Short Term Request # 1 and # 2 (Eric Ward)

Note: I ran the killer whale PVA, with a 50% sex ratio, as the panel suggested. I also removed the 3-year old female whale L112 from the simulations, because she washed up dead earlier this year. Below are 5 tables of various metrics, at 5, 15 and 30 years, for different levels of the Fall terminal run size (as I used in the 3rd talk at Workshop # 2, examining fishing effects on killer whale growth rates). The panel's request was not about absolute numbers, but relative changes, so all tables below are relative to the long term mean of the index (1200).

Table 1. Change in total SRKW population size

	Change in population size		
Fall terminal run	**5 year**	**15 year**	**30 year**
600	-16.5	-39.4	-69.1
700	-12.8	-32.0	-58.6
800	-9.6	-25.0	-47.3
900	-6.7	-18.2	-35.8
1000	-4.2	-11.8	-23.9
1100	-1.9	-5.7	-11.8
1200	0.0	0.0	0.0
1300	1.7	5.0	10.9
1400	3.1	9.6	21.2
1500	4.3	13.4	30.5
1600	5.3	17.0	38.9
1700	6.3	20.3	47.0

Table 2. Change in whales added per year

	Change in whales added / yr		
Fall terminal run	**5 year**	**15 year**	**30 year**
600	-3.3	-2.6	-2.3
700	-2.6	-2.1	-2.0
800	-1.9	-1.7	-1.6
900	-1.3	-1.2	-1.2
1000	-0.8	-0.8	-0.8
1100	-0.4	-0.4	-0.4
1200	0.0	0.0	0.0
1300	0.3	0.3	0.4
1400	0.6	0.6	0.7
1500	0.9	0.9	1.0
1600	1.1	1.1	1.3
1700	1.3	1.4	1.6

Table 3. Change in the probability of downlisting (2.3% for 14 years)

	Change in Pr(downlisting)		
Fall terminal run	**5 year**	**15 year**	**30 year**
600	-0.04	-0.16	-0.24
700	-0.04	-0.16	-0.23
800	-0.04	-0.15	-0.21
900	-0.04	-0.13	-0.17
1000	-0.03	-0.10	-0.14
1100	-0.02	-0.06	-0.08
1200	0.00	0.00	0.00
1300	0.02	0.08	0.07
1400	0.04	0.15	0.14
1500	0.06	0.21	0.21
1600	0.08	0.30	0.28
1700	0.10	0.35	0.34

Table 4. Change in the probability of downlisting (2.3% for 28 years)

	Change in Pr(delisting)		
Fall terminal run	**5 year**	**15 year**	**30 year**
600	0.00	-0.01	-0.14
700	0.00	-0.01	-0.14
800	0.00	-0.01	-0.13
900	0.00	-0.01	-0.12
1000	0.00	-0.01	-0.09
1100	0.00	0.00	-0.06
1200	0.00	0.00	0.00
1300	0.00	0.01	0.06
1400	0.00	0.02	0.12
1500	0.00	0.04	0.18
1600	0.00	0.04	0.25
1700	0.00	0.07	0.30

Table 5. Change in probability of meeting PSP recovery goal (at least 95 whales in 2020)

Fall terminal run	Pr (> 94 whales)
600	-0.48
700	-0.45
800	-0.41
900	-0.34
1000	-0.24
1100	-0.12
1200	0.00
1300	0.11
1400	0.20
1500	0.26
1600	0.31
1700	0.36

Short term request # 3: Summarizing interbirth interval comparison for NRKW and SRKW (Eric Ward, John Ford)

Comparing interbirth intervals between the 2 populations is slightly more crude than previous analyses, because the ages of females aren't considered. Using intervals from all females, we can run simple t-tests, and see that differences between the populations aren't statistically significant.

Across populations, the data appear to be skewed (as we might expect): the mean is 5.34, and the variance is 7.58. If we ignored the overdispersion and fit Poisson-GLMs to the data, we would conclude that there has been a negative trend over the time series (-0.011 / yr), and that this trend is most supported on the year of the start of the interbirth interval (we also examined the midpoint and final year). We evaluated models with population-specific trends, and there appears to be no difference supporting separate trends by populations.

A more appropriate approach to analyzing the data is with a negative binomial glm (using glm.nb in the 'MASS' library in R). We compared models with no trend, population-specific trends, and shared trends in interbirth intervals. The model with shared trend was most supported (deltaAIC of 2 better than the model with different trends, and deltaAIC of 10 better than the model with no trend). This trend was estimated to be identical as before, a trend of -0.011/yr.

For a population reaching carrying capacity, or being affected by density dependence, we might expect the interbirth interval to increase slightly – however, this appears to not be the case. One alternative explanation for the negative trend is that the search effort by Center for Whale Research, NOAA, DFO, and the larger public, has increased over time with more awareness of where the whales are throughout the year. A decline in the interbirth interval would also be consistent with the increase in search effort through time (it has become increasingly likely that a calf that doesn't survive to age 1 is missed).
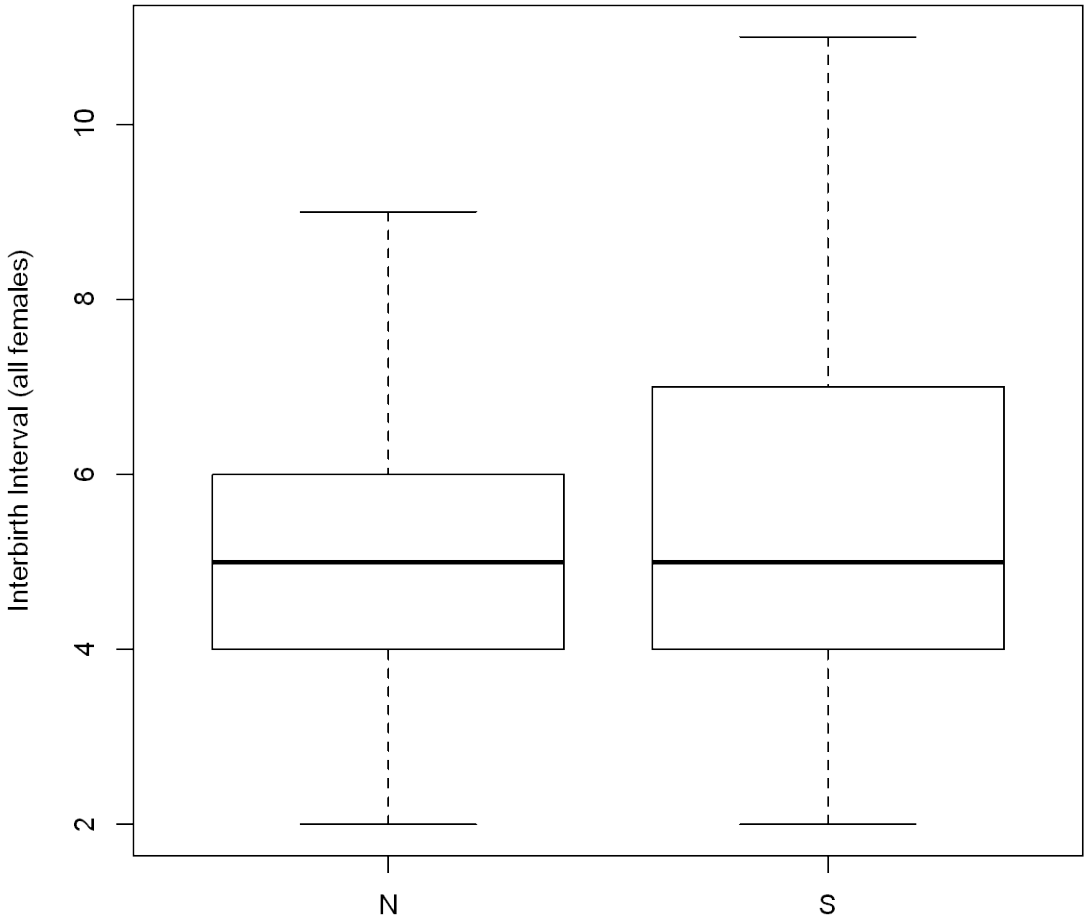
Figure 1. Interbirth intervals for NRKW and SRKW, 1974-2011.