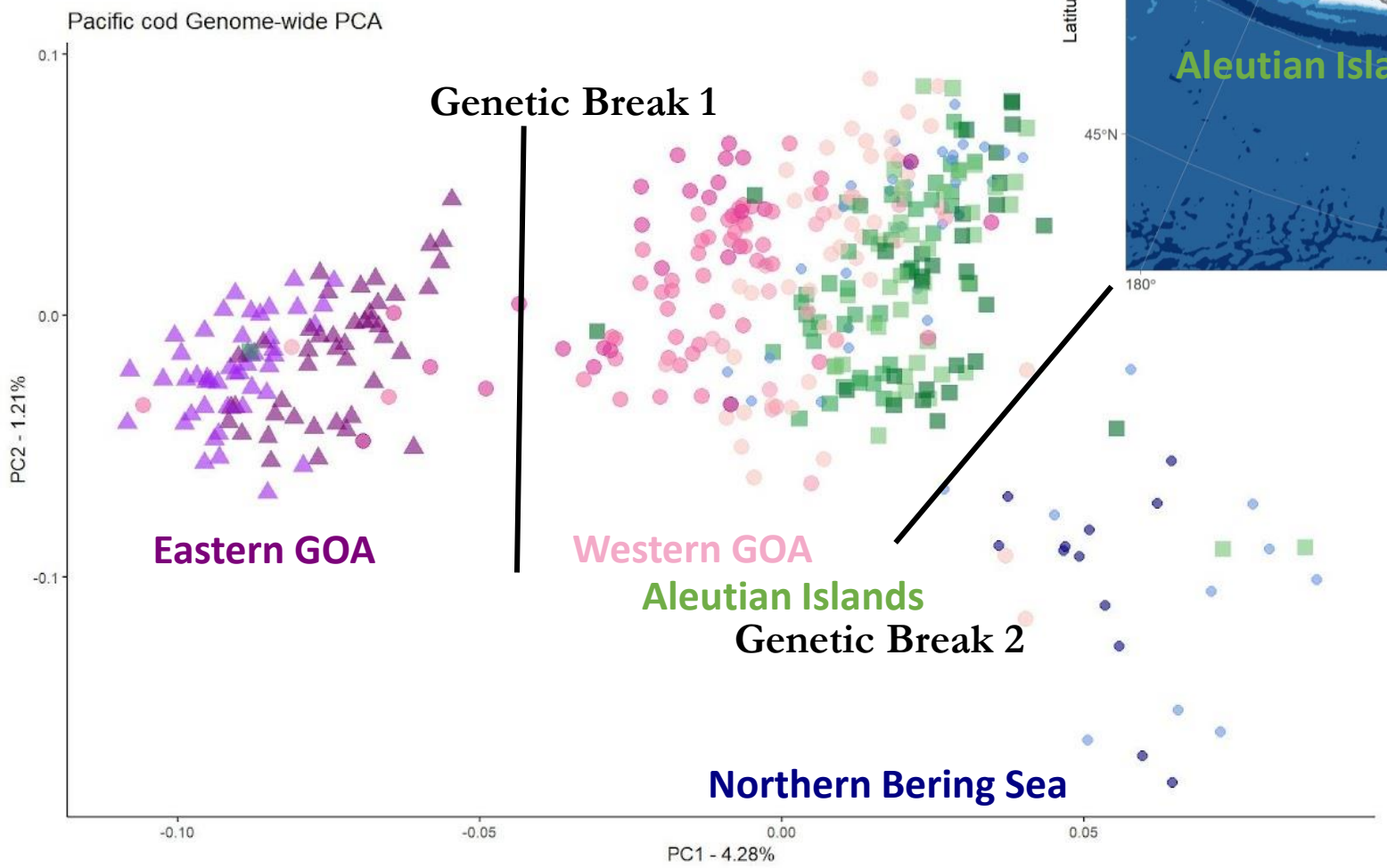
Two major genetic breaks representing reduced gene flow.

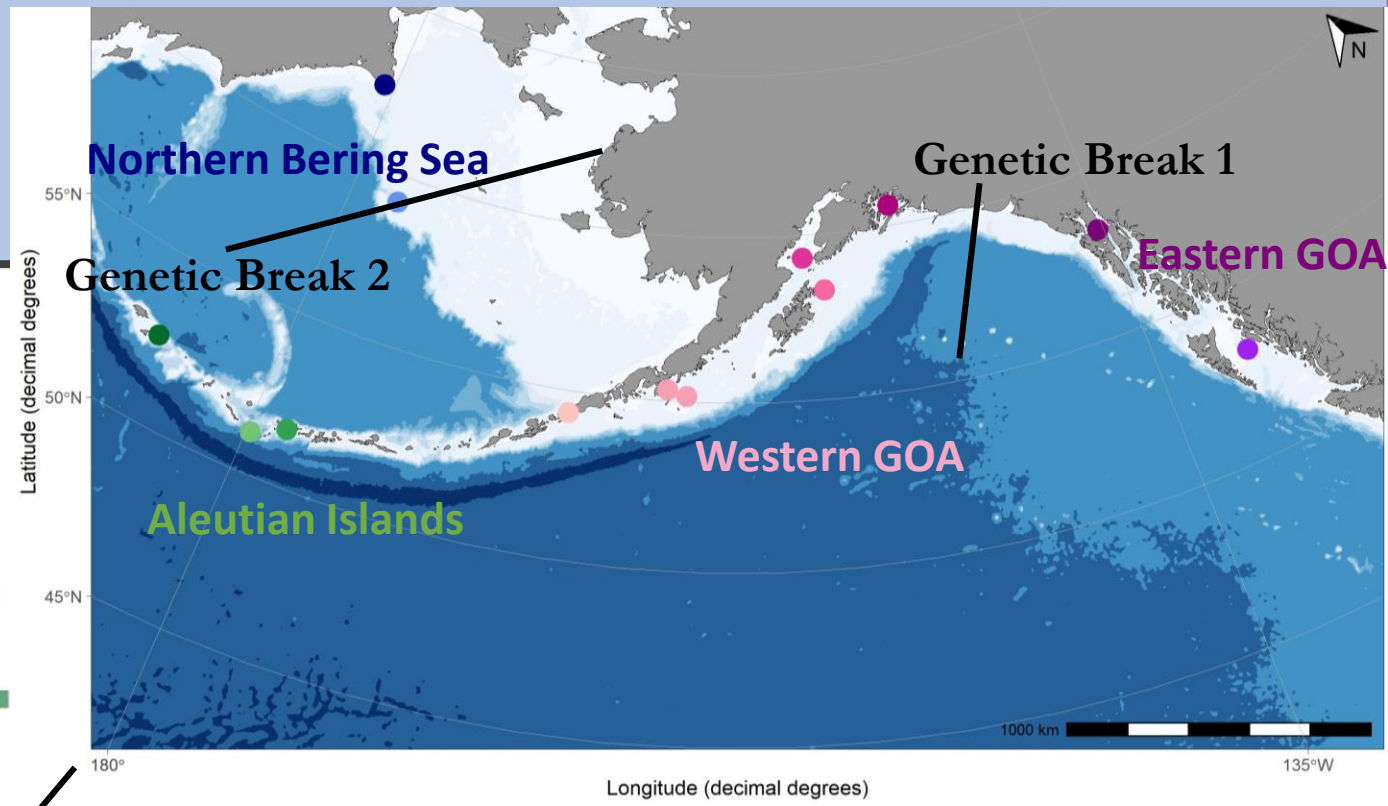




Whole genome sequencing

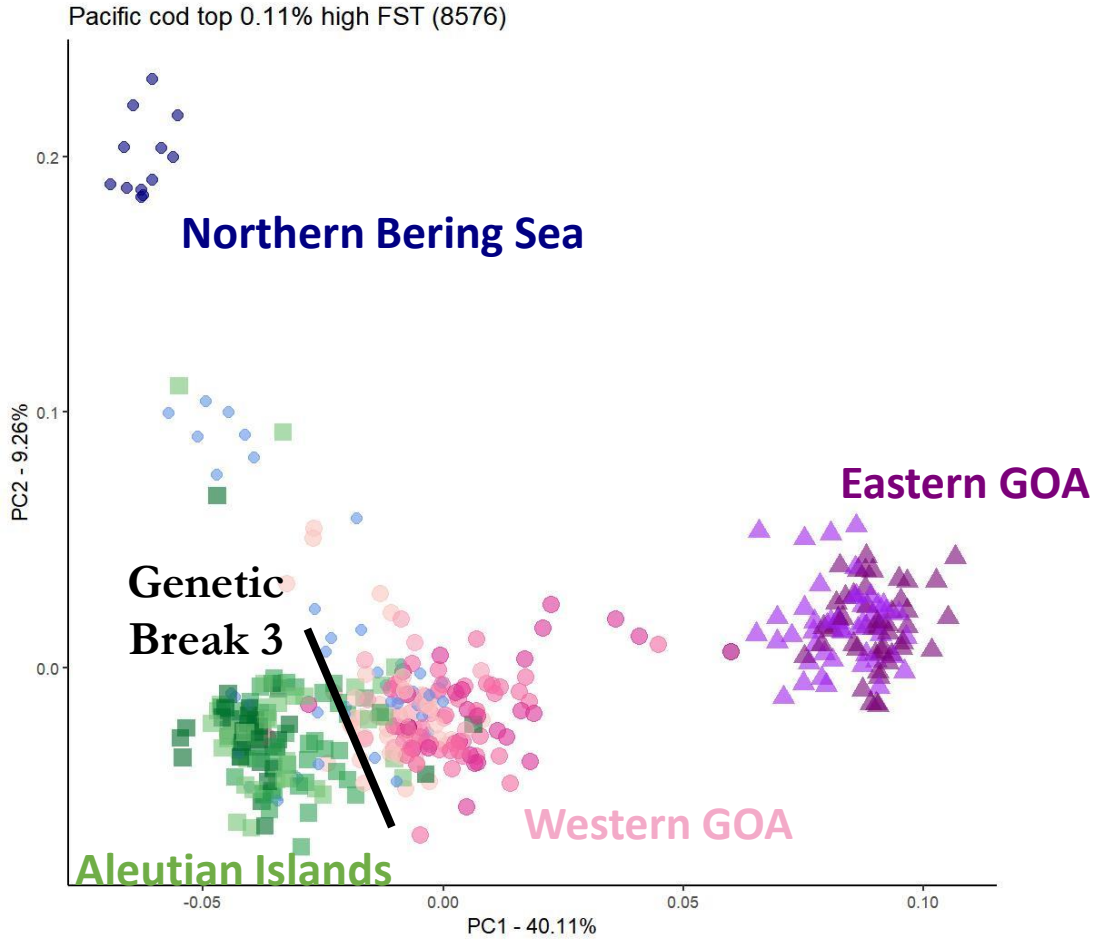
Two major genetic breaks representing reduced gene flow.

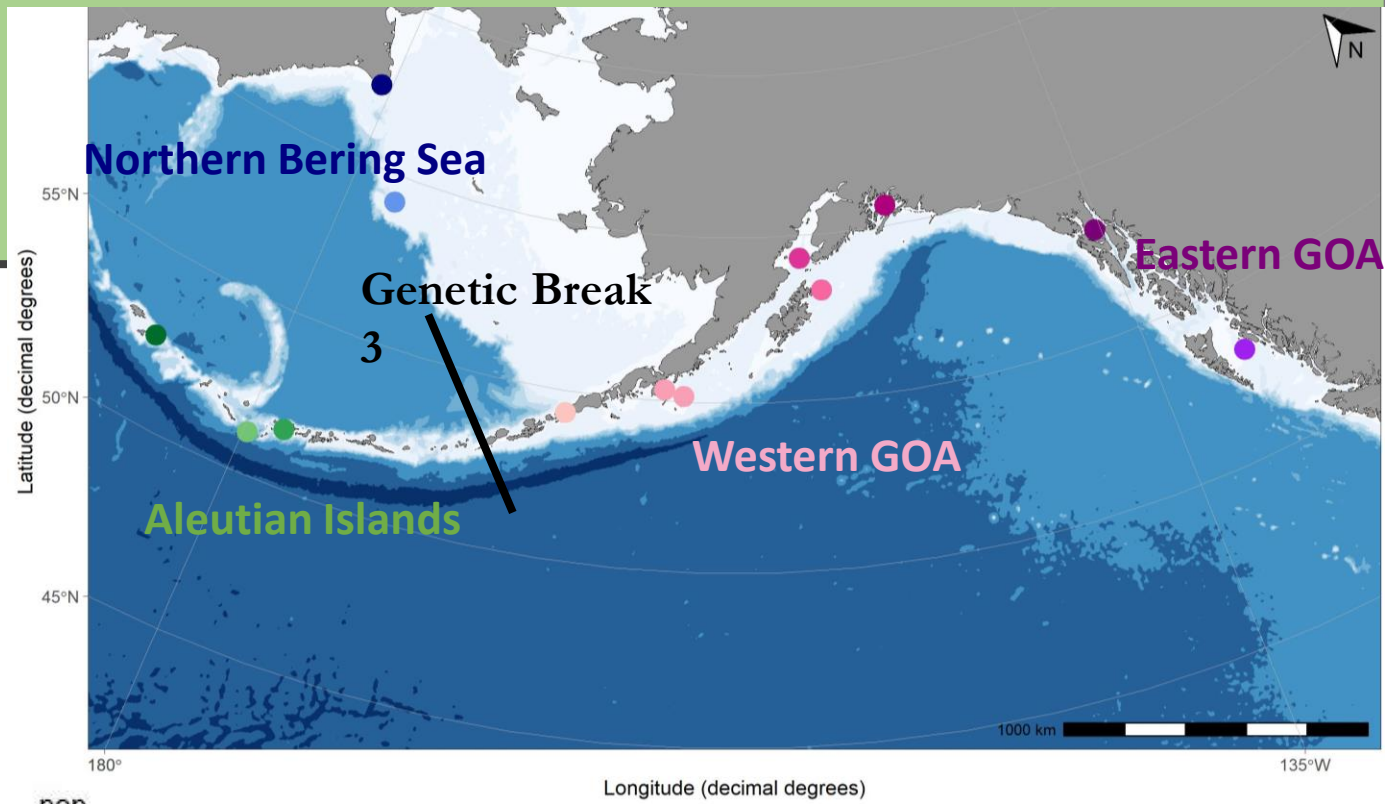


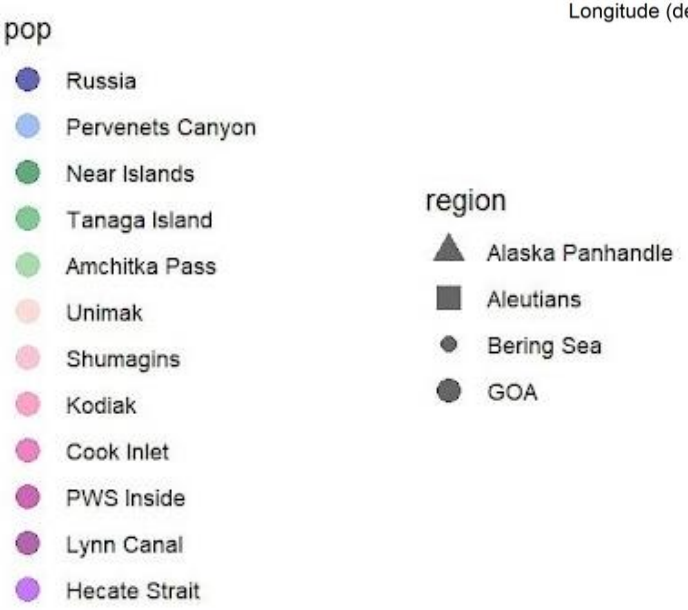


Whole genome sequencing

Genetic break found with adaptive markers between Aleutian Islands and wGOA due to putative divergent selection





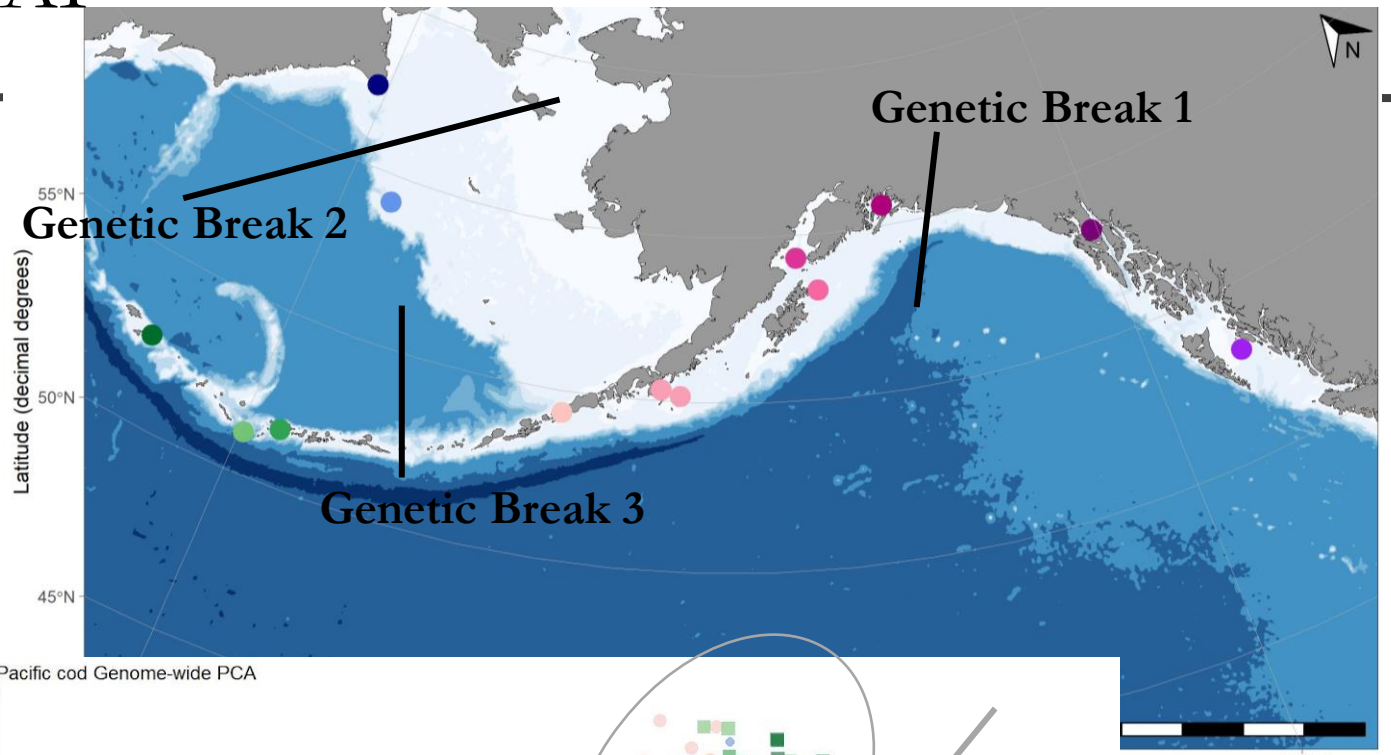


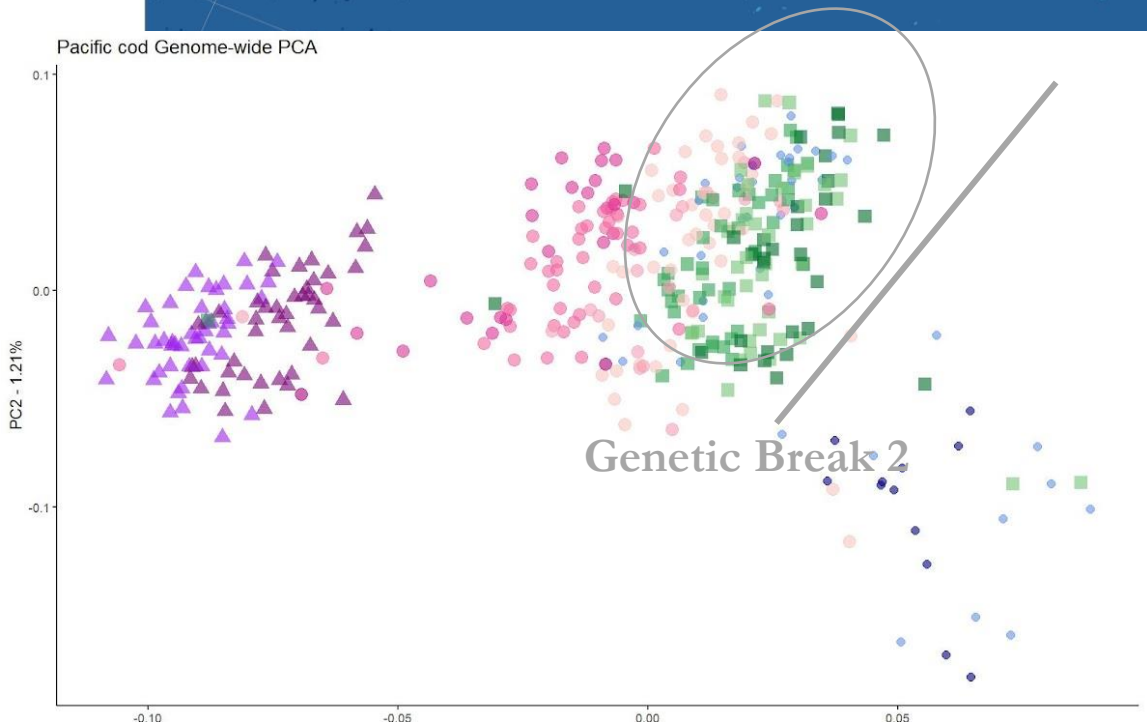
Genetic populations GOA BS and AI

- Two genetic breaks due to limited migration:
  1) eGOA and wGOA
  2) Northern Bering Sea and GOA/AI

- Third genetic break due to adaptive variation: 3) AI and wGOA

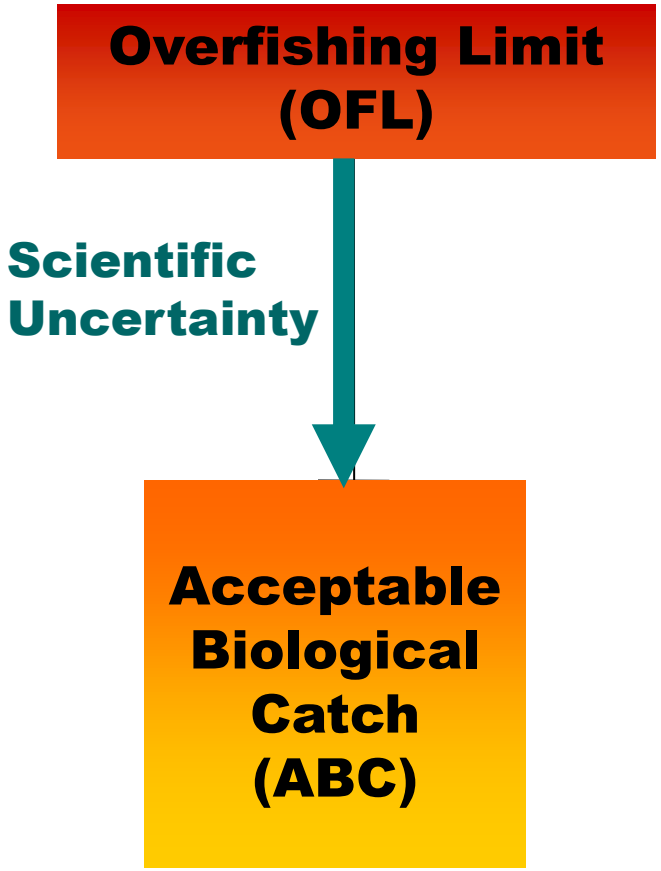
- The Bering Sea genetic break is complex





Cod specifications and allocations

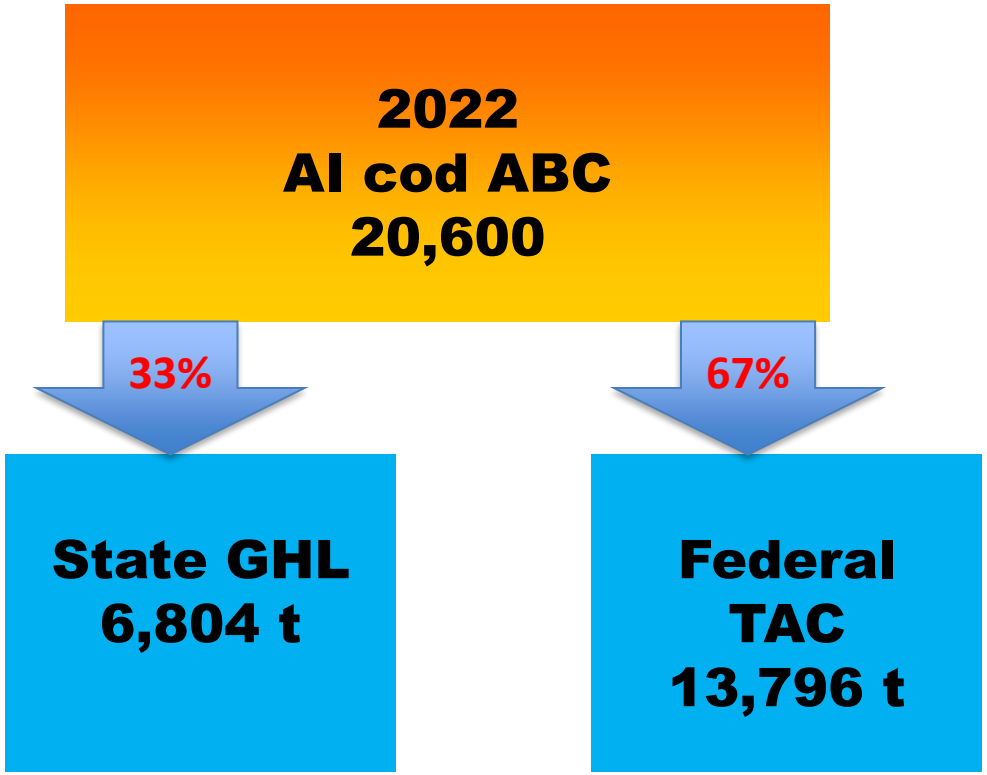
Assessment, Plan Team, SSC Role: Specify separate AI and EBS

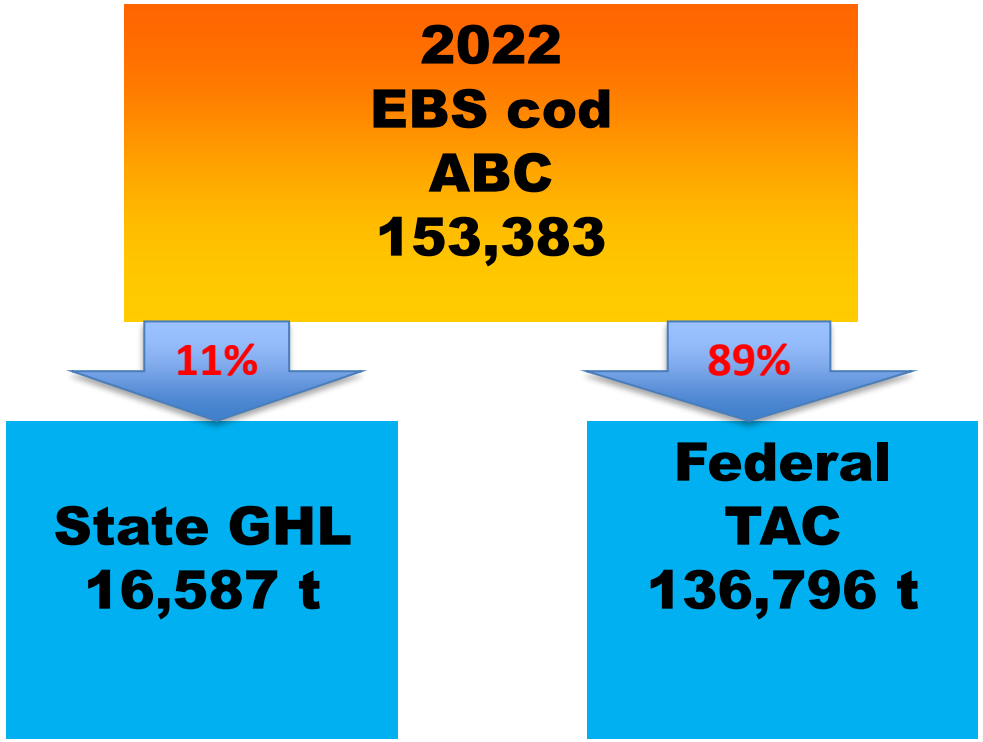


The ABC (or ABC proxy) is:

- A limit.
- A level of annual catch that should not be exceeded in order to have a low probability that the maximum fishing mortality threshold is exceeded.
- Reduced from the overfishing limit (OFL) to account for scientific uncertainty in OFL.
- Is recommended by the SSC to the fishery management council.

How is the BSAI ABC reduced prior to TAC-setting?





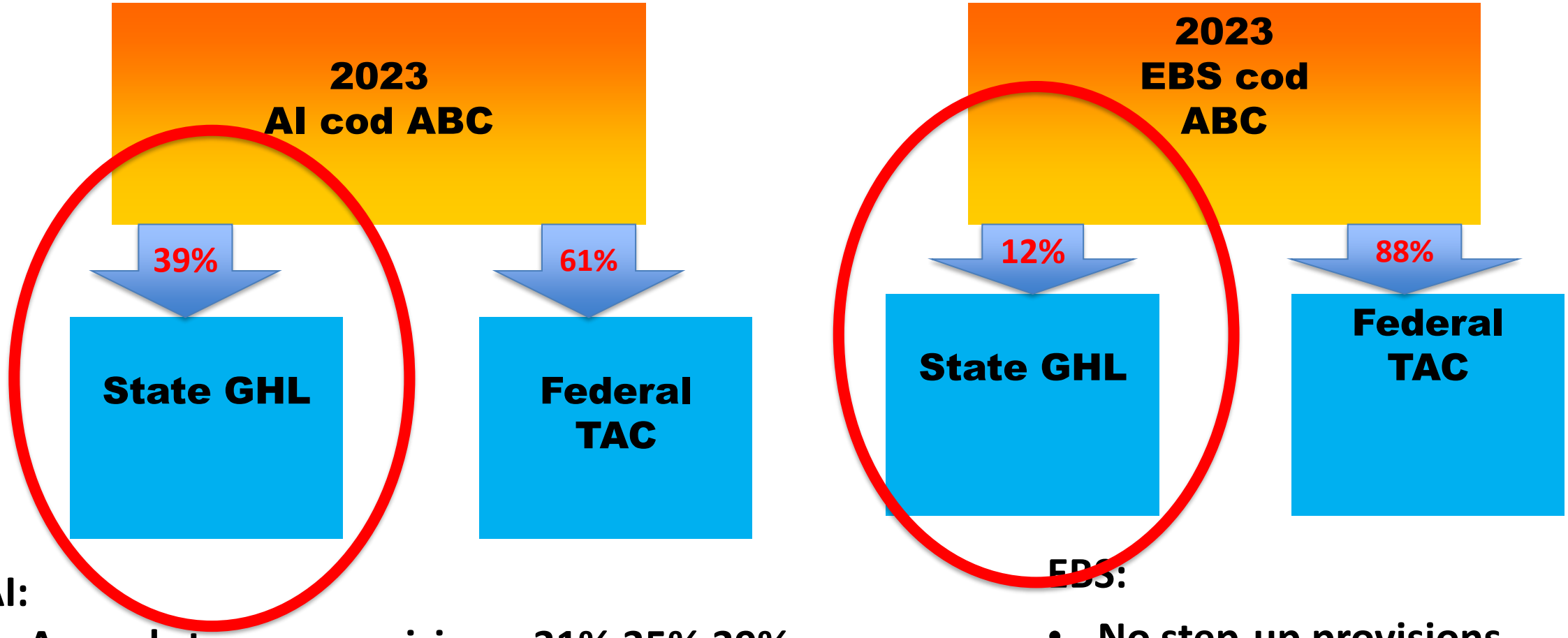
AI:

- **Annual step-up provisions: 31%,35%,39%**
- **Maximum 15 million pounds (6,804 mt)**

EBS:

- **No step-up provisions**
- **No maximum**

How is the ABC reduced prior to TAC-setting?



AI:

- **Annual step-up provisions: 31%,35%,39%**
- **Maximum 15 million pounds (6,804 mt)**

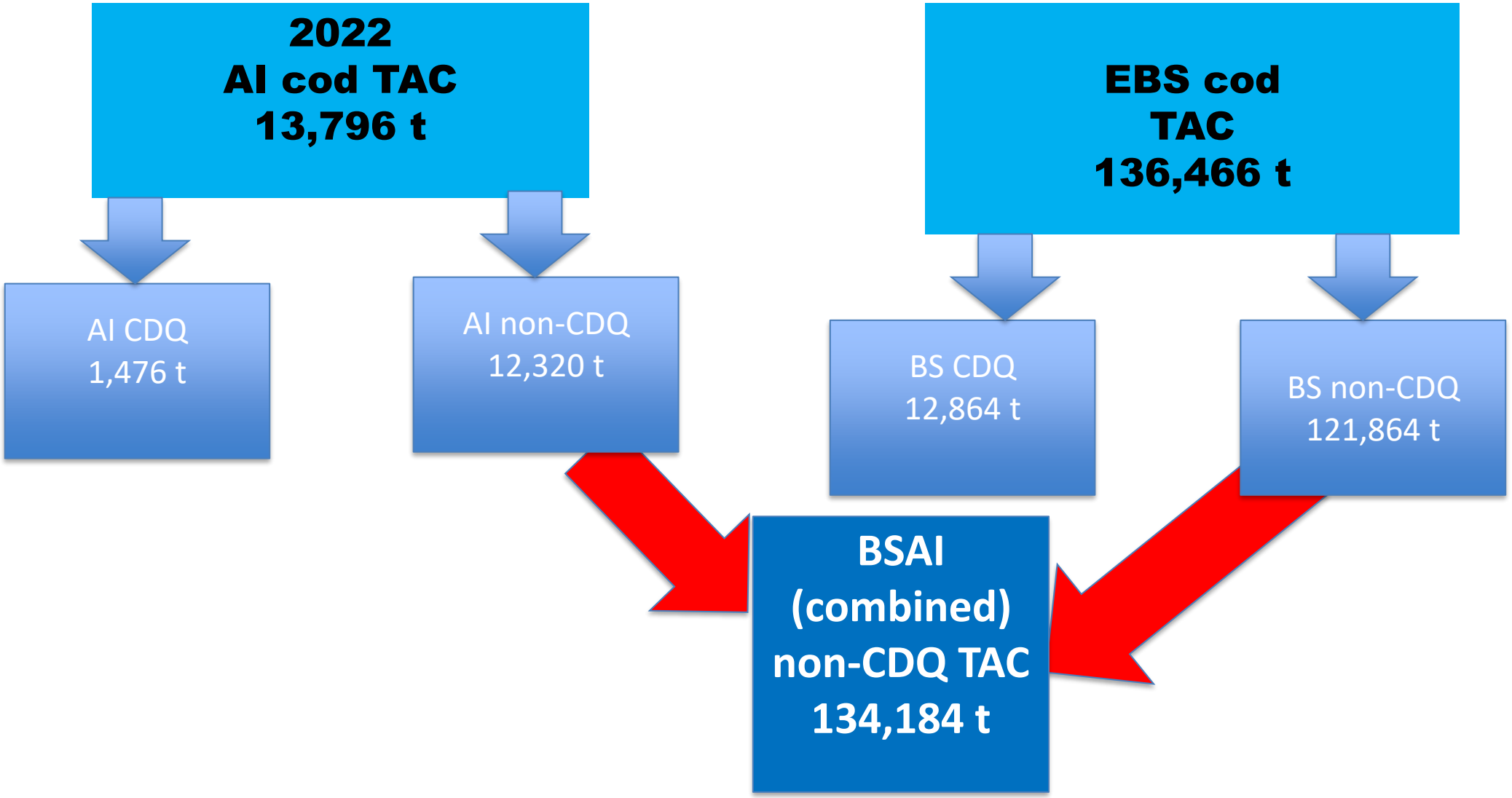
EBS:

- **No step-up provisions**
- **No maximum**

BS & AI Pacific Cod Overview

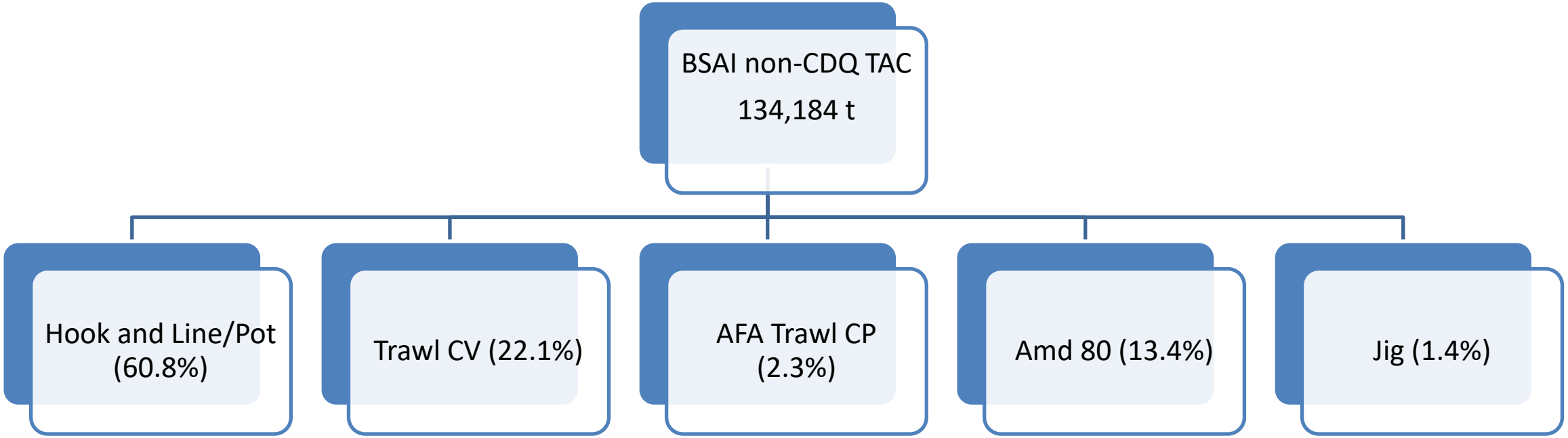
- BS and AI Cod fully prosecuted fishery
- Targeted by multiple gear types
  - Primarily trawl gear and hook-and-line CPs
  - Smaller amounts by hook-and-line, jig vessels, and pot gear
- Council has modified BSAI sector cod allocations for nearly 3 decades
  - 6 major modifications to the BSAI sector cod allocations since 1994

TAC and sector allocations

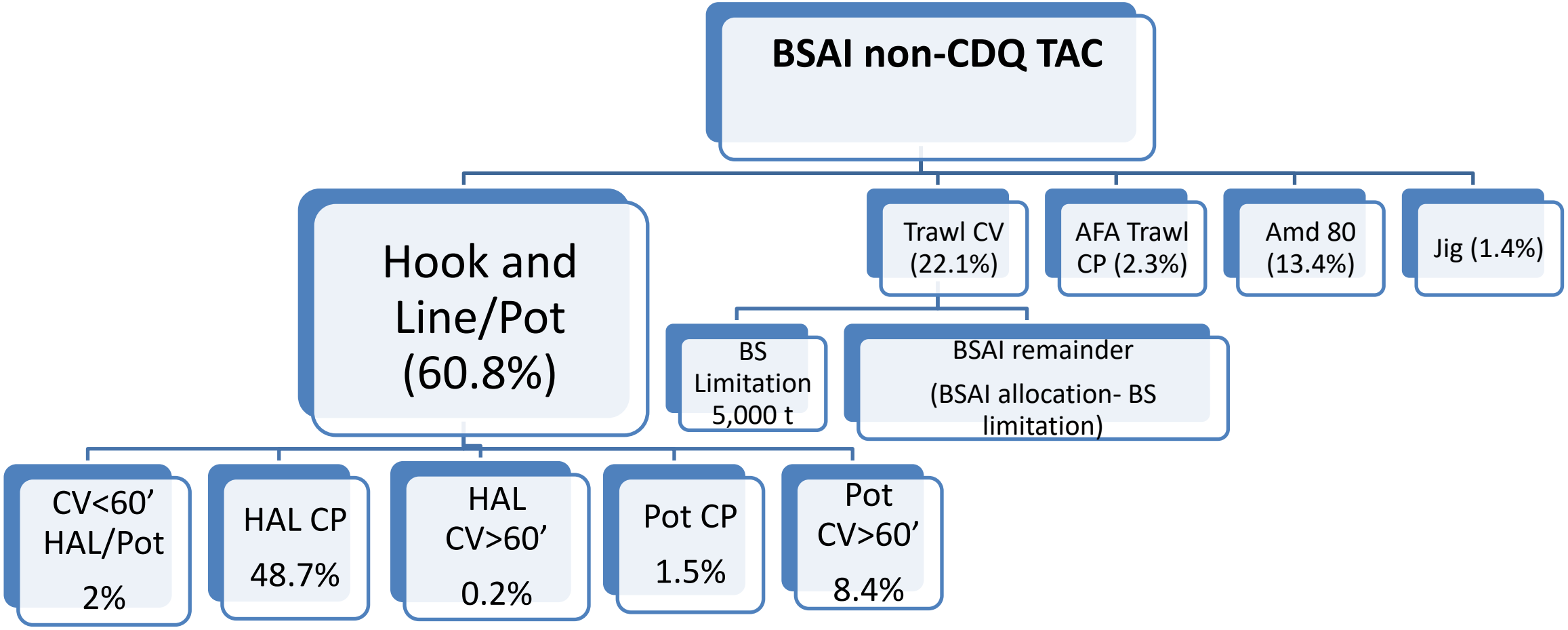



WAI Limit
(Area 543)
4,018 t
SSL Provision

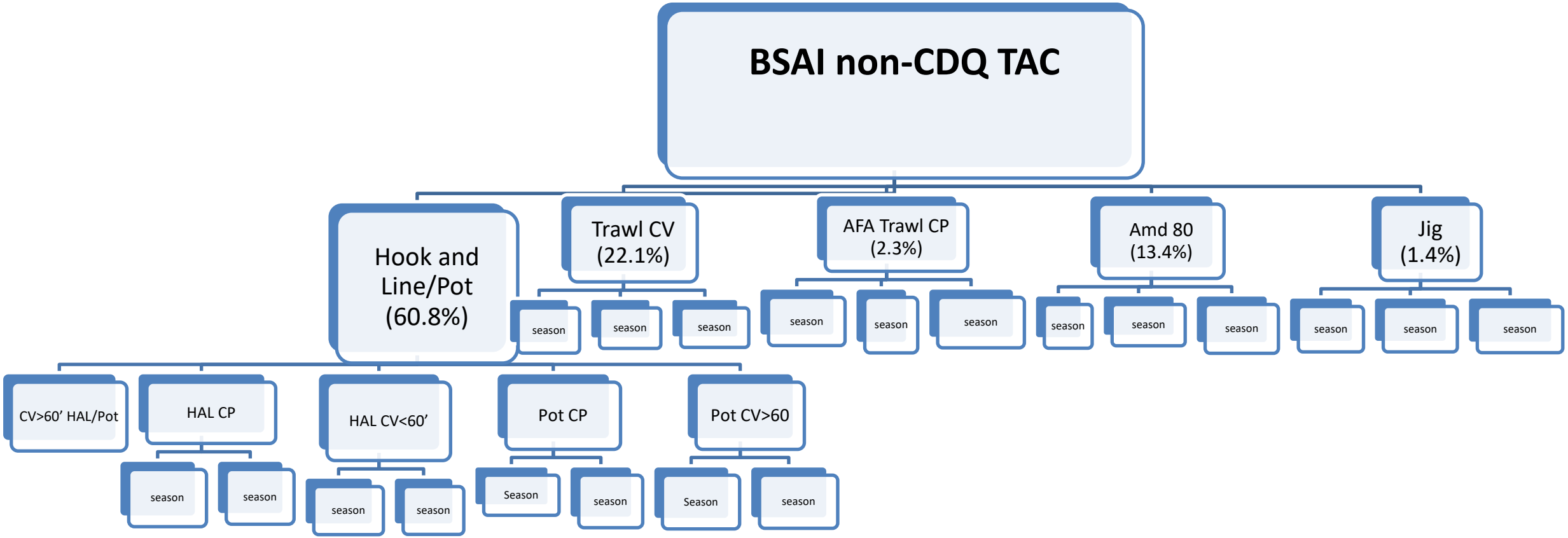
Cod allocation to sector



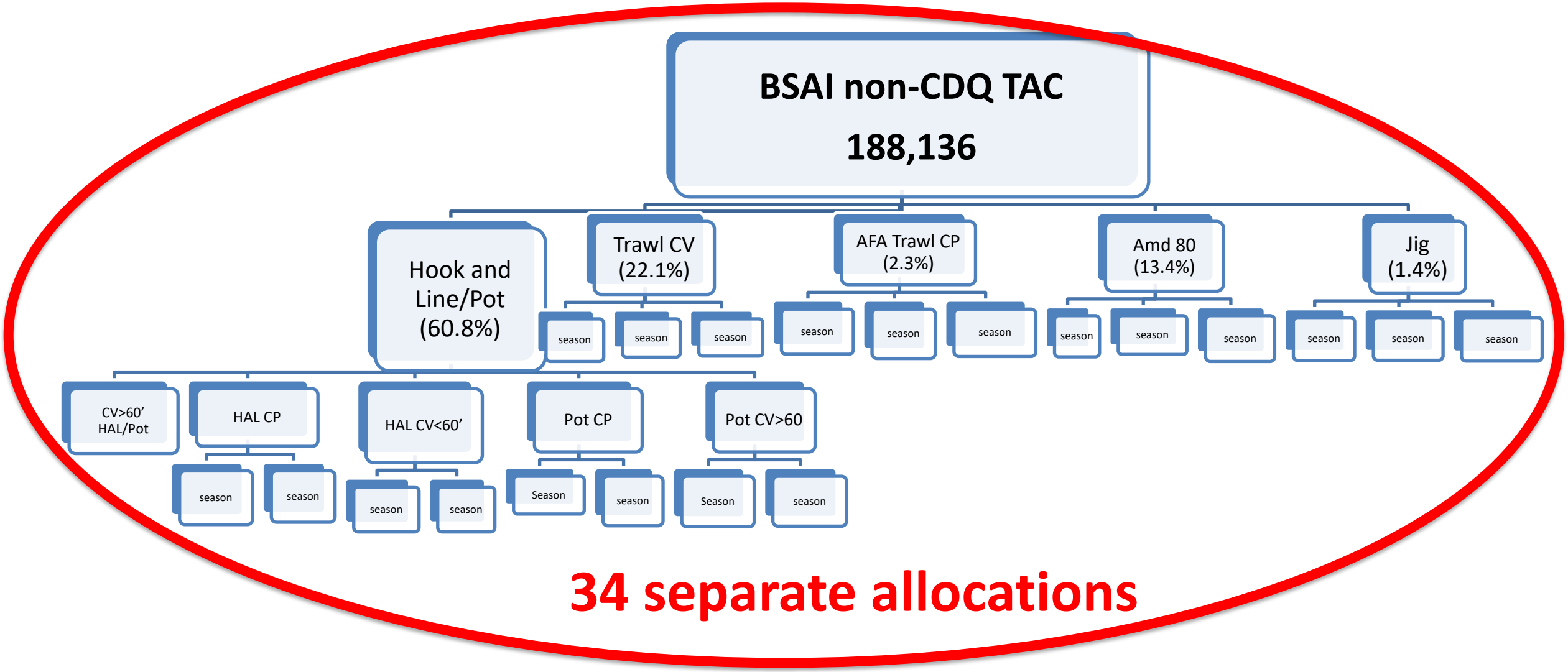
Cod allocation to sector



Cod allocation to sector/season



Cod allocation to sector/season

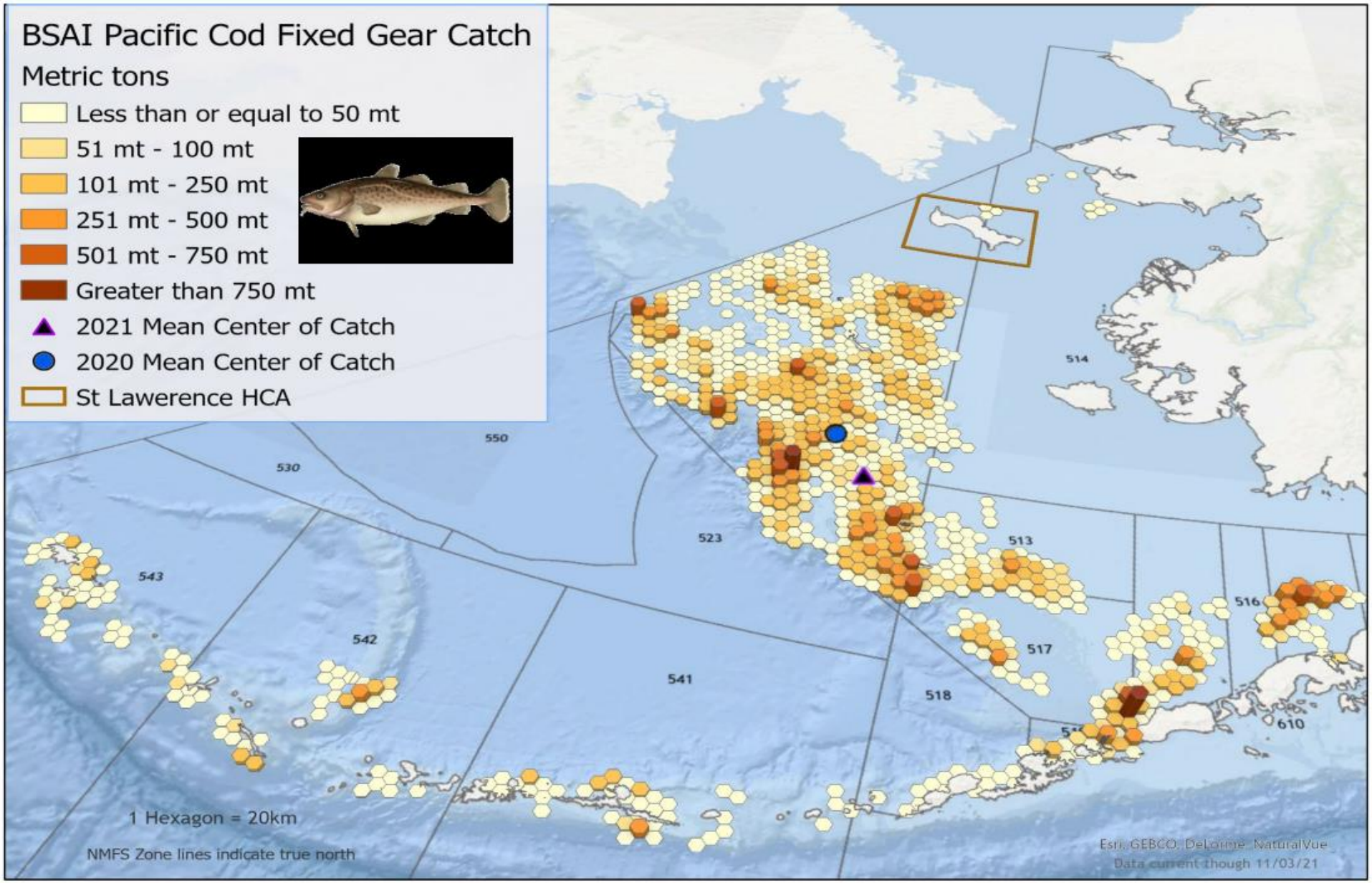


Catch by sector 2021-2022

BSAI Sector	Catch 2021	# vessels	Catch 2022*	# vessels
CDQ	7,361	61	6,677	47
Hook-and-line C/P	49,643	17	59,251	19
Pot C/P	1,123	3	1,562	3
Pot CV >= 60 ft	7,138	23	10,862	30
Hook-and-line/Pot CVs < 60 ft	3,908	28	5,452	21
Jig	0	<3	0	<3
Trawl CV	21,022	93	23,958	96
AFA C/P	5,122	15	2,274	15
Amendment 80 C/P	11,112	18	14,607	18
HAL/POT ICA	267	80	337	84
Total	106,696	328	124,980	333

* Catch through 9/24/22

2021 Pacific Cod Catch by Non-Trawl Gear

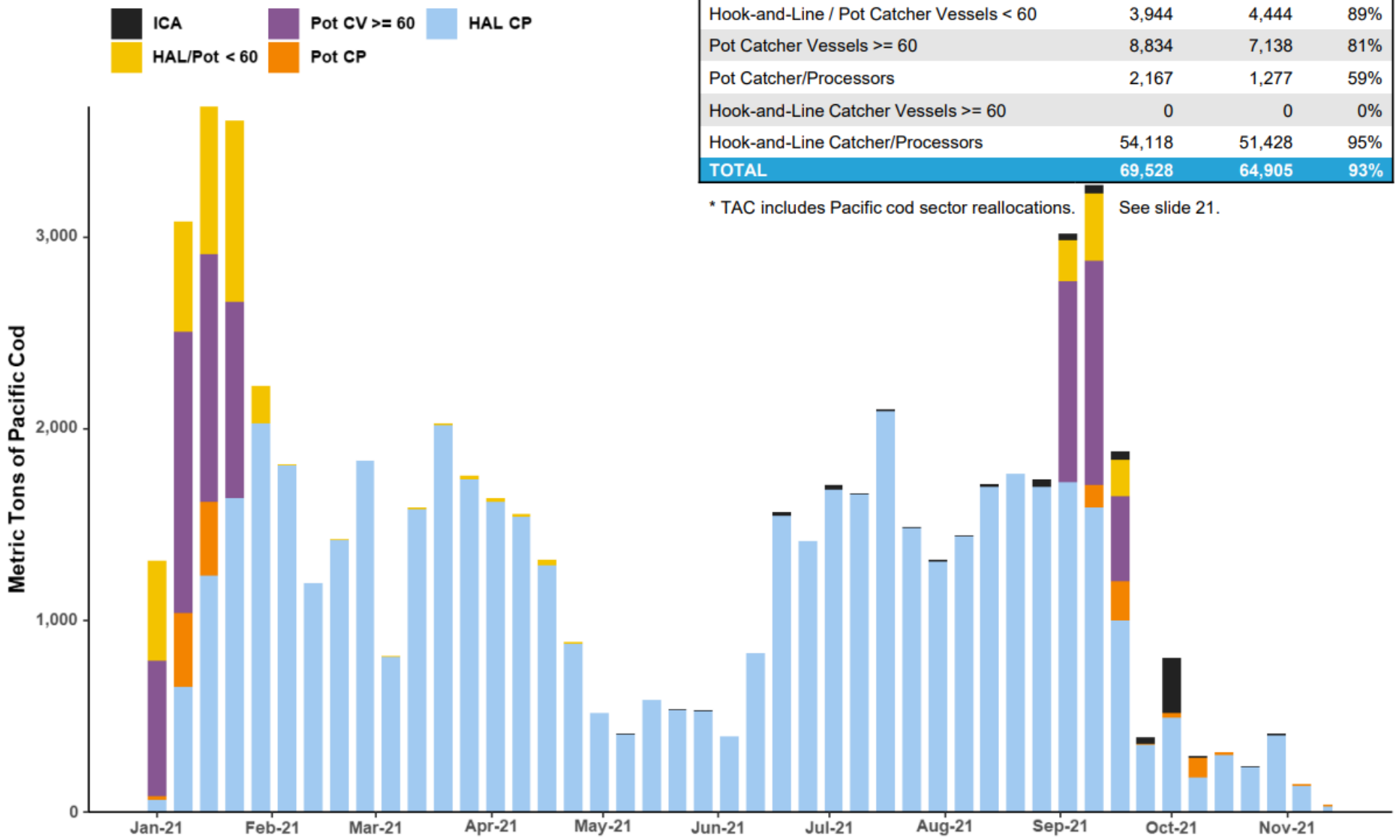


2021 Non-Trawl Pacific Cod Catch

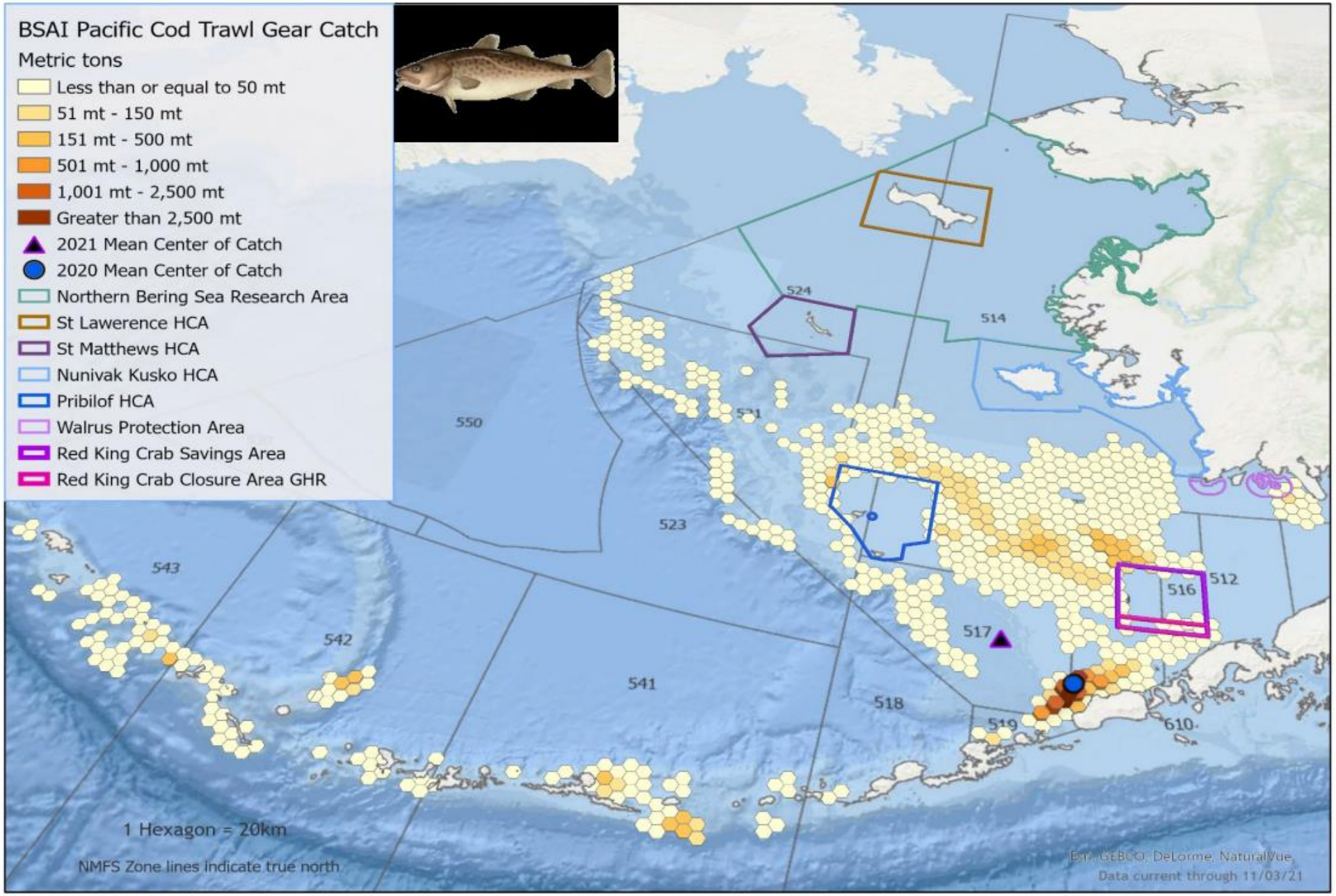
2021	TAC (mt)	Catch (mt)	%
Hook-and-Line / Pot ICA	400	618	155%
Jig Gear	65	0	0%
Hook-and-Line / Pot Catcher Vessels < 60	3,944	4,444	89%
Pot Catcher Vessels >= 60	8,834	7,138	81%
Pot Catcher/Processors	2,167	1,277	59%
Hook-and-Line Catcher Vessels >= 60	0	0	0%
Hook-and-Line Catcher/Processors	54,118	51,428	95%
TOTAL	69,528	64,905	93%

* TAC includes Pacific cod sector reallocations.

See slide 21.



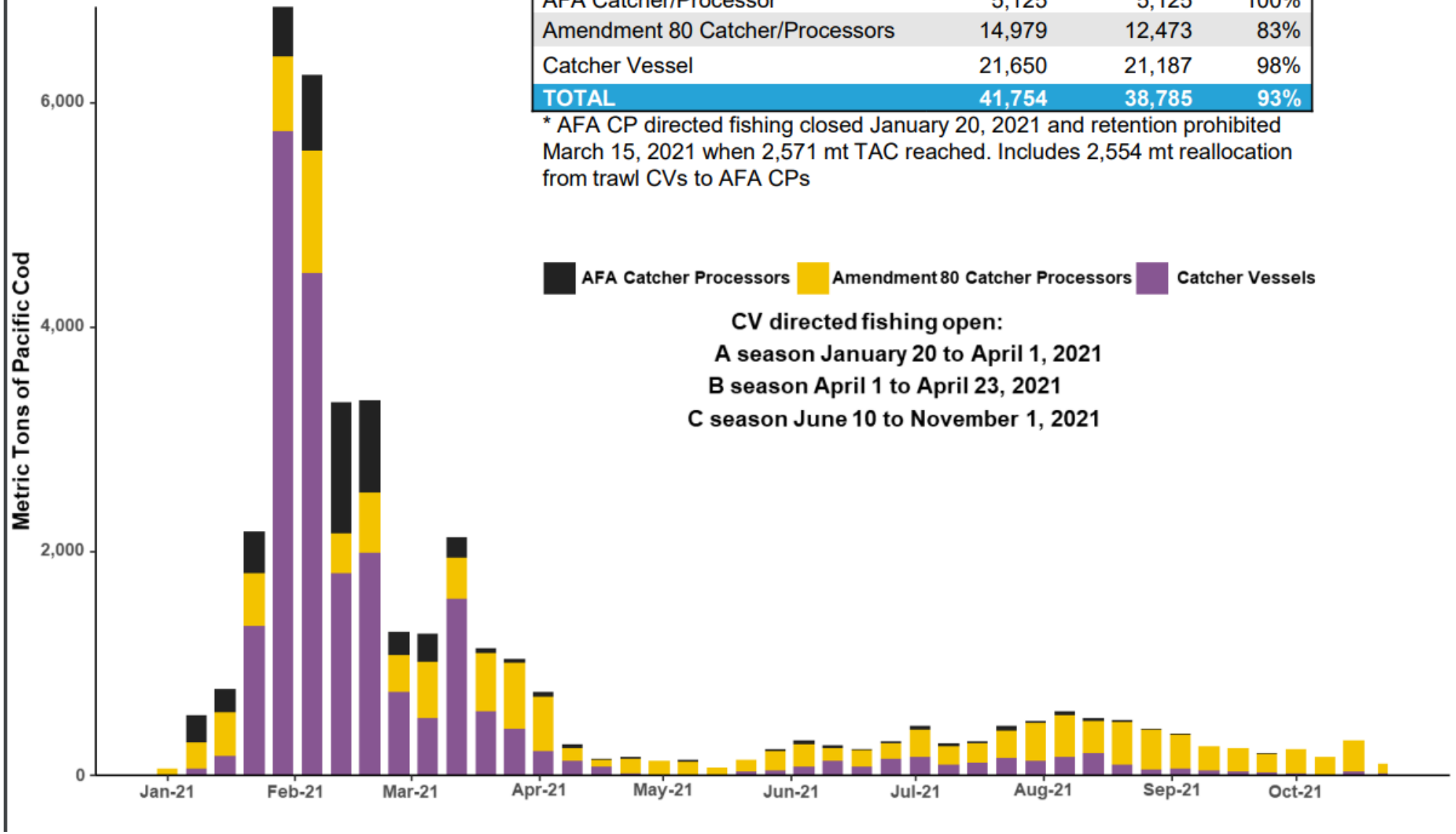
2021 Pacific Cod Catch by Trawl Gear



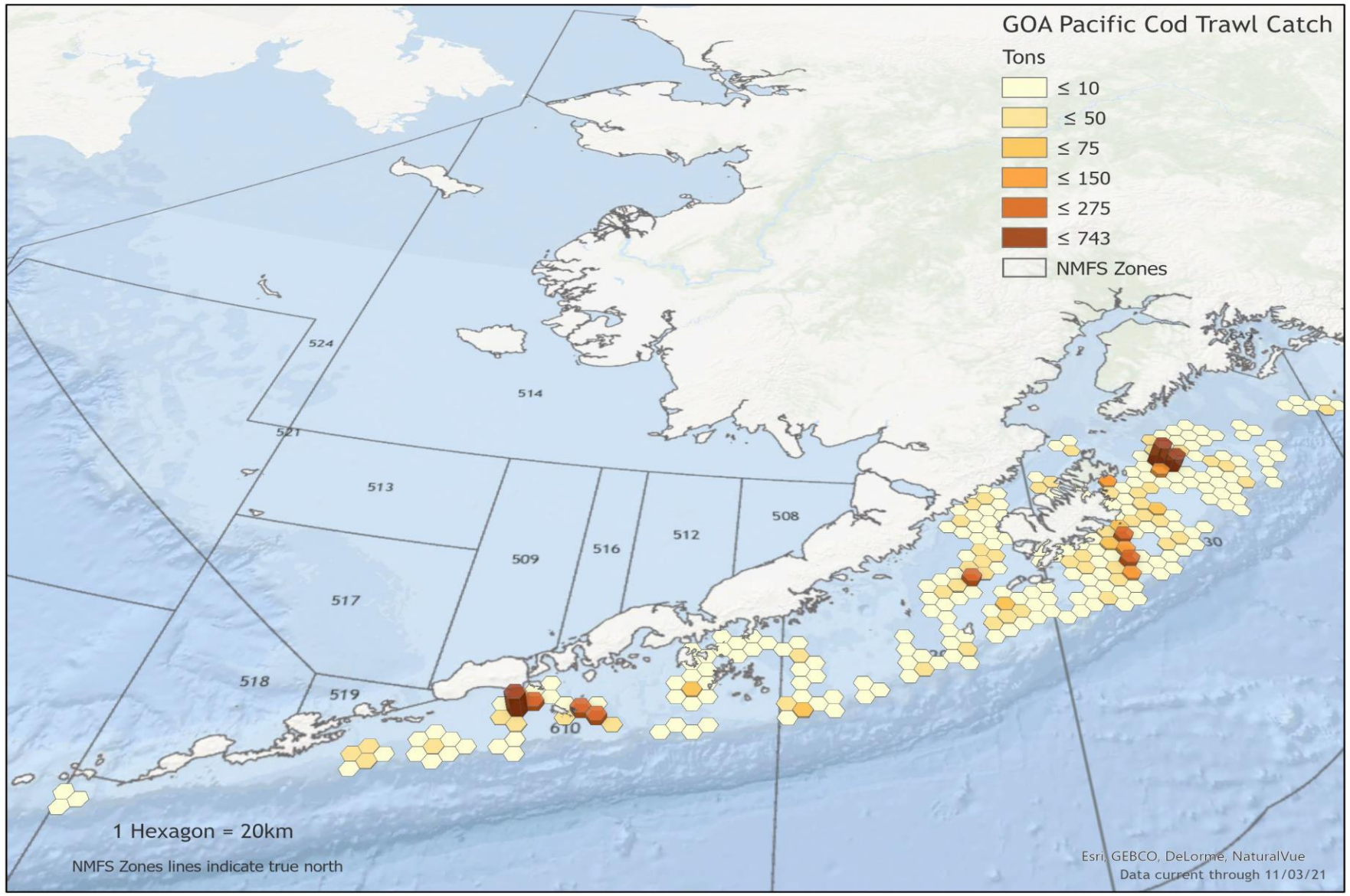
2021 Trawl Catch of Pacific Cod

2021	TAC (mt)	Catch (mt)	%
AFA Catcher/Processor *	5,125	5,125	100%
Amendment 80 Catcher/Processors	14,979	12,473	83%
Catcher Vessel	21,650	21,187	98%
TOTAL	**41,754**	**38,785**	**93%**

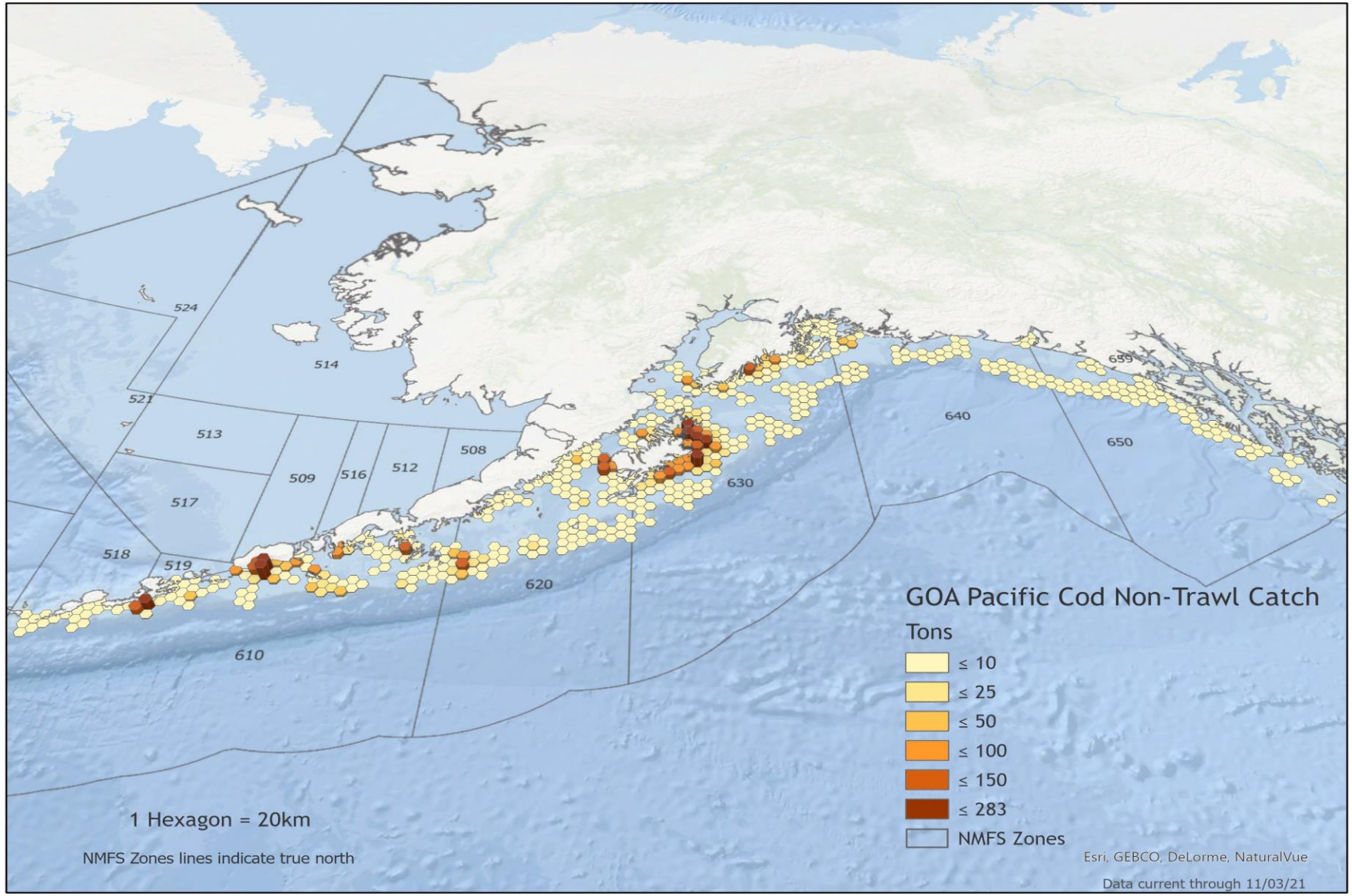
* AFA CP directed fishing closed January 20, 2021 and retention prohibited March 15, 2021 when 2,571 mt TAC reached. Includes 2,554 mt reallocation from trawl CVs to AFA CPs



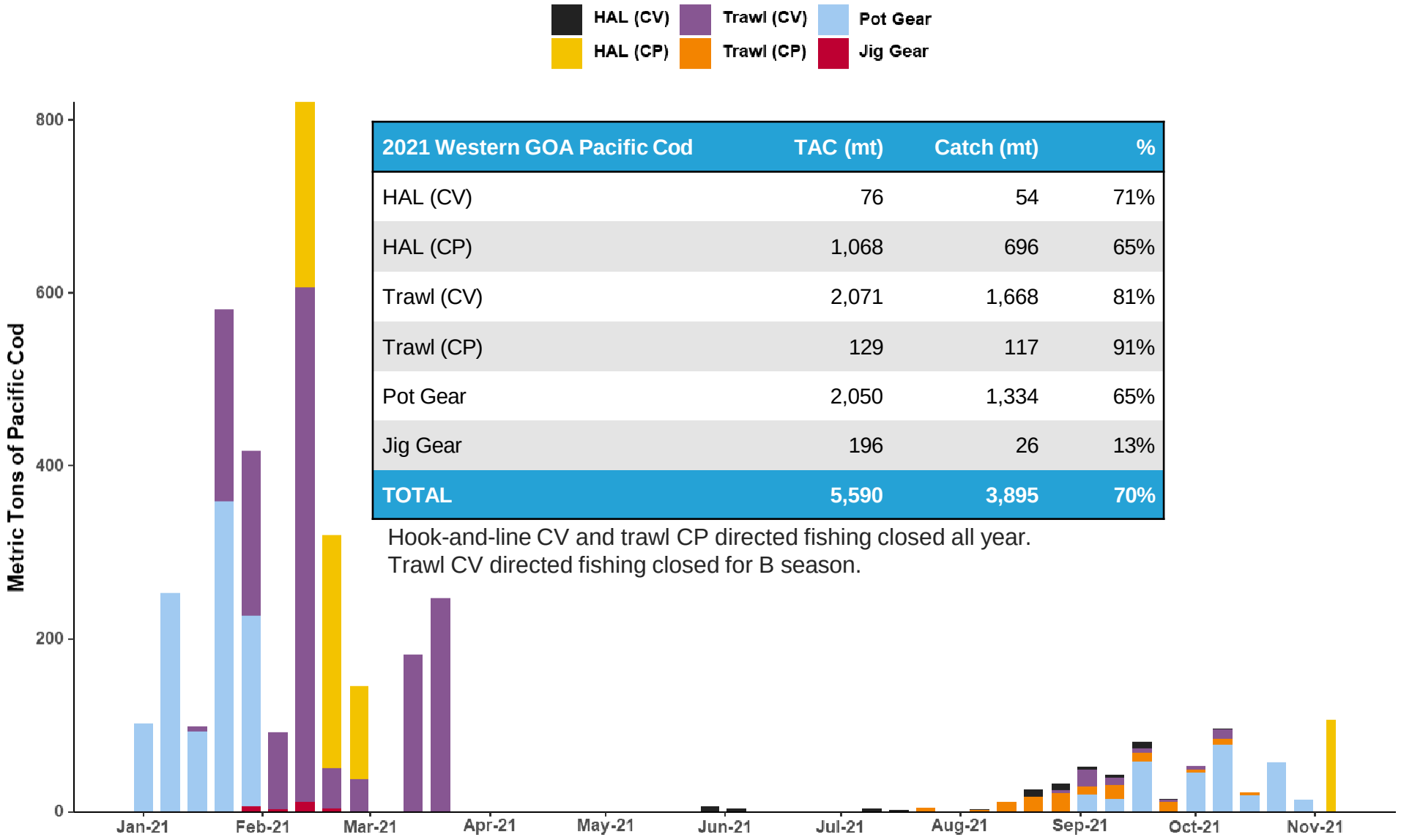
2021 Gulf of Alaska Pacific Cod Catch by Trawl Gear



2021 Gulf of Alaska Pacific Cod Catch by Non-Trawl Gear



2021 Western GOA Pacific Cod Catch by Week and Sector

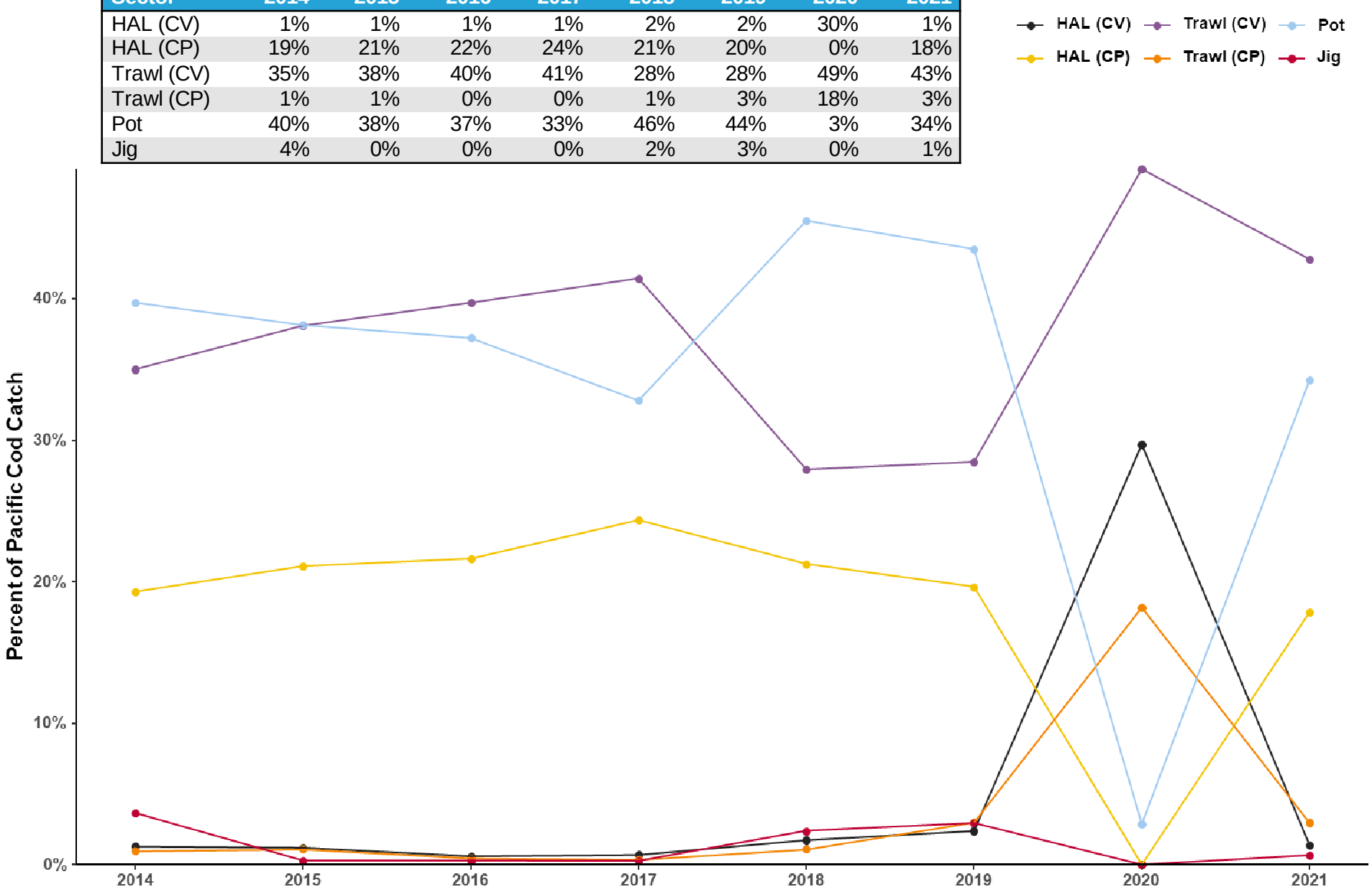


2021 Western GOA Pacific Cod	TAC (mt)	Catch (mt)	%
HAL (CV)	76	54	71%
HAL (CP)	1,068	696	65%
Trawl (CV)	2,071	1,668	81%
Trawl (CP)	129	117	91%
Pot Gear	2,050	1,334	65%
Jig Gear	196	26	13%
TOTAL	**5,590**	**3,895**	**70%**

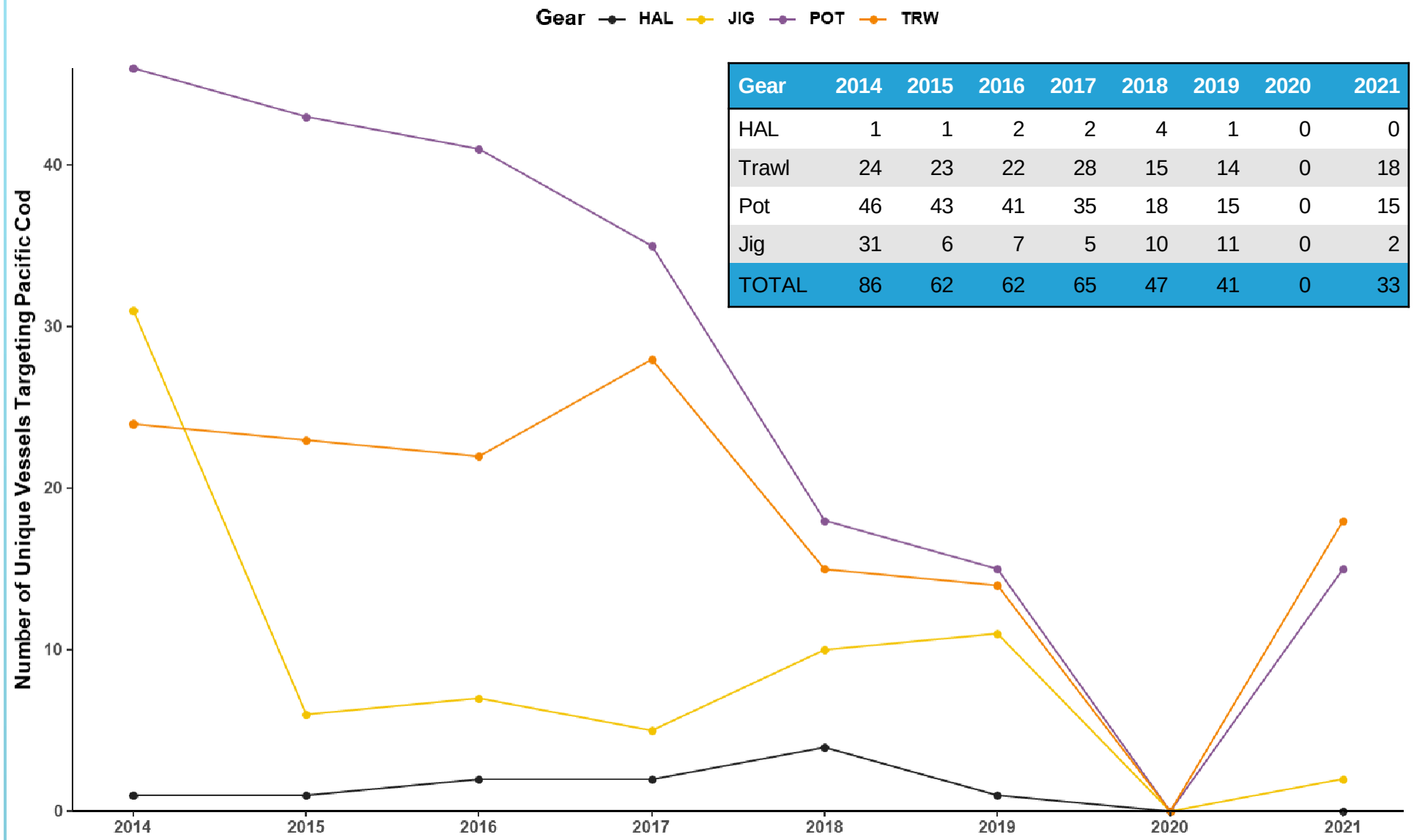
Hook-and-line CV and trawl CP directed fishing closed all year.
Trawl CV directed fishing closed for B season.

Western GOA Pacific Cod Catch by Sector

Sector	2014	2015	2016	2017	2018	2019	2020	2021
HAL (CV)	1%	1%	1%	1%	2%	2%	30%	1%
HAL (CP)	19%	21%	22%	24%	21%	20%	0%	18%
Trawl (CV)	35%	38%	40%	41%	28%	28%	49%	43%
Trawl (CP)	1%	1%	0%	0%	1%	3%	18%	3%
Pot	40%	38%	37%	33%	46%	44%	3%	34%
Jig	4%	0%	0%	0%	2%	3%	0%	1%

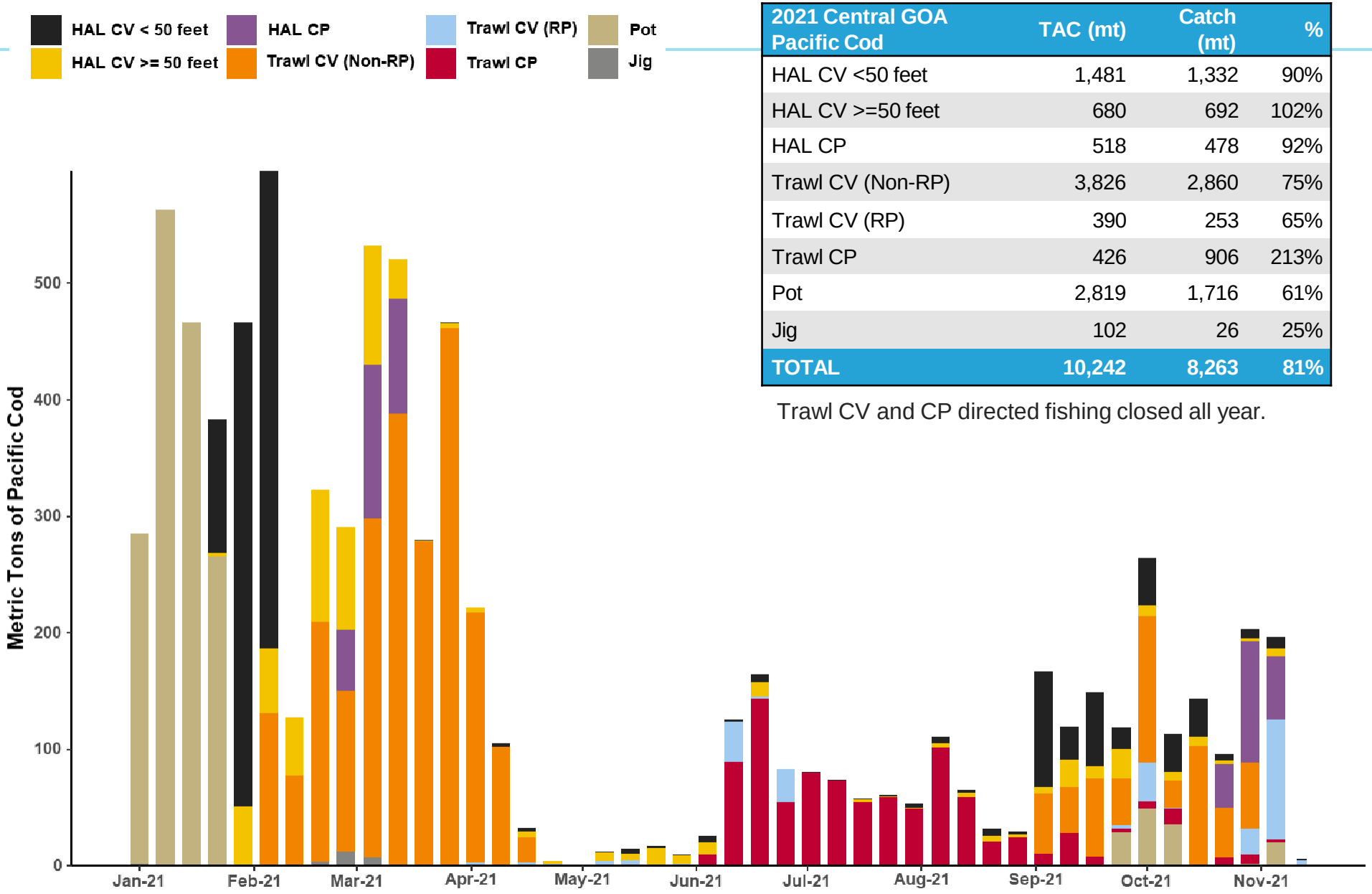


Counts of Catcher Vessels Targeting Western GOA Pacific Cod



Gear	2014	2015	2016	2017	2018	2019	2020	2021
HAL	1	1	2	2	4	1	0	0
Trawl	24	23	22	28	15	14	0	18
Pot	46	43	41	35	18	15	0	15
Jig	31	6	7	5	10	11	0	2
TOTAL	86	62	62	65	47	41	0	33

2021 Central GOA Pacific Cod Catch by Week and Sector

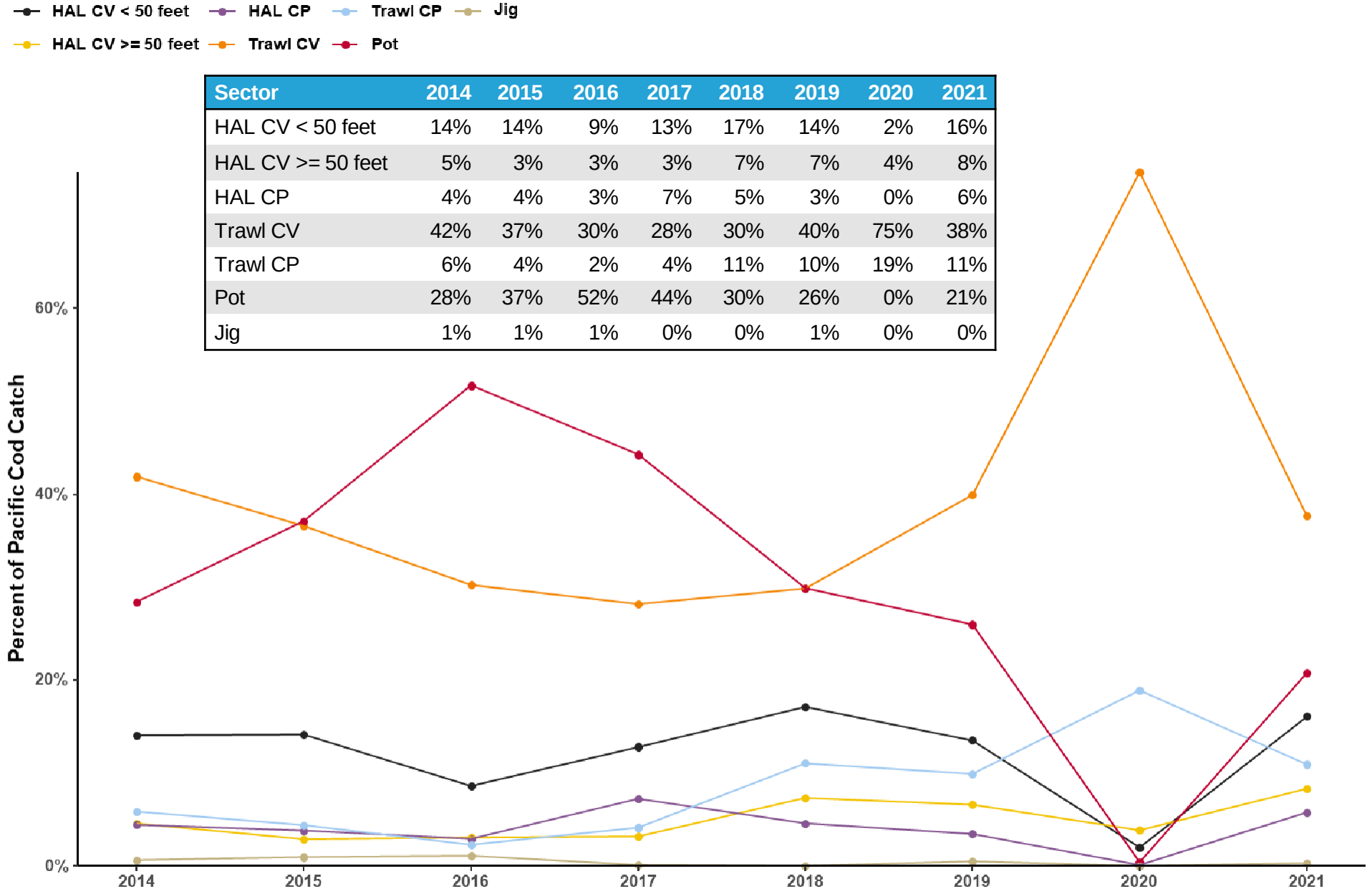


2021 Central GOA Pacific Cod	TAC (mt)	Catch (mt)	%
HAL CV <50 feet	1,481	1,332	90%
HAL CV >=50 feet	680	692	102%
HAL CP	518	478	92%
Trawl CV (Non-RP)	3,826	2,860	75%
Trawl CV (RP)	390	253	65%
Trawl CP	426	906	213%
Pot	2,819	1,716	61%
Jig	102	26	25%
TOTAL	**10,242**	**8,263**	**81%**

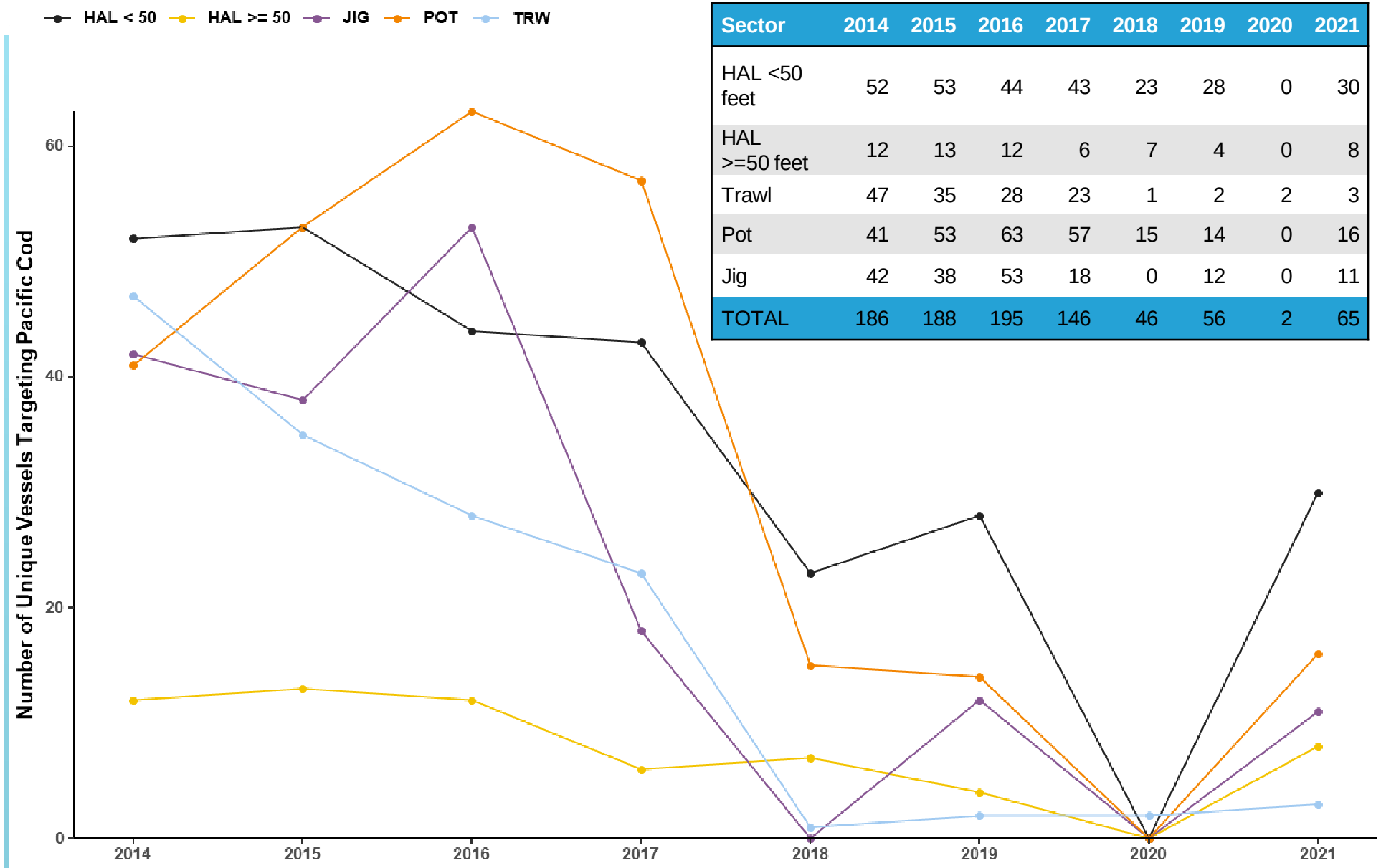
Trawl CV and CP directed fishing closed all year.

Central GOA Pacific Cod Catch by Sector

Sector	2014	2015	2016	2017	2018	2019	2020	2021
HAL CV < 50 feet	14%	14%	9%	13%	17%	14%	2%	16%
HAL CV >= 50 feet	5%	3%	3%	3%	7%	7%	4%	8%
HAL CP	4%	4%	3%	7%	5%	3%	0%	6%
Trawl CV	42%	37%	30%	28%	30%	40%	75%	38%
Trawl CP	6%	4%	2%	4%	11%	10%	19%	11%
Pot	28%	37%	52%	44%	30%	26%	0%	21%
Jig	1%	1%	1%	0%	0%	1%	0%	0%



Counts of Catcher Vessels Targeting Central GOA Pacific Cod



Sector	2014	2015	2016	2017	2018	2019	2020	2021
HAL <50 feet	52	53	44	43	23	28	0	30
HAL >=50 feet	12	13	12	6	7	4	0	8
Trawl	47	35	28	23	1	2	2	3
Pot	41	53	63	57	15	14	0	16
Jig	42	38	53	18	0	12	0	11
TOTAL	186	188	195	146	46	56	2	65

BSAI Cod Observer Coverage

- Majority of fleet is in 100% coverage
- Small percentage in partial coverage.
  - BSAI Observer partial coverage in 2022
    - Hook-and-line: 19%
    - Pot-no Tender: 17%
    - Pot-Tender: 5.3%
    - Trawl: 230%

GOA cod TACs

Specifications	Western	Central	Eastern	Total
ABC	7,285	14,474	2,284	24,043
State GHL	2,186	3,619	571	6,375
(%)	30%	25%	25%	25-30
Federal TAC	5,100	10,856	1,713	17,669

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