



**NOAA
FISHERIES**

Crab Estimations and Electronic Monitoring (EM)

Krista Milani (AKRO Inseason)
Jason Gasper (AKRO CADQ)
Josh Keaton (AKRO Monitoring)
Mike Vechter (FMA)

CPT 5/17/2023

During the September 2023 CPT meeting

The CPT requested a follow-up presentation on EM, including

- 1) estimates of the proportion of crab remaining unidentified,
- 2) the percentage of the fleet moving to EM, and
- 3) a summary of bycatch data collection and processing (e.g. weight extrapolation, mortality rates applied).

EM on Hook-and-Line and Pot Gear vs BS Trawl Gear

- **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), **discarding of crab is prohibited**
 - Observers at the dock monitor 100% of the offload and randomly sample catch
 - All crab bycatch is weighed and counted at the dock by the processor
- **Hook-and-line and pot** (regulations starting in 2018)
 - EM for catch estimations
 - Cameras must be on for all hauls when a trip is selected (not all hauls reviewed)
 - Same discarding rules as non-EM HAL and pot vessels, **discarding crab PSC is required**
 - Video is reviewed to identify and count discards, but EM reviewers are unable to identify crab to species
 - Crab that are not identified to species do not count towards any stock species

Trawl EM



Start of haul retrieval; (+5 minutes after start)

Council Timeline for Trawl EM

1. Council identified priority (2018)

Developing EM for use in pelagic trawl catcher vessel fisheries

2. Council formed Committee (2018)

Trawl EM Committee- industry participants, EM providers, agency representatives, stakeholders

3. Pilot project phase (2018-2019)

Testing EM systems to assess EM data quality, timeliness, and costs as compared to observers

4. Exempted Fishing Permit (EFP) (2020-2024)

Evaluate the efficacy of EM systems and shoreside observers for pollock

5. Council analytical process (2021-2023)

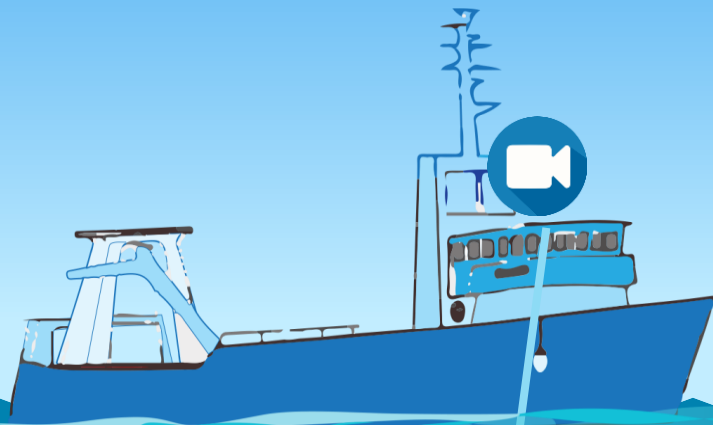
1. Initiated analysis, approved purpose and need and alternative set, 2. Initial review, 3. Final action

6. NMFS implementation of regulated program (expected 2025)



EM on Bering Sea (BS) Pelagic Trawl Vessels

EFP 2020-2024: EM for compliance on pelagic trawl vessels

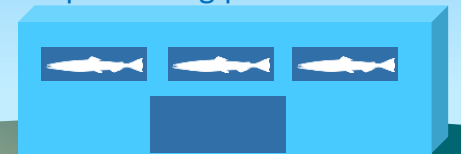


50 Catcher vessels (BS AFA pollock in 2022)

**Primary objective:
Monitor compliance**



Observers sample at processing plants



Observers in processing plants randomly sample deliveries to collect catch and biological data



Electronic monitoring for compliance

- EM compliance monitoring to ensure maximized retention of all species and verify self-reported data of any discard events.
- Catch and discard information from landing reports and logbooks.



Trawl EM in the Bering Sea

- Trawl EM is a Compliance Monitoring EM system
 - EM System is designed to monitor compliance with regulations, no catch estimation
 - EM System must be on 100% of the time for all trips
- Maximized Retention rules - “Almost all” catch retained for delivery
 - A few exceptions including:
 - Large sharks/skates (too big), jellyfish (product quality), net bleeding (stability and safety)
 - At-sea discards reported in logbook
- Most catch data collected and reported shoreside at time of offload
 - Shoreside observers monitor entire offload
 - Shoreside observers collect species comp and biological samples
 - Observers only collect crab data if crab end up in the sample
 - Processor records retained catch and some PSC species (such as crab) in eLandings
- EM hard drives are mailed to EM program for review where they:
 - Review the entire trip for compliance
 - Quantify legal discards and compare them to logbooks provided by vessel



BS Trawl EM in Catch Accounting for Crab

- Discarding of crab is prohibited: all crab returns to dock and is reported in eLandings and imported into CAS
- Used for Prohibited Species Catch (PSC) accounting
- Not yet incorporated into CAS for stock assessment
 - Should be available for stock assessment by the time the regulations take effect in 2025
 - Very little crab seen during BS pelagic trawl offloads

Total number of crab on fishtickets in EM BS pelagic trawl pollock deliveries

Crab Species	2020	2021	2022	2023 (A season)
RKC	4	2	7	9
BST	35	27	9	5
BSS	44	11	8	8
BKC	1	0	0	0
GCK	5	0	0	1

Number of Trawl Vessels

Number of BS pelagic trawl vessels using EM from 2020-2023

Year	Total # of inshore BS pollock vessels	# of inshore BS pollock vessels using EM
2020	76	21
2021	74	46
2022	71	50
2023 - A season only	63	45

- Expected to be in regulation by 2025
- Number of vessels will likely increase once in regulation

Hook-and-Line (HAL) and Pot EM



View from EM cameras on Pot vessel fishing for Pacific Cod. Source: PSMFC

HAL and Pot EM Program

- Program was implemented in 2018 (50 CFR 679.51(f))
- Option for catcher vessels greater than or equal to 40 feet LOA using HAL and/or pot gear (Partial Coverage)
 - Funding is limited
 - Agency can prioritize vessels who are approved based on data gaps
 - Currently there are not more vessels asking to get in than there is available funding - likely to remain stable due to funding constraints
- Opt-in for the calendar year: Vessels volunteer to use EM instead of carrying an observer

Number of partial coverage vessels participating in BSAI with EM

Year	# EM HAL vessels	Total # HAL vessels	% HAL in EM	# EM pot vessels	Total # pot vessels	% pot in EM
2020	13	52	25.00%	12	81	14.81%
2021	12	47	25.53%	7	55	12.73%
2022	11	49	22.45%	10	62	16.13%

More Information on EM can be found at:

<https://www.fisheries.noaa.gov/alaska/resources-fishing/electronic-monitoring-alaska>



EM in Alaska on HAL and Pot Catcher Vessels

Electronic monitoring on HAL and pot catcher vessels

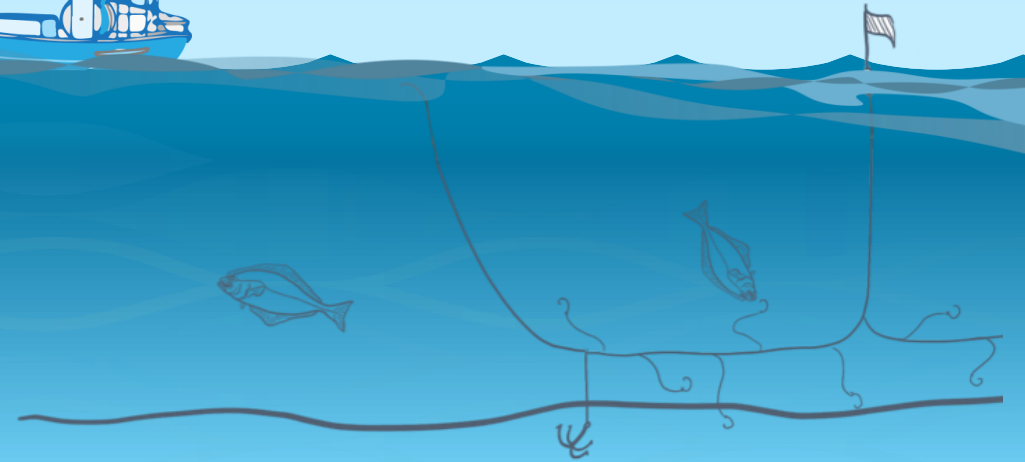


Primary objective:
Catch estimation



Electronic monitoring for catch and discard information

- EM provides catch and discard information.
- Vessels chose to have EM on their boats instead of observers.
- Trips are randomly selected for monitoring.
- Data collected from EM is used with observer data to estimate catch of the entire partial coverage pot and HAL fleet.



168 Catcher vessels participating out of
1258 total boats Alaska-wide in 2021



HAL and Pot EM Process

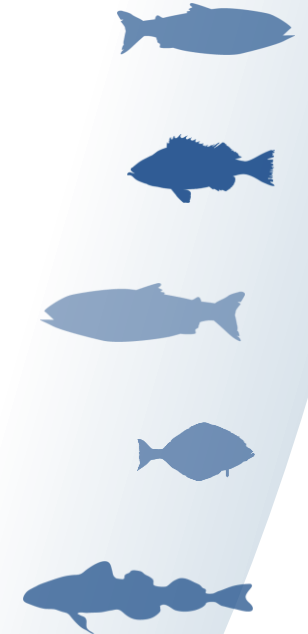
- Vessel submits a Vessel Monitoring Plan (VMP) to AKRO for approval
 - VMP includes information on how the vessel will ensure all discarded catch is handled in such a way as to be identified and counted during the EM review
- After VMP approval, the EM vessel logs trips in the Observer Deploy and Declare System (ODDS)
 - 30 % selection rate since the program started
- If a logged trip is selected for EM coverage, the vessel is notified to turn on their camera system for that trip
 - Trip ends when all catch onboard has been offloaded either to a tender or a processing plant
- Vessels are allowed to discard as normal
 - Discarding of crab PSC is required
- Vessels are instructed to mail their hard drives to the video review provider after completing 1 monitored EM trip



EM Video Review

An EM reviewer will record the following information during the review of the EM video and EM data.

	Trips	Sampled Hauls	Unsampled Hauls
Trip start and trip end	Y		
Gear type of a haul		Y	Y
Haul begin retrieval date/time and position		Y	Y
Haul end retrieval date/time and position		Y	Y
Count of fish/organisms		Y	N
ID of fish/organisms		Y	N
Fate (retained or discard) of fish/organisms		Y	N



- EM reviewers select hauls or sets to “sample”
 - Sampling includes counts, IDs, and fate of organism
 - Single pot gear goal is to sample 1 out of every 3 pots for the trip, longline pot gear goal is to sample $\frac{1}{3}$ of all sets
 - HAL gear goal is to sample $\frac{2}{3}$ of all sets
- During the review, EM reviewers also determine the quality of the data and if the vessel operator followed the VMP
- Observations are recorded in a web portal and auto-generates an email to the vessel owner
- EM service providers communicate with vessel operators to address equipment malfunctions and VMP deficiencies



Current Estimation Process for EM HAL and Pot

- Hierarchical: At-sea EM data used to derive the discard rates are as proximate as possible (in time and space) to EM trips with cameras off near the fishing event
 - Believed to reduce variance by matching at-sea discard information in space/time with fishing event
- Rate based estimation for stock assessment processes
 - Discard rates calculated from EM hauls or sets and applied to total groundfish
 - EM hauls are aggregated according to hierarchical logic (i.e., post-strata)
 - Discard rates and estimated crab (counts and weight) are specific to crab stock area
 - Weights are not determined by the EM reviewer or the EM software
 - FMA appends average weights sourced from observer-collected data
 1. Previous year – species code, gear type, and NMFS area
 2. Previous year – species code, gear type, and area (BSAI or GOA)
 3. Previous year – species code and gear type (Alaska-wide)
 4. Most recent year with available data – species code



Stock Assessment Post Strata

	Description	Min Haul Count	Vessel	Trip Target Date	Week end date	Stock Assessment Area	Processing Sector (CP, M, S)	Trip Target Code	Gear	State Statistical Area	Obs Strata
50	Vessel	1	yes	yes		yes	yes	yes	yes		yes
40	Three Week MA	3			yes	yes	yes	yes	yes	yes	yes
30	Three Month MA	3			yes	yes	yes	yes	yes	yes	yes
15	Year	3			yes	yes	yes	yes	yes		yes
10	Gear/year	1				yes			yes		

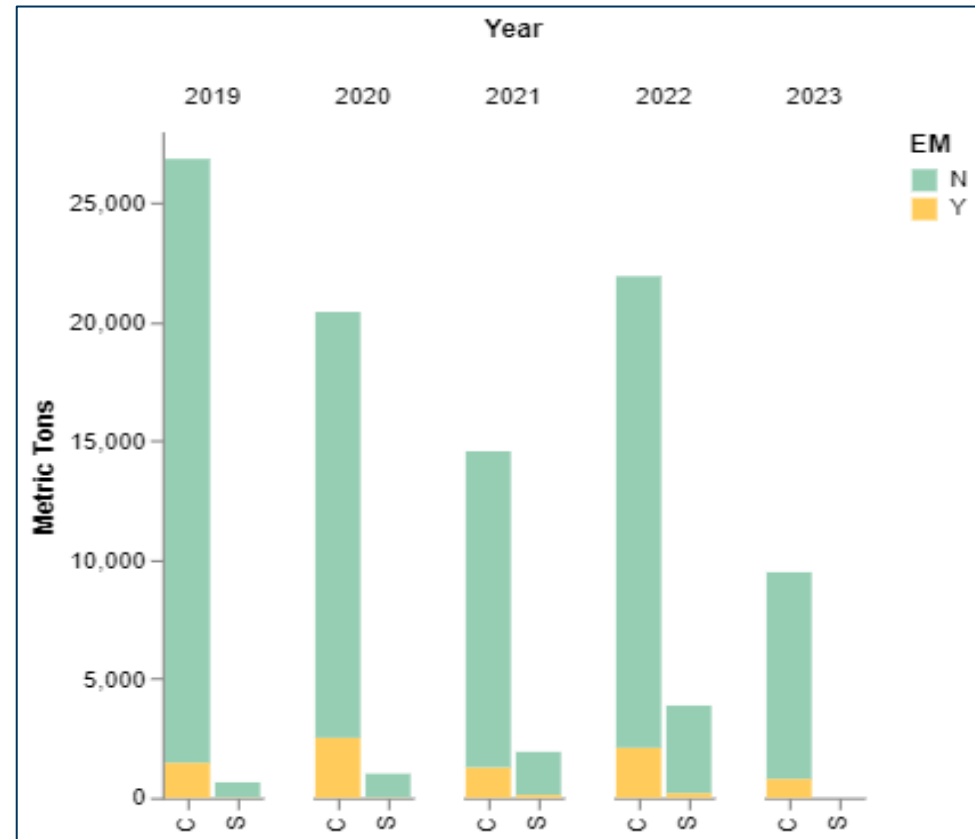
There is a 5 precedent, but it hardly is ever used- it will aggregate across gear types and accounted for <0.0000001 tons of crab in 2022, for example.

- Haul-level EM accounting when available, but when crabs are not identified, the estimate is zero which is used to estimate for all EM strata trips
- If there are not enough EM hauls for estimation, then observer data is used

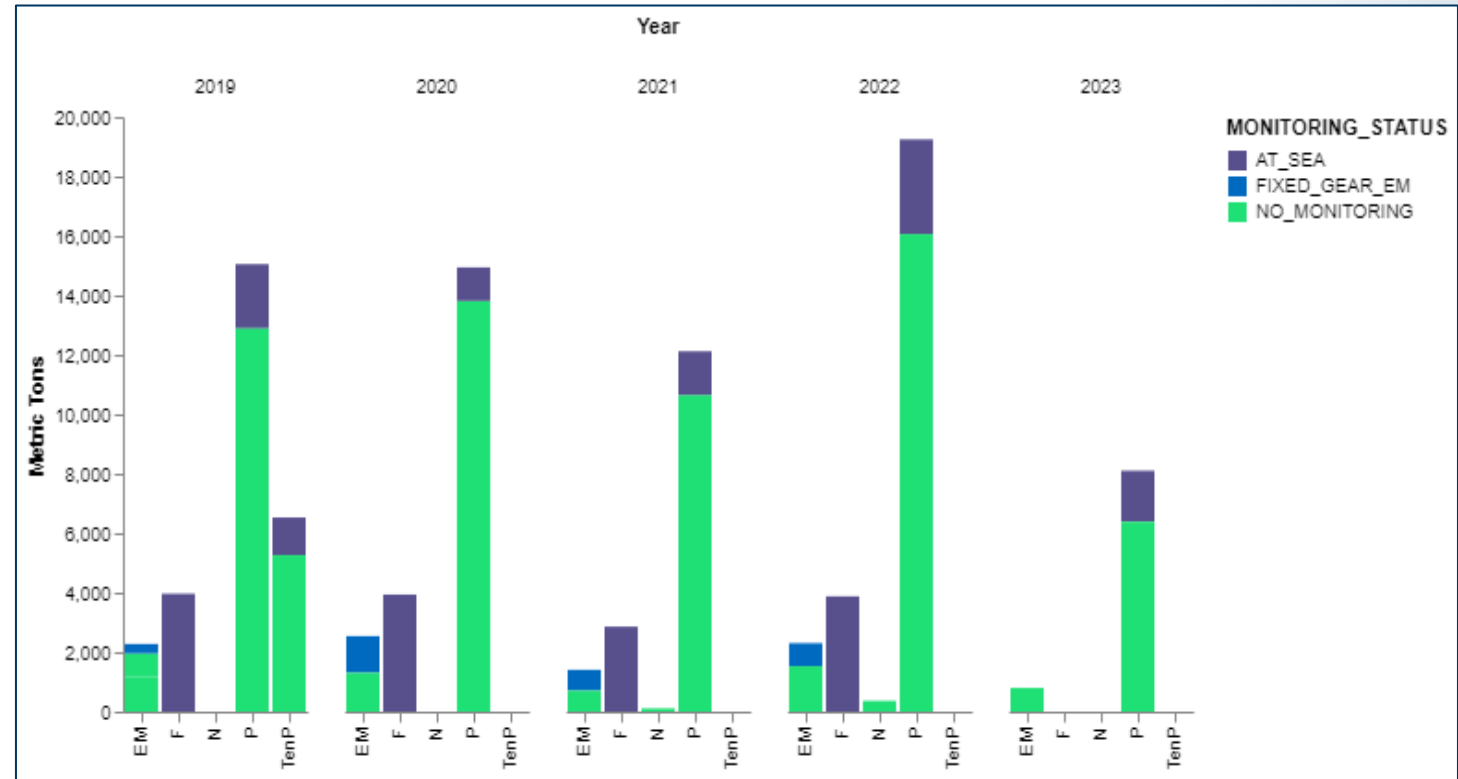
Summary of Pot EM versus Non-EM

All pot catch (includes full coverage , EM, partial observer, and no coverage) in the BSAI

Pot partial coverage by trip target and EM and non-EM vessels in the BSAI



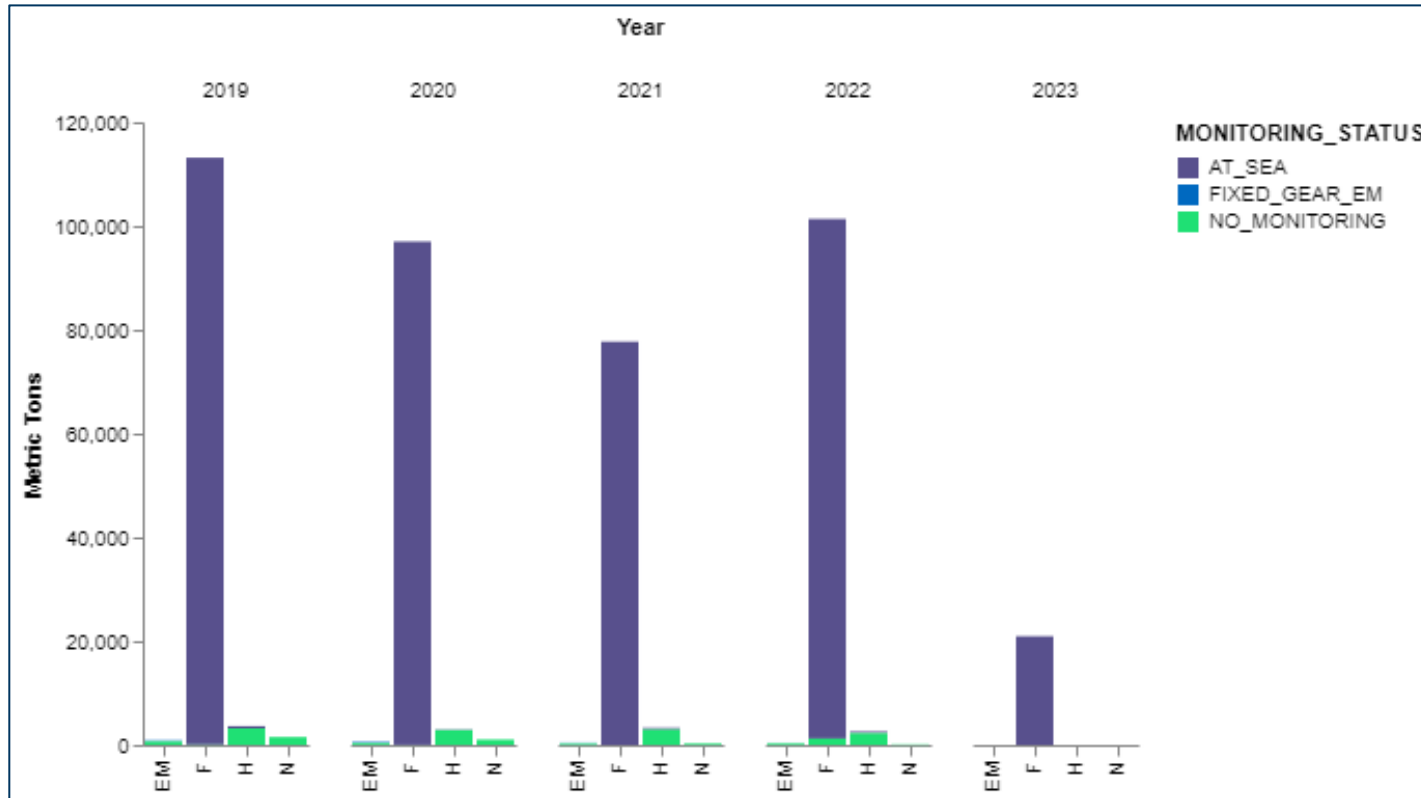
Y-axis is metric tons of groundfish and halibut. C= Cod and S= Sablefish targets



Y-axis is metric tons of groundfish and halibut. EM = Electronic Monitoring, F=Full Observer Coverage, N= No Coverage ,P=Partial Observer Coverage, TenP= Tender Pot Observer Coverage

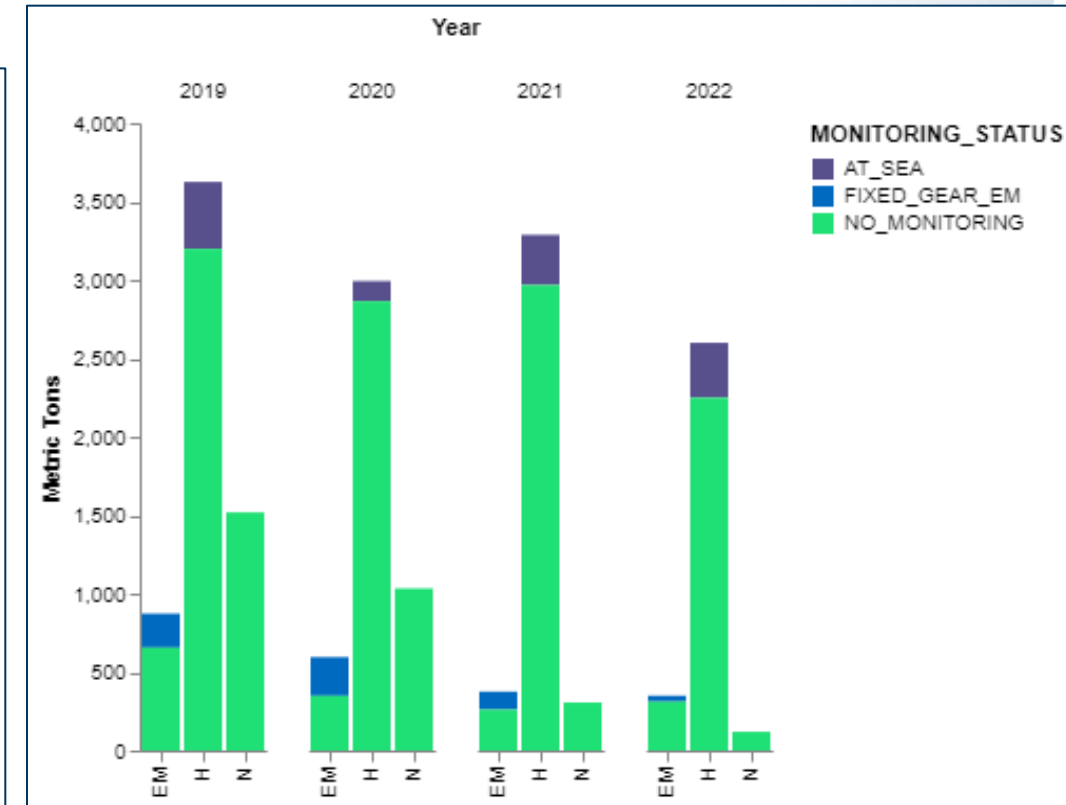
Summary of EM HAL versus At-Sea

All HAL Catch (includes full, EM, partial observer, and no coverage) in the BSAI



Y-axis is metric tons of groundfish and halibut. EM = Electronic Monitoring, F=Full Observer Coverage, N= No Coverage , H=Partial Observer Coverage

Partial Coverage HAL Vessels Only (includes EM, partial observer, and no coverage in the BSAI)



Y-axis is metric tons of groundfish and halibut. EM = Electronic Monitoring, N= No Coverage , H=Partial Observer Coverage

Challenges with EM in HAL and Pot Gear

- Timeliness of data
 - Takes a long time to review video
 - Data is not available in time to make inseason management decisions
 - Currently about six months behind with video review
 - The agency can prioritize certain fisheries to be reviewed first
- Inability to ID crab to species
 - EM reviewers are counting crab
 - EM reviewers are identifying crab as far as possible
 - No crab are being identified to species
 - Crab usually identified as king crab or Tanner crab unidentified
 - Crab that are not identified to species are not accounted for in the stock assessment



Number of Crab in EM that is Unidentified

Number of crab unidentified in EM pot and HAL

Year	Gear	Aleutian Islands		Bering Sea	
		Unidentified king crab	Unidentified Tanner crab	Unidentified king crab	Unidentified Tanner crab
2018	Pot	0	0	0	0
	HAL	10	1	0	0
2019	Pot	0	0	26	579
	HAL	0	0	0	0
2020	Pot	0	0	39	4,544
	HAL	2	0	1	0
2021	Pot	0	0	1,389	4,811
	HAL	10	0	0	0
2022	Pot	0	0	2	2,398
	HAL	0	1	0	0

- All unidentified crab in HAL gear came from sablefish or halibut trips
- All unidentified crab in pot gear came from Pacific cod trips
- 2022 EM pot trips have not all been reviewed yet



Upcoming Changes

➤ Current CAS Work (Full Coverage)

Reconcile differences in estimates between stock assessment and PSC

- Posting of haul-level estimates instead of rate-based estimates for full coverage vessels
 - Implementation of Amendment 122 (Pacific Cod Cooperative Trawl Program) will result in full coverage on all trawl vessels in the BSAI and the need for vessel-specific estimates for quota monitoring
 - Incorporate trawl EM into process

➤ Current CAS Work (Partial Coverage)

Reconcile differences in estimates between stock assessment and PSC

- BSAI PSC estimates will have a stock area component for partial coverage vessels such that estimates for stock will be consistent with PSC
- Partial coverage evaluation of stratification definitions- evaluate variance/PSC alignment/CAS legacy system changes
 - Working with Jen Cahalan (AFSC/PACStates) and Katie Palof (ADFG) on method development for crab.
- Filling the EM crab information gap?



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Questions?