2021 *Draft* Annual Deployment Plan

for Observers and Electronic Monitoring in the Groundfish and Halibut Fisheries off Alaska

Predicted Fishing Effort and Comparison of Alternative Designs

September 2020 – Partial Coverage Fishery Monitoring Advisory Committee

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2021 DRAFT Annual Deployment Plan

How NOAA Fisheries intends to assign observer and electronic monitoring resources to vessels in the partial coverage category

The [every year] Draft ADP Analysis is focused on presenting several variants of the partial coverage fishery monitoring program for comparison

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2021 DRAFT Annual Deployment Plan

PCFMAC and the Council Priorities:
January 2020

1. Ongoing support for the pelagic trawl electronic monitoring (EM) EFP
2. Integration of EM into the overall monitoring of fixed gear and evaluation of the baseline observer coverage needed to inform fixed gear EM to obtain average weight data for discards and biological samples.
3. Evaluate different criteria to define the 'zero selection' pool to meet both data needs and improve cost efficiency. If possible, these changes would be incorporated in the draft 2021 ADP.

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FMAC and the Council Priorities:
June 2020

Recommends NMFS place a high priority on developing a 2021 ADP that provides necessary data and is also responsive to continued COVID-19 challenges and Council priorities, particularly improving cost efficiencies in the partial coverage category.

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Hopefully the Council and NMFS are in agreement that collectively,

We are trying to move towards one fully integrated fishery monitoring program, where each monitoring tool is maximized towards efficiency and effectiveness.

The following analysis is an attempt towards that endpoint

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Analytical problems

1. What will fishing effort be in 2021?
2. How to allocate afforded samples?
3. What vessels will be participating in fixed gear EM (2021)?
4. What vessels will be participating in Trawl EM EFP?
5. Account for variance in ODDS selection rates
6. Don’t go over budget
7. NEW Account for COVID19
    1. Fishing Effort
    2. Quarantine Rules for Observers

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Some guiding principles

Use models only where useful

Incorporate as many sources of variance as necessary

Vaguely right is better than precisely wrong

Show relative gain / risk

Science is about understanding properties, not forecasting single outcomes

Budgets:

Set at a level for 2021 that if maintained, would result in a fiscally solvent partial coverage program for the next four years.

Fishing Effort

Methods following Ganz and Faunce (2019; NOAA/AFSC-TM 395) with modification for COVID19:

- Fishing trends per *Sector* (Target + Gear + FMP) in the past are compared to current fishing trends to date.
- Then we determine a suite of years - or single year - to extrapolate the current year's fishing effort for the rest of the year.
- Normally, we would use this value as a guide for 2021 fishing. However, we have to admit:

We have no clear idea what is going to happen now.

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Fishing Effort

NEW So we are introducing a guess factor. Yes, a guess.

We add a guess factor to the number of trips we came up with before. We randomly add 25% above and below this value (a 50% realistic guess fudge factor).

Its somewhat informed:

- (Google Trends data and AKRO Landings show declines 30-40% - Early effects of COVID-19 interventions on US fisheries and seafood. Doi:10.31219/osf.io/9bxnh.
- Second quarter US GDP down @30% https://www.bea.gov/news/2020/gross-domestic-product-2nd-quarter-2020-second-estimate-corporate-profits-2nd-quarter

And it's not unfair to say a 50% slop represents a big guess.

So we create a suite of possible number of fishing trips for 2021.

Costs:

What would a cost efficient fishery monitoring program look like?

It would use tools where cheap, and use them at different rates

NEW Based on a break-even price point, here we include results from fishery monitoring programs in which the NMFS has selected the most cost effective fishery monitoring tool for all partial coverage boats, as well as applied only those that volunteer for EM.

Allocation strategies:

Equal rates

- Applies relative weightings to the size (effort) within each deployment stratum
  - Fishing trips with gear types that have more trips in the year get proportionally more monitored trips.
  - All logged trips get the same selection probability

Minimum + Optimization (*Status quo*)

- Applies equal rates algorithm up to a minimum coverage rate and then applies an optimization algorithm for additional monitored trips
  - Minimum coverage set to 15%
  - Optimization by combination
    - Discarded groundfish
    - Chinook Prohibited Species Catch
    - Halibut Prohibited Species Catch
  - Every logged trip in a *stratum* gets same selection probability; probabilities differ among strata.

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Allocation scenarios

Pollock trawl EM EFP

('Trawl:No' or 'Trawl:Yes')

- **TN** : No pollock trawl EM EFP
- **TY**: All pelagic pollock trips by listed vessels

Fixed-gear EM expansion

('Fixed-gear:No' or 'Fixed-gear:Constrained' or 'Fixed-gear:Optimzed')

- **FN** : No vessels added to the fixed gear EM pool
- **FC** : Cost-effectiveness is constrained to existing EM volunteer vessels
- **FO**: Cost-effectiveness is optimized to all PC non-zero coverage vessels

Port-based (trip-selection) Observer Deployment

('Port:No' or 'Port:Yes')

- **PN** : Observers are deployed to all ports (pre-COVID19)
- **PY** : Observers are constrained to 14 ports defined in the current COVID19 Deployment Model.

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Allocation scenarios

Scenario 1 (TN FN PN): This is the "control" - Trip based deployment, no fixed gear EM, no COVID, no EFP. From here we can evaluate the magnitude of benefit / risk by adding elements as follows:

Scenario 2 – (TY FC PY): Port-based deployment for COVID19, EFP, EM; Potential EM vessel list is constrained by who volunteers. Existing vessels are admitted and new volunteering vessels are evaluated for cost efficiency and data utility by NMFS (modified 2020 protocol)

Scenario 3 – (TY FO PY): Port-based deployment for COVID19, EFP, EM: NMFS identifies all eligible EM participants - its maximum membership is held at the size in effort (days) to Scenario 2 for comparison. The entire PC fleet monitoring is optimized for cost efficiency and utility.

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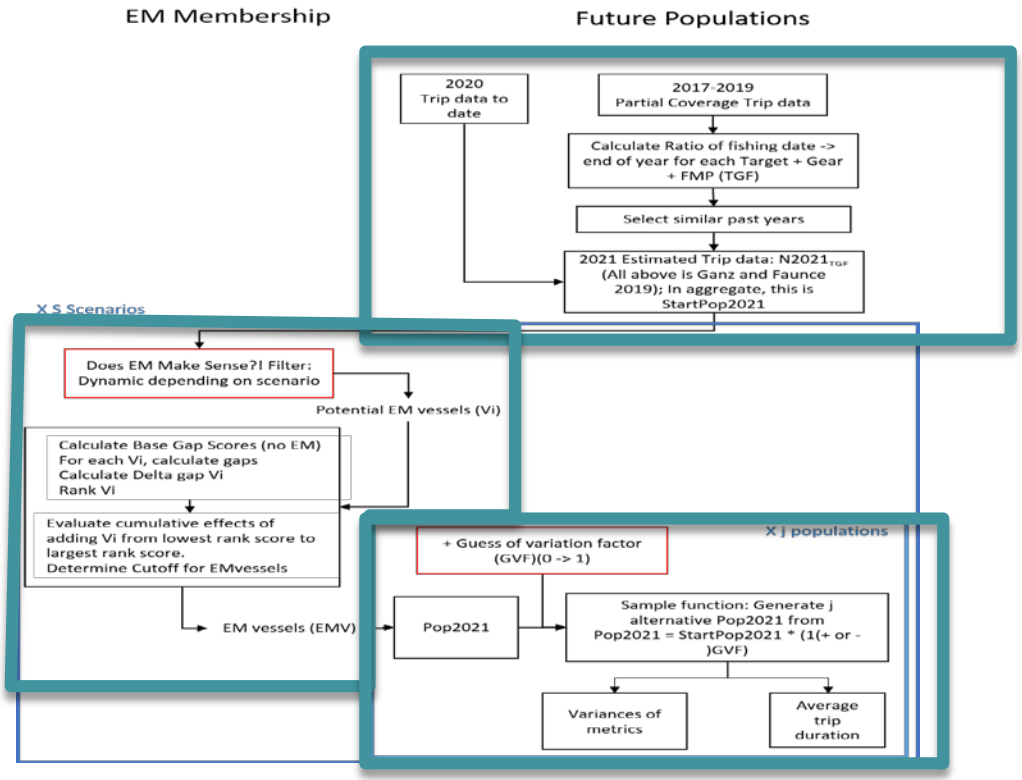
Methods Overview



2021 Effort

EM Evaluations

Guess Variation Factor

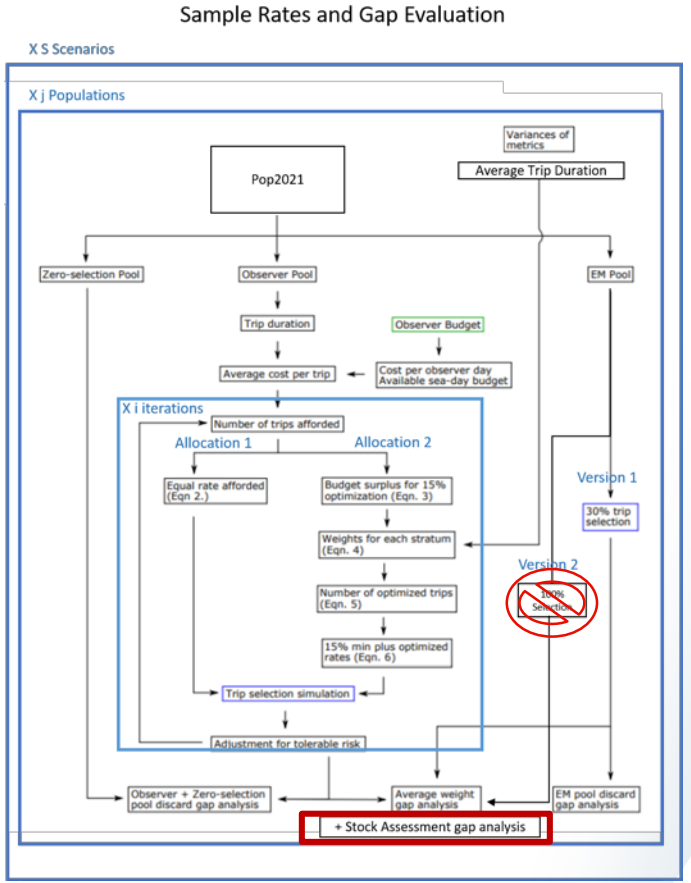
Methods Overview

Core processes are virtually unchanged

But…

- An evaluation of our ability to provide data in support for stock assessment was added, and one planned allocation was not conducted.

- NEW Former Gap Analyses have been re-termed **Similarity Scores** because they reflect how similar monitored trips are to unmonitored trips rather than showing actual data gaps.



NEW Methods - Optimize EM

We conducted a scenario with 'optimized EM' where EM boats were added that were cost effective and did not result in large changes in data availability, while also giving priority to pre-existing EM boats for inclusion.

Here's how:

For cost-effective vessels, we put them into two lists, one for pre-existing EM vessels (past 3 years) and one for potential new EM vessels.

Then, for each list, we evaluate the change in similarity scores from the "no-EM" "Control" scenario and the same scenario with each potential EM vessel added one at a time.

Then, we rank the potential EM vessels according to their change in scores within each list, smallest first.

Then, starting with the list of pre-EM boats, we add vessels to the 2021 EM pool and sum the total expected fishing days until the total reaches the same total size of EM from 2019 (thus ensuring fair comparisons with the "constrained EM Scenario").

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Methods – How representative and useful is fishery monitoring data?

- Prior to this analysis all evaluations were focused on the data available for the catch accounting system – the needs of the stock assessment authors were not considered
- NEW We added new stock assessment evaluations because:

  Very few AFSC surveys were conducted this year due to COVID19

  Biological collections by observers represent one of two major data constraints to expanding Electronic Monitoring Tools.

Methods – Stock Assessment Support

During Summer of 2019, scientists at the AFSC Seattle and Auke Bay Laboratories were asked by members of the Fishery Monitoring Science Committee to provide information as to how they were dividing (time, space, gear, etc.) fishery data in their Stock Assessment.

How the otolith (and length) data are subdivided provided the means to develop a new analyses / performance metrics for each scenario and allocation scheme.

We continue to use the former evaluation metrics (similarity scores)

Methods – Data Representativeness

Analyses	Selected using:	Metric
NEW Spatial Representation of Otolith Collections	**Equal rates/ 15% + Opt**	**Proportion of times ANY otoliths on observed trips in areas used in the assessment (or one step finer)**
Observer/Observer pool discards (OB-OB)	Equal rates/ 15% + Opt	Relative similarity score within each domain measured across the scenarios
Observer/Zero pool discards (OB-ZE)	Equal rates/ 15% + Opt	
EM pool discards (EM-EM)	30%	
Average weight (OB-EM)	Equal rates/ 15% + Opt	

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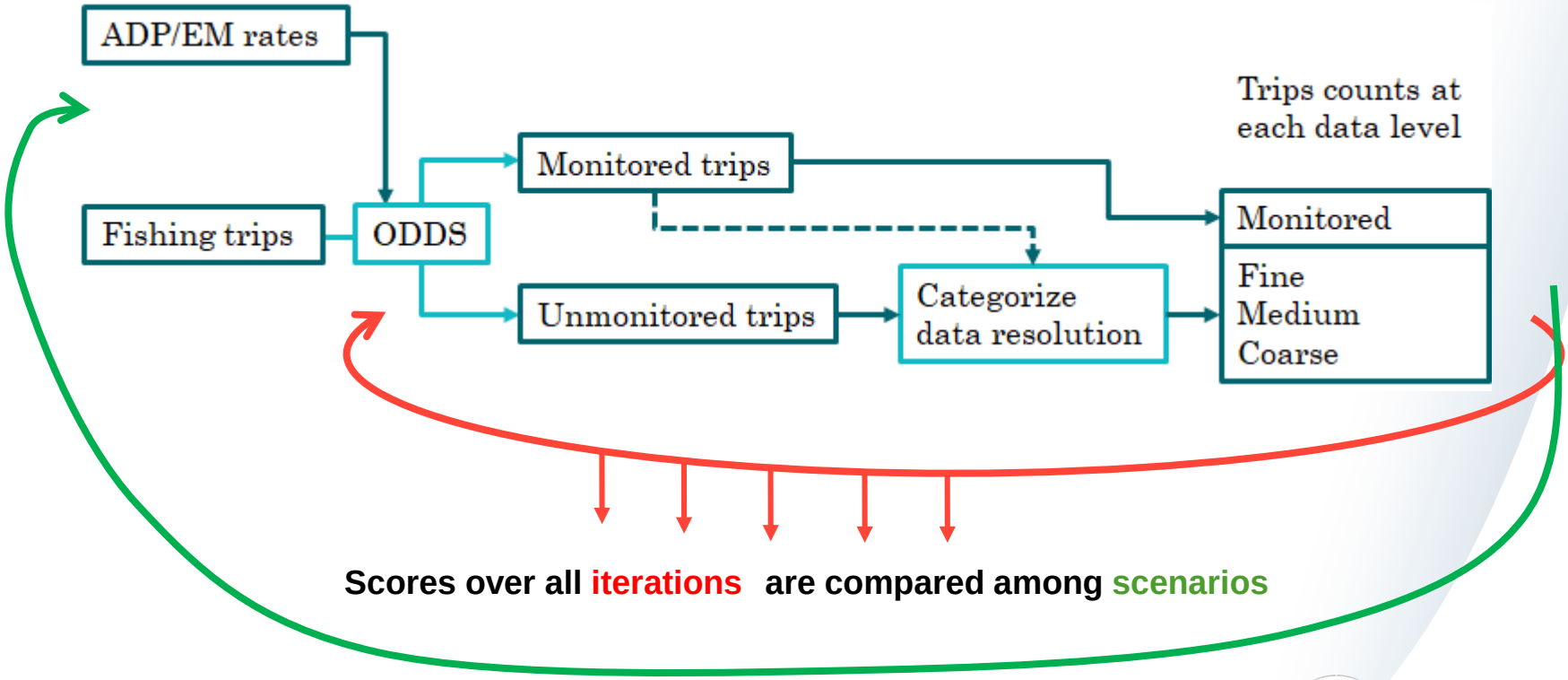
Methods – Data Representativeness



Coverage rates in a COVID19 World

Port-Based deployment means that we no longer have access to a portion of the fleet we mean to derive estimates from.

- Prior analyses have shown the basis for our 15% coverage base rate by gear type in the PC fleet.
- This amount of data is necessary to achieve stable estimates of catch.
- But a problem arises if we start removing fishing activity because we can't get into some ports - we have to sample the remaining ports harder to achieve the same coverage amounts across the entire gear type.

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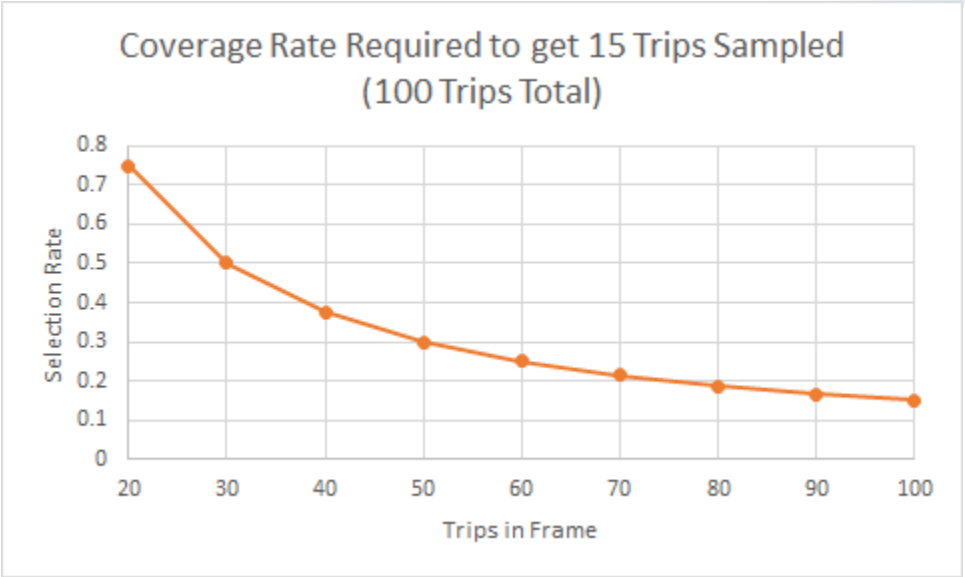
Coverage rates in a COVID19 World (Cont.)

- We call the stratum-wide rate the **Monitoring Rate**
- We call the selection rate programmed into ODDS the **Programmed Rate**.
- The difference between these two rates increases as a greater proportion of the fleet is missing from ports that we can sample from.



Results

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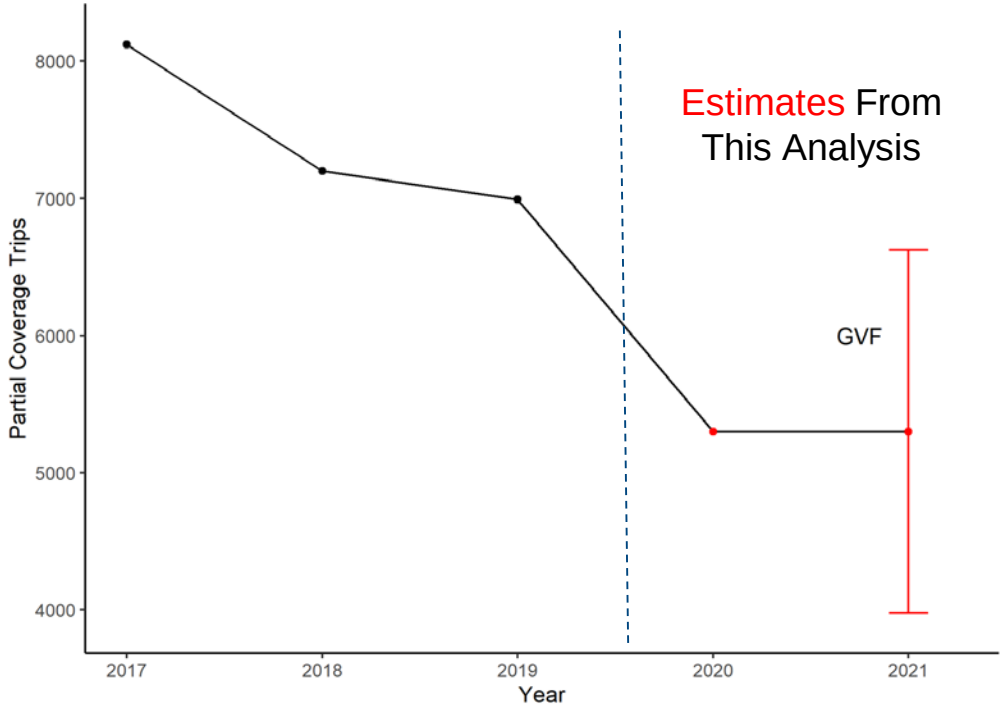
Results - Fishing Effort



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Results - Fixed gear EM Optimization

Current EM pool (Scenario 2) vs 'Optimized' EM Pool (Scenario 3)

The optimized EM pool was built in a way to maintain a similar number of total fishing days as the current EM pool but with fewer vessels by only including vessels that meet an effort threshold (average at least 30 days per year) and cause relatively low impacts to similarity scores.

As a result, the optimized EM pool had the following key differences:

- More trips in HAL-Halibut-BSAI (53 vs 16)
- Fewer trips in HAL-Halibut-GOA (238 vs 335)
- Fewer trips in HAL-PCod-BSAI (6 vs 10)
- Fewer trips in POT-PCod-BSAI (44 vs 69)

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Results - Scenarios and Budgets

In the TNFNPN scenario (Scenario 1), without the fixed-gear EM program, the budget was devoted entirely to purchasing Observer Sea Days.

Scenario	Total 2021 Budget	EM Costs	2021 OB Budget	OB Sea Day Budget 2021-2024	Option Days	OB Cost per Day
1	$4.497 M	$0 M	4.497 M	2906	906	$1547.69
2	$4.473 M	$1 M	3.473 M	2004	4	$1733.23
3	$4.473 M	$1 M	3.473 M	2004	4	$1733.23

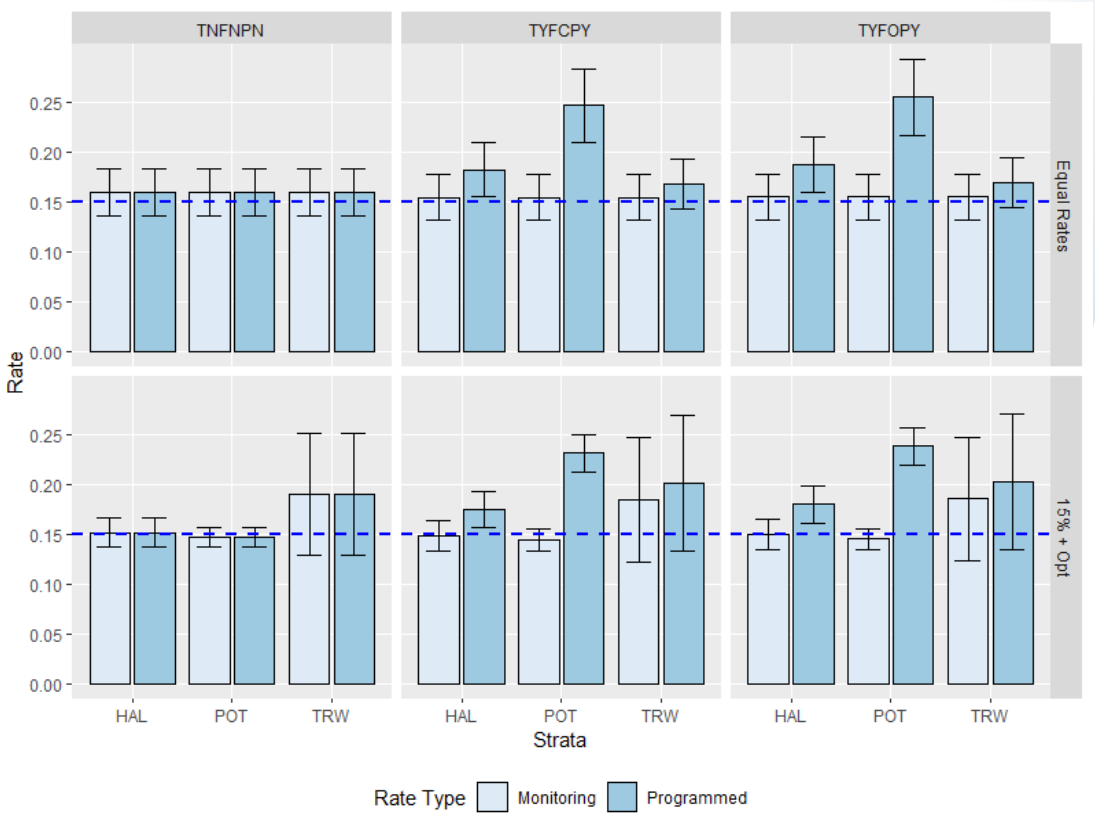
Results - Rates by Scenario and Allocation

Scenario	Trawl EFP	Fixed Gear EM	Port-based Deployment	Nickname	Allocation Scheme	Strata	Monitoring Rate (%)	Percent in Sampling Frame	Programmed Rate (%)
1	No	No	No	TNFNPN	Equal Rates	HAL	15.94	100.00	15.94
						POT	15.94	100.00	15.94
						TRW	15.94	100.00	15.94
					15% + Opt	HAL	15.17	100.00	15.17
						POT	14.71	100.00	14.71
						TRW	19.00	100.00	19.00
2	Yes	'Current' EM Pool	Yes	TYFCPY	Equal Rates	HAL	15.46	84.62	18.27
						POT	15.46	62.62	24.71
						TRW	15.46	91.75	16.85
					15% + Opt	HAL	14.84	84.62	17.53
						POT	14.48	62.62	23.14
						TRW	18.48	91.75	20.14
3	Yes	'Optimized' EM Pool (89 vessels, 58 which are in current EM pool + 31 new vessels)	Yes	TYFOPY	Equal Rates	HAL	15.55	82.89	18.76
						POT	15.55	61.04	25.49
						TRW	15.55	91.76	16.95
					15% + Opt	HAL	14.94	82.89	18.03
						POT	14.51	61.04	23.79
						TRW	18.56	91.76	20.22

Results - Rates by Scenario and Allocation

On average, all scenarios met the 15% hurdle.

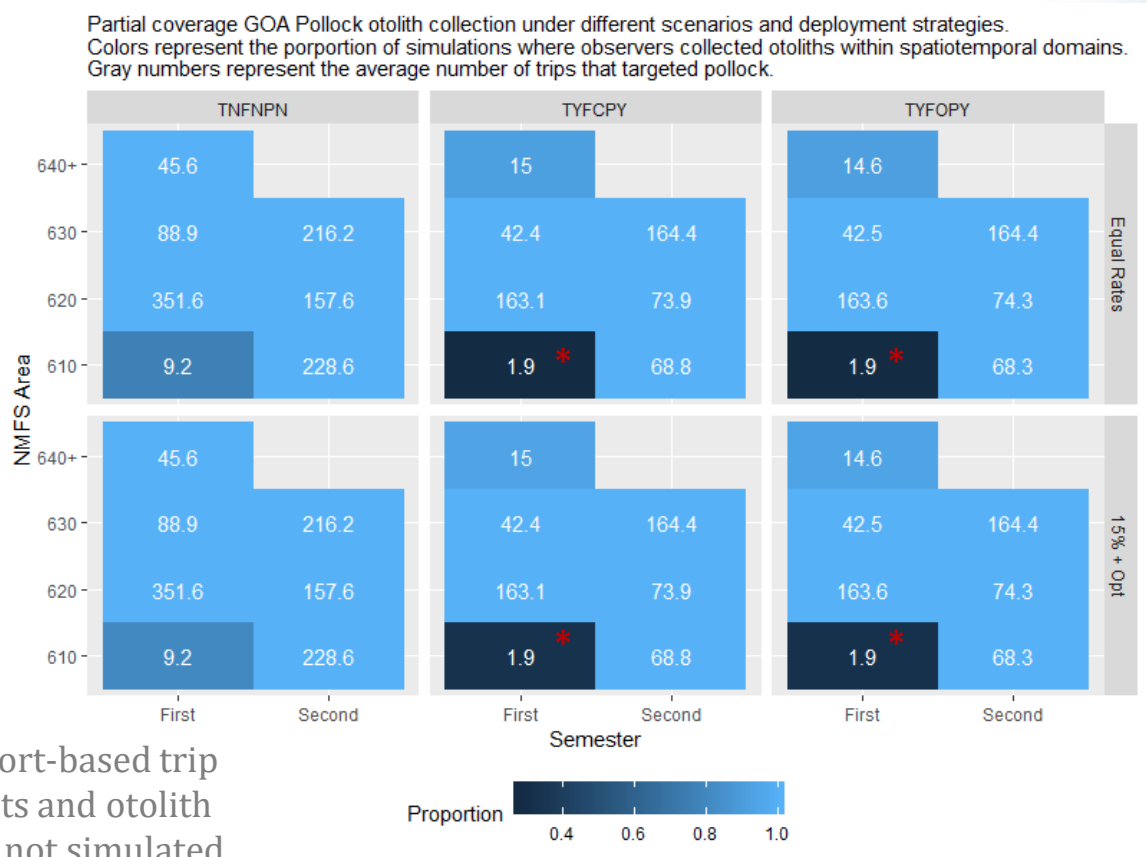
Scenarios 2 and 3 have very similar deployment rates because the strata are similar in size.



Results - Stock Assessment – GOA Pollock

The GOA Pollock stock assessment stratifies age-based otolith data by half-year and NMFS Area.

In Scenario 1, otoliths were collected in Area 610 in the first Half of the year 75-80% of the time, but only 28-32% of the time in Scenarios 2 and 3.

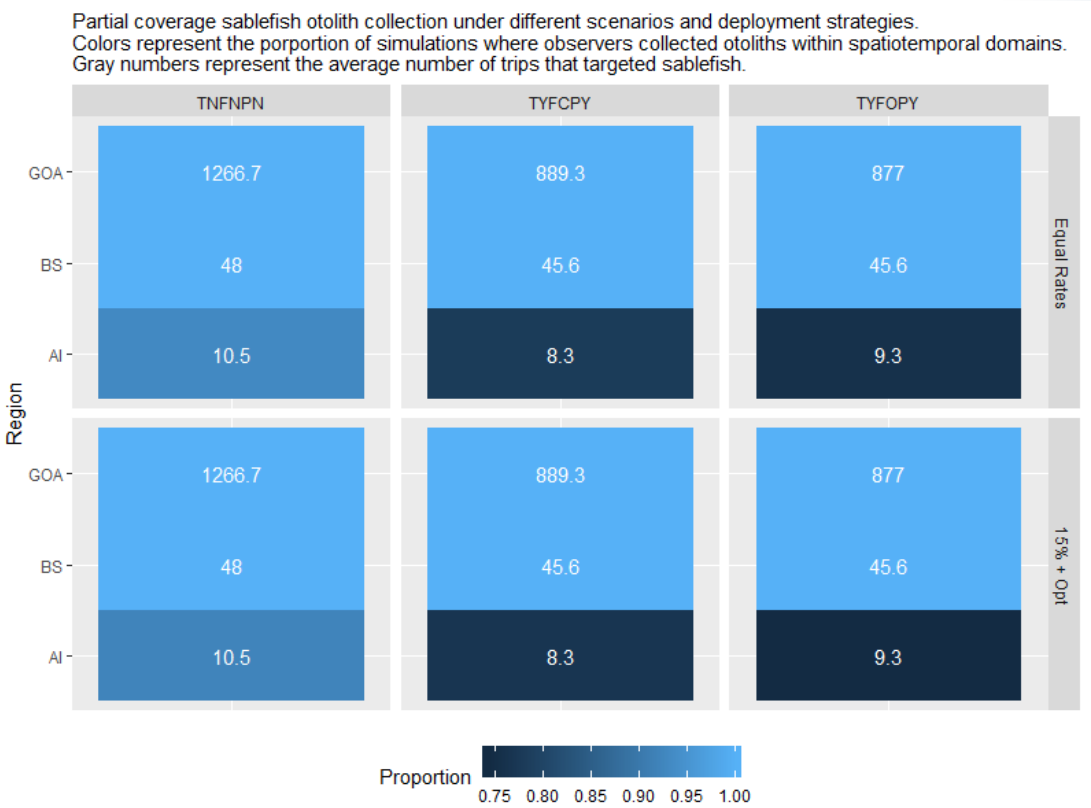


* Akutan was assumed to not have port-based trip deployment due to logistic constraints and otolith collection for Trawl EFP vessels was not simulated.

Stock Assessment – Sablefish

The Sablefish stock assessment stratifies age-based otolith data by year and region defined by GOA, BS, and AI.

In Scenario 1, otoliths were collected in the AI 92-93% of the time, compared to 74-78% of the time in Scenarios 2 and 3.

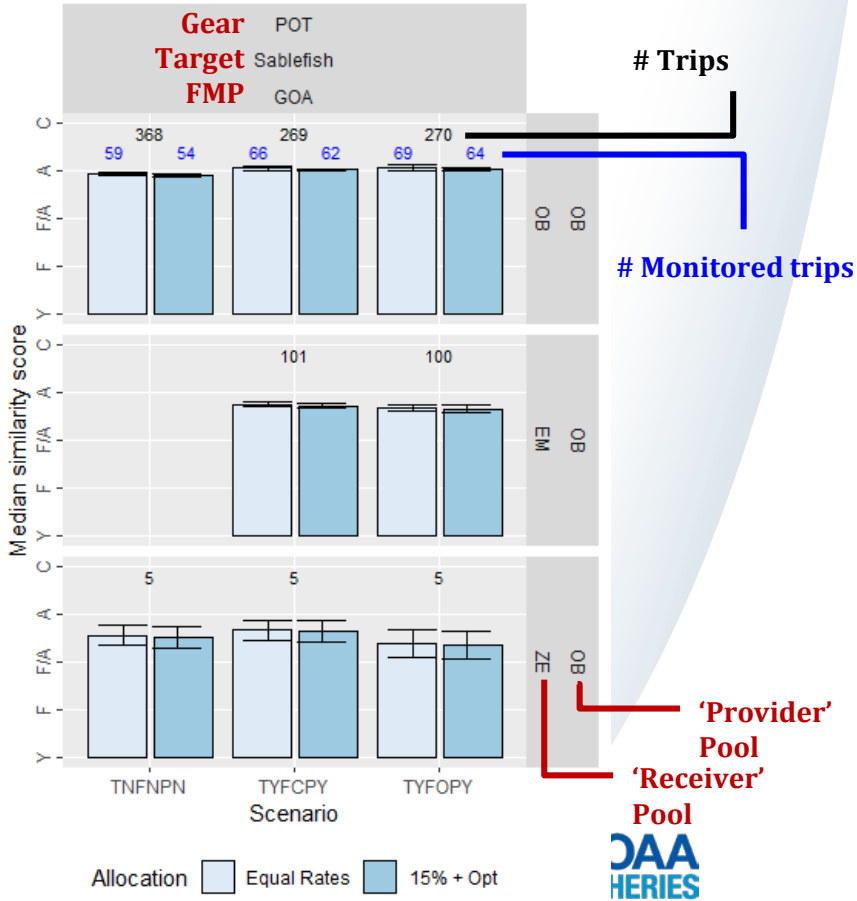


Results - Similarity Analyses

Observer data is used by all three PC pools so it is important that this data is **representative**. 'Similarity' was assessed for groups defined by **Gear**, **Target and FMP** by quantifying the **spatiotemporal proximity** of fishing effort in the PC pools to observed trips.

Similarity scores fall between 0 and 1 and describe the average proximity among all trips within a group, but are more easily interpreted as:

Score	Category	Description
1.00	C	All trips monitored ("**Covered**")
0.75	A	Within 15 days of monitored trip in same NMFS **Area**
0.25	F	Within 45 days of monitored trip in same **FMP**
0.00	Y	'**Year**-to-Date', i.e. > 45 days and/or FMP

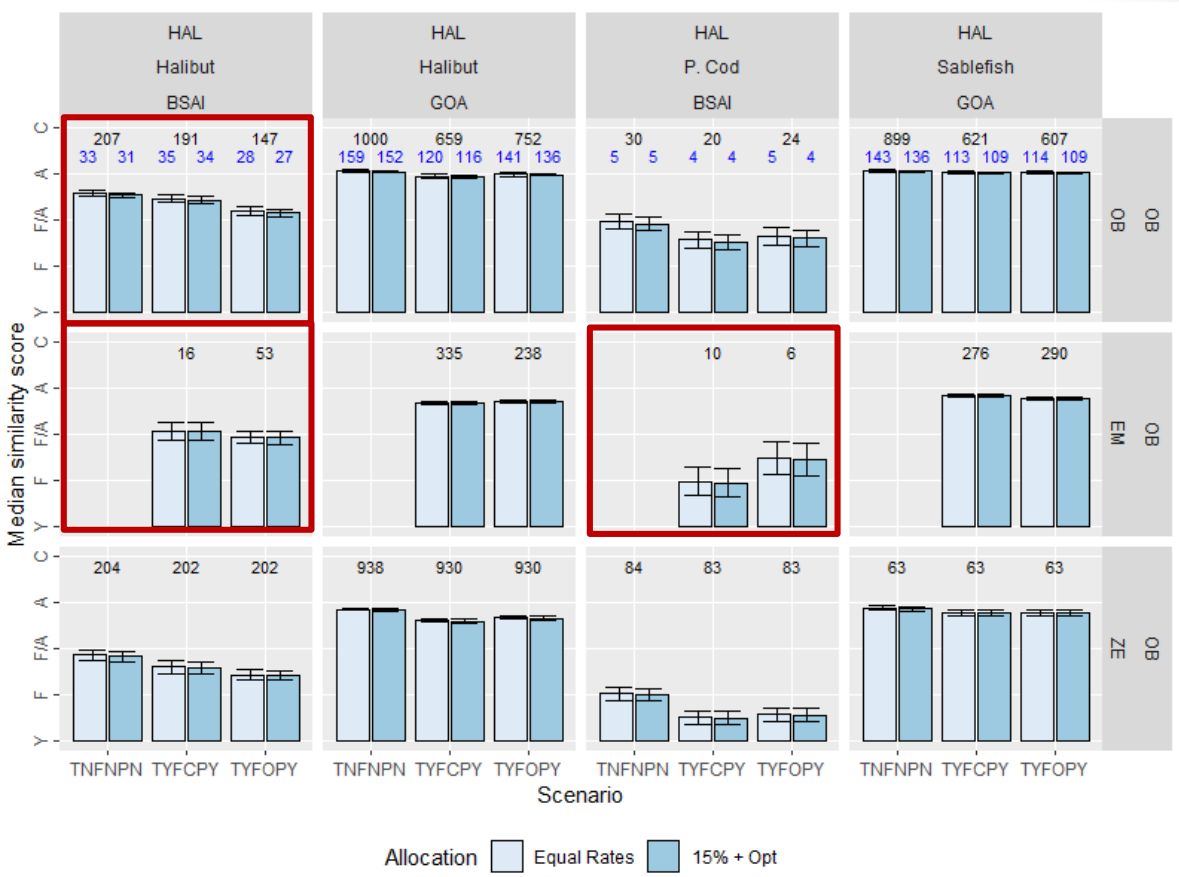


Results - Similarity Analyses

The effect of scenario is more apparent than allocation strategy.

The optimized EM pool increased the number of EM trips in HAL-Halibut-BSAI

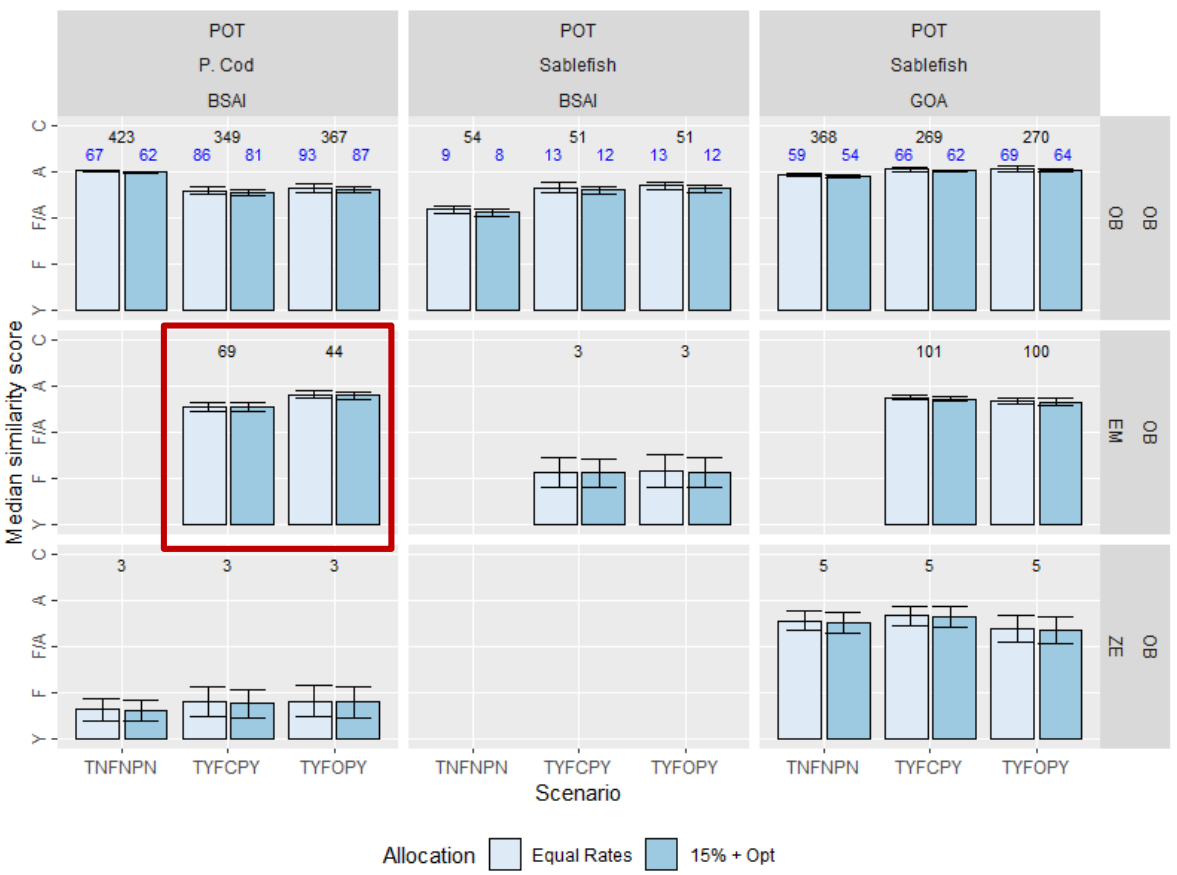
This resulted in a drop in the OB-OB similarity for HAL-Halibut-BSAI…
…but in return improved OB-EM similarity for HAL-PCod-BSAI,



Results - Similarity Analyses

The effect of scenario on fixed gear is more apparent than that due to allocation strategy.

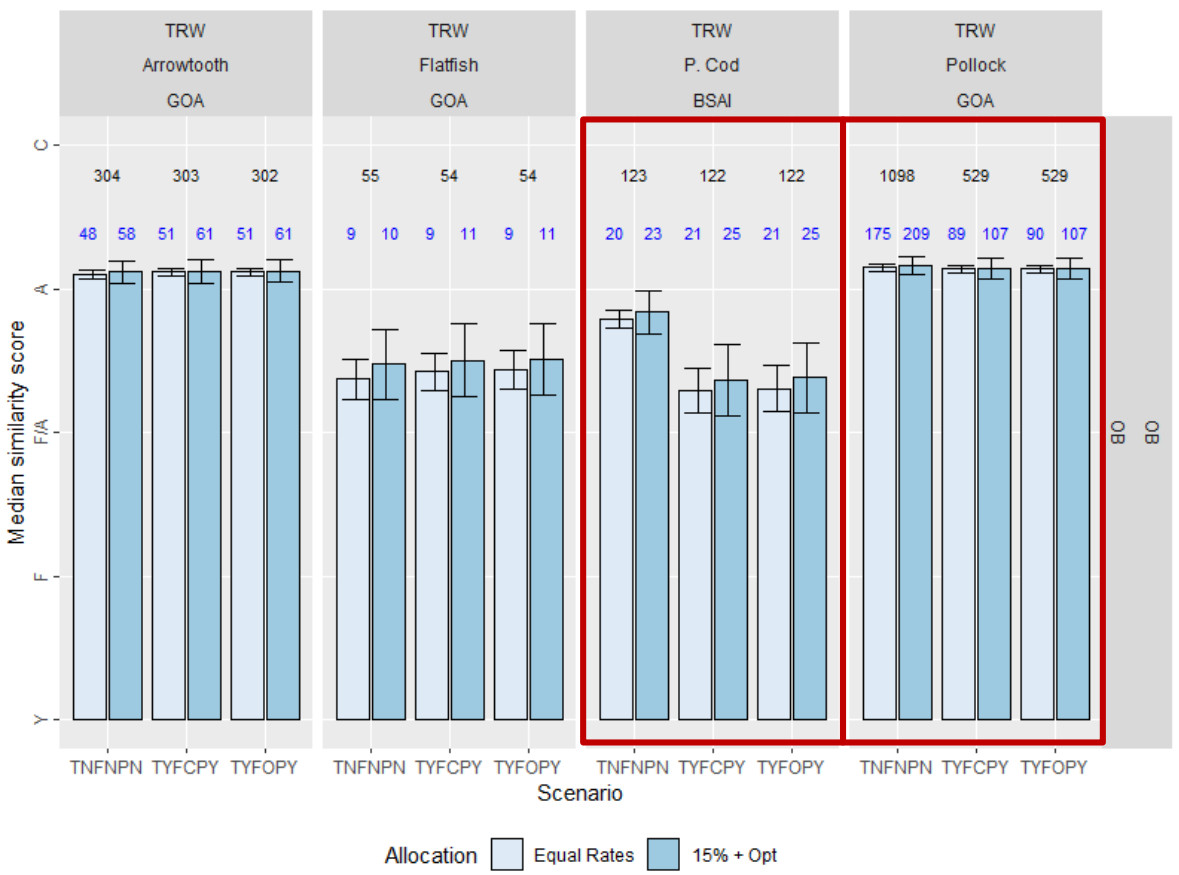
'Optimized' EM pool had more BSAI P.Cod trips in OB pool and fewer in EM pool and improved OB-EM similarity for POT-C-BSAI.



Results - Similarity Analyses

For trawl gear, scenarios affects BSAI P. Cod more than other domains due to the exclusion of Akutan in these analyses.

Although the Trawl EFP moves half of the GOA Pollock trips out of the OB pool, similarity scores are essentially unaffected.

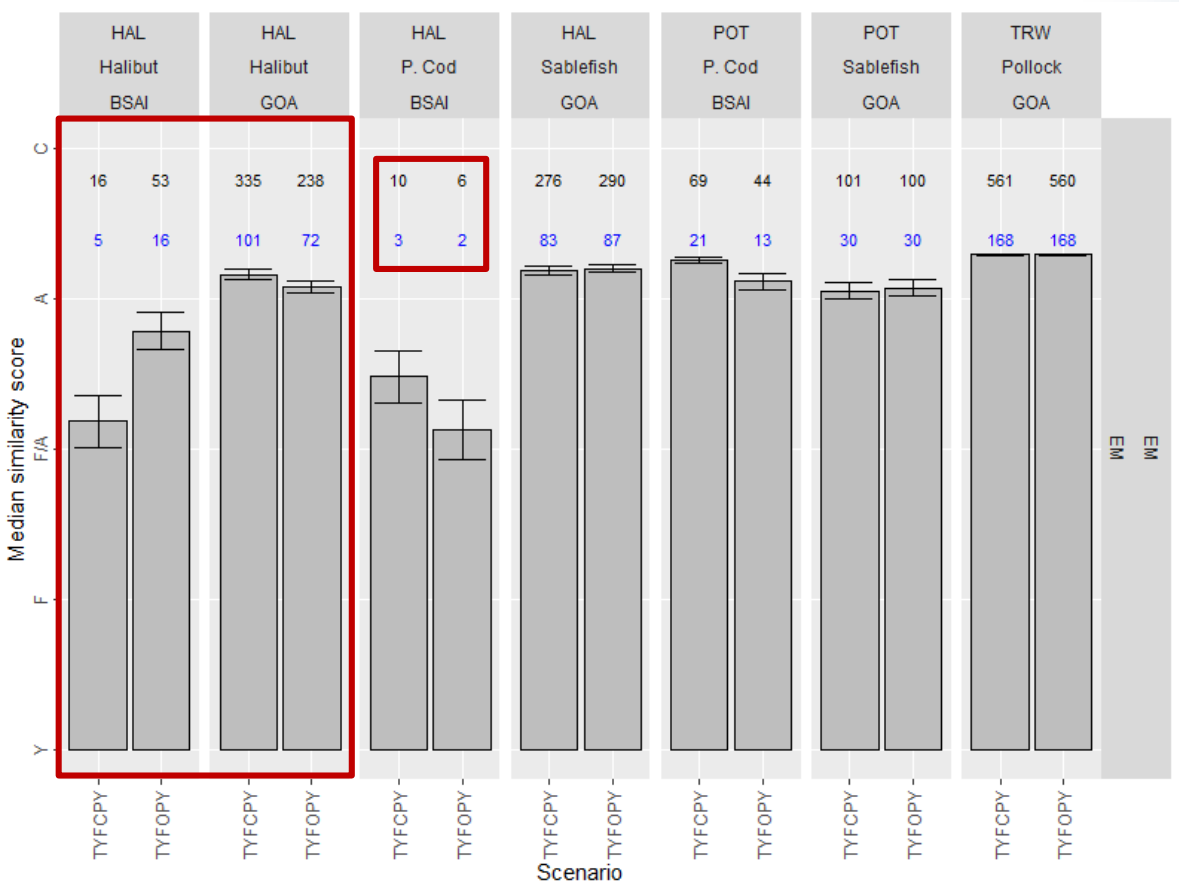


Results - Similarity Analyses

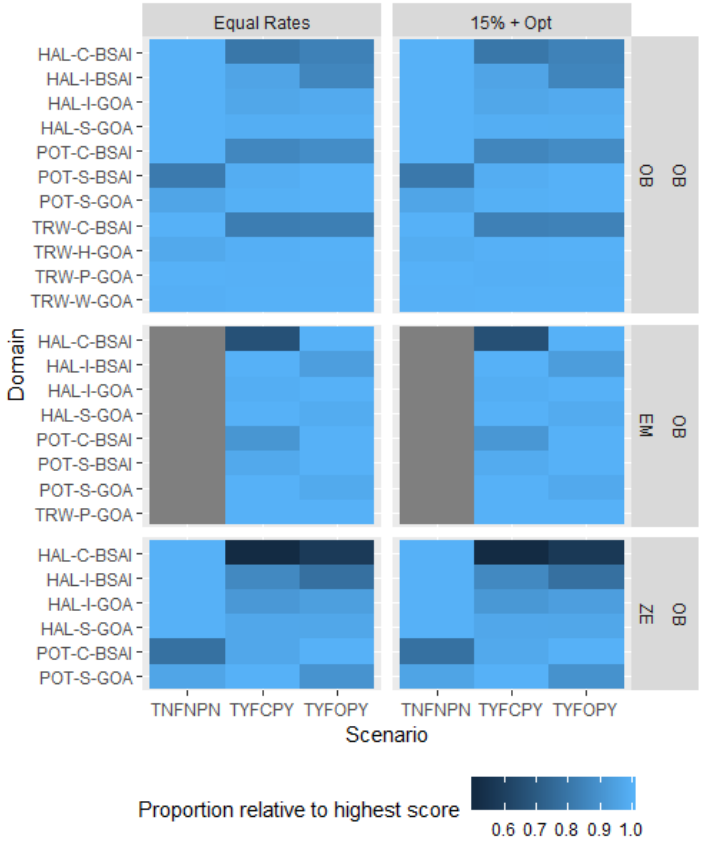
EM to EM similarity is important for estimating discard rates.

The optimized fixed-gear EM pool moved monitoring **out of HAL-Halibut-GOA** with minimal losses and **into HAL-HAlibut-BSAI** with appreciable gains.

Small number of trips in HAL P. Cod BSAI downweights the results of the change in EM.

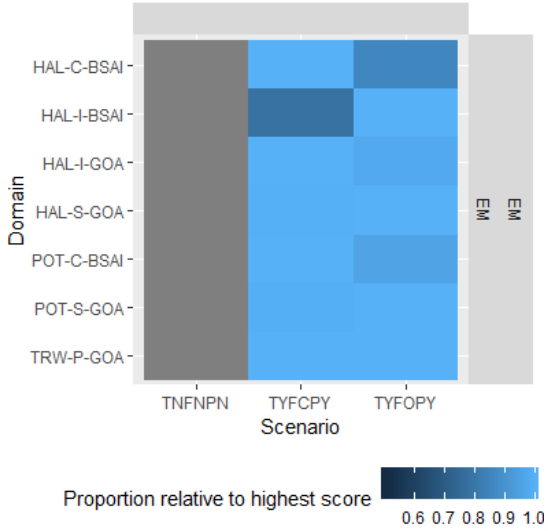


Results - Similarity Analyses



Each row of Gear + Target Species + FMP contains a comparison.

The best score is the lightest shade.



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Results: ADP Analyst Team Conclusions

- We don't have a clear idea of future fishing but have done due diligence in presenting our uncertainty about that.
- We have made an honest attempt at being cost effective with our fishery monitoring tools by beginning to examine the effects of optimizing EM.
- Scenarios 2-3 affect fixed gear, allocations don't.
- Allocations affect trawl gear while scenarios 2-3 don't.
- Port-based deployment disproportionately affects Pot fisheries, and outweighs the effects of optimizing deployment among gear types.
- Despite EM optimization (Scenario 3), similarity scores are only slightly improved from status quo EM (Scenario 2)
- However, EM optimization shifts coverage to the BSAI and results in extra $ (next slide).

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Ways to save money

- EM and observer funds were kept separate in this analysis.
- Instead, we built an optimized EM program that had the same number of total monitored days (assumed to have a recurrent cost $1M).
- Therefore, we did not use any potential cost savings from EM for observers.
- However, we estimate that the 'optimized' EM pool of only 89 vessels would save $128,000 per year in equipment costs (Larger programs require larger infrastructure support.)
- This would have translated into 147 more observer days per year and would lower the total observer program cost per day by $41.
- **Optimizing EM can result in lowered costs of BOTH monitoring tools.**

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NMFS Recommendations - EM

Fixed Gear EM trip-selection pool:

- Requests to opt in (or out) EM selection pool for 2021 must be received by November 1, 2020.
- NMFS will inform operators as to adherence to approved VMP; vessels which do adhere to their VMP may not be eligible to participate in the following year.
- Expect the EM pool size to be maintained from 2020. If funding is insufficient to accommodate all the vessels that request to participate in the EM selection pool, NMFS will prioritize placement in the EM selection pool as follows:
  - vessels that are already equipped with EM systems;
  - vessels that are cost effective for EM and unlikely to introduce large data gaps; and
  - vessels 40-57.5 ft LOA where carrying an observer is problematic due to bunk space or life raft limitations.

Trawl EM Trip-Selection Pool

- NMFS will continue to support the Trawl EM EFP.
- NMFS will increase shore-based observer coverage to help fill in data gaps when possible.

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NMFS Recommendations - Observer Coverage

Observer trip-selection pool

NMFS recommends 3 sampling strata for the deployment of observers in 2021:

- Hook-and-line vessels greater than or equal to 40 ft LOA,
- Pot vessels greater than or equal to 40 ft LOA, and
- Trawl vessels

Port Based Deployment

Consistent with revisions to the 2020 deployment plan due to COVID-19, during 2021, observers will be deployed from select ports throughout Alaska.

Waivers

NMFS may release trips from observer coverage on a case-by-case basis for vessels in the Partial Coverage Category.

NMFS may modify the list of ports with available observers in the future in response to transportation availability and/or changes in health mandates.

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NMFS Recommendations - Observer Coverage

NMFS recommends an observer deployment allocation strategy of 15% plus optimization based on discarded groundfish and halibut PSC, and Chinook PSC.

As a preliminary budget for the draft ADP, NMFS estimated total expenditures in 2021 of $4.47M resulting in estimated coverage rates:

- Hook-and-line – 15%
- Pot – 15%
- Trawl – 18.5%
- Fixed Gear EM – 30%
- Trawl EM EFP – 100%

These coverage rates are preliminary estimates and will differ from rates determined in the final ADP.

No-selection pool

As in previous deployment plans, NMFS recommends the no-selection pool continue to be composed of: 1) fixed-gear vessels less than 40 ft LOA and vessels fishing with jig gear, which includes handline, jig, troll, and dinglebar troll gear; 2) vessels voluntarily participating in EM innovation and research.

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Supplemental Information

The Break-Even Price Point:

Observers

Yearly cost of OB vessel = (*number of days fished* × cost per day × selection rate)

- The 2020 Final ADP estimated the observer cost-per-day for the 2021 calendar year, assuming a minimum 2000 sea day program as $1629.03 per day.
- 15% Selection Rate

Electronic Monitoring for Catch Estimation

Yearly cost of EM vessel = (equipment costs / equipment lifespan) + (cost per day × *number of days fished* × review rate)

- Equipment costs estimated at $10,000
- Equipment lifespan estimated at 5 years
- From Table 2-6 from the 2018 Annual Report, we estimate the recurring costs of these EM that corresponded to 1005 sea days. $593,109 / 1005 sea days = $590.16 per review day.
- 30% Review Rate

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The Break-Even Price Point:

Using the Power of Algebra we set these costs equal and solve for number of days fished

Yearly cost of OB vessel = (*number of days fished* × cost per day × selection rate)

Yearly cost of OB vessel = (*number of days fished* × $1629.03 × 0.15)

Yearly cost of OB vessel = (*number of days fished* × $244.35)

Yearly cost of EM vessel = ($10,000/ 5) + (590.16 × *number of days fished* × 0.3)

Yearly cost of EM vessel = ($2000) + ($177.05 × *number of days fished*)

244.35D = 177.05D + 2000

244.35D – 177.05D = 2000

67.3D = 2000

D = 29.71 days fished

2020 Final ADP estimates for trip duration of fixed-gear EM vessels as 1,363 days / 276 trips = 4.94 days per trip,

In this Analysis, EM vessels will need to make around 29.71 / 4.94 = 6 trips per year to fish 30 days per year and therefore be more cost-effective than using observers.

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