Gadget-Atlantis Bootstrap Test

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A little background

This exercise compares Bjarki's Gadget bootstrap method to a suite of gadget models with known variance placed on the samples from Atlantis. This particular example uses the cod data from Atlantis.

Brief Methods

I took the age, length, and count data from Atlantis and sampled those data 50 different times using an evenly spaced sequence of variance levels (sd $\in (0, 0.3)$). The chosen interval was determined by bootstrapping survey index-like samples in Atlantis and looking at the log-log regression of these bootstrapped samples against the true values (for different sampling sizes and different levels of variance). The residuals on these regressions were always about 0.26-0.28, so I rounded up a bit and went with 0.3. I used this sampled data from Atlantis to peform 50 Gadget optimizing runs.

I then performed a Gadget bootstrap of 100 iterations on the Atlantis data with no variance added to the samples. Why did I use data with no variance? That's a good question that I don't have a great answer to other than that I was interested in the variance associated with the bootstrap rather than error in the data.

All models were fit with known growth and known selection on the commercial fleet. Natural mortality, initial numbers, and recruitment for each year were all estimated.

Results

Biomass

The time-series trends (Fig. 1) and density plots by year (Fig. 2) for biomass seem very similar between the bootstrapped models.

Numbers

The numbers tell a little bit different story. In general the bootstrap models seemed to underestimate the number of fish compared with the models with differing levels of variance (Figs. 3 & 4).

I have not run statistical tests on any of these results yet, but I have to imagine that there would be no statistical difference between the bootstrap and variance models at least for biomass.

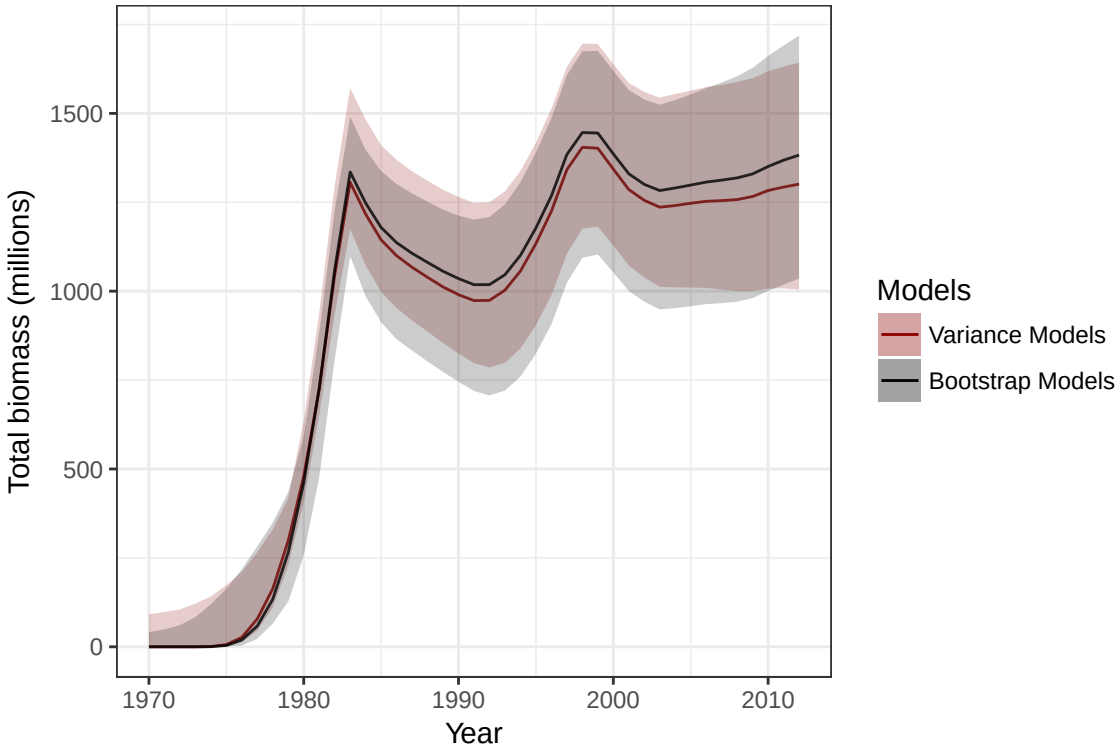

Figure 1: Time series sequence of total biomass of fish (in thousands of tons) for both gadget model runs with different levels of variance (reddish) and bootstrapped models (grayish)

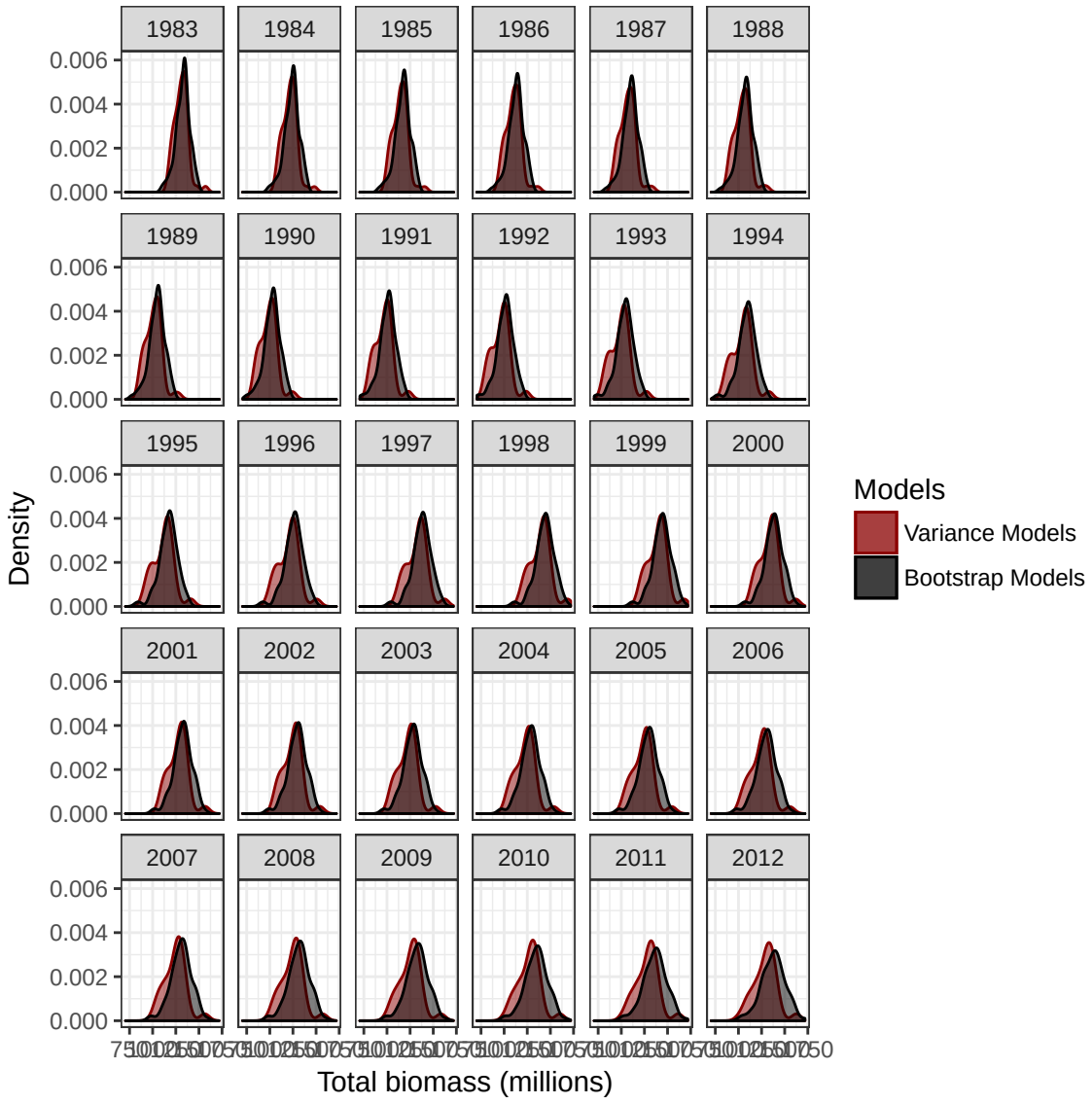

Figure 2: Density plots of total biomass of fish (in thousands of tons) for each year of model (without the burn-in period - 1970-1982). Reddish densities are for variance models and grayish densities are bootstrapped models

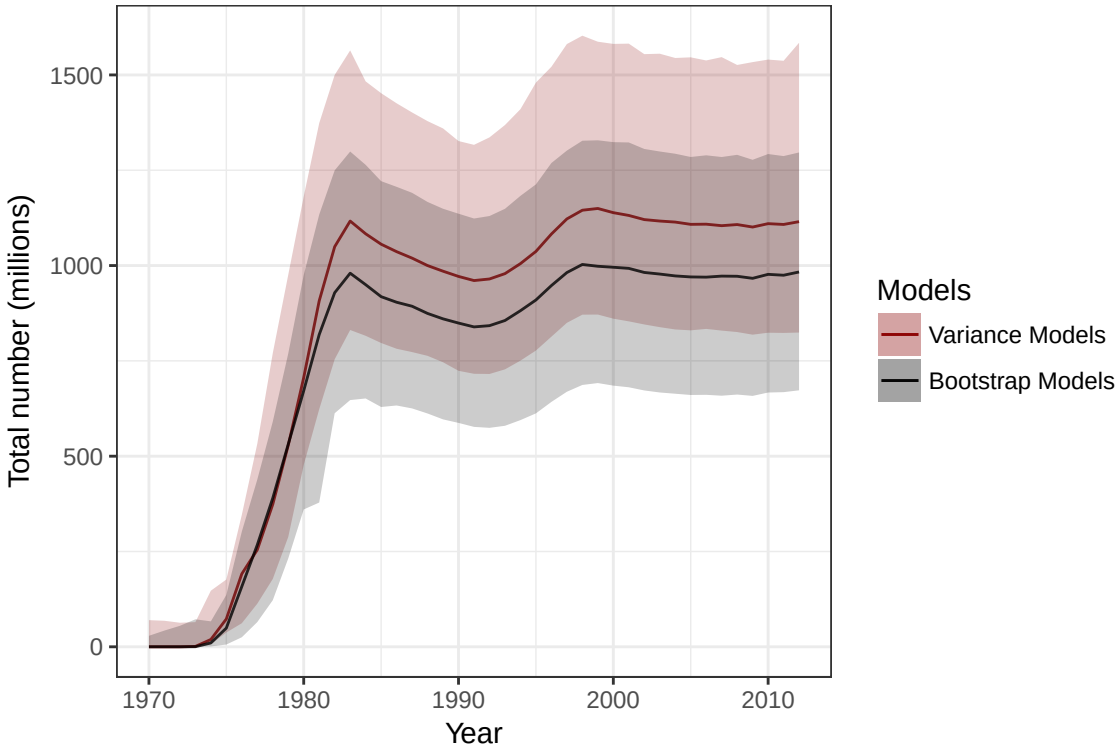

Figure 3: Time series sequence of total number of fish (in millions) for both gadget model runs with different levels of variance (reddish) and bootstrapped models (grayish)

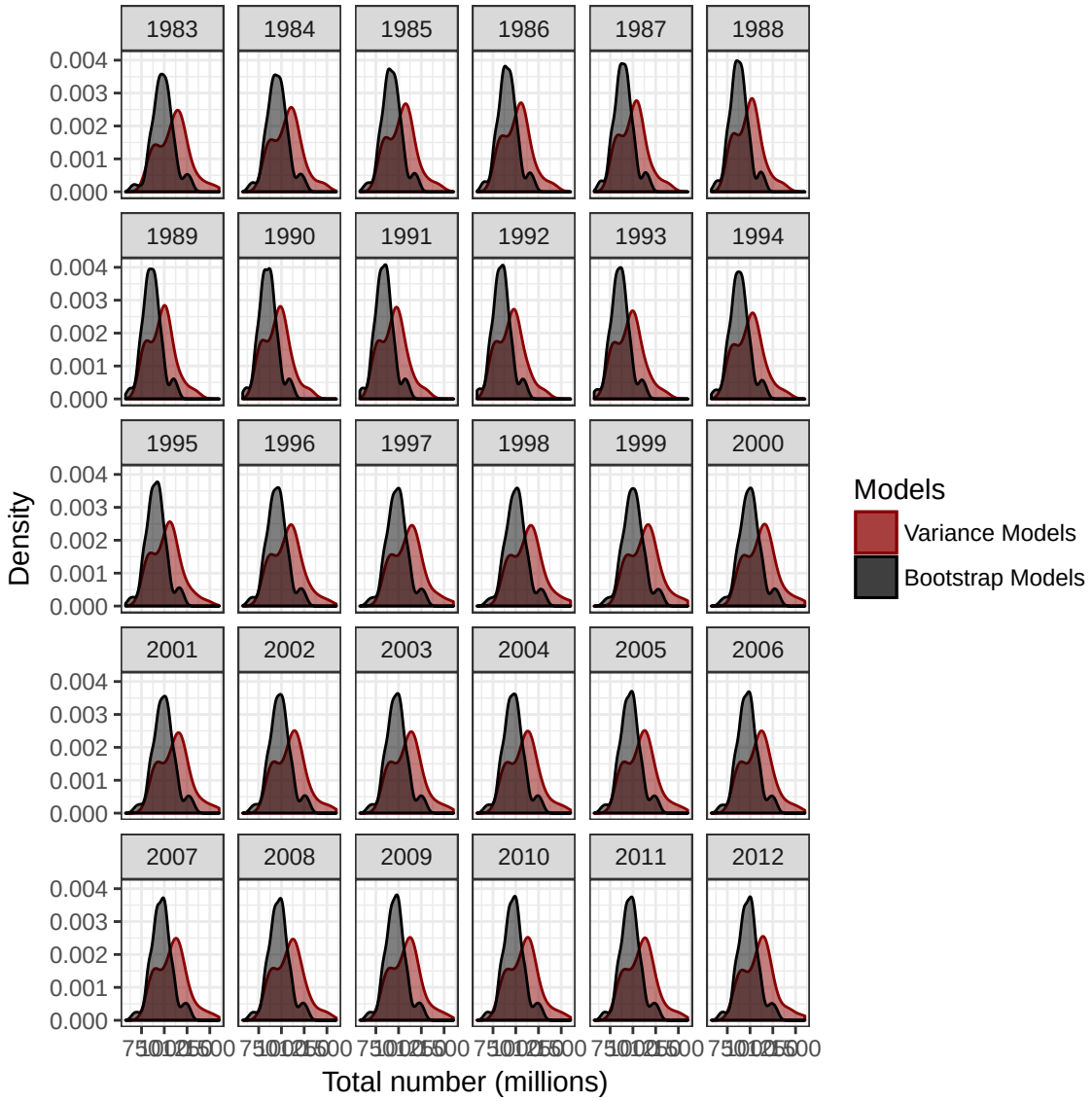

Figure 4: Density plots of total number of fish (in millions) for each year of model (without the burn-in period - 1970-1982). Reddish densities are for variance models and grayish densities are bootstrapped models