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Results of trials to evaluate the Interim Allowance Strategy for W. Greenland minke whales

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INTERNATIONAL WHALING COMMISSION

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ABSTRACT

The framework developed during the 2015 Annual Meeting of the Scientific Committee to evaluate an 'interim allowance' strategy is applied to West Greenland minke whales based on the agreed *Strike Limit Algorithms* for these two groups of whales. The values for the 'mandatory' performance statistics for the 'phase-out' and 'interim allowance' strategy suggest that adopting the 'interim allowance' strategy has no substantial impact on risk, although there is a lesser ability to satisfy need.

INTRODUCTION

IWC (2016) considered a proposal for the Bering-Chukchi-Beaufort Seas stock of bowhead whales that the 'phase out' approach - in which catch limits are reduced by 50% (the 'grace period') once a recent abundance estimate has not been available for 10 years – be replaced by an 'interim allowance' approach in which the 50% phase-out during the grace period would not apply. Punt (2015), Punt and Brandão (2017) and Punt (2019) conducted projections to evaluate the consequences of adopting such an 'interim allowance' strategy for the B-C-B bowhead whales and humpback, fin and bowhead whales off West Greenland.

IWC (2019) recommended that similar calculations be conducted for North Pacific gray whales, as well as for minke whales off West Greenland. This document reports results for minke whales off West Greenland.

METHODS

The projections were based on the *Evaluation Trials* for the West Greenland minke whales (IWC, 2019), Table 1. Table 2 lists the three scenarios regarding the frequency of future surveys (the scenarios involving a three year period for estimates to be available are ignored here). Table 3 lists the performance statistics. This paper provides only provides the 'mandatory' statistics (except for rescaled final depletion which is not calculated for West Greenland minke whales – there are no incidental catches for this case), but the full set of results is available on request. The strike limit algorithm was taken to be the agreed *minke whale SLAs* (IWC, 2019). Note that RMP catches are taken from various regions of the North Atlantic and will complicate the outcomes of the trials.

RESULTS AND DISCUSSION

Table 4 list the values for mandatory performance statistics for each combination of trial and scenario. The results for 'interim allowance' and 'phase out' (denoted 'interim' and 'original' in Table 4) are quite similar, although the final depletion statistics are higher for the interim strategy and need satisfaction statistics are lower.

REFERENCES

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Table 1
The trials for West Greenland minke whales. Trial M01 and M02 are the reference trials

Trial	*MSYR*	Stock Hypothesis	Mixing Proportions	Mixing	Survey Bias	Survey period	Survey CV	Condition
M01	1% (1+) & 4 % (mat)	1	A1	Independent	1	10	Base	Yes
M02	1% (1+) & 4 % (mat)	2	B1	Independent	1	10	Base	Yes
M03	1% (1+) & 4 % (mat)	1	A2	Independent	1	10	Base	Yes
M04	1% (1+) & 4 % (mat)	1	A3	Independent	1	10	Base	Yes
M05	1% (1+) & 4 % (mat)	1	A4	Independent	1	10	Base	Yes
M06	1% (1+) & 4 % (mat)	1	A5	Independent	1	10	Base	Yes
M07	1% (1+) & 4 % (mat)	1	A6	Independent	1	10	Base	Yes
M08	1% (1+) & 4 % (mat)	2	B2	Independent	1	10	Base	Yes
M09	1% (1+) & 4 % (mat)	2	B3	Independent	1	10	Base	Yes
~~M10~~	~~1% (1+) & 4 % (mat)~~	~~2~~	~~B4~~	~~Independent~~	~~1~~	~~10~~	~~Base~~	Yes
M11	1% (1+) & 4 % (mat)	1	A1	Density-dependent	1	10	Base	Yes &
M12	1% (1+) & 4 % (mat)	2	B1	Density-dependent	1	10	Base	Yes &

Table 2
Specifications for future surveys

Case	Survey frequency	Time until estimate becomes available
10-2	10	2
15-2	15	2
20-2	20	2

Table 3
The performance statistics

ID	Name	Mandatory	Optional	Time Periods	Use to explain performance to layperson	Use to evaluate performance for SC	Details
D1	Final Depletion	1+, mature		100	Yes	Yes	P_T / K
D2	Lowest Depletion		mature	100	Yes	Yes	$\min(P_t / K) : t = 0,1,...,T$
D6	Trajectories 1 and 2		1+, mature	100	Yes	No	
D7	Pointwise Quantile Trajectories		1+, mature	100	Yes	No	
D8	Rescaled final Depletion	Yes		100		No	P_T / P_T^*
D9	Minimum number of whales		1+, mature	100		No	$\min(P_t) : \ t = 0,1,...,T$
D10	Relative Increase	Yes		100		Yes	P_T / P_0
N1	Total Need Satisfaction		Yes	20, 100	Yes	Yes	$\sum_{t=0}^{T-1} C_t / \sum_{t=0}^{T-1} Q_t$
N2	Longest Shortfall		Yes	20, 100	Yes, after rescaling	Yes	(negative of the greatest number of consecutive years in which $C_t < Q_t$) / T
N4	Fraction of years in which catch = quota		Yes	20, 100	Yes	Yes	
N7	Percent Need Satisfaction Pointwise Quantile Trajectory Plot		Yes	100	No	Yes	
N8	Percent Need Satisfaction Trajectories 1 and 2 Plot		Yes	100	No	Yes	
N9	Average need satisfaction	Yes		20, 100	Yes	Yes	$\frac{1}{T}\sum_{t=0}^{T-1}\frac{C_t}{Q_t}$
N10	Average Annual Variation in Catch		Yes	100	No	Yes	
N11	Anti-curvature Catch Variation Statistic		Yes	100	No	Yes	
N12	Mean downstep	Yes					
R1	Relative Recovery	1+		100	Yes	Yes	$P_{t_r^*} / P_{t_r^*}^*$ where t_r^* = 1st year in which P_t^* passes through *MSYL*
R3	Time Frequency in Recovered State after Recovery		1+, mature	100	Yes	Yes	
R4	Relative Time to Recovery		1+,mature	100	Yes	Yes	

Table 4
Performance statistics for the trials to compare the performance of the 'phase out' ('original') and 'interim allowance' ('interim') options for the West Greenland minke whales. The conservation-related performance statistics pertain to the stock off West Greenland.

Trial	Option	D1 (Fin Dep) (1+)			D1 (Fin Dep) (fem)			D10 (Rel Recov)			N9 (Ave need Sat: 20)			N9 (Ave need Sat: 100)			N12 (Mean Down Step)		
		5%	Med	95%	5%	Med	95%	5%	Med	95%	5%	Med	95%	5%	Med	95%	5%	Med	95%
10 year surveys																			
M01-1A	Original	0.574	0.690	0.785	0.518	0.638	0.739	0.860	0.956	1.091	0.916	1.000	1.000	0.646	0.921	1.000	0.000	0.028	0.077
M01-1A	Interim	0.614	0.719	0.800	0.558	0.668	0.755	0.918	0.997	1.109	0.866	0.950	0.950	0.604	0.841	0.910	0.099	0.108	0.135
M02-1A	Original	0.729	0.834	0.891	0.678	0.792	0.867	0.970	1.011	1.082	0.914	1.000	1.000	0.637	0.907	1.000	0.000	0.032	0.075
M02-1A	Interim	0.759	0.848	0.900	0.708	0.809	0.878	1.003	1.031	1.098	0.864	0.950	0.950	0.582	0.827	0.910	0.099	0.108	0.137
15 year surveys																			
M01-1A	Original	0.578	0.677	0.779	0.523	0.627	0.735	0.850	0.949	1.081	0.994	1.000	1.000	0.681	0.942	1.000	0.000	0.020	0.061
M01-1A	Interim	0.730	0.789	0.850	0.673	0.743	0.814	1.064	1.105	1.186	0.696	0.700	0.700	0.451	0.607	0.640	0.461	0.470	0.500
M02-1A	Original	0.755	0.820	0.892	0.706	0.776	0.867	0.978	1.01	1.081	0.992	1.000	1.000	0.641	0.941	1.000	0.000	0.021	0.059
M02-1A	Interim	0.848	0.883	0.925	0.805	0.850	0.907	1.059	1.082	1.155	0.694	0.700	0.700	0.428	0.607	0.640	0.461	0.471	0.503
20 year surveys																			
M01-1A	Original	0.571	0.693	0.791	0.522	0.638	0.755	0.867	0.962	1.114	0.994	1.000	1.000	0.605	0.911	0.960	0.042	0.045	0.069
M01-1A	Interim	0.784	0.843	0.880	0.742	0.809	0.858	1.133	1.175	1.246	0.496	0.500	0.500	0.321	0.460	0.480	0.469	0.492	0.510
M02-1A	Original	0.748	0.839	0.902	0.700	0.795	0.877	0.982	1.015	1.095	0.992	1.000	1.000	0.612	0.906	0.960	0.042	0.046	0.067
M02-1A	Interim	0.869	0.914	0.942	0.838	0.891	0.930	1.082	1.124	1.184	0.494	0.500	0.500	0.320	0.456	0.480	0.474	0.492	0.508