

Draft 2024 Annual Deployment Plan and Partial Coverage Cost Efficiencies Analysis

Page 1 U.S. Department of Commerce | National Oceanic and Atmospheric Administration | National Marine Fisheries Service

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)
- Collect data that reflects the full range of fishing activities



Stratification

- How fishing trips are grouped for sampling
- Groups are defined by trip characteristics known *before* random selection
- Every sampling unit can only be in one stratum

Can be used to:

- Focus sampling on a particular objective
- Control costs

Can be defined by:

- Monitoring method
- Gear
- FMP Bering Sea / Aleutian Islands / Gulf of Alaska



Stratification Issues



- Few trips fish in multiple FMPs
- AI-BS most multiple-FMP trips
 - Stable pattern expected to persist

- AK-wide sampling resulted in few BS and AI monitored trips
 - data gaps negatively impact the ability of the AFSC to move to a tier 3 assessment for some stocks (AI P. cod)
- Evaluated
 - AK-wide, BSAI and GOA, BS and AI and GOA stratification definitions
- Including **BSAI** and **GOA** in stratum definition
 - allowed targeted sampling
 - avoided creation of strata with few trips



Stratification Issues



- Each trip (or delivery) must be on only one stratum
- Evaluated
 - combining HAL and POT gears to a single stratum
 - creating a new stratum of only trips fishing with multiple gears
- Combined HAL+POT with FMP stratum definition (Fixed-FMP)
 - allowed targeted sampling
 - increased statistical integrity





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



Stratification Definitions Not Evaluated

FMP (AI, BS, GOA)

- Separate strata for each of the three FMPs; need to declare when logging trips
- This stratification increased logistical difficulties and resulted in strata with few trips

HAL, POT, and BOTH

- Separate strata for HAL, POT, and trips that fish both gears
- This stratification increased logistical difficulties and resulted in strata with few trips when coupled with stratification by FMP



Allocation: Distributing samples to different strata

Equal Rates

Goal: Representative sample with equal burden of monitoring

Baseline 15% plus optimization (Status quo)

Goal: *Equal Rates* to 15% observed strata plus variance minimization with EM rates set by policy

EM integrated Baseline 15% plus optimization

Goal: Equal Rates to 15% for all strata plus variance minimization

Cost-weighted boxes

- Goal: maximize the proportion of "boxes" monitored (or near), decreasing allocation to strata with high monitoring costs *Proximity*
- Goal: maximize proportion of trips near monitored trips while guarding against low sample sizes



Allocation



Box definition:

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



Allocation Method	Objective	Rational	Benefits	Shortcomings
Equal Rates	Sample proportionally to the size of the stratum	Simple allocation relies on few assumptions	Few assumptions on data	At low sample size, can be prone to data gaps
Baseline 15% plus optimization (status quo)	 30% coverage on EM Baseline 15% observer rate, Minimize combined variance of discards of groundfish, halibut PSC, and salmon PSC 	Lower variance on estimates of halibut PSC and salmon PSC	Baseline rate to decrease data gaps	 High EM rate results in low at-sea observer rates Policy based EM rates Low funding, at-sea baseline rates not reached Uses between-trip (not CAS) variance
EM integrated Baseline 15% plus optimization	 Baseline 15% rate Minimize combined variance of discards of groundfish, halibut PSC, and salmon PSC 	Lower variance on estimates of halibut PSC and salmon PSC	Baseline rate to decrease data gaps	 Low funding, at-sea baseline rates not reached Uses between-trip (not CAS) variance
Cost Weighted Boxes	 Decrease data gaps Minimize overall costs 	Collection of representative data at varied resolution and cost efficiency	 High data utility Fewer data gaps Limits sampling in high-cost strata 	Iterative process to set stratum weightings
Proximity	 Decrease data gaps Prevent low sample size 	Collection of representative data at varied resolutions and sufficient sample size	 High data utility Fewer data gaps Fewer low-sample strata 	Iterative process to allocate sample effort

	Stratification	Definition	
Allocation Method	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



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 - what we proposed

- It is unlikely that one design will be the best across all metrics
- Scores and rankings will change with different budgets
- We want the best design that will work on small and large budgets.

Metric		Desi	gn	
	Α	В	С	D
Trips sampled (observers, all data)	<mark>291</mark>	126	221	237
Trips monitored (observers or EM)	20	37	60	43
Variance in expenses	3115	3028	3017	2979
Short-tailed albatross	0.03	0.07	0.25	0.15
Steller sea lion	0.01	0.04	0.04	0.01
Observer effects	0.45	0.47	0.39	0.56
Burden share	0.42	0.85	1	0.49
Data timeliness	164	164	200	159
Salmon PSC (#)	3940	4444	3892	4602
Halibut PSC (t)	60	180	98	181
Crab PSC	51	111	70	38
Groundfish discards (t)	651	735	1198	338
Interspersion	0.16	0.11	0.54	0.5

Evaluations of Designs



Evaluations of Designs - Budgets

Discards - Crab PSC - 31.64 39.18 33.77 30.46 33.04 41.59 33.04 29.31

OB at sea

OB at sea

OB to OB -

OB to ZERO -

OB to OB

GOA OB to OB

BSAI OB to EM_FIXED

OB to EM_FIXED

EM_TRW to EM_TRW

GOA EM_FIXED to EM_FIXED

EM_FIXED to EM_FIXED

OB to ZERO

GOA OB to ZERO

Steller SL

Short-tailed Alb. -

Laysan Alb Data Timeliness -

Chinook PSC

Halibut PSC -

OB to EM_FIXED -

EM_TRW to EM_TRW -

EM_FIXED to EM_FIXED -

EM TRW shoreside

\$5.25 M

\$4.5 M

\$3.5 M

						Budget	: \$4.5M												Budget:	\$5.25M	l.				
	Stra	tification	CURR	ENT	5	Stratificat	tion: FM	Р	Strat	fication:	FIXED	FMP		Stra	tification	CURR	ENT	S	tratificat	ion: FM	Р	Strati	fication:	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	cv- g	3.02	3.08	2.97	2.98	2.98	3.08	3.03	2.94	3.02	3.07	3.02	2.98
tsea- 🔬 🕫	255	172	265	265	256	170	262	245	256	171	258	258	OB at sea - 🙀 📆	333	248	339	344	331	247	331	323	331	248	327	332
eside - de g	70	256	42	36	70	256	45	25	70	256	59	46	EM_TRW shoreside -	90	256	62	53	90	256	67	36	90	256	86	68
Total - 🖑 👸	325	428	307	301	326	426	307	270	326	427	317	304	Total - 88 🗟	423	504	401	397	421	503	398	359	421	504	413	400
t sea - :: Bigging	255	172	265	265	256	170	262	245	256	171	258	258	OB at sea - :: 5	333	248	339	344	331	247	331	323	331	248	327	332
t sea - la odu	97	323	173	179	98	323	168	162	97	323	144	151	EM_FG at sea - 20	126	323	250	227	127	323	238	209	126	323	201	189
Total - 🕫 Ö	352	495	438	444	354	493	430	407	353	494	402	409	Total - 🖉 👸	459	571	589	571	458	570	569	532	457	571	528	521
^{о ОВ -} 🖌	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 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
XED - 5	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 EM_FIXED - 5	0.912	0.866	0,909	0.910	0.912	0.866	0.905	0.883	0.912	0.866	0.887	0.854
ERO - 2	0.833	0.740	0.844	0.825	0.833	0.740	0.826	0.783	0.833	0.740	0.805	0.761	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
TRW - 2	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_TRW to EM_TRW -	0.982	0.995	0.971	0.964	0.982	0.996	0.974	0.940	0.982	0.996	0.981	0.974
XED- =	0.743	0.957	0.878	0.884	0.743	0.957	0.874	0.854	0.743	0.957	0.838	0.832	EM_FIXED to EM_FIXED -	0.810	0.957	0.933	0.921	0.810	0.957	0.930	0.904	0.810	0.957	0.902	0.879
OB_ GOA	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 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
DOB_ BSAL	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 OB	0.799	0.732	0.792	0.803	0.799	0.732	0.837	0.936	0.799	0.732	0.877	0.926
KED GOA	0.880	0.794	0.880	0.878	0.880	0.794	0.871	0.824	0.880	0.794	0.846	0.796	OB to EM_FIXED	0.920	0.874	0.917	0.918	0.920	0.874	0.910	0.880	0.920	0.874	0.888	0.849
XED E	0.777	0.681	0.771	0.779	0.777	0.681	0.796	0.886	0.777	0.681	0.831	0.873	OB to EM_FIXED	0.830	0.770	0.823	0.828	0.830	0.770	0.850	0.923	0.830	0.770	0.876	0.906
ERO SOA	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	0.914	0.864	0.922	0.908	0.914	0.864	0.899	0.851	0.914	0.864	0.877	0.832
ERO de	0.434	0.330	0.452	0.421	0.434	0.330	0.502	0.726	0.434	0.330	0.521	0.608	OB to ZERO	0.508	0.425	0.527	0.494	0.508	0.425	0.592	0.778	0.508	0.425	0.607	0.683
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_TRW to EM_TRW	0.982	0.996	0.971	0.964	0.982	0.996	0.974	0.940	0.982	0.996	0.981	0.974
XED_	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	0.824	0.988	0.943	0.931	0.824	0.986	0.998	0.901	0.824	0.966	0.904	0.874
XED _ BSAI	0.571	0.868	0.742	0.765	0.571	0.868	0.784	0.907	0.571	0.868	0.796	0.906	EM_FIXED to EM_FIXED BSAL	0.649	0.868	0.823	0.812	0.649	0.868	0.868	0.942	0.649	0.868	0.878	0.937
er SL - g	0.19	0.13	0.20	0.20	0.20	0.13	0.20	0.19	0.22	0.15	0.22	0.22	Steller SL = o	0.25	0.19	0.25	0.25	0.25	0.19	0.25	0.25	0.28	0.21	0.28	0.28
Alb Mag	0.09	0.16	0.10	0.10	0.09	0.16	0.10	0.09	0.09	0.16	0.09	0.09	Short-tailed Alb 형용	0.11	0.17	0.13	0.13	0.11	0.17	0.13	0.12	0.11	0.17	0.13	0.12
Alb 20	0.97	0.99	0.98	0.98	0.96	0.99	0.97	0.96	0.98	0.99	0.98	0.98	Laysan Alb	0.99	0.99	0.99	0.99	0.98	0.99	0.99	0.98	0.99	0.99	0,99	0.99
ness- given	15	44	25	26	15	44	24	23	15	44	21	22	Data Timeliness -	19	-44	35	32	19	-44	33	29	19	44	28	27
PSC- c	19.83	11.98	25.14	27.18	19.84	12.05	24.35	32.99	19.84	12.05	21.14	23.96	Chinash DCC	17.74	10.00	20.40	22.40	17.00	10.05	40.74	07.07	17.00	40.05	47.00	10.42
PSC - 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	Chindok PSC-	17.21	10.90	20.46	22.10	17.23	01.00	13.14	21.21	17.23	0.95	17.20	13.93
ards - ib-	7.83	7.11	7.12	7.63	7.80	7.07	7.35	8.89	8.55	7.66	8.09	8.80	Hallout PSC - a -	19.95	20.71	16.58	16.88	20.32	21.03	17.34	20.82	20.33	21.12	16.97	17.37
PSC - LIN	31.64	39.18	33.77	30.46	33.04	41.59	33.04	29.31	32.82	40.86	26.49	21.79	Discards - P in	6.75	6.03	5.94	6.49	6.78	6.01	6.23	7.56	7.39	6.51	6.91	7.63
	5	00	'n	×	- 5	w 0	'n	*	- 5-			÷	Crab PSC - ≥	27.27	32.19	29.83	26.79	28.49	33.84	29.03	24.73	28.68	33.38	22.35	18.51
	NA	ATU	CWE	PRO)	NUC	ATU	CWE	RO)	NUC	ATU	CWE	RO)		NAL	TUS	0WB	SOX	NAL	1US 0UO	BWB	XOX	UAL	200	BWB	XOX
	Ш	ST		LL.	Ĕ	Alloc	ation	LL.	Ĕ	ST		LL.		EQ	STAT	0	ď	EQI	Alloc	ation	dd.	EQ	STAT	0	ď
		-																							
	Wa	rst										Best		W	orst									I	Best

	Stra	tification	CURR	ENT	ŝ	Budget	: \$3.5M tion: FM	P	Strat	flication:	FIXED	FMP
cv- 8	4.23	3.51	4.19	4,21	4,18	3.50	4.21	4.29	4,19	3.52	4.24	4.22
OBatsea- an ma	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	26
Total - 38	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 - 88	229	403	253	287	228	403	250	262	229	403	243	268
OB to OB - Q	0.787	0.575	0.798	0.793	0.787	0.575	0.797	0.751	0.787	0.575	0.786	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	0.670	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 OB	0.625	0.423	0.625	0.640	0.625	0.423	0.655	0.791	0.625	0.423	0.717	0.814
OB to EM_FIXED	0.784	0.568	0.793	0.783	0.784	0.568	0.783	0.704	0.784	0.568	0.755	0.684
OB to EM_FIXED	0.671	0.471	0.670	0.680	0.671	0.471	0.687	0.796	0.671	0.471	0.733	0.795
OB to ZERO	0.768	0.548	0.787	0.757	0.768	0.548	0.764	0.661	0.768	0.548	0.735	0.659
OB to ZERO BSAL	0.321	0.180	0.339	0.311	0.321	0.180	0.361	0.616	0.321	0.186	0.385	0.472
EM_TRW to EM_TRW _ goa	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	0.684	0.801	0.628	0.966	0.682	0.732	0.628	0.966	0.656	0.721
EM_FIXED to EM_FIXED BSAI	0.440	0.868	0.507	0.666	0.440	0.868	0.530	0.821	0.440	0.868	0.551	0.831
Steller SL - g	D.13	0.06	0.14	0.13	0.13	0.06	0.14	0.12	0.15	9.07	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	0.06
Laysan Alb 20	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 -	10	44	12	17	10	44	12	16	10	44	11	15
Chinook PSC - 🤿	25.13	15.41	36.67	36.87	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 - 2 g	9.90	10.19	10.01	9.87	9.93	10.09	10.20	11.38	10.79	10.92	10.91	11.09
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
	EQUAL-	STATUS QUO	CWB-	- XOR4	EQUAL -	STATUS -	-BMO	- ROX -	EQUAL-	STATUS QUO	CWB-	PROX-
	Wo	rst			_							Best

Evaluations of Designs - Budgets

\$5.25 M

									Budget:	\$5.25M					
		-	Stra	tification	CURR	ENT		5	Itratificat	ion: FM	P	Sti	atification	FIXED	FMP
	CV -	ŝ	3.02	3.08	2.97	2,98		2.98	3.08	3.03	2.94	3.02	3.07	3.02	2.98
	OB at sea -	10	333	248	339	344		331	247	331	323	331	248	327	332
EM	RW shoreside -	ogic	90	258	62	53		90	256	67	36	90	256	86	68
0.500	Total -	Biol	423	504	401	397		421	503	398	359	421	504	413	400
	OB at sea -	5	333	248	339	344	i	331	247	331	323	331	248	327	332
	EM EG at sea -	ositi	126	323	250	227		127	323	238	209	126	323	201	189
	Total -	Sarr	459	571	589	571		458	570	569	532	457	571	528	521
	OR IN OR -		0.010	0.975	0.017	0.922	ú	0.010	0.975	0.021	0.042	0.01	0.975	0.012	0.001
	UN EM EIVED -	(AK)	0.012	0.070	0.000	0.010		0.013	0.075	0.005	0.993	0.01	0.070	0.012	0.001
	OB to ZERO -	sion	O BBO	0.827	0.888	0.873		0.880	0.827	0.873	0.845	0.88	0.0827	0.854	0.820
EM T	WINEM TOW-	sper	0.000	0.027	0.000	0.075		0.000	0.027	0.075	0.040	0.00	2 0.000	0.004	0.020
EM EIVE	IN EM EIXED	Inter	0.810	0.957	0.933	0.921		0.810	0.957	0.930	0.904	0.81	0 0.957	0.902	0.879
	to cm_rotco		0.010	0.001	0.000	0.011		0.010	0.00	0.000	0.004	0.01		0.002	0.010
	GOA		0.938	0.897	0.937	0.940		0.938	0.897	0.934	0.910	0.93	8 0.897	0.917	0.886
	OB to OB BSAI		0.799	0.732	0.792	0.803		0.799	0.732	0.837	0.936	0.79	9 0.732	0.877	0.926
	to EM_FIXED	(d)	0.920	0.874	0.917	0.918		0.920	0.874	0.910	0.880	0.92	0 0.874	0.888	0.849
	to EM_FIXED_ BSAI	n (FI	0.830	0.770	0.823	0.828		0.830	0.770	0.850	0.923	0.83	0 0.770	0.876	0.906
	OB to ZERO	ersio	0.914	0.864	0.922	0.908		0.914	0.864	0.899	0.851	0.91	4 0.864	0.877	0.832
10000	OB to ZERO BSAI	arspe	0.508	0.425	0.527	0.494		0.508	0.425	0.592	0.778	0.50	8 0.425	0.607	0.683
EM_T	W to EM_TRW_ GOA	Inte	0.982	0.996	0.971	0.964		0.982	0.996	0.974	0.940	0.98	2 0.996	0.981	0.974
EM_FIXE	to EM_FIXED GOA		0.824	0.966	0.943	0.931		0.824	0.966	0.936	0.901	0.82	4 0.966	0.904	0.874
EM_FIXE	to EM_FIXED BSAI		0.649	0.868	0.823	0.812		0.649	0.868	0.868	0.942	0.64	9 0.868	0.878	0.937
	Steller SL -	8-	0.25	0.19	0.25	0.25		0.25	0.19	0.25	0.25	0.28	0.21	0.28	0.28
	hort-tailed Alb	wer I etec	0.11	0.17	0.13	0.13		0.11	0.17	0.13	0.12	0.11	0.17	0.13	0.12
	Laysan Alb	20	0.99	0.99	0.99	0.99		0.98	0.99	0.99	0.98	0.95	0.99	0.99	0.99
	lata Timeliness -	Days	19	-44	35	32		19	-44	33	29	19	- 44	28	27
	Chinook PSC -	5	17.21	10.96	20.48	22.16		17.23	10.95	19.74	27.27	17.2	3 10.95	17.26	19.43
	Halibut PSC -	evel (C)	19.96	20.71	16.58	16.88		20.32	21.03	17.34	20.82	20.3	3 21.12	16.97	17.37
	Discards -	iance	6.75	6.03	5.94	6.49		6.78	6.01	6.23	7.56	7.35	6.51	6.91	7.63
	Crab PSC -	- 10	27.27	32.19	29.83	26.79		28.49	33.84	29.03	24.73	28.6	8 33.38	22.35	18.51
			- TEUAL -	STATUS QUO	CWB-	- ROX -		EQUAL -	Alloc	ation	- XOX-	- EQUAL -	STATUS QUO	CWB-	- ROX -
			Wo	rst											Best

\$4.5 M

							Budget	\$4.5M						
		Sti	atification	: CURR	ENT	S	stratificat	tion: FM	Р		Strat	ification:	FIXED	FMP
	cv - tso	3.50	3.40	3.47	3.48	3.50	3.41	3.55	3.53		3.52	3.42	3.59	3.5
	OB at sea - 😸	m 255	172	265	265	256	170	262	245		256	171	258	25
	M_TRW shoreside -	8 70	256	42	36	70	256	45	25		70	256	59	46
	Total - 0	325	428	307	301	326	426	307	270		326	427	317	30-
	OB at sea - 🙀	255	172	265	265	256	170	262	245		256	171	258	25
	EM_FG at sea - 🖻	97	323	173	179	98	323	168	162		97	323	144	15
	Total - 00	5 352	495	438	444	354	493	430	407		353	494	402	40
	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	0.84
	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	0.80
	OB to ZERO -	0.833	0.740	0.844	0.825	0.833	0.740	0.826	0.783		0.833	0.740	0.805	0.76
	_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	0.95
-	XED 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	0.83
	OB to OB	0.903	0.821	0.904	0.906	0.902	0.821	0.900	0.860	£.	0.902	0.821	0.880	0.81
	GOA OB to OB	0.740	0.635	0.734	0.748	0.740	0.635	0.775	0.894		0.740	0.635	0.827	0.85
	OB to EM_FIXED	0.880	0.794	0.880	0.878	0.880	0.794	0.871	0.824		0.880	0.794	0.846	0.75
	OB to EM_FIXED	0.777	0.681	0.771	0.779	0.777	0.681	0.796	0.886		0.777	0.681	0.831	0.87
	OB to ZERO	0.870	0.778	0.881	0.862	0.870	0.778	0.856	0.789		0.870	0.778	0.831	0.73
	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	0.60
	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	0.95
	XED 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	0.83
	GOA XED 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	0.90
	BSAI	01011	01000	0.11	0.11 000	0107.1	0.000		0.001		010111	0.000	0.1.00	0.00
	Steller SL - g	0.19	0.13	0.20	0.20	0.20	0.13	0.20	0.19		0.22	0.15	0.22	0.2
	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	0.0
	Laysan Alb 🕰	0.97	0.99	0.98	0.98	0.96	0.99	0.97	0.96		0.98	0.99	0.98	0.9
	Data Timeliness -	15	44	25	26	15	44	24	23		15	44	21	22
	Chinook PSC -	5 19.83	11.98	25.14	27.18	19.84	12.05	24.35	32.99		19.84	12.05	21.14	23.9
	Halibut PSC -	23.22	24.69	19.46	20.08	23.48	25.39	20.23	25.04		23.54	25.50	19.70	20.3
	Discards - E	7.83	7.11	7.12	7.63	7.80	7.07	7.35	8.89		8.55	7.66	8.09	8.8
	Crab PSC -	31.64	39.18	33.77	30.46	33.04	41.59	33.04	29.31		32.82	40.86	26.49	21.7
		- TA	50	-82	×	'F	50	-B-	×		- TA	50	-B'	×
		EQU	IAT	0	PR	EQU	1AT OI	0	R.		EQU	DAT	U	PR
			U)				Alloc	ation				0)		
l												_		
ļ														Dent
I		W	oist											⊳est
I														
I														

Me

\$3.5 M



Evaluation Metrics - Cost and Samples

Number of samples refers to the number of trips where biological or species composition data were collected

						Budget	: \$4.5M					
	Stra	tification	: CURR	ENT	3	Stratifica	tion: FN	1P	Strat	ification:	FIXED	_FMP
Cost - VO	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	46
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
	EQUAL -	STATUS QUO	CWB -	PROX-	EQUAL -	STATUS QUO Alloca	tion	PROX -	EQUAL -	QUO QUO	CWB -	- XOX-



Evaluation Metrics - Interspersion

						Budget:	\$4.5M					
	Strati	fication:	CURRE	NT	St	ratificatio	on: FMF)	Strati	fication:	FIXED_	FMP
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	0.826	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 GOA	0.902	0.821	0.904	0.906	0.902	0.821	0.900	0.860	0.902	0.821	0.880	0.838
.e OB to OB - BSAI	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 EM_FIXED GOA	0.880	0.794	0.880	0.878	0.880	0.794	0.871	0.824	0.880	0.794	0.846	0.796
OB to EM_FIXED BSAI	0.777	0.681	0.771	0.779	0.777	0.681	0.796	0.886	0.777	0.681	0.831	0.873
OB to ZEROo GOA	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 BSAI	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 _ GOA	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 _ BSAI	0.571	0.868	0.742	0.765	0.571	0.868	0.784	0.907	0.571	0.868	0.796	0.906
	EQUAL -	STATUS QUO	CWB-	- ROX -	EQUAL -	STATUS - QUO	ation	- PROX -	EQUAL -	STATUS QUO	CWB-	- ROX -

Worst

Evaluation Metrics - Power to detect



Evaluations of Designs - Tradeoffs

- Summaries are great but they suffer from a loss of information in an attempt to simplify.
- One example is how power to detect is influenced by sample size. From summaries it would appear that *Status quo* allocation has the greatest ability to detect albatross. However, this is a function of total samples in the design.
- When we dive further into the stratum that actually have the bycatch, we see that *Status quo* allocation actually performs the worst for the OB-HAL... stratum because few samples are going into the BSAI (Figures 5-2 to 5-4).

Evaluation Metrics - Monitoring Effects Power

)	CUR	RENT								FMP			_					FIX	ED_F	MP						
	EQUAL -	6	0	-7	21	16	12	36	5	3	-2	-7	22	20	51	5	4	12	25	2	-7	50	11	4	12				
	STATUS_QUO -	6	0	-7	21	16	12	36	5	3	-2	-7	22	20	51	5	4	12	25	2	-7	50	11	4	12	DUR/			
	CWB -	6	0	-7	21	16	12	36	5	3	-2	-7	22	20	51	5	4	12	25	2	-7	50	11	4	12	ATION			
	PROX -	6	0	-7	21	16	12	36	5	3	-2	-7	22	20	51	5	4	12	25	2	-7	50	11	4	12				
	EQUAL -	-4	-14	-4	16	20	1	12	-4	-6	-10	-4	6	17	45	0	-40	3	-9	-9	-4	28	2	-40	3	RET	Po	wer	00
ation	STATUS_QUO -	-4	-14	-4	16	20	1	12	-4	-6	-10	-4	6	17	45	0	-40	3	-9	-9	-4	28	2	-40	3	AINE	-	0.7	75
Alloca	CWB -	-4	-14	-4	16	20	1	12	-4	-6	-10	-4	6	17	45	0	-40	3	-9	-9	-4	28	2	-40	3	D_CA	-	0.5	50
	PROX -	-4	-14	-4	16	20	1	12	-4	-6	-10	-4	6	17	45	0	-40	3	-9	-9	-4	28	2	-40	3	ТСН	-	0.2	25
	FOUN	Б	10	2	0	0	11	6	e	12	15	2	10	7	2	10	10	10	G	7	2	F	6	10	10				
	EQUAL-	-5	-10	-3	-0	-0	-11	-0	-0	15	-15	-3	-19	-7	-3	-10	-12	-10	0	-1	-3	-5	-0	-12	-10	S			
;	STATUS_QUO -	-5	-10	-3	-8	-8	-11	-6	-6	13	-15	-3	-19	-7	-3	-10	-12	-10	6	-7	-3	-5	-6	-12	-10	PEC			
	CWB -	-5	-10	-3	-8	-8	-11	-6	-6	13	-15	-3	-19	-7	-3	-10	-12	-10	6	-7	-3	-5	-6	-12	-10	IES			
	PROX -	-5	-10	-3	-8	-8	-11	-6	-6	13	-15	-3	-19	-7	-3	-10	-12	-10	6	-7	-3	-5	-6	-12	-10				
		EM_HAL -	EM_POT -	EM_TRW -	OB_HAL -	OB_POT-	OB_TRW -	EM_HAL-BSAI -	EM_HAL-GOA -	EM_POT-BSAI -	EM_POT-GOA-	EM_TRW-GOA -	OB_HAL-BSAI -	OB_HAL-GOA -	OB_POT-BSAI -	OB_POT-GOA-	OB_TRW-BSAI -	OB_TRW-GOA -	EM_FIXED-BSAI -	EM_FIXED-GOA -	EM_TRW-GOA-	OB_FIXED-BSAI -	OB_FIXED-GOA -	OB_TRW-BSAI -	OB_TRW-GOA -				

Method Gear-FMP

Evaluation Metrics - Timeliness



Evaluation Metrics - Trip level CV





Evaluations of Designs - Budgets

Short-tailed Alb. -

Laysan Alb Data Timeliness -

Halibut PSC -

\$5.25 M

\$4.5 M

\$3.5 M

						Budget	\$4.5M												Budget:	\$5.25M					
	Stra	tification	CURR	ENT	5	Stratificat	ion: FM	P	Strat	ification:	FIXED	FMP		Stra	tification:	CURRE	ENT	s	tratificat	ion: FM	Þ	Strati	fication:	FIXED_	FMP
CV - to	3.50	3.40	3.47	3.48	3.50	3.41	3.55	3.53	3.52	3.42	3.59	3.53	cv- 8	3.02	3.08	2.97	2.98	2.98	3.08	3.03	2.94	3.02	3.07	3.02	2.98
OB at sea - 👷 😨	255	172	265	265	256	170	262	245	256	171	258	258	OB at sea - 🙀 🗑	333	248	339	344	331	247	331	323	331	248	327	332
N shoreside -	70	256	42	36	70	256	45	25	70	256	59	46	EM_TRW shoreside -	90	256	62	53	90	256	67	36	90	256	86	68
Total - 🕅 🛅	325	428	307	301	326	426	307	270	326	427	317	304	Total - 🖉 🗃	423	504	401	397	421	503	398	359	421	504	413	400
OB at sea - 😸 💆	255	172	265	265	256	170	262	245	256	171	258	258	OB at sea - 👷 🛱	333	248	339	344	331	247	331	323	331	248	327	332
1_FG at sea - Eg	97	323	173	179	98	323	168	162	97	323	144	151	EM_FG at sea -	126	323	250	227	127	323	238	209	126	323	201	189
Total - 8 5	352	495	438	444	354	493	430	407	353	494	402	409	Total - 8 5	459	571	589	571	458	570	569	532	457	571	528	521
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 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
EM_FIXED - S	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 EM_FIXED - 🖉	0.912	0.866	0.909	0.910	0.912	0.866	0.905	0.883	0.912	0.866	0.887	0.854
DB to ZERO -	0.833	0.740	0.844	0.825	0.833	0.740	0.826	0.783	0.833	0.740	0.805	0.761	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
to EM_TRW - B	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_TRW to EM_TRW -	0.982	0.995	0.971	0.964	0.982	0.996	0.974	0.940	0.982	0.996	0.981	D.974
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	EM_FIXED to EM_FIXED -	0.810	0.957	0.933	0.921	0.810	0.957	0.930	0.904	0.810	0.957	0.902	0.879
OB to OB GOA	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 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 OB BSAI	0.740	0.635	0.734	0.748	0.740	0.635	0.775	0.894	0.740	0.635	0.827	0.893	9 OB to OB BSAL	0.799	0.732	0.792	0.803	0.799	0.732	0.837	0.936	0.799	0.732	0.877	0.926
EM_FIXED GOA	0.880	0.794	0.880	0.878	0.880	0.794	0.871	0.824	0.880	0.794	0.846	0.796	OB to EM_FIXED GOA	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_FIXED	0.777	0.681	0.771	0.779	0.777	0.681	0.796	0.886	0.777	0.681	0.831	0.873	OB to EM_FIXED	0.830	0.770	0.823	0.828	0.830	0.770	0.850	0.923	0.830	0.770	0.876	0.906
GOA	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	0.914	0.864	0.922	0.908	0.914	0.864	0.899	0.851	0.914	0.864	0.877	0.832
BSAI	0.434	0.330	0.452	0.421	0.434	0.330	0.502	0.726	0.434	0.330	0.521	0.608	OB to ZERO _ BSAI	0.508	0.425	0.527	0.494	0.508	0.425	0.592	0.778	0.508	0.425	0.607	0.683
GOA EN EIVER	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_TRW to EM_TRW _ E	0.982	0.996	0.971	0.964	0.982	0.996	0.974	0.940	0.982	0.996	0.981	0.974
GOA	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 _ GOA	0.824	0.966	0.943	0.931	0.824	0.966	0.936	0.901	0.824	0.966	0.904	0.874
BSAI	0.571	0.868	0.742	0.765	0.571	0.868	0.784	0.907	0.571	0.868	0.796	0.906	EM_FIXED to EM_FIXED _ BSAI	0.649	0.868	0.823	0.812	0.649	0.868	0.868	0.942	0.649	0.868	0.878	0.937
Steller SL - 윤정	0.19	0.13	0.20	0.20	0.20	0.13	0.20	0.19	0.22	0.15	0.22	0.22	Steller SL - 2	0.25	0.19	0.25	0.25	0.25	0.19	0.25	0.25	0.28	0.21	0.28	0.28
rt-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	Short-tailed Alb	0.11	0.17	0.13	0.13	0.11	0.17	0.13	0.12	0.11	0.17	0.13	0.12
Laysan Alb	0.97	0.99	0.98	0.98	0.96	0.99	0.97	0.96	0.98	0.99	0.98	0.98	Laysan Alb	0.99	0.99	0.99	0.99	0.98	0.99	0.99	0.98	0.99	0.99	0,99	0.99
a Timeliness -	15	44	25	26	15	44	24	23	15	44	21	22	Data Timeliness -	19	-44	35	32	19	-44	33	29	19	-44	28	27
hinook PSC - 2	19.83	11.98	25.14	27.18	19.84	12.05	24.35	32.99	19.84	12.05	21.14	23.96	Chinook PSC - 😴	17.21	10.96	20.48	22.16	17.23	10.95	19.74	27.27	17.23	10.95	17.26	19.43
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	Halibut PSC -	19.96	20.71	16.58	16.88	20.32	21.03	17.34	20.82	20.33	21.12	16.97	17.37
Discards - 은 E	7.83	7.11	7.12	7.63	7.80	7.07	7.35	8.89	8.55	7.66	8.09	8.80	Discards - 2 g	6.75	6.03	5.94	6.49	6.78	6.01	6.23	7.56	7.39	6.51	6.91	7.63
Crab PSC - 🗧	31.64	39.18	33.77	30.46	33.04	41.59	33.04	29.31	32.82	40.86	26.49	21.79	Crab PSC -	27.27	32.19	29.83	26.79	28.49	33.84	29.03	24.73	28.68	33.38	22.35	18.51
	- TY	SUO	WB	XOX	. TAL	DUC.	WB.	XOX	- TY	SUO	MB	X0X		-TV	50	vB.	×	- TK	50	-87	×	·T	50	vB.	×
	EOI	STA ^C	0	4	EQI	STA'	0	4	EO	STA'	0	Ľ.		no	DU	CO	PR(no	DU	S	PR(ino	DO	S	PR
						Alloc	ation								00				Alloc	ation		-	0		
	1																								
	Wo	rst										Best		We	rst	and the owner of the owner.	States of the local division of the local di								Best

	Budget: \$3.5M														
	Stra	tification	CURRENT		Stratification: FMP				Strat	Stratification: FIXED_FMP					
cv- 00	4.23	3.51	4.19	4,21	4.18	3.50	4.21	4.29	4.19	3.52	4.24	4.22		C'	∨-
OB at sea - in 7	166	80	177	170	166	80	175	158	166	80	172	167		OB at se	ia -
EM_TRW shoreside -	45	256	20	20	45	256	21	15	45	256	28	26	EN	I_TRW shoresid	le -
Total - 🕅 a	211	336	197	190	211	336	196	173	211	336	200	193		Tota	al -
OB at sea - 👸	166	80	177	170	166	80	175	158	166	80	172	167		OB at se	a-
EM_FG at sea -	63	323	76	117	62	323	75	104	63	323	71	101		EM_FG at se	a -
Total - 0	229	403	253	287	228	403	250	262	229	403	243	268		Tota	al -
OB to OB -	0.787	0.575	0.798	0.793	0.787	0.575	0.797	0.751	0.787	0.575	0.786	0.745		OB to O	в-
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 EM_FIXE	D -
OB to ZERO -	0.730	0.517	0.749	0.719	0.730	D.517	0.729	0.657	0.730	0.517	0.705	0.643		OB to ZER	0-
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_	RW to EM_TRV	N -
EM_FIXED to EM_FIXED -	0.613	0.957	0.670	0.790	0.613	0.957	0.669	0.739	0.613	0.957	0.647	0.730	EM_FIX	ED to EM_FIXE	D-
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 OI	в.
OB to OB	0.625	0.423	0.625	0.640	0.625	0.423	0.655	0.791	0.625	0.423	0.717	0.814	.9	OB to OI	В.
OB to EM_FIXED	0.784	0.568	0.793	0.783	0.784	0.568	0.783	0.704	0.784	0.568	0.755	0.684	Aetr	DB to EM_FIXE	Ď-
OB to EM_FIXED	0.671	0.471	0.670	0.680	0.671	0.471	0.687	0.796	0.671	0.471	0.733	0.795	~	DB to EM_FIXE	D.
OB to ZERO	0.768	0.548	0.787	0.757	0.768	0.548	0.764	0.661	0.768	0.548	0.735	0.659		OB to ZER	ö.
OB to ZERO	0.321	0.180	0.339	0.311	0.321	0.180	0.361	0.616	0.321	0.186	0.385	0.472		OB to ZER	ĝ.
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_	IRW to EM_TRV	Ň.
EM_FIXED to EM_FIXED	0.628	0.966	0.684	0.801	0.628	0.986	0.682	0.732	0.628	0.966	0.656	0.721	EM_FIX	ED to EM_FIXE	D.
EM_FIXED to EM_FIXED BSAI	0.440	0.868	0.507	0.666	0.440	0.868	0.530	0.821	0.440	0.868	0.551	0.831	EM_FIX	ED to EM_FIXE BS/	D-
Steller SL - o	0.13	0.06	0.14	0.13	0.13	0.06	0.14	0.12	0.15	0.07	0.15	0.15		Steller S	sL -
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	0.06		Short-tailed Alb	b
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		Laysan Alt	b
Data Timeliness -	10	44	12	17	10	44	12	16	10	44	11	15		Data Timelines	;s -
Chinook PSC -	25.13	15.41	36.67	36.87	25.13	15.56	35.89	42.92	25.13	15.56	31.05	32.30		Chinook PS	с-
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		Halibut PS	с-
Discards -	9.90	10.19	10.01	9.87	9.93	10.09	10.20	11.38	10.79	10.92	10.91	11.09		Discard	is -
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		Crab PSI	c-
	EQUAL -	STATUS.	CWB-	PROX-	EQUAL-	Allo ano	-BMO	- XOR4	EQUAL -	STATUS QUO	CWB-	- XOX4			
	Wo	rst			_							Best			

Metric

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.

Cost Efficiency Considerations



Zero Selection

- Increasing the number of vessels in Zero Selection would increase the coverage rates in strata that remain available to monitoring
- We would expect this to decrease the **precision** of estimates
 - Data from a few vessels is likely to be more variable than data from many vessels.
- We don't know what affect this would have on the **accuracy** of estimates
 - It is generally best to get a sample from all segments of a population
 - The presence of a Zero Selection pool is known to decrease the accuracy of estimates (compared to having all vessels available to sampling), but it's a logistical concession that had to be made to accommodate vessels that are not capable of carrying an observer
 - As technology advances, it would increase the accuracy of estimates if affordable monitoring can be achieved on small vessels using EM
 - It is unknown whether monitoring effects disappear at coverage rates less than 100%



Hiring Observers as Federal Employees

At-Sea

- With 2 supervisors: \$1,237 \$1,260 per day (11-13% less than most recent 3-year average of cost per day)
- With 4 supervisors: \$1,276 \$1,319 per day (7-10% less than most recent 3-year average of cost per day)

Shoreside

- With 1 supervisor: ~\$779 per day for 1,306 days (Kodiak only)
- Future contract (estimate): \$500-\$1,050 per day (\$775 average)



Fixed-Gear EM Review Timeliness

- Pacific States currently has 3 staff who review video from fixed-gear trips in Alaska
- During much of the year, this number of video reviewers is sufficient to produce a 1-week turnaround time on video review from the time the hard drive is received
- However, there are times of the year when 6-10 video reviewers would be needed to maintain a 1-week review time
- Therefore, an additional 3 reviewers (for a total of 6) would be needed to achieve a 1-week review time for **most** of the year
- This all assumes no backlog of trips to review from the prior year
- The estimated cost of 3 additional reviewers annually is 3 x \$100,000 = \$300,000, a 30% increase in the current EM budget of ~\$1,000,000



Multi-Provider / Voucher Program to Procure Observers

- Vessels would procure observer coverage directly from providers
- NMFS would then reimburse vessels for coverage with money from the landing fee
- In 2017, the Observer Advisory Committee reviewed a discussion paper (<u>NPFMC 2017; section 3.5</u>) that evaluated this approach
 - The paper outlined legal issues, explained the complication of setting a voucher amount that is equitable, and discussed ways that it could introduce bias
- In 2022, the PCFMAC discussed this approach again and decided it did not want to divert NMFS staff resources to evaluate it
 - The committee recommended that if the Council were to initiated by the Council, it be developed by Council staff and considered separately from the 2024 ADP and Cost Efficiencies Analysis





Have Observers Review EM Video

- Under this approach, deployed observers would review video during their down time in port
- NMFS did a preliminary analysis and did not find evidence of sufficient observer down time that could be dedicated to video review
- Additionally, this approach would have logistical difficulties
 - Field computers that are sufficient for video review
 - Training observers on video review software
 - Observers tracking hard drives in between going to sea
- NMFS did not consider this approach further



Structure of Partial Coverage Contract

- In August 2024, a new partial coverage contract will begin. The structure of the Request for Proposals includes several components designed to improve efficiency and reduce costs:
 - Guaranteed days have been set to the maximum realistic amount in order to get the maximum price per day as low as possible
 - Plant days to support EM on trawl vessels are incorporated, which reduces travel costs and may add flexibility for the provider to reduce lodging costs
 - Moved from half-day to hourly billing
 - Comparative costs of observer deployment from recent past programs will be provided by all bidders
 - Contract is not solely evaluated on the cost of observer deployment



Biological Data Collection

- Use fishery-independent longline survey data for weights to inform fixed-gear EM? Stock assessment authors were consulted and they raised several concerns:
 - This is problematic for the growing EM sablefish pot fishery because of gear selectivity differences
 - Average weights in the fishery may be higher than survey because the fishery is targeting larger fish at ideal depths
 - Weight data is only one component of observer data used in assessments
 - If full retention requirements for sablefish were to be removed, the assessment would have no data to understand discard information



Biological Data Collection

- Opportunistically deploy idle observers for focused collection of biological data?
 - Opportunistic deployments do not add value to a statistically rigorous sampling plan
 - Sea days are more expensive than idle days
 - Predicting where and when observers will be idle is challenging
 - NMFS is not planning to evaluate this further



Biological Data Collection

- Specify differing observer sampling protocols regionally or temporally based on data needs?
 - The highest quality data come from standardized sampling protocols
 - It is most efficient to have observers with skills that are interchangeable
 - NMFS is not planning to evaluate this further



Reduce Flexibility for Fishery Participants

- Although the following ideas may result in cost savings, the PCFMAC did not support moving any of them forward due to the impact on fishery participants:
 - Requiring vessels to pick up observers in specific ports
 - Multi-trip or vessel selection
 - Extending notification before a trip



Acknowledgments

- Thank you to the observers, observer providers, captains, crew members, EM providers, video reviewers, and agency staff who make fishery-dependent data collection possible
- Thank you to the members of the FMAC, PCFMAC, and Trawl EM Committee for their input, feedback, and dedication to sustainable fisheries management
- Thank you to the AFSC, AKR, and PSMFC staff who have developed new deployment models to evaluate for 2024



Preliminary Budget for 2024

Funds already in place:

- Carryover funds from Year 4 into Year 5 on AIS contract: \$1,365,291
- FY23 fee funds obligated for Year 5 AIS contract (Aug 2023 Aug 2024): \$3,084,915
- FY23 federal funds obligated for Year 5 AIS contract (Aug 2023 Aug 2024): \$827,192
- FY23 fee funds for fixed gear EM implementation July 2023 June 2024: \$1,019,314

Additionally, we can expect the following funding to be available for the new observer contract (deployments starting after August 2024) and to provide support for EM:

- FY23 fee funds carrying forward: \$1,687,988 (these are with NMFS)
- 2023 fee funds assessed to date: \$3,260,000
 - a. Note that the AKR is projecting \$4.71M total assessment in 2023
- FY24 federal funds: \$700,000
- Industry is applying for funding to finish the final year of the trawl EM EFP as well



Fishing Year, Fiscal Year, Grant Year, and Contract Year



Discussion



Sample Size and Rates

	Allocation scheme									
			EQUAL		STATUS_QUO		CWB		PROX	
Stratification	Stratum	N	Rate	n	Rate	n	Rate	n	Rate	n
CURRENT	EM_HAL	722	9.06	65	30.00	217	15.45	112	13.50	97
	EM_POT	353	9.06	32	30.00	106	17.34	61	23.14	82
	EM_TRW	768	9.06	70	33.33	256	5.44	42	4.67	36
	OB_HAL	1,352	9.06	122	6.07	82	9.78	132	8.60	116
	OB_POT	1,086	9.06	98	6.07	66	8.05	87	9.66	105
	OB_TRW	389	9.06	35	6.07	24	11.93	46	11.22	44
FMP	EM_HAL-BSAI	32	9.06	3	30.00	10	19.42	6	54.45	17
	EM_HAL-GOA	690	9.06	63	30.00	207	13.87	96	9.94	69
	EM_POT-BSAI	57	9.06	5	30.00	17	21.98	13	31.23	18
	EM_POT-GOA	296	9.06	27	30.00	89	18.05	53	19.52	58
	EM_TRW-GOA	768	9.06	70	33.33	256	5.82	45	3.22	25
	OB_HAL-BSAI	106	9.06	10	6.07	6	12.76	14	35.15	37
	OB_HAL-GOA	1,246	9.06	113	6.07	76	8.32	104	5.96	74
	OB_POT-BSAI	255	9.06	23	6.07	15	8.99	23	11.28	29
	OB_POT-GOA	831	9.06	75	6.07	50	9.01	75	8.35	69
	OB_TRW-BSAI	21	9.06	2	6.07	1	18.38	4	44.29	9
	OB_TRW-GOA	368	9.06	33	6.07	22	11.40	42	7.47	27
FIXED_FMP	EM_FIXED-BSAI	89	9.06	8	30.00	27	23.15	21	44.89	40
	EM_FIXED-GOA	986	9.06	89	30.00	296	12.47	123	11.30	111
	EM_TRW-GOA	768	9.06	70	33.33	256	7.65	59	6.00	46
	OB_FIXED-BSAI	361	9.06	33	6.07	22	13.89	50	20.45	74
	OB_FIXED-GOA	2,077	9.06	188	6.07	126	7.46	155	5.89	122
	OB_TRW-BSAI	21	9.06	2	6.07	1	20.93	4	61.66	13
	OB_TRW-GOA	368	9.06	33	6.07	22	13.21	49	13.20	49

NOAA FISHERIES

Page 42