

TRAWL EM INITIAL REVIEW

Presenters: Anna Henry (NPFMC), Maggie Chan (NMFS),
Melanie Ricket (NMFS), Darrell Brannan (Brannan & Assoc.)

FMAC Meeting, June 1, 2022



Prepared by: Darrell Brannan (Contractor in support of NOAA),
Maggie Chan (AKRO), Anna Henry (NPFMC), Josh Keaton (AKRO),
Megan Mackey (AKRO), Melanie Rickett (AKRO)

OUTLINE

-
- Introduction/Timeline
 - Trawl EM overview
 - Shoreside sampling
 - Cost elements and comparisons



TIMELINE OF TRAWL EM DEVELOPMENT

- 2018 Trawl EM Committee Formed
- 2018-19: Pilot Projects
- 2020-now: Exempted Fishing Permit
- June 2021: Council initiated analysis, approved purpose and need and alternative set
- February 2022: Preliminary review (SSC only)
- **June 2022: Initial review**
- October 2022: Final review
- October 2022-June 2023: Development and publication of proposed/final rule
- January 2024: Regulatory program begins



PURPOSE AND NEED

To carry out their responsibilities for conserving and managing groundfish resources, the Council and NMFS must have high quality, timely, and cost-effective data to support management and scientific information needs. In part, this information is collected through a fishery monitoring program for the groundfish fisheries off Alaska. While a large component of this monitoring program relies on the use of human observers, the Council supports integrating electronic monitoring and reporting technologies into NMFS North Pacific fisheries-dependent data collection program, where applicable, to ensure that scientists, managers, policy makers, and industry are informed with fishery-dependent information that is relevant to policy priorities, of high quality, and available when needed, and obtained in a cost-effective manner.

*The Council and NMFS have been on the path of integrating technology into the fisheries monitoring systems for many years, with electronic reporting systems in place, and operational EM in some fisheries. **An EM program for compliance purposes on pelagic pollock trawl catcher vessels and tenders both delivering to shoreside processors will obtain necessary information for quality accounting for catch including bycatch and salmon PSC in a cost-effective manner, and provide reliable data for compliance monitoring of a no discard requirement for salmon PSC. This trawl EM program has the potential to advance cost efficiency and compliance monitoring, through improved salmon accounting and reduced monitoring costs.***

Regulatory change is needed to modify the current retention and discard requirements to allow participating CVs to maximize retention of all species caught (i.e., minimize discards to the greatest extent practicable) for the use of EM as a compliance tool on trawl catcher vessels in both the full and partial coverage categories of the Observer Program and meet monitoring objectives on trawl catcher vessels in the Bering Sea (BS) and Gulf of Alaska (GOA) pelagic pollock fisheries.

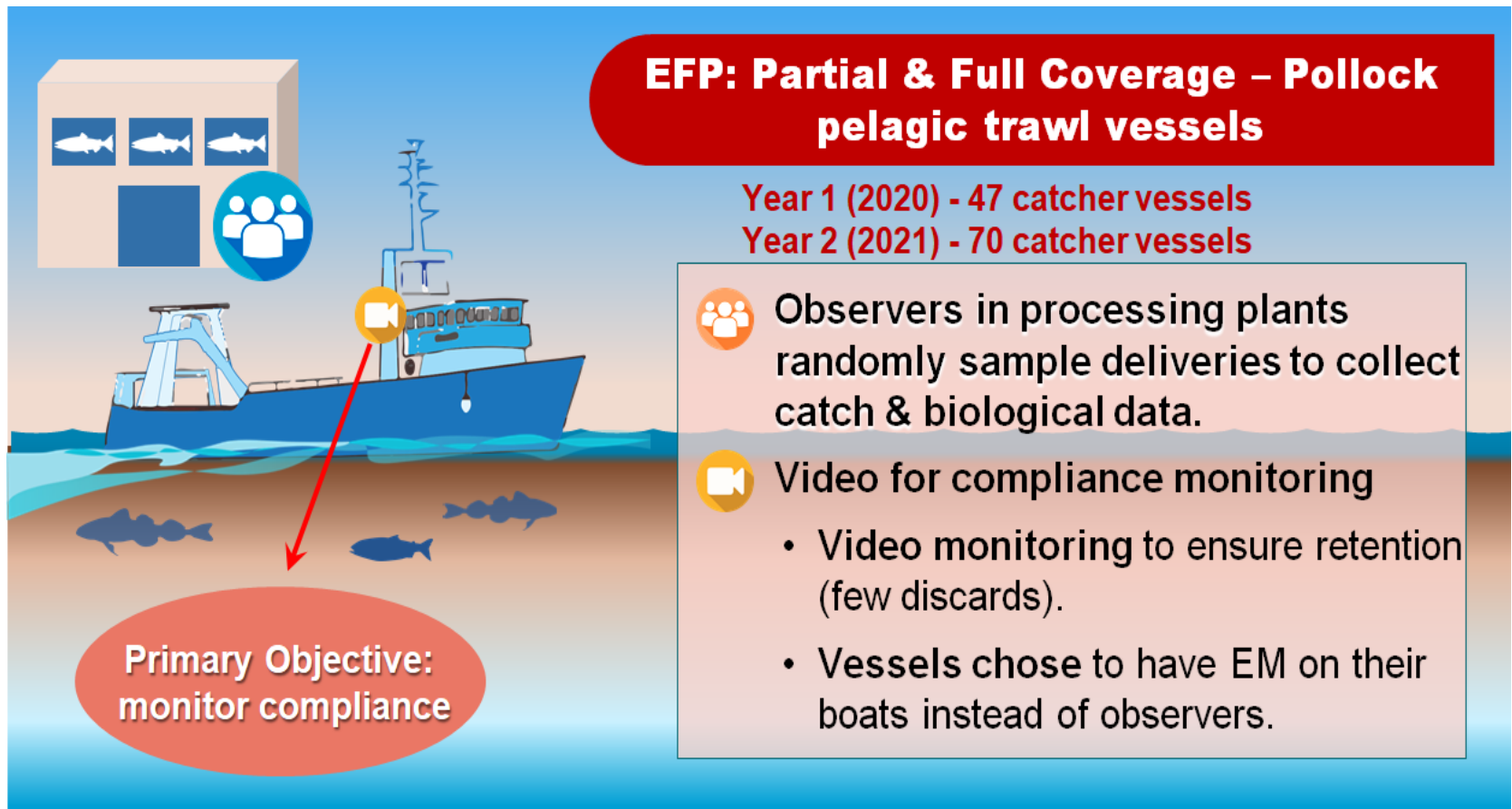


ALTERNATIVES

- Alternative 1, No Action
- Alternative 2, Electronic Monitoring implemented on vessels (both catcher vessels and tenders) in the Bering Sea and Gulf of Alaska
- Alternative 3, Electronic Monitoring implemented on catcher vessels delivering to shoreside processors (CVs only, no tenders)
 - Option 1 Bering Sea
 - Option 2 Bering Sea and Gulf of Alaska



OVERVIEW OF EM IN ALASKA



EFP: Partial & Full Coverage – Pollock pelagic trawl vessels

Year 1 (2020) - 47 catcher vessels
Year 2 (2021) - 70 catcher vessels

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

Video for compliance monitoring

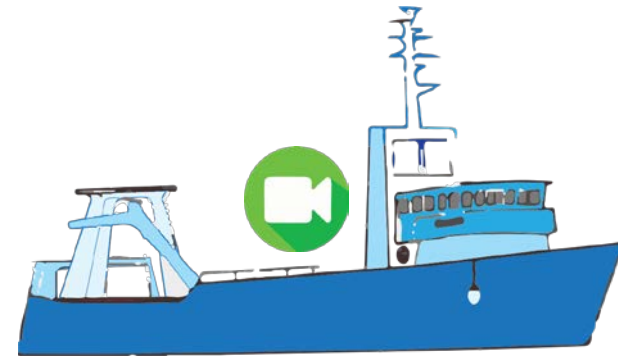
- Video monitoring to ensure retention (few discards).
- Vessels chose to have EM on their boats instead of observers.

Primary Objective: monitor compliance



EM FOR COMPLIANCE MONITORING

- Maximized Retention rules - “Almost all” catch retained for delivery
 - Most trips have no discard events
- Exceptions to retention requirements
 - Marine mammals
 - Sharks (too big)
 - Jellyfish (product quality)
 - Discards for vessel stability and safety
- **ALL** discards reported in logbook and eLandings
- Cameras record **ALL** hauls
- **ALL** hauls are reviewed to verify logbook and eLandings data
- Vessel logbook data, verified through EM, is used for catch accounting
- Shoreside observers sample unsorted catch in the plant
- Vessel Monitoring Plan (VMP) is a flexible tool that outlines operator responsibilities, annually created specific to each vessel.



TRAWL EM CAMERA VIEWS- START



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



TRAWL EM CAMERA VIEWS; +15 MINUTES



Screenshots from EM;
+15 Minutes



STOCK ASSESSMENT DATA STREAM UPDATES

Status quo: At-sea observers collect data at the individual tow level.

Proposed regulatory Trawl EM program: Shoreside observers collect data at the trip level. Vessels record tow specific information in logbooks.

- SSC requested that stock assessment scientists specifically address the impacts.
- Some loss of spatial and temporal resolution. Some data impacts can be mitigated with tow information from logbooks. AKRO will link tow specific information from logbooks with trip level data collected by shoreside observers.
- Pollock: trip level information does not negatively impact stock assessments, but may affect development of future approaches to the assessments and/or other uses for spatially resolved fishery data.
- Pacific cod and Pacific ocean perch: trip level information will likely have little impact on stock assessments.
- Sharks: trip level information will likely have little impact on stock assessments. Trawl EM may provide additional or new information for scientists.



FUNDING FOR EM VIDEO REVIEW

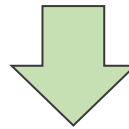
Excerpt of Table 3-8 in Draft EA/RIR (page 79)

Cost Category (per NMFS Policy 04-115-02)	Trawl EM Cost	Responsible Parties	Proposed Funding Source
Sampling Cost	Video Review	EM Review service provider	Partial Coverage Observer Fee - GOA
			New BSAI EM Review Fee
Sampling Cost	Data Storage	EM Review service provider	Partial Coverage Observer Fee - GOA
			New BSAI EM Review Fee



NEW BSAI EM REVIEW FEE

Cost of BSAI video review and data storage from previous year (Year 1)



Use pollock history to divide cost amongst BSAI Trawl EM vessels
(Year 1 costs / Year 1 BSAI Trawl EM vessels based on pollock history)



Billing occurs during fishing season (during Year 2)



If vessel fails to pay fee, could result in removal from the Trawl EM program
the following year (potential removal for Year 3)



COMMUNICATION IS KEY

Direct communication between vessel and shoreside observer **DOES NOT** replace plant to observer communications!



 = GOA communication only

 = All communications (BSAI and GOA)



CATCH SAMPLING SHORESIDE METRICS

- Early in the EFP, it was identified that shoreside observers were not able to meet sampling objectives due to many factors. The team met and discussed options to improve.

	First 3mos of EFP	A Season 2020	B season 2020	A/B Season 2021	A Season 2022
Bering Sea (Goal 100%)					
PSC Retention	100%	100%	100%	100%	100%
Pollock Biological Data (Otoliths and Length)	98%	99%	97%	96%	77%
Species Composition	98%	80%	98%	99%	77%
Gulf of Alaska (Goal 30%)					
PSC Retention	32%	31%	33%	33%	33%
Pollock Biological Data (Otoliths and Length)	5%	13%	32%	25%	27%
Species Composition	1%	2%	32%	25%	27%



CATCH MONITORING CONTROL PLAN

What is a Catch Monitoring Control Plan (CMCP)?

A plan submitted by the owner and manager of a processing plant, and approved by NMFS, detailing how the processing plant will meet the catch monitoring and control standards that are determined by federal regulations.

Why have a CMCP?

A CMCP is in place for all BSAI processing plants that take AFA pollock deliveries, but these are not currently in place for the GOA.

Proven benefits of CMCP's:

- ❑ Tracking salmon for accurate retention counts
- ❑ Detailed communication guidelines
- ❑ Description/diagrams of the observer sample collection points.
- ❑ Flexible tool that can help meet sampling goals



***May be a cost for plants, especially in the GOA**
***Outreach needed: GOA processing plants**



OBS DATA COLLECTION: VESSEL VS PLANT

Data type	Vessel Observer	Shoreside Observer
Haul specific	Y	*
Trip specific	Y	Y
Species composition	Y	Y
Biologicals	Y	Y
Halibut	Y	Y
Salmon	Y	Y**



Plant observer may have more opportunities to collect data on a safe and stable platform

* Some haul specific data can be approximated using trip data and haul data reported in logbooks

** Next slide for details

Data will now be collected from tender vessels at shoreside processing plants by observers, and transfers monitored by EM data reviewer.



SHORESIDE SPECIES COMPOSITION AND BIOLOGICAL SAMPLING

- BSAI- 100% of the deliveries are sampled
- GOA- Goal of 30% of the deliveries are sampled
- Prohibited species data collection:
 - All Salmon are counted; Biological, and genetic samples collected from randomly selected salmon.
 - All Halibut are counted and measured
 - Crab and Herring are sorted and weighed by processor, Observer can monitor this.

Sampling Rates Goals set by FMA

Current goals (2021)

Predominant Species	Sex/Length Data	Biological Data (All specimen fish must have an associated s/l/w specimen)
Bering Sea Pollock	Every Sampled Offload ~100 pollock and ~100 squid (unsexed) and ~25 Rougheye and ~25 Sablefish	Every Sampled Offload
		2 pollock otolith pairs with maturity scan for all female otolith fish and ~ 8 pollock sex/length/weight specimens (must not be from an otolith fish)
		Every Sampled Offload
		25 Rougheye otolith pairs
Gulf of Alaska Pollock	Every Sampled Offload ~ 150 Pollock and ~ 30 Pacific Cod	Every Sampled Offload
		25 Pollock otolith pairs with maturity scan for all female otolith fish and 5 Pacific Cod otoliths

*Tender vessels are included in the observer sampling scheme.



SALMON RETENTION DATA UNCHANGED

Salmon retention remained the priority for observers at the plant (and the EM reviewers).



Observer duties:

- Collect and report **salmon retention** data
- **Identify species, count, sex and weigh** all the salmon
- Collect **salmon genetics** data on all sampled deliveries according to protocols in FMA observer manual.
- **FMA ID scales** for salmon according to protocols in FMA observer manual.
- Collect **tagged salmon data** according to protocols in FMA observer manual.

If observers are unable to collect all requested data shoreside then they are instructed to continue monitoring for salmon, and prioritize all salmon related retention and biological data.



CMCP's are critical to salmon retention data!



SAMPLING AND DATA COLLECTION CHALLENGES

- Communication gaps between vessels/plants. These were addressed in near real time, and CMCP's or Catch Handling Plans helped improve communications.
 - Observers must have adequate prior notice to delivery in order for them to be available to sample and collect unbiased data.
 - Observers must have specific information on delivery date/time and estimate tonnage prior to delivery.
- Work Load: Observers prioritized salmon retention data, which in some cases prevented them from collecting biological data resulting in need for multiple observers
 - CMCPs can introduce EM options like bin monitoring to assist observer provide precise salmon PSC data.
 - EM Options are currently used in some CMCPs to meet goals
 - By allowing observers to leave sorting line to sample during a haul we can better utilize their time and skills for other data collections



BSAI VS GOA SHORESIDE PLANTS: WHAT WORKED AND WHAT CAN BE IMPROVED.

- Based on post cruise surveys with observers working in plants.
- BSAI had preexisting Catch monitoring and control plan (CMCP) that aided the observers in data collection and communications.
- GOA implemented a Catch Handling Plan similar to the CMCP in year two of the Trawl EM EFP.
- Observer sampling areas or station exist at a minimal level for the collection of Salmon Retention data at AFA processing plants, are not in place for the GOA or non-AFA plants.
- Communication methods were challenging at start of EFP. These were modified several times



REGULATORY IMPACT REVIEW (RIR)

COST ELEMENTS
AND
COMPARISONS

APPROACH TO COST ANALYSIS

- Many uncertainties and challenges associated with estimating costs
 - **Differing levels of participation, effort, scope and program design specifics will entail very different cost structures, impacting both the range of individual costs and average costs per unit.**
 - Proprietary information (less than 3 providers) requires rolling up to large categories and overall costs (for both EM and observer costs)
 - Different companies have different structures and cost models
 - Despite the cost reporting subgroup's discussions there may still be nuances/differences to how each company defines each category.
 - **Providers do not track costs in ways that allow parsing by alternative or option (i.e., BS v. GOA, CVs v tenders)**
 - Impacts of scaling and program design- how would these costs change as the participation changes and specific program design changes and this is different for each provider based on their current staffing and ability to scale up/ thresholds where a new stair-step of costs may be reached.
 - Vessels participate in multiple programs- some in west coast, some in BS and GOA so costs are spread across different areas, while some vessels participate in one area
 - Unknown program design specifics that may influence costs (i.e., Design of program and fees can affect incentives to maintain equipment)
 - Technology changes- some costs will decrease as technology improves- i.e., data drives; some costs will go up- i.e., control centers that can do more may cost more
 - **Multitude of different fishery operations- rationalized program, race to fish, shoreside, tenders**
 - **Unknown future effort levels based on TACs and changes in management.**
 - **COVID- impact on costs**



APPROACH TO COST ANALYSIS

- Estimate range of costs of at sea observers (Alt 1) for fishing effort from 2021 EM EFP
 - Based on costs reported in Observer Program 2020 Annual Report
- Estimate range of costs of 2021 EM EFP (Alt 2)
 - EM costs reported by providers in cost categories identified by subgroup
 - Shoreside observer costs estimated based on discussions with providers
- Qualitatively describe comparisons and how costs may change with potential regulated program

Table 5-34 participation and effort by program component in 2021 EM EFP. *Metrics reported are for CVs that delivered to tenders. 4 tenders accepted EM deliveries in 2021. **Given overlapping participation totals may differ from sum of each element

Area	CVs		Trips		Hauls		Days	
	number	%	number	%	number	%	number	%
BS	34	59%	1,055	70%	3,321	78%	3,041	79%
BS and GOA	12	18%	na	na	na	na	na	na
GOA	22	41%	448	30%	951	22%	823	21%
using tenders in GOA*	3	4%	20	1%	24	1%	22	1%
Total**	68		1,503		4,272		3,864	



AT SEA OBSERVER COSTS

- Multiplied the sea days of all EM trips by the fully loaded sea day cost of an at sea observer as reported in the 2020 annual report.
- Sea days are calculated using two separate methods:
 - 1) estimated days fished, which assumes one of the days the vessel is gone is a day that the vessel did not harvest and retain catch (for example a trip that left on the 20th of the month and returned on the 22nd would be two days)
 - 2) estimated days +1 which assumes the vessel harvested and retained catch every day the vessel was gone (for example a trip that left on the 20th of the month and returned on the 22nd would be three days).



AT SEA OBSERVER COSTS-FULL COVERAGE

- Industry-funded through a pay-as-you-go system whereby fishing vessels procure observer services through NMFS-permitted observer service providers
- The average “fully-loaded” cost per day of observer coverage in the full coverage category in 2020 was \$375
- The 2020 Annual report also provides a daily rate that includes incidentals, for the pelagic trawl CVs of \$415

Table 5-26 estimates of 2021 BS costs for at-sea monitoring on EM trips

	EM days	fully loaded day		Total at-sea cost estimate for EM days	
		low	high	low	high
days fished	3,041	\$375	\$415	\$1,140,375	\$1,262,015
days +1	4,217	\$375	\$415	\$1,581,375	\$1,750,055

Sources: Sea days from AKFIN summary of CAS data (Trawl_EM_Trips 3-23-22). Cost per day from NPOP annual reports see <https://repository.library.noaa.gov/gsearch?terms=North%20Pacific%20Observer%20Program%202019%20Annual%20Report&collection=>



AT SEA OBSERVER COSTS- PARTIAL COVERAGE

- Since 2018, the target deployment rates for the trawl partial coverage strata have ranged from 16% to 30%
- The average “fully-loaded” cost per day of observer coverage in the partial coverage category was \$1309 in 2019 and \$1,381 in 2020 (As reported in the North Pacific Observer Program Annual Report)

Table 5-28 estimates of costs for at-sea monitoring on GOA EM trips in 2021

	EM days			fully loaded cost per day		Total at-sea cost estimate for EM days	
	EM days	16%	30%	low	high	low	high
days fished	823	132	247	\$1,309	\$1,381	\$172,369	\$340,969
days +1	1,264	202	379	\$1,309	\$1,381	\$264,732	\$523,675

Sources: Sea days from AKFIN summary of CAS data (Trawl_EM_Trips 3-23-22). Cost per day from NPOP annual reports see <https://repository.library.noaa.gov/gsearch?terms=North%20Pacific%20Observer%20Program%202019%20Annual%20Report&collection=>



FULL COVERAGE SHORESIDE PLANTS

- AFA plants are in the full coverage category whether they are physically located in the BSAI or GOA.
- AFA shoreside plants located in Dutch Harbor/Unalaska or Akutan will realize an increase in the number of observer plant days as it is anticipated that three to five observers will be required at each BS plant. Two observers working when plant is taking pollock deliveries.
- AFA plants that are located in the GOA and tend to take fewer AFA deliveries will also have additional plant observers, though likely not as many as AFA plants in Dutch Harbor/Unalaska or Akutan.
- A specific number of observers for each plant will not be defined in regulation to allow NMFS to adjust coverage to meet sampling needs as they may change.
- Increasing the number of plant observers needed is expected to increase costs plant operators must pay for coverage relative to the No Action alternative. The analysis does not address how increased plant observer costs and vessel observer cost savings will be negotiated between the parties involved.



FULL COVERAGE SHORESIDE PLANTS

- The plants contract directly with an approved observer provider for coverage.
- Compensation for observer coverage is negotiated between the vessels/plants and the observer provider.
- The average “fully-loaded” full coverage cost per day for an observer in 2020 was reported to be \$375 in the North Pacific Observer Program annual report.



FULL COVERAGE SHORESIDE PLANTS

- Based on discussions with observer providers and the average cost per day in 2020, a low (\$380/day), medium (\$410/day), and high (\$430/day) is assumed for full coverage plant observers.
- The values attempt to account for increasing observer travel costs, tight labor markets, overhead costs and general inflation.
- These values should be considered estimates and no specific value is given a higher probability of occurring when the program may be implemented in 2024.
- Based on 1,588 plant observer days in 2021 under the EM EFP, the assumed rates result in full coverage plant observer costs of \$608k to \$688k.



PARTIAL COVERAGE SHORESIDE PLANTS

- Shoreside plants in the partial coverage category do not have plant observers under the No Action Alternative. The observer assigned to the vessel monitors the offload, enumerates PSC, and takes required biological samples.
- At-sea coverage rates are determined in the ADP and for pelagic trawl was set at 16% in 2021. Note the rate ranged from 16% to 30% from 2018-2022.
- Plants are currently required to pay half of the 1.65% observer fee assessed on the ex-vessel value of deliveries.
- The 1.65% fee funds the at-sea observer coverage and the ADP determines sampling rates that can be funded with the available funds.
- One observer provider has the contract with NMFS for the partial coverage fleets.
- Estimating future daily costs for shoreplant observers challenging, but in 2020 the average partial coverage at-sea day was estimated to be \$1,381/day in the 2020 North Pacific Observer Program's annual report.



PARTIAL COVERAGE SHORESIDE PLANTS

- Actual cost data cannot be reported because of confidentiality restrictions.
- Confidentiality restrictions, uncertainty regarding actual costs, future contracts to provide partial coverage, and whether shoreplant observers will be compensated the same as at-sea observers results in a broad range of cost estimates for the shoreside partial coverage observers.
- Partial coverage shoreside plant observer costs were estimated to fall within a range that included a low (\$500/day), mid (\$1,050/day), and high (\$1,600/day) rate. These rates were based on the reported at-sea partial coverage rate and discussions with observer the provider.
- During 2021, there were 548 observer days at plants located in the GOA under the EFP. The analysts did not attempt to project the number of days that would be needed under the regulated program, but will depend on participation in the voluntary program, available funding, actual future daily rates, and coverage rates for plants determined in the ADP.
- Using the 2021 EFP shoreplant days and range of daily costs, a total annual cost for shoreplant partial coverage was estimated to range from \$274k to \$877k.



EM COSTS

Table 5-31 Total costs and average per unit costs for the 2021 Trawl EM EFP. Numbers in parenthesis correspond to the level of participation and effort in the 2021 EFP. *Day represents estimated fishing days, for example a trip that leaves on the 20th and returns on the 22nd is considered two days.

	Total costs	Average per unit cost for 2021 EFP			
		CV (68)	Trip (1503)	Haul (4272)	Day* (3864)
Ongoing costs					
1. Service Provider Fees and Overhead	\$188,559	\$2,773	\$125	\$44	\$49
2. EM Equipment Maintenance and Upkeep	\$86,832	\$1,277	\$58	\$20	\$22
3. Data Transmittal	\$5,720	\$84	\$4	\$1	\$1
5. Data Review	\$101,488	\$1,492	\$68	\$24	\$26
6. Data Processing and Storage	\$9,403	\$138	\$6	\$2	\$2
Total ongoing costs	\$392,002	\$5,765	\$261	\$92	\$101
One-time costs					
4. Equipment Purchases and Installation	\$276,653	\$17,496	\$7,106		

p. 162

Source: Discussions with EFP EM service providers and data reviewers.



Cost categories developed by subgroup described p. 152-154



SUMMARY OF ESTIMATED COSTS

Estimated costs of Alternative 1 (for effort associated with 2021 trawl EM EFP)			
Description	Area	Low Estimate	High Estimate
Partial coverage at-sea Observer Cost	GOA	\$172,000	\$524,000
Full coverage at-sea observer cost	BS	\$1,140,000	\$1,750,000
Full coverage shoreside monitoring cost	BS	\$304,000	\$344,000
Total	BS and GOA	\$1,616,000	\$2,618,000

Estimated costs of 2021 trawl EM EFP (Alternative 2 at EFP level of effort, scope, scale)			
Description	Area	Low Estimate	High Estimate
Ongoing EM costs (does not include one-time equipment costs)	BS and GOA	\$392,000	\$392,000
Partial coverage shoreside monitoring cost	GOA	\$274,000	\$877,000
Full coverage shoreside monitoring cost	BS	\$608,000	\$688,000
Total	BS and GOA	\$1,274,000	\$1,957,000

Table 5-40 p. 182



SALMON PSC ACCOUNTING

- It is anticipated that salmon bycatch accounting will improve under the action alternatives.
- The sampling and enumeration methods for salmon PSC will not change under this action.
- Under Alternative 1, observers in the partial coverage category are deployed using established random sampling methods to collect data on a statistically reliable sample of fishing vessels. The vessel observer monitors the offload and conducts a full enumeration of salmon at the shoreside processing plant.



SALMON PSC ACCOUNTING

- EM (under Alternative 2 or Alternative 3 option 2) is expected to improve salmon accounting on shoreside delivery partial coverage trips by:
 - reduced extrapolation of salmon bycatch estimates from sampled tender vessel deliveries across that strata,
 - ensuring at-sea discards do not occur and by having greater coverage of the CVs deck than one observer can provide,
 - all EM trips will have 100 percent EM review for discards at-sea,
 - Increasing the percentage of partial coverage trips that are monitored for discard/retention compliance at-sea (it is assumed that vessels with EM will account for a larger percentage of trips than currently covered by at-sea observers), and
 - full enumeration of salmon bycatch at the plant on larger percentage of partial coverage shoreside deliveries than are currently monitored by at-sea observers in the plant (note that under the EFP plants had 30 percent coverage and trawl CV's target coverage was 16 percent in the 2021 ADP), which results in less extrapolation of salmon bycatch rates to unobserved trips.



SAFETY

- The safety of members of the fishing industry and the observers that monitor those fisheries is of utmost importance.
- A beneficial aspect of the trawl EM EFP was that observers were collecting data on a stable and safe platform. By moving observer sampling duties to shoreside processors they were able to sample without the safety concerns associated with sampling at-sea.
- The pollock fishery is a relatively safe fishery by Alaskan fishery standards, but it is still a challenging working environment.
- NIOSH developed the Commercial Fishing Incident Database to track incidents/fatalities in the U.S. commercial fishing industry. Since 2003, NIOSH's CFID contained nine reported incidents in the pollock fishery. The most recent incident occurred in 2018.
- Two of the fatalities were at-sea observers, but the fatalities occurred while the vessel was moored at the dock.



THANK YOU

Contributors

- Steve Barbeax, AFSC
- Jennifer Cahalan, PSMFC
- Wynn Carney, NOAA OLE
- Kelly Cates, AKRO
- Obren Davis, AKRO
- Anne Marie Eich, AKRO
- Jennifer Ferdinand, AFSC FMA
- Mary Furuness, AKRO
- Phil Ganz, AKRO
- Jason Gasper, AKRO
- Pete Hulson, AFSC
- Jim Ianelli, AFSC
- Wes Larson, AFSC
- Bridget Mansfield, AKRO
- Tom Meyer, NOAA GC
- Krista Milani, AKRO
- Scott Miller, AKRO
- Jennifer Mondragon, AKRO
- Cole Monnahan, AFSC
- Alex Perry, NOAA OLE
- Julie Scheurer, AKRO
- Lisa Thompson, AFSC FMA
- Cindy Tribuzio, AFSC

Persons Consulted

- Julie Bonney, AGDB
- Samantha Case, CDC/NIOSH/WSD
- Ruth Christiansen, UCB
- Stefanie Dukes and Mike Orcutt, Archipelago Marine Research
- Jared Fuller
- Michael Lake and David Edick, Alaskan Observers
- Charlotte Levy, Aleutians East Burrough
- Nancy Munro, Stacey Hansen, and Jo Ann Alvarez, Saltwater Inc.
- Courtney Paiva, PSMFC
- Luke Szymanski, AIS

