Update on the Partial Observer Coverage Cost Efficiencies Integrated Analysis (i.e. the 2024 ADP)

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Pacific States Marine Fisheries Commission

Outline

- Background
  - Reminder of project priorities and scope
- Current '2024 ADP' project
  - Design elements
  - Designs under consideration
  - Design evaluation
- Information requested by the committee
  - Known data gaps for stock assessment
  - Zero coverage
  - Potential cost savings

Reminder of Priorities

C-2 Observer Fee Analysis - Council Motion

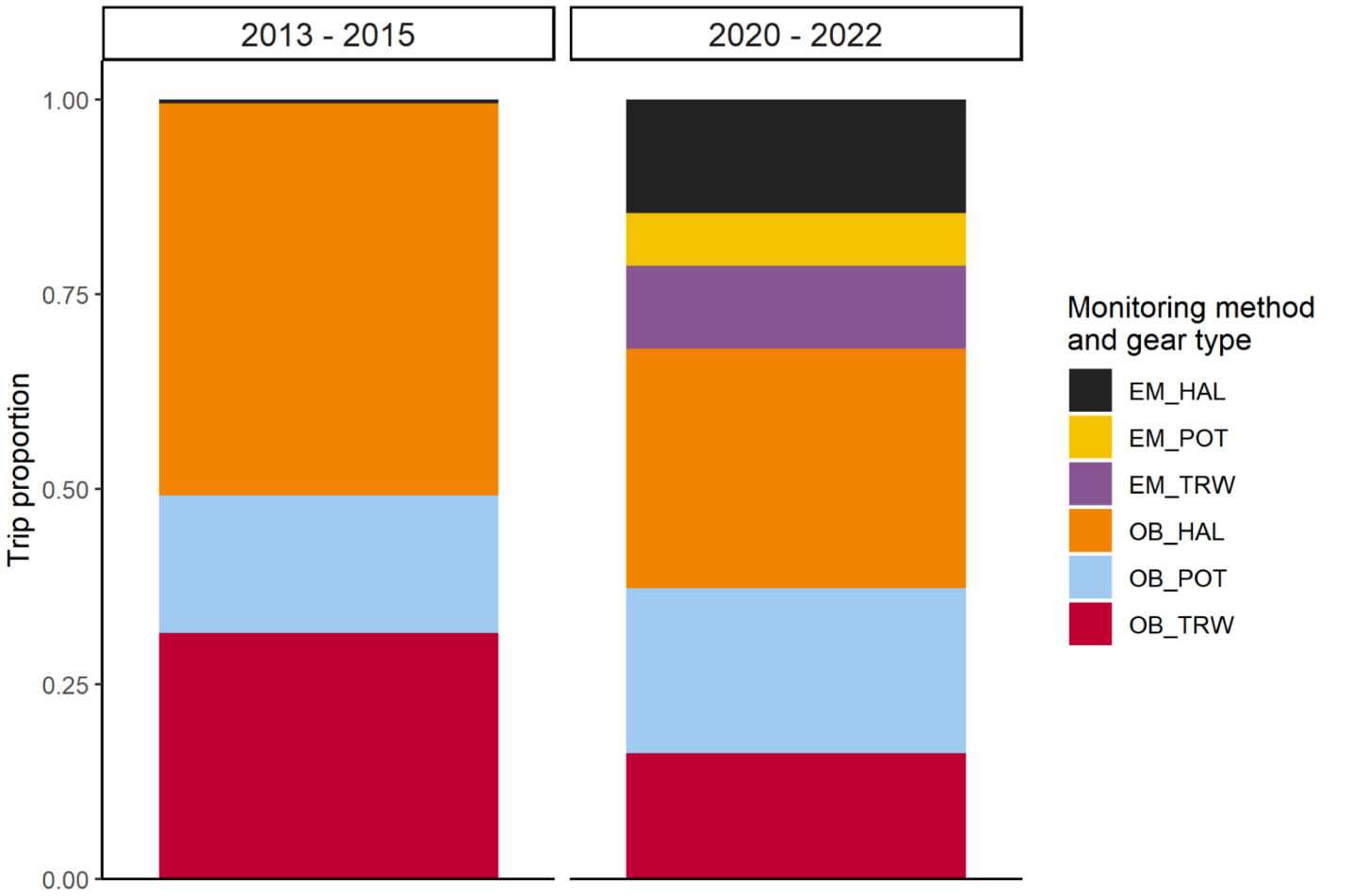
October 5, 2019

The Council identifies cost efficiency as its highest priority for work on the partial coverage observer program. Immediate efforts should focus on:

- Pelagic trawl EM combined with shoreside sampling (Analytical tasks 14,16);
- Integrated monitoring plan for fixed gear that combines EM, shoreside sampling, and at-sea observer coverage as needed (e.g., consider whether the 15% hurdle is still the appropriate baseline level for observer coverage in combination with EM coverage; develop average weight protocols to support use of EM, Analytical tasks 18, 19);
- Optimizing the size and composition of the fixed gear observed and EM fleets, taking into account both cost priorities and data needs for average weights and biological samples (including consideration of expansion of the zero-coverage pool to include vessels fishing from remote ports harvesting small amounts of fish).

The Council requests that staff work with the agency to provide a detailed workplan with timelines for each priority.

How Partial Coverage Has Changed



Integrating EM

Past

- Research
- Exempted Fishing Permits (EFPs)

Present

- Regulated program
- Rates set by policy at 30%
- Fixed gear EM review often not timely enough for data to be used for inseason management

Potential Future

- Rates set annually by analysis
- Shorter review times so that data can be used for inseason management
- Avoid stock assessment gaps

Reminder of Scope

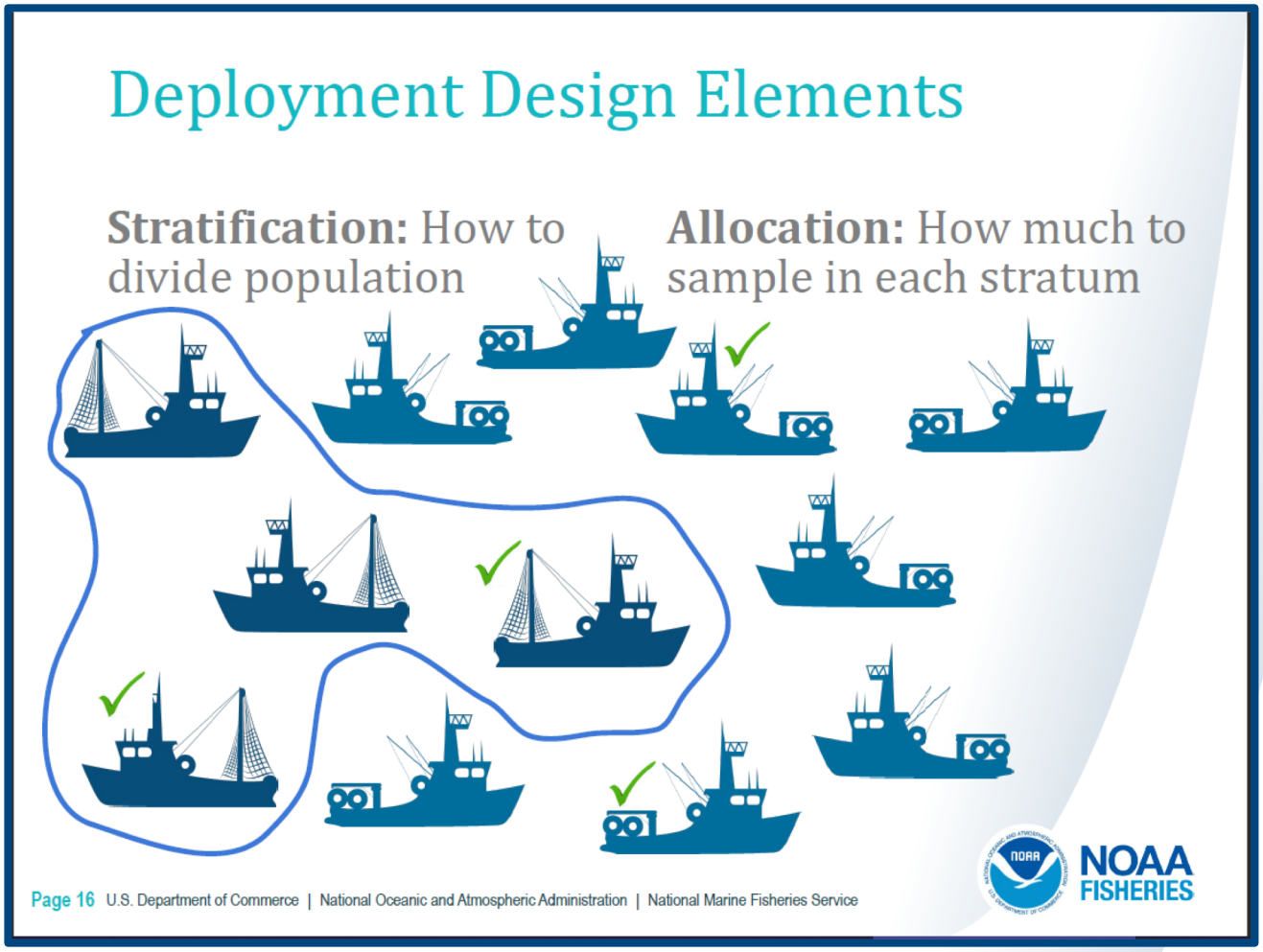
- The total cost of the program is determined by the fee percentage
- The fee percentage was informed, in part, by what coverage rates are likely at different levels of funding
- The 2024 ADP analysis will focus on the cost per unit of monitoring as opposed to total cost of the program
- The largest reductions in cost per unit of monitoring are likely to be found outside of stratification and allocation

Summary of Priorities

- Design a monitoring program that collects credible, statistically rigorous scientific data
- Collect the best and most data for a given budget

Proposed Sampling Designs

September 2022 PCFMAC meeting



Proposed Sampling Designs

Designs are the combination of **Stratification** & **Allocation**

Stratification

- used to simplify logistics
- decrease variance of estimates
- is defined by characteristics know before sampling (when a trip is logged in ODDS)
  - the type of monitoring tool
  - gear type
  - FMP

Allocation

- used to meet monitoring goals
  - spatial and temporal distribution of samples throughout fisheries
  - control costs
  - control variance
- one stage or two stage

Proposed Sampling Designs

Stratification I

- **Status quo:** Monitoring tool and Gear type

	Hook-and-line	Pot	Trawl
Observer	OB-HAL	OB-POT	OB-TRW
Electronic Monitoring	EM-HAL	EM-POT	EM-TRW

- **Considering adding FMP:**

OB-HAL-BSAI	OB-HAL-GOA	OB-POT-BSAI	OB-POT-GOA	OB-TRW-BSAI	OB-TRW-GOA
EM-HAL-BSAI	EM-HAL-GOA	EM-POT-BSAI	EM-POT-GOA	EM-TRW-BSAI	EM-TRW-GOA

Proposed Sampling Designs

Stratification II

- **EM and Observers at-sea on fixed-gear EM vessels simultaneously**
  - A subset of trips selected for at-sea EM monitoring additionally selected to carry an observer.
  - Reduce gaps in biological data (haul-specific)
  - Excludes fixed-gear EM vessels that cannot accommodate an observer
- **Dockside sampling of EM-POT vessels**
  - These vessels generally have low at-sea discards
  - Requires maximized retention of catch
  - Dockside sampling of catch by observers
  - Reduce gaps in biological data (trip-specific)

Proposed Sampling Designs

Allocation

Equal Rates

Status Quo

Proximity

Cost-weighted boxes

- Acts as a baseline to which all other designs can be compared.
- All strata are allocated the same sampling rate, proportionate to the number of trips in the strata.

Proposed Sampling Designs

Allocation

Equal Rates

Status Quo

Proximity

Cost-weighted boxes

Current method

- 30% Fixed-gear EM strata trips
- 33.3% Trawl EM strata deliveries
- Observer strata sample effort allocation
  - 15% minimum rate
  - mean of between-trip PSC salmon, PSC halibut and discard variance ('compromise allocation', Cochran 1977)

Proposed Sampling Designs

Allocation

Equal Rates

Status Quo

Proximity*

Cost-weighted boxes

* Under development!

Balances ability to capture variety of fishing effort and sample size.

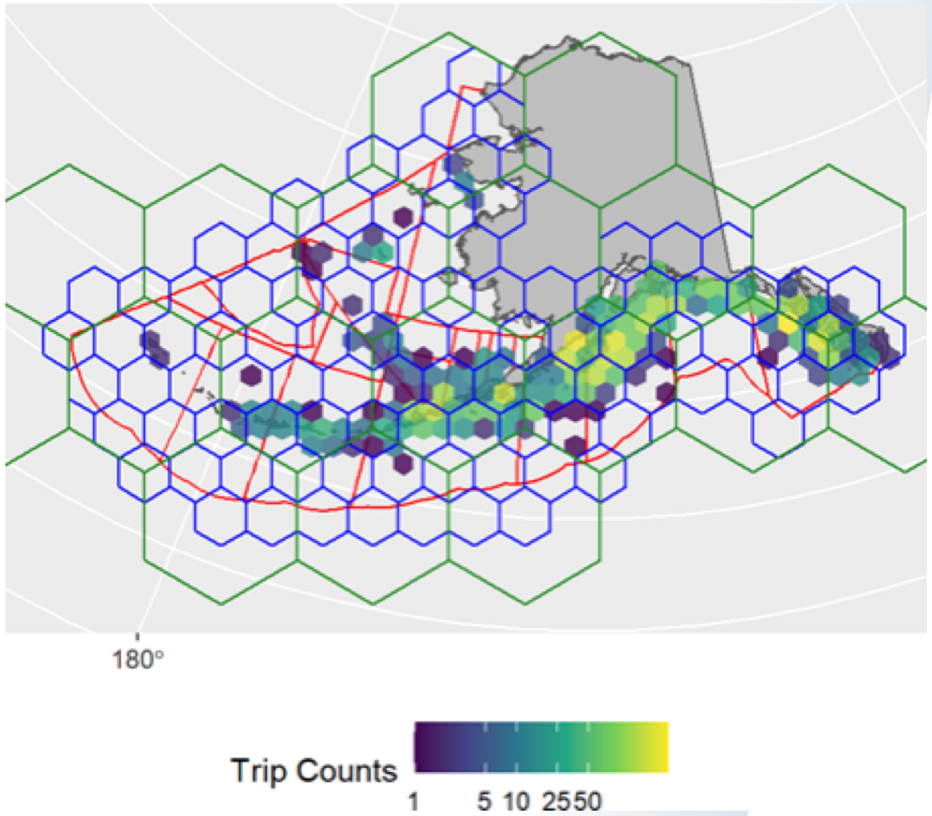
- Quantifies probability a '**trip**' or neighbor will be sampled
- Controls for small sample size

Allocates more to strata with

- More dispersed fishing effort
- Lower fishing effort

‘Boxes’

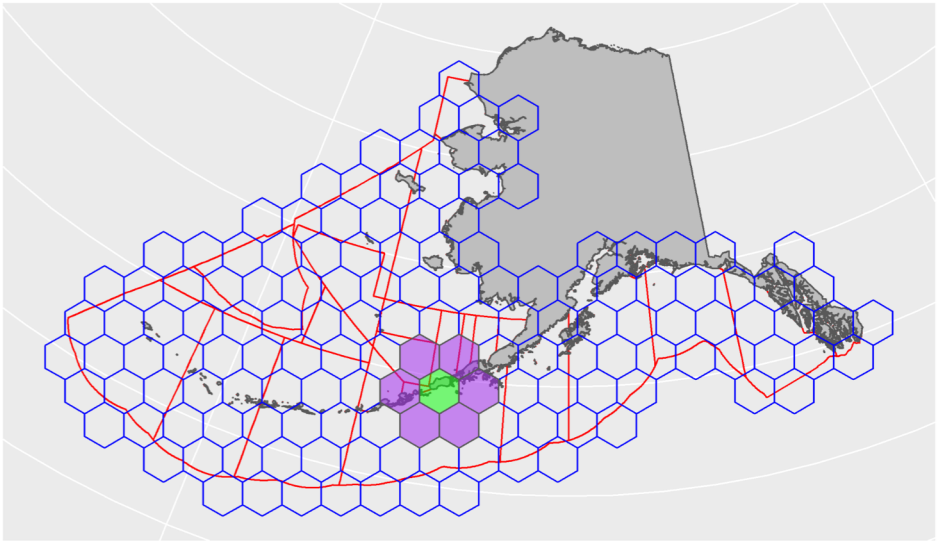
- Space and time only
  - Assessed a wide range of spatial and temporal combinations
  - Each box counts ‘neighboring’ trips in both space and time. More trips = greater likelihood of being included in samples
  - Allocate based on the distribution of fishing trips in space and time



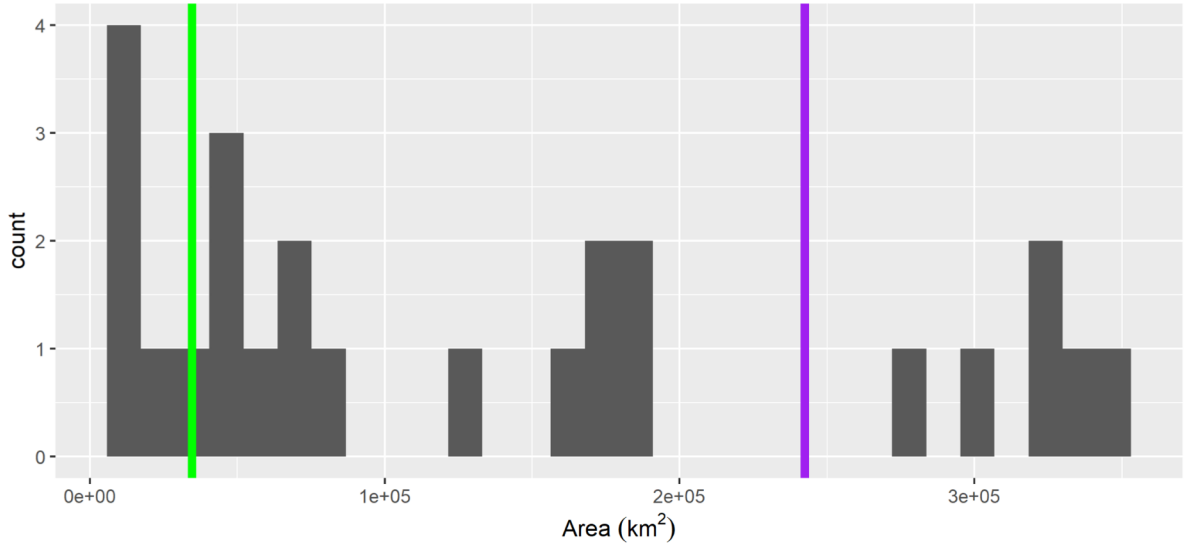
‘Boxes’

- Each box : **200km-wide** hexagon cell and **1-week**
- Neighboring trips : Include **adjacent cells** and **+/- 1 week**
- For reference, the spatial extent of a box and its neighbors is ~ NMFS area.

Grid of 200km-wide hexagon cells.

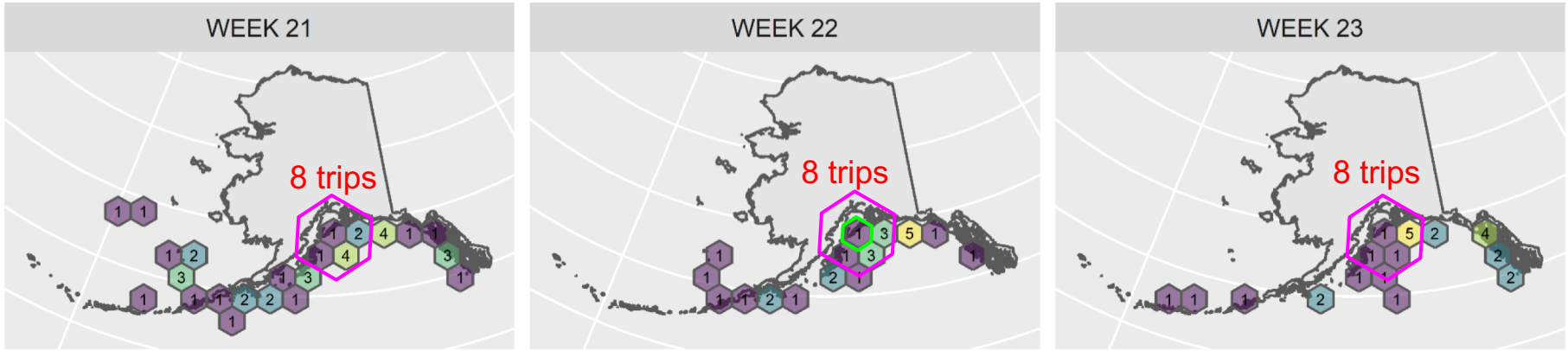


Histogram of extent of NMFS Areas. Green = box, Purple = box with 6 neighbors.



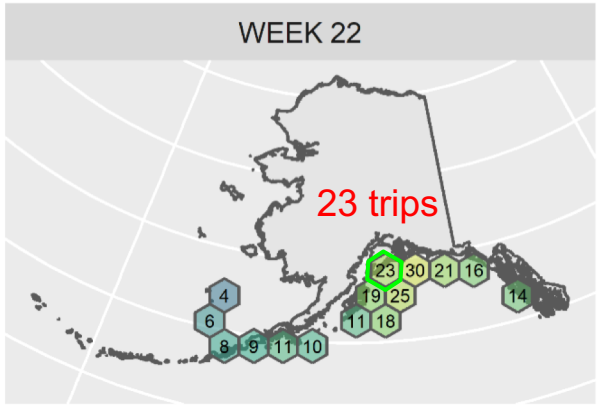
Proposed Sampling Designs

Count of trips per cell



Count of neighboring trips per cell

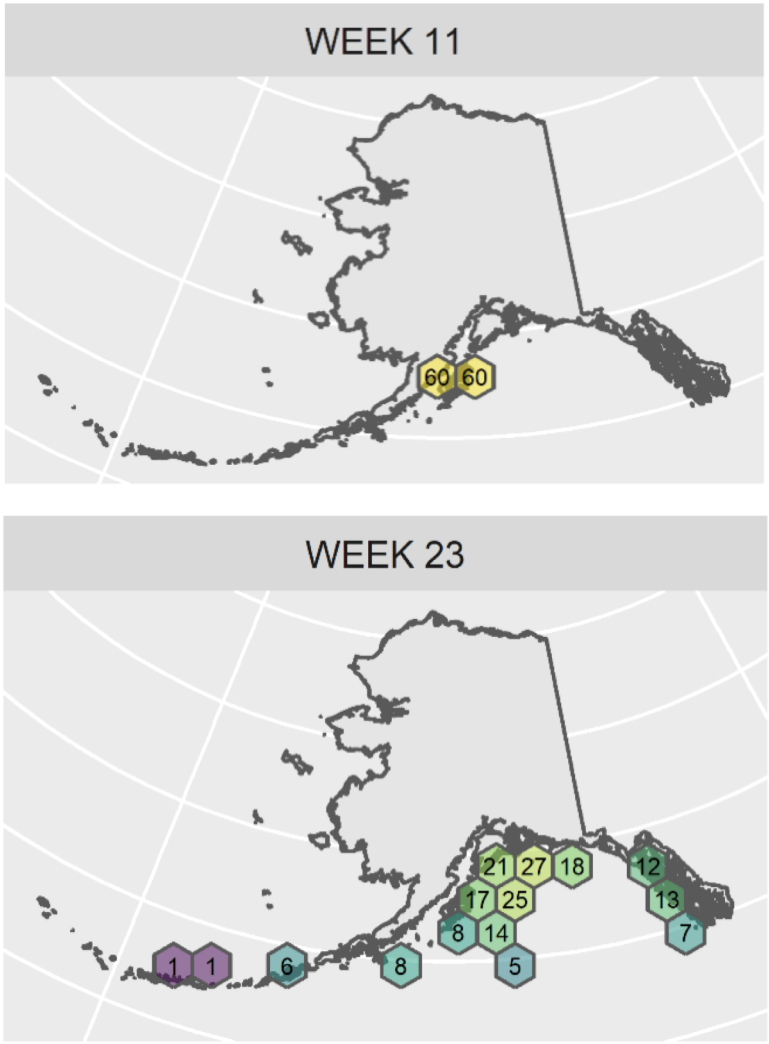
- Within each stratum, for each box, count the number of trips in neighboring spatial cells and neighboring weeks.
- The greater the number of trips that can contribute to a box, the more likely the box will be sampled.



- Assuming a sample rate, you can predict the average proportion of trips within a stratum that will be in sampled boxes:

$$\frac{\textit{trips in sampled boxes}}{\textit{total trips}}$$

Proposed Sampling Designs



- For any given sampling rate, strata with clustered fishing effort are more likely to have unsampled trips near sampled neighbors.
- Allocate more to strata with diffusely distributed fishing effort.

- **In addition** to allocating based on the expected proximity of sampled trips to unsampled trips, **allocate more to smaller strata**

    - Protects against small sample size

- **Balances the goals of reducing instances where we have no data and reducing uncertainty**

Proposed Sampling Designs

Allocation

Equal Rates

Status Quo

Proximity

Cost-weighted boxes*

* Under development!

Balances ability to capture variety of fishing effort and costs.

- Quantifies probability a '**box**' or its neighbor will be sampled
- Allocates more sample effort to strata with
  - higher proportion of boxes with low probability of being sampled
  - lower sampling costs

Days Above Baseline

- Which proposed allocation strategies could include a second stage to allocate days above a minimum baseline?
- Any design (excluding Equal Rates and Status quo for the sake of comparison)
- Currently (status quo) second stage to minimize the between trip variance of discards of 1) halibut 2) salmon and 3) groundfish (averaged)

Evaluation of Sampling Designs

Spatiotemporal representation

Compare the proportion of trips sampled or near a sampled neighbor **between sampling designs**

- Simulate sampling and identify sampled boxes
- Calculate the proportion of all trips that are in sampled boxes or neighboring sampled boxes.

Measures whether sampled trips are interspersed with non-sampled trips

Evaluation of Sampling Designs

Spatiotemporal representation

EM does not collect the full suite of data collected by observers

Zero-selection pool has no monitoring

- The fixed-gear EM pool and zero-selection pool rely on the data collected by at-sea observers

Important to make sure that observer samples adequately overlap these other pools

- e.g., calculate the proportion of trips in these pools neighboring sampled **observer** trips

Evaluation of Sampling Designs

We also plan to develop metrics to evaluate:

- Cost
- Detection
- Inseason management data quality
- Precision (potentially different from CAS variances, which are not current)
- Stock assessment data quality

Evaluation of Sampling Designs

Stock assessment Data Quality

Data summaries

- (ignoring year bc this will be an annual evaluation) are by area (BS separate from AI) x gear.
- Where there are too few data, data are combined (CPUE HAL + POT)

Seems this would be an appropriate evaluation "box"

Evaluation of Sampling Designs

Stock assessment Data Quality

The data summary *metrics* revolve around*

1. Catch
2. Lengths
3. Combinations of these two with effort (Catch per haul, lengths per ton)

*There is interest in depredation by whales

Known concerns

Stock assessment Data Quality

- EM can only collect information on mortality of marine mammals and whale depredation data if in view of cameras.
- Lots of catches monitored with no biological samples in Pacific cod assessment, esp. pot gear.
- Not enough Pacific cod length data in the AI to be useful

Other things to pay attention to:

- If fishery monitoring data is biased towards large fish bad things happen.
- Misreporting that degrades catch data so that it moves away from the correct value in only one direction over several years is bad.

Design-Independent Decisions That Could Impact Cost Efficiency

NOAA FISHERIES

Design-Independent Decisions That Could Impact Cost Efficiency

Zero Coverage

- Increasing the number of vessels in zero coverage would reduce the number of monitored days if other selection rates remain constant
- However, data also get less representative as more vessels move into zero coverage
- So far in the analysis, we have focused on other decision points that are:
  - More likely to result in cost efficiencies
  - Unlikely to reduce data quality

Design-Independent Decisions That Could Impact Cost Efficiency

- Ways to reduce the time it takes to review EM data
  - Will increase cost
  - Will also expand what the data can be used for
- Prorating partial sea days by the hour
  - Initial estimates show potential cost savings
- Hiring federal observers
  - Have begun estimating these costs
  - Not clear yet whether this would result in cost savings
  - We plan on presenting the results regardless
- Allowing observers to review EM video
  - We have tabled this for now due to logistical complexity and our judgement that it is unlikely to result in significant cost savings

Design-Independent Decisions That Could Impact Cost Efficiency

- EM Improvement Projects
  - Move observer effort shoreside
    - Pollock Trawl EM: Proposed rule expected by end of 2023; final rule in mid-2024; full regulatory implementation in 2025
    - Rockfish Trawl EM: Pilot in 2023, fish handling and discard rules could enable shoreside sampling by observers; potentially automate review using AI
      - Full coverage test, but could have future application to non-pelagic partial coverage fisheries

Design-Independent Decisions That Could Impact Cost Efficiency

- EM Improvement Projects Continued
  - Reduce review costs
    - E-Logbooks on GOA fixed gear would reduce data input costs
    - AI in EM review: human on deck detection
    - Switch gear EM: reduce catch handling changes; focus EM review on discards
    - AI for operator feedback: could reduce trips with unusable data
  - Reduce observer costs
    - Shoreside EM: salmon "surveillance," salmon speciation

Discussion