**New Assessment of the status of the Southwest Atlantic Humpback Whale population.**

Background and outline for discussion, 4 December 2017 (by Alex Zerbini)

**1) 2006 Assessment**

*1.1) Input data:*

* Catch data: modern whaling catches starting in 1904.
* Absolute abundance: aerial survey in 2005 (potentially biased low due to lack of correction for perception bias).
* Observed growth rate: population growth between 1995 and 1998 (estimated from count data separately with GLM methods).
* Indices of relative abundance: two indices:
  + breeding grounds (uncorrected aerial surveys from 2002 to 2004)
  + feeding grounds (ship surveys with limited spatial coverage, three data points in 1982, 1987 and 1998).

*1.2) Priors:*

* Rmax: uninformative and informative, upper bound at 10.6%/year – biological constraints.
* Current abundance: uninformative, prior on the abundance in 2005, the year of the aerial survey.

*1.3) Genetic constraint:*

Lower bound on the population trajectory to account for a minimum population in the year of lowest abundance (assumed to be 4 x the number of known haplotypes in the population). The number of haplotypes was used as an indication of the minimum number of mature females in the population. It was multiplied by two to account for the sex ratio (assumed to be 1:1) and again by two under the assumption that half of the population corresponded to immature animals.

*1.4) Modeling:*

See description in Zerbini et al. (2011). Some features:

* Deterministic generalized logistic model.
* Scaling parameters (*q*) estimated analytically.
* Backwards method (prior in *N2005* and *rmax*, solving for *K* taking the catches into account and using the bisection method).
* Multiple scenarios for data inclusion, catch allocation, priors, genetic constraint
* Shape parameter (*z*) assumed to be fixed at 2.39 (maximum productivity at 0.6*K* as per IWC standards).

**2) 2017 Assessment**

*2.1) Input data:*

* Catch data: modern whaling catches starting in 1904 and pre-modern whaling catches 1830 to 1914. Need to include multipliers for the following:
  + Uncertainty in the pre-modern whaling catches
  + Struck and lost rates for pre-modern whaling catches
  + Struck and lost rates for modern whaling catches
* Absolute abundance: estimates of abundance for ship surveys have become available. They do not suffer from the perception bias problems inherent to the aerial survey ones. There is a conventional line transect estimate in 2008 and there are two new estimates using spatial modeling (2008 and 2012, where the 2012 extrapolates for areas not surveyed).

* Observed growth rate: given limitations with these data and the availability of new, more robust indices of abundance, I would consider not including this in the analysis. But open for discussion.
* Indices of relative abundance:
  + The previous breeding ground index of abundance has been expanded. Now there are data from 2002-2015 and two separate analysis have computed these indices. One is based on conventional design-based distance sampling methods (years 2002-2005, 2008, and 2011) and the other using a hierarchical Bayesian distance sampling model (2008, 2011 and 2015).
  + No new information on the feeding ground index of abundance is available. I am considering dropping this from the analysis because the spatial coverage of the ship surveys is very limited compared to the known range of this population in the feeding grounds.

*2.2) Priors:*

* Consider same priors as before (perhaps a change in the informative one to a humpback-specific prior or a baleen whale prior from the meta-analysis Andre did for IWC, or both).
* More liberal upper bound on the prior on *rmax.*
* Prior on the shape parameter (*z*) of the generalized logistic model.

*2.3) Genetic constraint:*

To be discussed with Jen Jackson

2.4) *Modeling:*

* Same as above except that:
  + Consider estimation of process error
  + Consider accounting for environmental variability (Cooke model – 2015)
  + Shape parameter is not fixed.