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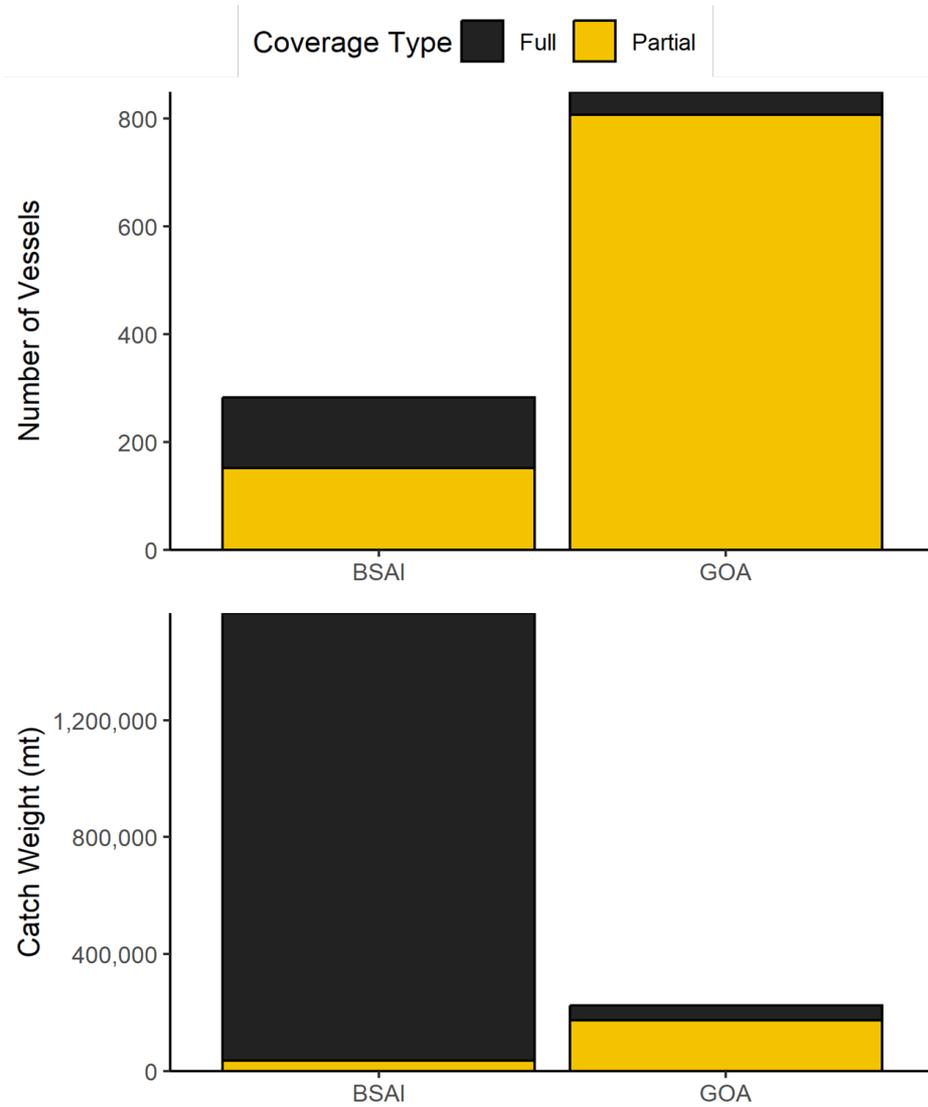
Draft 2024 Annual Deployment Plan and Partial Coverage Cost Efficiencies Analysis

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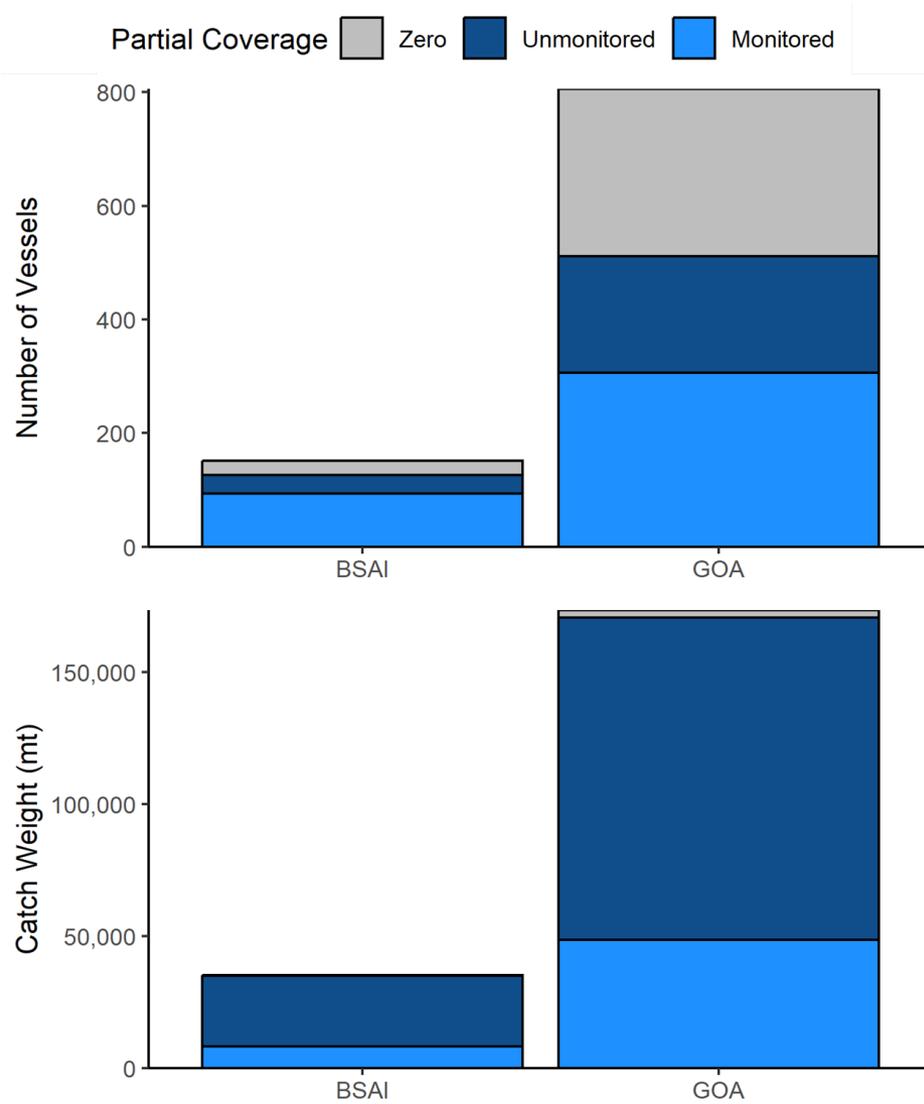
NPFMC Groundfish Plan Team

September 19th, 2023

Catch and Effort 2022



Partial Coverage Catch and Effort 2022





Summary of Priorities

- Design a monitoring program that collects credible, statistically rigorous scientific data
- Collect the best and most data for a given budget
- Collect data for a wide range of analytic needs (multi-objective program)

Challenge is to...

- Meet the data needs of data users with a wide range of analytic objectives (MSA) at a variety of budgets
- Collect data that reflects the full range of fishing activities



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Timeline

- Analytic Plan (03/2022 - 06/2023)
- Fish. Monit. Sci. Comm. (*Sandra Lowe, Steve Barbeaux, Jason Gasper, Ray Webster*)
 - 7/5 (Overview)
 - 7/18 (Stratifications and Allocations),
 - 8/15 (Evaluation metrics)
 - 9/05 (Review Document)
- Council Partial Coverage Fish. Monit. Comm. (09/14)
- Council Groundfish Plan Team (09/19)
- Council Advisory Panel (10/03) - No SSC
- Council (10/06)
- Final ADP Development (10 - 11/2023)
- Council GPT (Nov.)
- Council (Dec.)
- **Implementation (01/01/2024)**



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Observer and Electronic Monitoring

Full Coverage



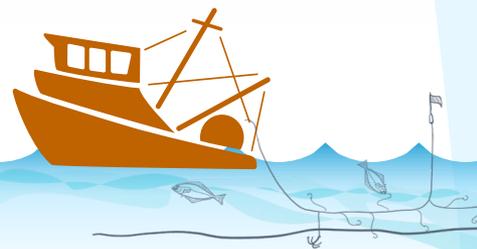
The majority of groundfish harvest is from vessels with full coverage: at least one observer present during all fishing or processing activity.

Partial Coverage



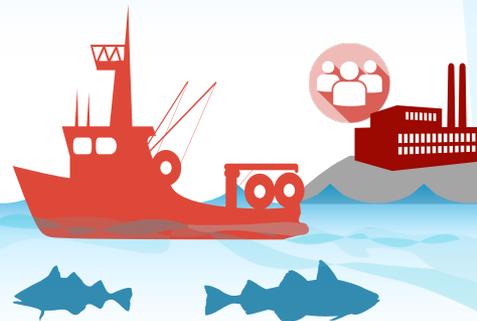
Vessels are assigned partial observer or EM coverage. Partial coverage vessels are mainly smaller boats representing all gear types.

Fixed Gear EM



A randomly selected 30% of trips are covered by EM for volunteer vessels using fixed gear (hook-and-line or pots).

Pelagic Pollock Trawl EM



Participating vessels volunteering for 100% EM coverage within the pelagic pollock trawl fleet and 33% of trips are sampled shoreside.

Designs:

Stratification & Allocation

- **Stratification:** *Currently* defined by monitoring method (at-sea observer, fixed-gear EM, or shoreside observer with full retention compliance monitoring at-sea) and gear type (hook-and-line, pot, or trawl)
- **Allocation:** *Currently:*
 - Fixed-gear EM: 30.0% (policy)
 - Trawl EM: 33.3% (policy)
 - At-sea Observer: **[Remaining funds]: 15%**baseline, then minimize variance on groundfish discards, halibut PSC, and Chinook PSC.



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Designs:

Stratification & Allocation

- **Stratification:** *Currently* defined by monitoring method (at-sea observer, fixed-gear EM, or shoreside observer with full retention compliance monitoring at-sea) and gear type (hook-and-line, pot, or trawl)
- *Alternatively*, also stratify by FMP, splitting trips in the **BSAI** vs **GOA**
 - Higher sample allocation in BSAI
- *Alternatively*, combine fixed gear trips into one stratum (hook-and-line and pot)
 - Addresses issues with trips fishing **both gear types.**



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Stratification Definitions Evaluated

Stratification	Number of Sampled Strata	Definition	Rationale
2023 (CURRENT)	6	Monitoring Method (Observer, EM Fixed Gear, EM Trawl) and Gear Type (HAL, POT, TRW)	Current stratification definition
FMP	11	Monitoring Method (Observer, EM Fixed Gear, EM Trawl) and Gear Type (HAL, POT, TRW) and FMP (BSAI, GOA)	Potential to reduce the likelihood of data gaps
Combined fixed gear - FMP (FIXED-FMP)	7	Monitoring Method (Observer, EM Fixed Gear, EM Trawl) and Gear Type (FIXED , TRW) and FMP (BSAI, GOA)	Maintains statistical integrity without creating small strata and allowing focused sampling



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Designs:

Stratification & Allocation

- **Allocation: Currently:**

Fixed-gear EM: 30.0% (policy)

Trawl EM: 33.3% (policy)

At-sea Observer: **[Remaining funds]: 15%**

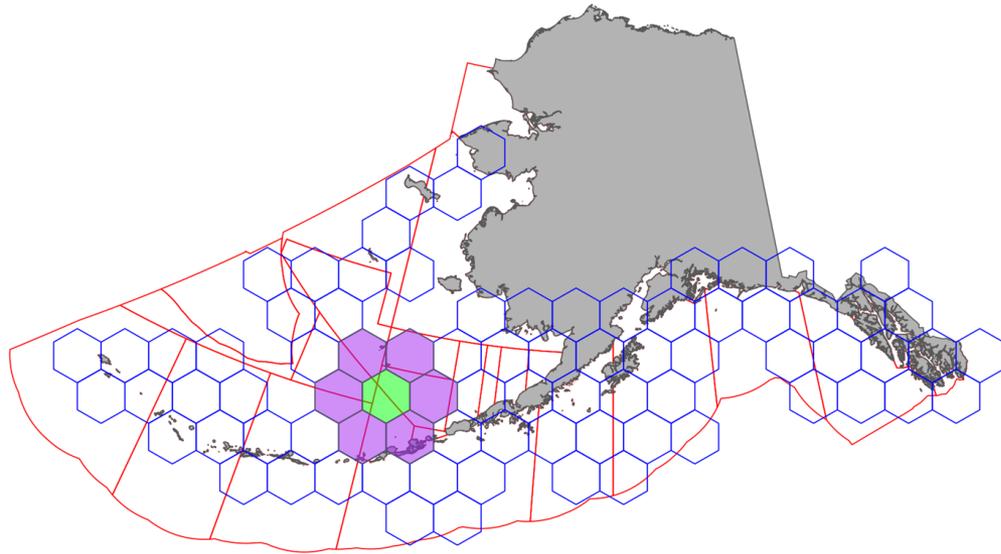
baseline, then minimize variance on groundfish discards, halibut PSC, and Chinook PSC.

- ***Alternatively***, allocate sampling effort to reduce data gaps in a way that also scales with budget
- ***Alternatively***, allocate more to cheaper strata
- ***Alternatively***, allocate more to strata with fewer trips to guard against sample size



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Allocation



Box definition:

200 km wide hexagon and 1 week period and adjacent neighboring hexagons and weeks

New Allocation Methods:

Cost-weighted Boxes (CWB)

- spatiotemporal gaps
- monitoring costs

Proximity (PROX)

- spatiotemporal gaps
- sample size



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Allocation Method	Stratification Definition		
	2023 (Current)	FMP	Combined Fixed Gear and FMP
Equal Rates	Integrated EM, baseline comparison	Integrated EM	Integrated EM
15% plus optimization (status quo)	both the stratification definition and allocation method were used in 2023		
Cost Weighted Boxes	2023 stratification definition and gap minimization with cost efficiencies	Integrated EM	Integrated EM
Proximity	2023 stratification and gap minimization with sample size buffer	Integrated EM	Integrated EM



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Sample Size and Rates

Budget: \$5.25M			Allocation scheme							
			EQUAL		STATUS_QUO		CWB		PROX	
Stratification	Stratum	N	Rate	n	Rate	n	Rate	n	Rate	n
CURRENT	EM_HAL	722	11.75	85	30.00	217				
	EM_POT	353	11.75	41	30.00	106				
	EM_TRW	768	11.75	90	33.33	256				
	OB_HAL	1,352	11.75	159	8.78	119				
	OB_POT	1,086	11.75	128	8.78	95				
	OB_TRW	389	11.75	46	8.78	34				
FIXED_FMP	EM_FIXED-BSAI	89			35.55	32	55.21	49		
	EM_FIXED-GOA	986			17.15	169	14.18	140		
	EM_TRW-GOA	768			11.22	86	8.80	68		
	OB_FIXED-BSAI	361			18.60	67	26.60	96		
	OB_FIXED-GOA	2,077			9.30	193	7.43	154		
	OB_TRW-BSAI	21			25.67	5	71.70	15		
	OB_TRW-GOA	368			16.91	62	18.10	67		



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Evaluation Metrics

- Data collection opportunities
 - Trips sampled (observers)
 - Trips monitored (observers or EM)
- Variance in *expenses*
- ~~Burden share~~
- Power to detect
 - Rare events (Short-tailed albatross, Steller sea lion)
 - Observer effects
- Data timeliness
- Variance between trips
 - Salmon PSC
 - Halibut PSC
 - Groundfish discards
 - Crab PSC
- Interspersion (monitored trips near unmonitored trips)

Evaluations of Designs

Stratifications

Metrics

Metric	Stratification: CURRENT				Budget: \$4.5M Stratification: FMP				Stratification: FIXED_FMP						
	CV	OB at sea	EM_TRW shoreside	Total	CV	OB at sea	EM_TRW shoreside	Total	CV	OB at sea	EM_TRW shoreside	Total			
Cost	3.50	3.40	3.47	3.48	3.50	3.41	3.55	3.53	3.52	3.42	3.59	3.53			
Biological	255	172	265	265	256	170	262	245	256	171	258	258			
Composition	97	323	173	179	98	323	168	162	97	323	144	151			
Interseparation (AK)	0.880	0.796	0.881	0.884	0.880	0.796	0.883	0.865	0.880	0.796	0.873	0.846			
Interseparation (FMP)	0.902	0.821	0.904	0.906	0.902	0.821	0.900	0.860	0.902	0.821	0.880	0.838			
Power to Detect	0.19	0.13	0.20	0.20	0.20	0.13	0.20	0.19	0.22	0.15	0.22	0.22			
Days	15	44	25	26	15	44	24	23	15	44	21	22			
Tip-Level Variance (CV)	7.83	7.11	7.12	7.63	7.80	7.07	7.33	8.89	8.55	7.66	8.09	8.80			
Allocation	EQUAL	STATUS	QUO	CWB	PROX	EQUAL	STATUS	QUO	CWB	PROX	EQUAL	STATUS	QUO	CWB	PROX

Worse performance

Allocations

Better performance

Evaluations of Designs - Budgets

\$3.5 M

\$4.5 M

\$5.25 M

Metric	Budget: \$3.5M				Budget: \$3.5M				Budget: \$3.5M							
	Stratification: CURRENT		Stratification: FMP		Stratification: FMP		Stratification: FIXED_FMP		Stratification: CURRENT		Stratification: FMP		Stratification: FIXED_FMP			
CV	4.23	3.51	4.19	4.21	4.18	3.50	4.21	4.29	4.19	3.52	4.24	4.22				
OB at sea	166	80	177	170	166	80	175	158	166	80	172	167				
EM_TRW shoreside	45	256	20	20	45	256	21	15	45	256	28	28				
Total	211	336	197	190	211	336	196	173	211	336	200	193				
OB at sea	166	80	177	170	166	80	175	158	166	80	172	167				
EM_FG at sea	63	323	76	117	62	323	75	104	63	323	71	101				
Total	229	403	253	287	228	403	250	262	229	403	243	268				
OB to OB	0.787	0.575	0.798	0.793	0.787	0.575	0.797	0.751	0.787	0.575	0.788	0.745				
OB to EM_FIXED	0.775	0.560	0.783	0.774	0.775	0.560	0.775	0.712	0.775	0.560	0.753	0.693				
OB to ZERO	0.730	0.517	0.749	0.719	0.730	0.517	0.729	0.657	0.730	0.517	0.705	0.643				
EM_TRW to EM_TRW	0.956	0.996	0.859	0.866	0.956	0.996	0.869	0.793	0.956	0.996	0.914	0.905				
EM_FIXED to EM_FIXED	0.613	0.957	0.870	0.790	0.613	0.957	0.669	0.739	0.613	0.957	0.647	0.730				
OB to OB	0.812	0.598	0.825	0.816	0.812	0.598	0.819	0.745	0.812	0.598	0.797	0.734				
OB to EM_FIXED	0.825	0.423	0.825	0.840	0.825	0.423	0.855	0.791	0.825	0.423	0.717	0.814				
OB to ZERO	0.784	0.568	0.793	0.783	0.784	0.568	0.783	0.704	0.784	0.568	0.755	0.684				
EM_TRW to EM_TRW	0.671	0.471	0.870	0.680	0.671	0.471	0.687	0.798	0.671	0.471	0.733	0.705				
EM_FIXED to EM_FIXED	0.768	0.548	0.787	0.757	0.768	0.548	0.764	0.681	0.768	0.548	0.735	0.659				
OB to ZERO	0.321	0.193	0.339	0.311	0.321	0.193	0.361	0.610	0.321	0.193	0.385	0.472				
EM_TRW to EM_TRW	0.956	0.996	0.859	0.866	0.956	0.996	0.869	0.793	0.956	0.996	0.914	0.905				
EM_FIXED to EM_FIXED	0.628	0.966	0.884	0.801	0.628	0.966	0.682	0.732	0.628	0.966	0.656	0.721				
EM_FIXED to EM_FIXED	0.440	0.888	0.507	0.686	0.440	0.888	0.530	0.821	0.440	0.888	0.551	0.831				
Steller SL	0.13	0.06	0.14	0.13	0.13	0.08	0.14	0.12	0.15	0.07	0.15	0.15				
Short-tailed Alb.	0.05	0.14	0.05	0.06	0.05	0.14	0.05	0.05	0.05	0.14	0.05	0.08				
Laysan Alb.	0.91	0.99	0.90	0.93	0.87	0.99	0.87	0.87	0.92	0.99	0.92	0.94				
Data Timeliness	19	44	12	17	19	44	12	16	19	44	11	15				
Chinook PSC	25.13	15.41	36.67	38.87	25.13	15.56	35.89	42.92	25.13	15.56	31.05	32.30				
Halibut PSC	29.21	36.45	25.86	26.71	29.51	37.53	26.72	32.69	29.46	37.74	25.93	26.35				
Discards	9.90	16.19	10.01	9.87	9.93	16.00	10.20	11.36	10.79	10.92	10.91	11.58				
Crab PSC	39.83	58.14	41.21	37.97	41.61	61.85	41.59	38.05	41.87	61.63	35.05	28.65				
Allocation	EQUAL	STATUS	CWB	PROX	EQUAL	STATUS	CWB	PROX	EQUAL	STATUS	CWB	PROX				



Metric	Budget: \$4.5M				Budget: \$4.5M				Budget: \$4.5M							
	Stratification: CURRENT		Stratification: FMP		Stratification: FMP		Stratification: FIXED_FMP		Stratification: CURRENT		Stratification: FMP		Stratification: FIXED_FMP			
CV	3.50	3.40	3.47	3.48	3.50	3.41	3.55	3.53	3.52	3.42	3.59	3.53				
OB at sea	255	172	265	265	256	170	262	245	256	171	258	258				
EM_TRW shoreside	70	256	42	36	70	256	45	25	70	256	59	48				
Total	325	428	307	301	326	426	307	270	326	427	317	304				
OB at sea	255	172	265	265	256	170	262	245	256	171	258	258				
EM_FG at sea	97	323	173	179	98	323	168	162	97	323	144	151				
Total	352	495	438	444	354	493	430	407	353	494	402	409				
OB to OB	0.880	0.796	0.881	0.884	0.880	0.796	0.883	0.865	0.880	0.796	0.873	0.846				
OB to EM_FIXED	0.871	0.784	0.871	0.870	0.871	0.784	0.864	0.829	0.871	0.784	0.845	0.802				
OB to ZERO	0.833	0.740	0.844	0.825	0.833	0.740	0.820	0.783	0.833	0.740	0.805	0.761				
EM_TRW to EM_TRW	0.975	0.996	0.951	0.940	0.975	0.996	0.956	0.899	0.975	0.996	0.969	0.957				
EM_FIXED to EM_FIXED	0.743	0.957	0.878	0.884	0.743	0.957	0.874	0.854	0.743	0.957	0.838	0.832				
OB to OB	0.902	0.821	0.904	0.906	0.902	0.821	0.900	0.860	0.902	0.821	0.880	0.838				
OB to EM_FIXED	0.740	0.635	0.734	0.748	0.740	0.635	0.775	0.894	0.740	0.635	0.827	0.893				
OB to ZERO	0.880	0.794	0.880	0.878	0.880	0.794	0.871	0.824	0.880	0.794	0.846	0.796				
EM_TRW to EM_TRW	0.777	0.681	0.771	0.779	0.777	0.681	0.796	0.888	0.777	0.681	0.831	0.873				
EM_FIXED to EM_FIXED	0.870	0.778	0.881	0.862	0.870	0.778	0.856	0.789	0.870	0.778	0.831	0.775				
OB to ZERO	0.434	0.330	0.452	0.421	0.434	0.330	0.502	0.726	0.434	0.330	0.521	0.608				
EM_TRW to EM_TRW	0.975	0.996	0.951	0.940	0.975	0.996	0.956	0.899	0.975	0.996	0.969	0.957				
EM_FIXED to EM_FIXED	0.758	0.966	0.890	0.894	0.758	0.966	0.882	0.849	0.758	0.966	0.842	0.825				
EM_FIXED to EM_FIXED	0.571	0.868	0.742	0.765	0.571	0.868	0.784	0.907	0.571	0.868	0.796	0.906				
Steller SL	0.19	0.13	0.20	0.20	0.20	0.13	0.20	0.19	0.22	0.15	0.22	0.22				
Short-tailed Alb.	0.09	0.16	0.10	0.10	0.09	0.16	0.10	0.09	0.09	0.16	0.09	0.09				
Laysan Alb.	0.97	0.99	0.98	0.98	0.96	0.99	0.97	0.98	0.98	0.99	0.98	0.98				
Data Timeliness	15	44	25	26	15	44	24	23	15	44	21	22				
Chinook PSC	19.83	11.98	25.14	27.18	19.84	12.05	24.35	32.99	19.84	12.05	21.14	23.96				
Halibut PSC	23.22	24.69	19.46	20.08	23.48	25.39	20.23	25.04	23.54	25.50	19.70	20.36				
Discards	7.83	7.11	7.12	7.63	7.80	7.07	7.35	8.89	8.55	7.66	8.09	8.80				
Crab PSC	31.64	39.16	33.77	30.46	33.04	41.59	33.04	29.31	32.82	40.86	26.49	21.79				
Allocation	EQUAL	STATUS	CWB	PROX	EQUAL	STATUS	CWB	PROX	EQUAL	STATUS	CWB	PROX				



Metric	Budget: \$5.25M				Budget: \$5.25M				Budget: \$5.25M							
	Stratification: CURRENT		Stratification: FMP		Stratification: FMP		Stratification: FIXED_FMP		Stratification: CURRENT		Stratification: FMP		Stratification: FIXED_FMP			
CV	3.62	3.08	2.97	2.98	2.98	3.08	3.03	2.94	3.02	3.07	3.02	2.96				
OB at sea	333	248	338	344	331	247	331	323	331	248	327	332				
EM_TRW shoreside	90	256	62	53	90	256	67	36	90	256	86	68				
Total	423	504	401	397	421	503	398	359	421	504	413	400				
OB at sea	333	248	338	344	331	247	331	323	331	248	327	332				
EM_FG at sea	120	323	250	227	127	323	238	209	120	323	201	189				
Total	459	571	589	571	458	570	569	532	457	571	528	521				
OB to OB	0.919	0.875	0.917	0.922	0.919	0.875	0.921	0.913	0.919	0.875	0.912	0.891				
OB to EM_FIXED	0.912	0.888	0.909	0.910	0.912	0.888	0.905	0.883	0.912	0.888	0.887	0.854				
OB to ZERO	0.880	0.827	0.888	0.873	0.880	0.827	0.873	0.845	0.880	0.827	0.854	0.820				
EM_TRW to EM_TRW	0.982	0.998	0.971	0.964	0.982	0.998	0.974	0.940	0.982	0.998	0.981	0.974				
EM_FIXED to EM_FIXED	0.810	0.967	0.933	0.921	0.810	0.967	0.930	0.904	0.810	0.967	0.902	0.879				
OB to OB	0.938	0.897	0.937	0.940	0.938	0.897	0.934	0.910	0.938	0.897	0.917	0.886				
OB to EM_FIXED	0.799	0.732	0.792	0.803	0.799	0.732	0.837	0.936	0.799	0.732	0.877	0.926				
OB to ZERO	0.920	0.874	0.917	0.918	0.920	0.874	0.910	0.880	0.920	0.874	0.888	0.849				
EM_TRW to EM_TRW	0.830	0.770	0.823	0.828	0.830	0.770	0.850	0.923	0.830	0.770	0.876	0.906				
EM_FIXED to EM_FIXED	0.914	0.864	0.922	0.908	0.914	0.864	0.909	0.851	0.914	0.864	0.877	0.832				
OB to ZERO	0.508	0.425	0.527	0.494	0.508	0.425	0.592	0.778								

Evaluations of Designs - Tradeoffs

Under budgets examined, *Current Stratification* and *Status quo* allocation resulted in much more EM sampling than observers.

- ✓ Greatest cost efficiency
- ✓ Most samples (largely from Trawl EM)
- ✓ Best CV for between trip Chinook PSC

- ❖ Doesn't address multiple gear types on same trip
- ❖ Differences between FMP not detected
- ❖ Few at-sea observer biological measurements and tissue collections
- ❖ Low interspersion of observers to EM or observers to zero coverage
- ❖ Worst power to detect Steller Sea lion bycatch - relatively poor at Short tailed albatross in the BSAI.
- ❖ High between trip CV for Pacific halibut PSC and worst CV for crab PSC.
- ❖ EM data too slow to be useful for quota management

Evaluations of Designs

- **Analysts recommend we make changes for the 2024 ADP.**
- **Analysts recommend use of the *Fixed FMP* stratification for 2024.**
 - ✓ Facilitates multiple fixed gear types on the same trip.
 - ✓ Accounts for FMP differences without resulting in strata with too little effort.
- **When combined with either *CWB* or *Proximity* allocation:**
 - ✓ Greatly improves EM timeliness.
 - ✓ Uses cost / effort in its algorithm to avoid over/under sampling.
 - ✓ Relatively good interspersion
 - ✓ Relatively good power to detect Albatross in the BSAI.
 - ✓ Decreased between trip CV of Pacific halibut and Crab PSC
 - ❖ **Increased between trip CV of Chinook PSC.**



Additional Program Considerations

- Size of zero coverage stratum
- Current observer contract structure (hourly billing savings 10%)
- Future observer employment structure (7-13% savings)
- Hiring additional EM video reviewers (300k, 30% increase in EM budget)
- Biological data collection
- Balancing flexibility with cost



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What we need from you

- Interspersion as a metric.
- FMP Differences - Fixed FMP.
- Other [scientific] concerns.



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Discussion