hi Caleb

Sorry for the delay in getting back to you, but I've now looked over the outputs. Clearly there's patterning present in the data, as seen in both this and the previous set of analyses, so I think we are on the right track. However, something in our new set of model appears to have gone awry. In other words, the analysis is ultimately uninformative if \*all\* of the species strongly support the bottleneck scenario (with model 1 consistently getting a support value of ~1 and model 0 consistently gaining a support of ~0). In addition, we now find that (i) the Antarctic fur seal results have changed and no longer fit what we know about this model species' harvesting history; (ii) we know some of the species did not experience bottlenecks, and at least one of these did not show evidence of a bottleneck according to our previous set of analyses. Also, as you point out, (iii) the posteriors are climbing for bottleneck time and Ne for many of the species, which does not appear to make a lot of sense (although remember that the smoothing parameter with DIY-ABC is quite strong so a climbing bottleneck time might in some cases be resolved as a peak when the data are plotted differently).

First of all, I should say that although bottleneck timing should be very similar across species, generation time may differ and there is also a great deal of variation in probable Ne among species. This may make it difficult to converge on a single pair of models (i.e. bottleneck versus non-bottleneck) that fits all species perfectly. Nevertheless, I still think we should try, as I hope and believe we may be able to find such a model pair, and this will undoubtedly make the results more easy to compare and discuss. It could turn out in the end that we also need to fit models that are specifically catered towards each species, but this may also be difficult to do for certain species due to poor data availability, and we will have to clearly justify all of our prior choices.

Second, it is becoming obvious that we will need to do some exploration of the parameter space for the 'generalised model pair' before running all of the final analyses. I suspect that for this we should at a minimum analyse (i) the Antarctic fur seal, to ensure that the results are comparable to before, (ii) perhaps another heavily bottlenecked species such as the Northern elephant seal and (iii) a couple of clearly non-bottlenecked species, such as the Antarctic pack ice seals. A sample of species such as this should help to give us a snapshot of how various models may be performing. Of course, if it is just as quick and easy, there is no harm in running all of the species.

Going back to the 'generalised model pair'. We did not do much to alter the bottleneck versus non-bottleneck models applied previously, so it probably follows that one or more of these changes have undermined the ability of our analysis to discriminate between the two scenarios. We made the following changes:

(i) we put an extra time prior in the constant population size model

(ii) we expanded the bottleneck time prior from 1-30 to 1-100 generations ago

(iii) we expanded the time prior for historic Ne.

So which of these could be to blame? My feeling is that expanding the time prior for historic Ne is unlikely to have had much influence, suggesting that we should consider the effects of (i) and (ii).

(i) I'm not sure how adding an extra time prior in the constant population size model would influence the results given that Ne is constrained to be identical among the three time points. However, I guess it is a remote possibility that this could be to blame. A simple way to test this might be to run our original AFS model with the two time-point null model and the three time-point null model. If there is a difference, then we know that the null model specification plays a role.

(ii) I suspect bottleneck time prior could be the major offender. I was looking at the leopard seal, which is unlikely to have passed through a bottleneck due to hunting. In this species, we find support for a bottleneck, with a reduction in Ne down to ~800 but the bottleneck time prior is climbing to the right. This could be interpreted as meaning that the population size was reduced, but not within the historical harvesting period (i.e. somewhere in the more distant past). In other words, it is possible that the more one expands the bottleneck time prior, the more datasets will support the bottleneck scenario if some other factor, such as environmental variation, caused a reduction in Ne in the recent past that was not coincident with the historical harvesting period but somewhat older. Following this logic, the tighter one can bound the bottleneck to the historical harvesting time-window, the fewer species will support the bottleneck scenario, since only species that were historically hunted should show the concurrent reduction in Ne during this tighter time window, and species that have undergone reductions due to other factors in the more distant past will be less likely to 'sneak in'. The ringed seal provides another example. Here, the bottleneck time posterior climbs, again suggesting that the reduction may have taken place in the more distant past than the historical harvesting time period. However, the bottleneck Ne also climbs. Perhaps this means that there was a reduction in Ne, more ancient than the harvesting time-window, but that the reduction was not as severe as in the leopard seal. In other words, the models would be consistent with some degree of reduction in Ne, but this would be both weaker and more ancient than if hunting were to have impacted the population. As with you, I find it odd that the bottleneck scenario is still supported in such cases, but perhaps this could be related to the point below.

Following on from the above, for certain species with historically much smaller Ne's than the Antarctic fur seal, the difference between contemporary / historical Ne and the bottleneck Ne prior (i.e. 1-1000) may be small. It is possible that this allows the bottleneck scenario to be favoured (i.e. we are not enforcing a strong enough reduction in Ne). We could consider enforcing a stronger bottleneck by reducing the bottleneck Ne prior from 1-1000 to 1-500. However, this should not be influencing the pack ice seals, which have not been hunted, because their Ne's are mostly very large.

Finally, I'm not sure what to make of your last slide. Certainly, this could be a way of visualising the relative support for the two models plus, potentially more usefully, the overlap between the two models (could one reason that the stronger the overlap between the models, the less power we have to discriminate between them?). It might therefore be good to include these plots in subsequent results.

And last but not least, I've summarised the models fitted so far and their results in two powerpoint files (attached). I think I will generate a similar file such as this each time we do an analysis. This might help to keep track of what models were fitted and what the results were. I've included a third powerpoint to suggest the nest model pair to evaluate.

OK, so what do you think?

All the best

Joe