Towards the Selection of a Final Set of Trials for the 2012 ENP Gray Whale Implementation Review

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Abstract
At the March 2012 Intersessional meeting of the AWMP Working Group in La Jolla, CA, a set of trials was agreed upon for consideration as part of the Eastern Pacific Gray Whale Implementation Review. Since then, progress has been made on conditioning that set of trials. An assessment of the preliminary conditioning results is presented here, with a focus on five trials that were not able to mimic the available data as well as the remaining trials. If any of these five trials is to be dropped from further consideration, there must be unanimous agreement within the Working Group for such.

Background and Methods

The set of trials agreed upon at the March 2012 Intersessional meeting is outlined in Tables 1 and 2 (trials requiring conditioning have a 'Y' in the second column of those tables). The preliminary conditioning runs were completed by Punt. A small group, consisting of Punt, Scordino and Brandon then conducted an initial evaluation to determine the adequacy of the conditioning for each trial.

The primary factor assessed during this process was the extent to which each trial was able to mimic the observed patterns in the time series of PCFG abundance estimates (all of the trials were able to mimic the abundance estimates for the northern stock). Additionally, the posterior distributions for the parameters of the two-stock population dynamics model were examined to identify trials where the default range for certain priors needed to be adjusted.

Once Punt, Scordino and Brandon had agreed on a set of trials that deserved further scrutiny, Butterworth and Donovan then evaluated the preliminary conditioning results for those trials. Only trials that all five authors agreed deserved attention by the larger group are submitted here as potential trials to be dropped.

Results and Discussion

Results of the preliminary round of conditioning are available via the AWMP DropBox in the DiagnosticPlots2 directory (or via email from the contact author). The vast majority of trials was deemed to have been conditioned satisfactorily.

PCFG carrying capacity was the only parameter for which the bounds on the prior were found to be too restrictive for certain trials. For those trials that were unable to mimic the PCFG abundance estimates, several exhibited posterior distributions for PCFG carrying capacity that appeared to be piling up against the default upper bound (500). Those trials were hence re-conditioned after increasing the upper bound of the prior on this parameter to 1000, and then re-evaluated based on the updated runs. Depending on the scenario, these larger upper values were large enough that: (a) the scenario in question was able to mimic the abundance estimates; or (b) it became

obvious that further increases in this upper bound would make no substantial difference to the model trajectories.

After this process, five trials were identified for potential exclusion:

(i) B02C;
(ii) I02C;
(iii) P05A;
(iv) P14B; and
(v) P58B (robustness trial 8B).

Comparisons of model trajectories and PCFG abundance estimates for these trials are shown in Figures 1-3. When evaluating the adequacy of these five trials, it may be helpful to compare those to a trial which was assessed to be representative of a category of fit one notch better, *e.g.* trial I05A (Fig 4).

There were some questions about the adequacy of trial I05A. However, it is able to mimic the initial increase in abundance estimates, even though the model trajectory is systematically lower than the estimates in more recent years. For comparison, trial I02C (Fig 1. Right panel), is also able to mimic the initial increase in abundance, but the model trajectory in recent years is even lower than that for I05A. Trials P14B and P58B (Fig. 3) are able to mimic the abundance estimates in recent years, but do not mimic the initial increase very well. Trial P05A is not able to mimic either the initial increase or the recent abundance estimates.

There is something of a gradient in the ability of the trials to mimic the data. This presents a challenge in identifying a cut-off point for rejecting trials as implausible. We have identified several trials that represent the lower end of the plausibility spectrum, based on their relative inability to mimic the PCFG abundance estimates. However, if any of these five trials is to be dropped from further consideration, there must be unanimous agreement within the Working Group for such.

Table 1

The *Evaluation Trials*. Values given in bold type show differences from the base case trial. The final four columns indicate which trials apply to which 'broad' hypotheses. For 'broad' hypotheses B and I, the number given is the plus in 1999/2000. Note that operating models based on hypotheses P do not fit to the 1998 abundance estimate for the PCFG. Base-case Phi =0.3

			$MSYR_{1+}$	$MSYR_{1+}$	Final	Annual	Survey	Survey	Hypothesis		
Trial	Condition	Description	North	PCFG	Need	Immigration	freq.	Bias (North)	P	B	I
1A	Y	$MSYR_{1+}$ = 4.5%/4.5%	4.5%	4.5%	340 / 7	2	10 / 1	1	20*	Y*	10
1B	Y	$MSYR_{1+}$ = 4.5%/2%	4.5%	2%	340 / 7	2	10 / 1	1	20*	Y*	10
1C	Y	$MSYR_{1+}$ = 4.5%/1%	**4.5%**	**1%**	340 / 7	2	10 / 1	1	20*	Y*	10
1D	Y	$MSYR_{1+}$ = 2%/2%	**2%**	**2%**	340 / 7	2	10 / 1	**0.5→1**	20*	Y*	10
2A	Y	Immigration = 0	4.5%	4.5%	340 / 7	**0**	10 / 1	1	20	Y	10
2B	Y	Immigration = 0	4.5%	2%	340 / 7	**0**	10 / 1	1	20	Y	10
2C	Y	Immigration = 0	**4.5%**	**1%**	340 / 7	**0**	10 / 1	1	20	Y	10
2D	Y	Immigration = 0	**2%**	**2%**	340 / 7	**0**	10 / 1	**0.5→1**	20	Y	10
3A	Y	Immigration = 1	4.5%	4.5%	340 / 7	**1**	10 / 1	1	20	Y	10
3B	Y	Immigration = 1	4.5%	2%	340 / 7	**1**	10 / 1	1	20	Y	10
4A	Y	Immigration = 4	4.5%	4.5%	340 / 7	**4**	10 / 1	1	20	Y	10
4B	Y	Immigration = 4	4.5%	2%	340 / 7	**4**	10 / 1	1	20	Y	10
5A	Y	Immigration = 6	4.5%	4.5%	340 / 7	**6**	10 / 1	1	20*	Y*	10
5B	Y	Immigration = 6	4.5%	2%	340 / 7	**6**	10 / 1	1	20	Y	10
6A		High Northern Need	4.5%	4.5%	**530 / 7**	2	10 / 1	1	20	Y	
6B		High Northern Need	4.5%	2%	**530 / 7**	2	10 / 1	1	20	Y	
7A		3 episodic events[&]	4.5%	4.5%	340 / 7	2	10 / 1	1	20	Y	
7B		3 episodic events[&]	4.5%	2%	340 / 7	2	10 / 1	1	20	Y	
8A		Stochastic events 10% every 5 years[&]	4.5%	4.5%	340 / 7	2	10 / 1	1	20	Y	
8B		Stochastic events 10% every 5 years[&]	4.5%	2%	340 / 7	2	10 / 1	1	20	Y	
9A		Episodic events with future pulse events	4.5%	4.5%	340 / 7	2	10 / 1	1	20	Y	
9B		Episodic events with future pulse events	4.5%	2%	340 / 7	2	10 / 1	1	20	Y	
10A		Relative probability of harvesting a PCFG whale, ϕ_{PCFG} = 0.6	4.5%	4.5%	340 / 7	2	10 / 1	1	20	Y	
10B		Relative probability of harvesting a PCFG whale, ϕ_{PCFG} = 0.6	4.5%	2%	340 / 7	2	10 / 1	1	20	Y	
11A		Struck & Lost (25%)	4.5%	4.5%	340 / 7	2	10 / 1	1	20	Y	
11B		Struck & Lost (25%)	4.5%	2%	340 / 7	2	10 / 1	1	20	Y	
12A		Struck & Lost (75%)	4.5%	4.5%	340 / 7	2	10 / 1	1	20	Y	
12B		Struck & Lost (75%)	4.5%	2%	340 / 7	2	10 / 1	1	20	Y	
13A	Y	Higher 1999-2000 Pulse	4.5%	4.5%	340 / 7	2	10 / 1	1	**30**		
13B	Y	Higher 1999-2000 Pulse	4.5%	2%	340 / 7	2	10 / 1	1	**30**		
13C	Y	Higher 1999-2000 Pulse	**4.5%**	**1%**	340 / 7	2	10 / 1	1	**30**		
14A	Y	Lower 1999-2000 Pulse	4.5%	4.5%	340 / 7	2	10 / 1	1	**10**		
14B	Y	Lower 1999-2000 Pulse	4.5%	2%	340 / 7	2	10 / 1	1	**10**		

& The average value for adult survival needs to be adjusted to ensure the population is table for these trials

Table 2
The Robustness Trials.

Trial	Condition	Description	$MSYR_{1+}$ North	$MSYR_{1+}$ PCFG	Survey freq.	Hypothesis P	Hypothesis B
1A		6 year surveys	4.5%	4.5%	10 / 6	20	Y
1B		6 year surveys	4.5%	2%	10 / 6	20	Y
2A		Linear decrease in K^{1+} [K halves over years 0-99]	4.5%	4.5%	10 / 1	20	Y
2B		Linear decrease in K^{1+} [K halves over years 0-99]	4.5%	2%	10 / 1	20	Y
3A		Linear decrease in PCFG K [K halves over years 0-99]	4.5%	4.5%	10 / 1	20	Y
3B		Linear decrease in PCFG K [K halves over years 0-99]	4.5%	2%	10 / 1	20	Y
4A		Linear increase in M [M halves over years 0-99]	4.5%	4.5%	10 / 1	20	Y
4B		Linear increase in M [M halves over years 0-99]	4.5%	2%	10 / 1	20	Y
5A		Linear increase in PCFG M [M halves over years 0-99]	4.5%	4.5%	10 / 1	20	Y
5B		Linear increase in PCFG M [M halves over years 0-99]	4.5%	2%	10 / 1	20	Y
6A		Perfect detection; p_1 =0; p_2=0.01-0.05	4.5%	4.5%	10 / 1	20	Y
6B		Perfect detection; p_1 =0; p_2=0.01-0.05	4.5%	2%	10 / 1	20	Y
7A		p_1 = 0.5	4.5%	4.5%	10 / 1	20	Y
7B		p_1 = 0.5	4.5%	2%	10 / 1	20	Y
8B	Y	Survey bias PCFG + p_1 = 0.5	4.5%	2%	10 / 1	20	Y
9B	Y	Correlation (draw for N; same quantile in the range for PCFG)	4.5%	2%	10 / 1	20	Y
10B	Y	Double incidental catches	4.5%	2%	10 / 1	20	Y
11B	Y	Halve incidental catches	4.5%	2%	10 / 1	20	Y
12A		Sex ratio = 0.2: 0.8	4.5%	4.5%	10 / 1	20	Y
12B		Sex ratio = 0.2: 0.8	4.5%	2%	10 / 1	20	Y
13A		Relative probability of harvesting a PCFG whale, ϕ_{PCFG} = 1	4.5%	4.5%	10 / 1	20	Y
13B		Relative probability of harvesting a PCFG whale, ϕ_{PCFG} = 1	4.5%	2%	10 / 1	20	Y

4 – a 20% increase when an unepisodic event occurs

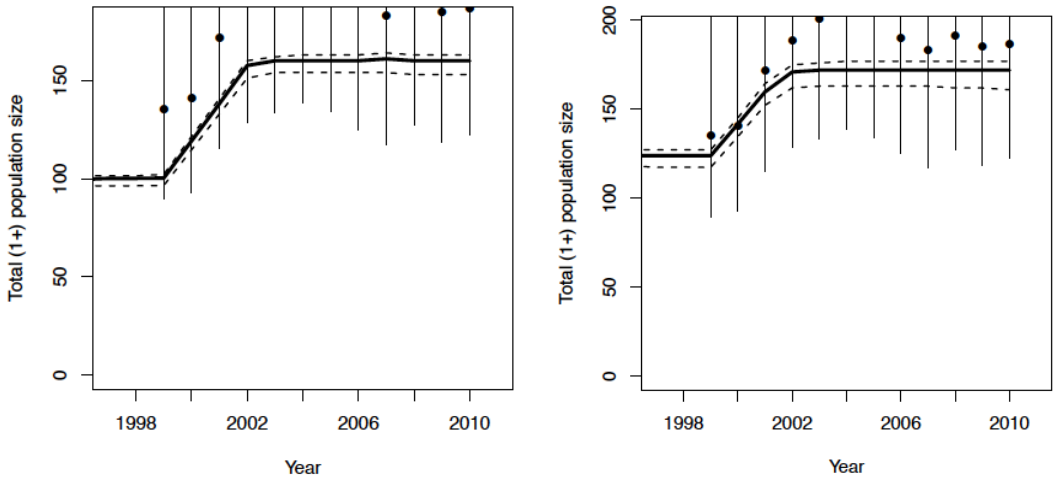

Fig 1.
Trials B02C (left panel) and I02C (right panel).

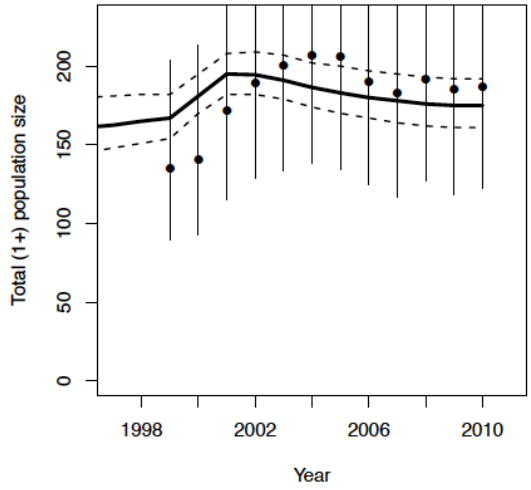

Fig 2.
Trial P05A

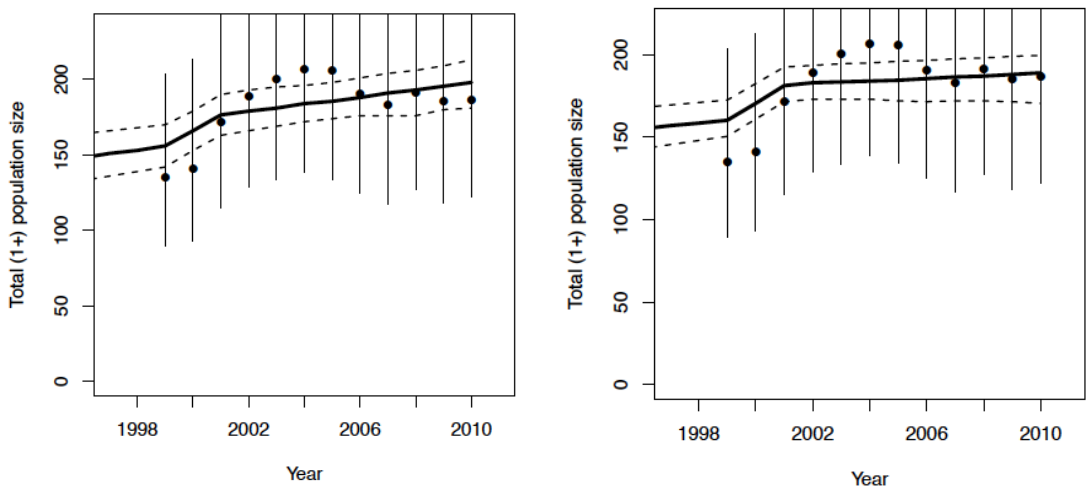

Fig 3.
Trials P14B (left panel) and P58B (right panel)

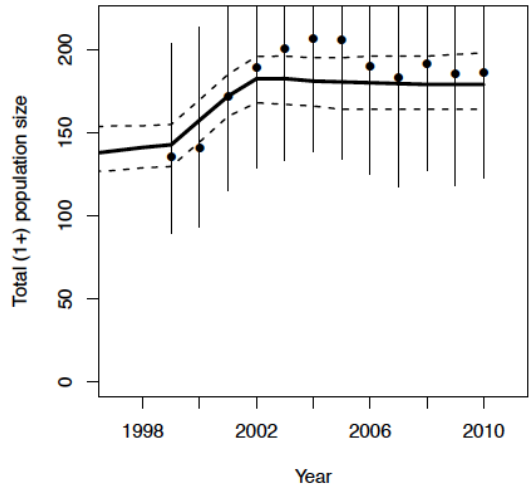

Fig 4.
Trial I05A