Larger rorqual whale mothers have more female calves

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Humpback whale and calf: Jasmine Carey/ Caters News

Mammals might adapt the sex ratio of their offspring to enhance reproductive success.

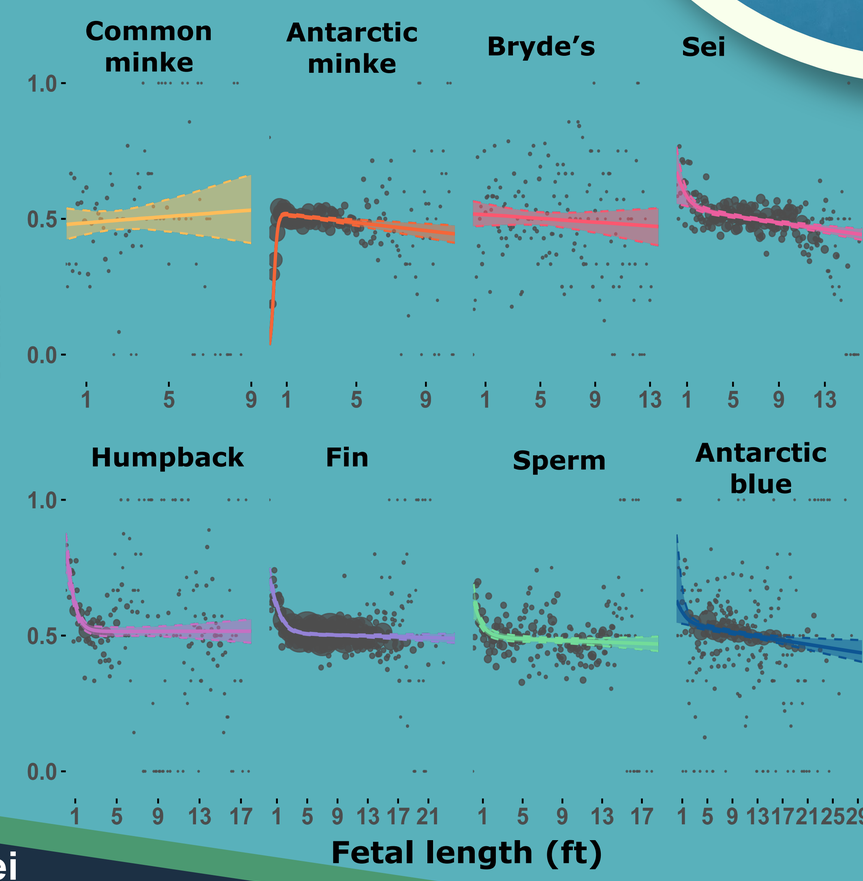
Figure 1. Humpback whale fetus from the South Georgia museum.

There are many hypotheses about the way this adaptation could occur.

In species where males compete for mates, mothers in good condition may have male offspring because these larger males will be better able to outcompete smaller males, increasing the lifetime reproductive success of their mothers.[1]

Whaling data provide an opportunity to test this hypothesis on wild populations of cetaceans.

Regulations required whalers to record the sex and size of whales, their pregnancy status, and the sex and size of fetuses. However, sex mis-identification may need to be accounted for when using fetal data from historical catches. [2,3,4]



Small females were mistaken for males across species.

Bayesian models were used to estimate the probability being a male fetus for a given fetal length. A correction factor for mis-identification was estimated using a logistic selectivity equation (Figure 2). Small males were mistaken for females in Antarctic minke whales and no correction was estimated for Common minke or Bryde's whales.

Figure 2. Fetal sex ratio (proportion male) in 1-inch bins (points) and model predictions (lines). The size of the points represents the relative sample size.

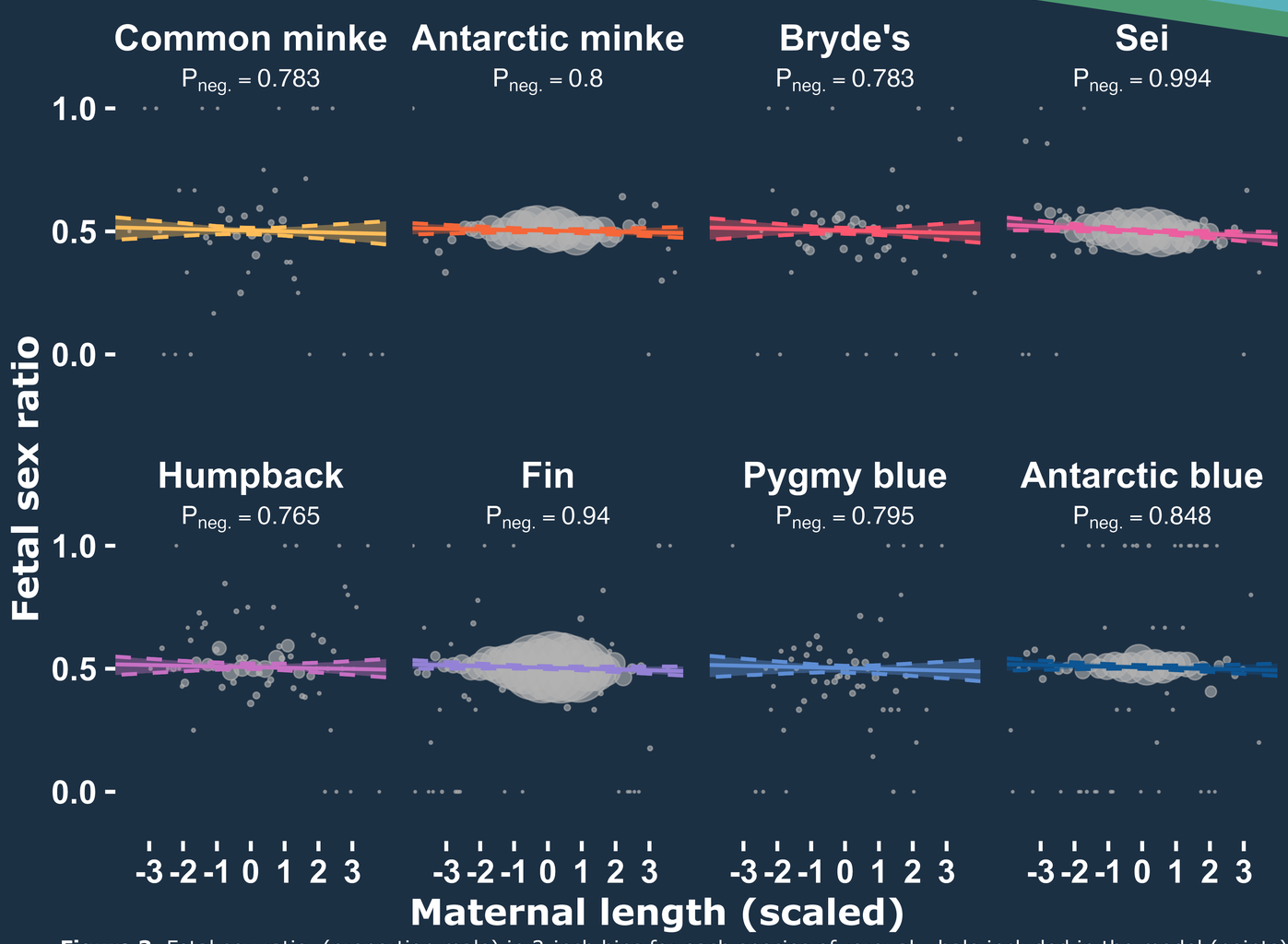


Figure 3. Fetal sex ratio (proportion male) in 3-inch bins for each species of rorqual whale included in the model (points). The size of the points reflects the relative sample size in each bin.The median model-predicted relationship between maternal length and fetal sex ratio is represented by the solid line and the shaded area represents the 95% credible intervals.

Do larger rorqual whale mothers have more male offspring?

Longer mothers had a higher probability of having a female calf.

This is true across species, though there was some inter-species variability. The probability that there was a negative relationship between maternal length and having a male fetus was 0.906 across all species. For individual species, this probability was highest for sei whales and lowest for humpback whales (Figure 3).

Bayesian generalized-linear mixed models were fit to rorqual whales (family Balaenopteridae) to estimate the probability of having a male offspring given maternal length with species as a random effect. Fetuses below the estimated correction length were removed to avoid issues with sex mis-identification.

Fetal sex mis-identification was a widespread problem across species, whaling stations, and fleets.

Longer mothers appear to have more female calves in rorqual whales.

This suggests that physical size may not be a very important factor for reproductive competition between males.
Instead, there may be higher variance in reproductive success between large and small female offspring, likely due to the high energetic costs of gestation and lactation.

Blue whale : Russell Leaper

Fin whale: Aqqa Rosing-Asvid

Check out our GitHub repository for our code and a virtual poster!

References:
1. Trivers, R.L. & Willard, D.E. 1973 Natural selection of parental ability to vary the sex ratio of offspring. *Science* **179**, 90-92.
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3. Gambell, R. 1968 Seasonal cycles and reprodution in sei whales of the Southern Hemisphere. *Discovery Reports* **35**, 31-134.
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