

Density Dependence

Simulations

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This document provides an example of how to model density dependence in mass and M-at-age.

The life history parameters of mackerel are used to construct an FLBRP object that represents the equilibrium dynamics, this is then used to construct an FLStock object that models the time series dynamics.

The Lorenzen relationship between mass-at-age and M can model M as a function of weight-at-age. For example, $\text{lorenzen } M = a \cdot 300^{-0.288}$, so if you want $M=0.2$ at 300g then $a = 0.2 / (300^{-0.288})$

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Simulations

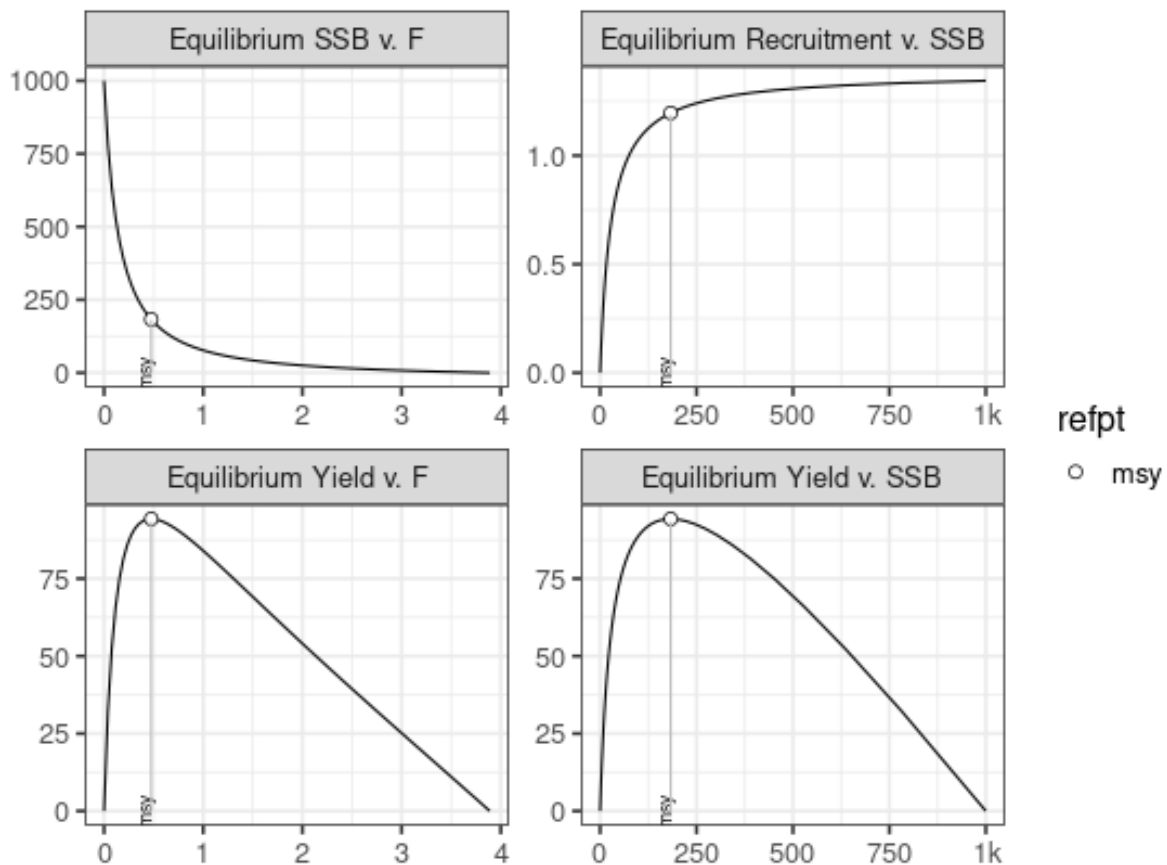


Figure 1 Equilibrium dynamics

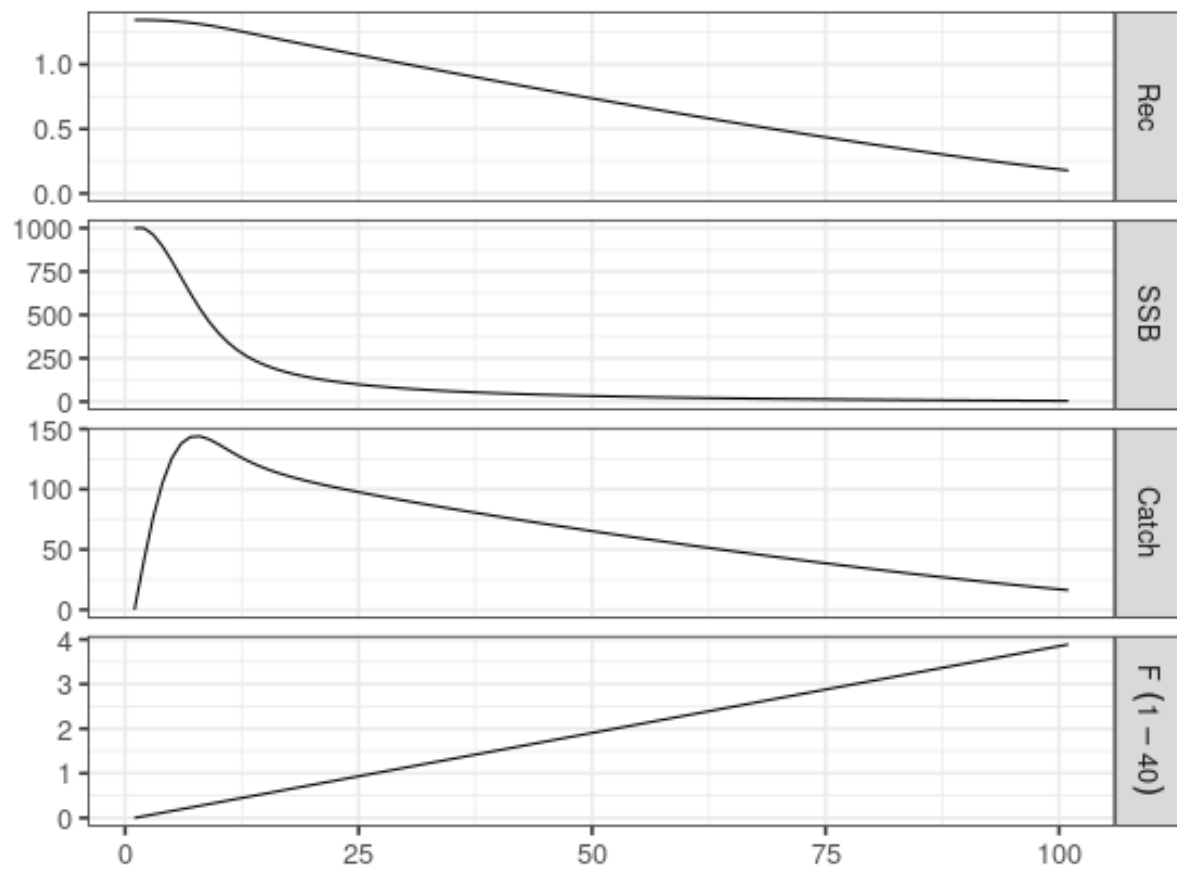


Figure 2 Time series dynamics

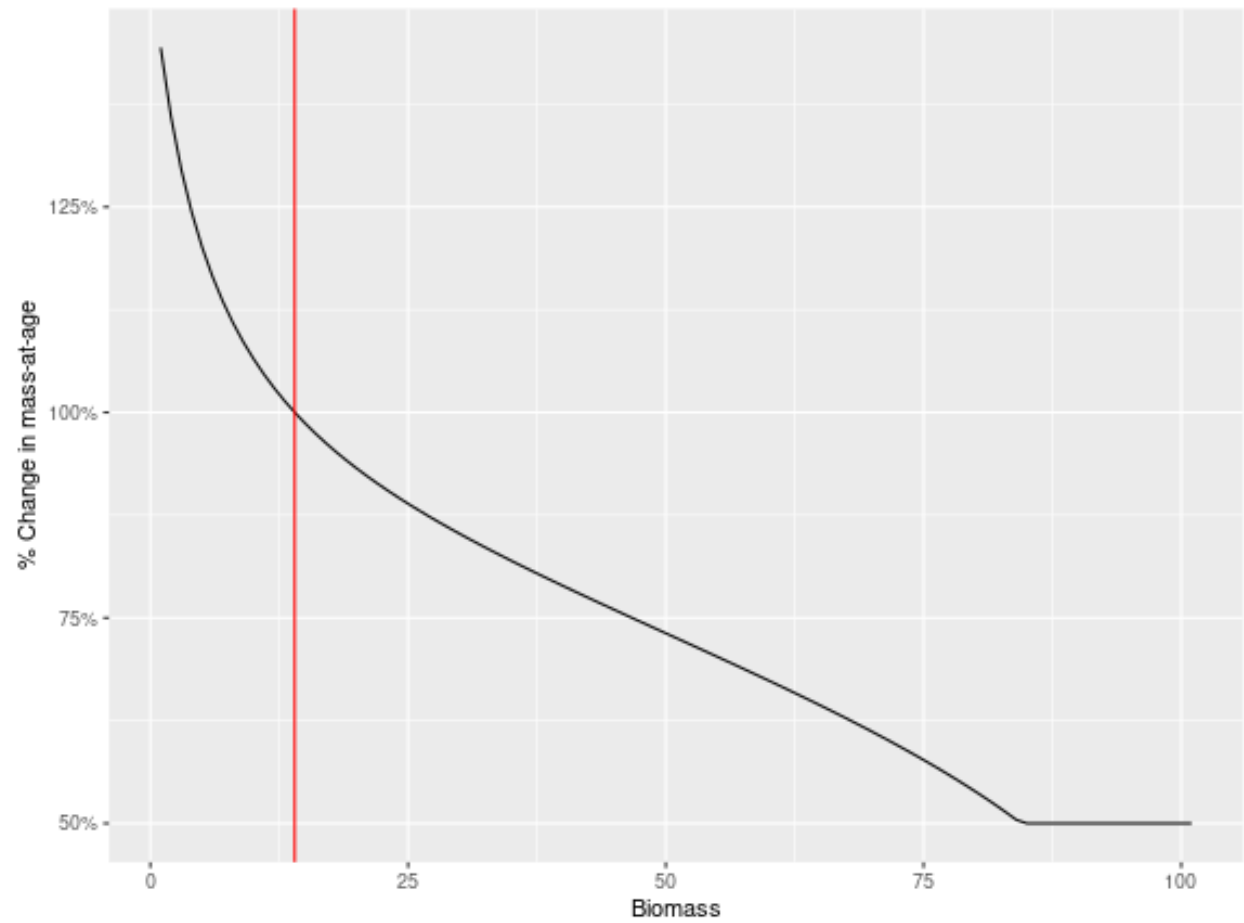


Figure 3 Density dependence multiplier, red is B_{MSY}

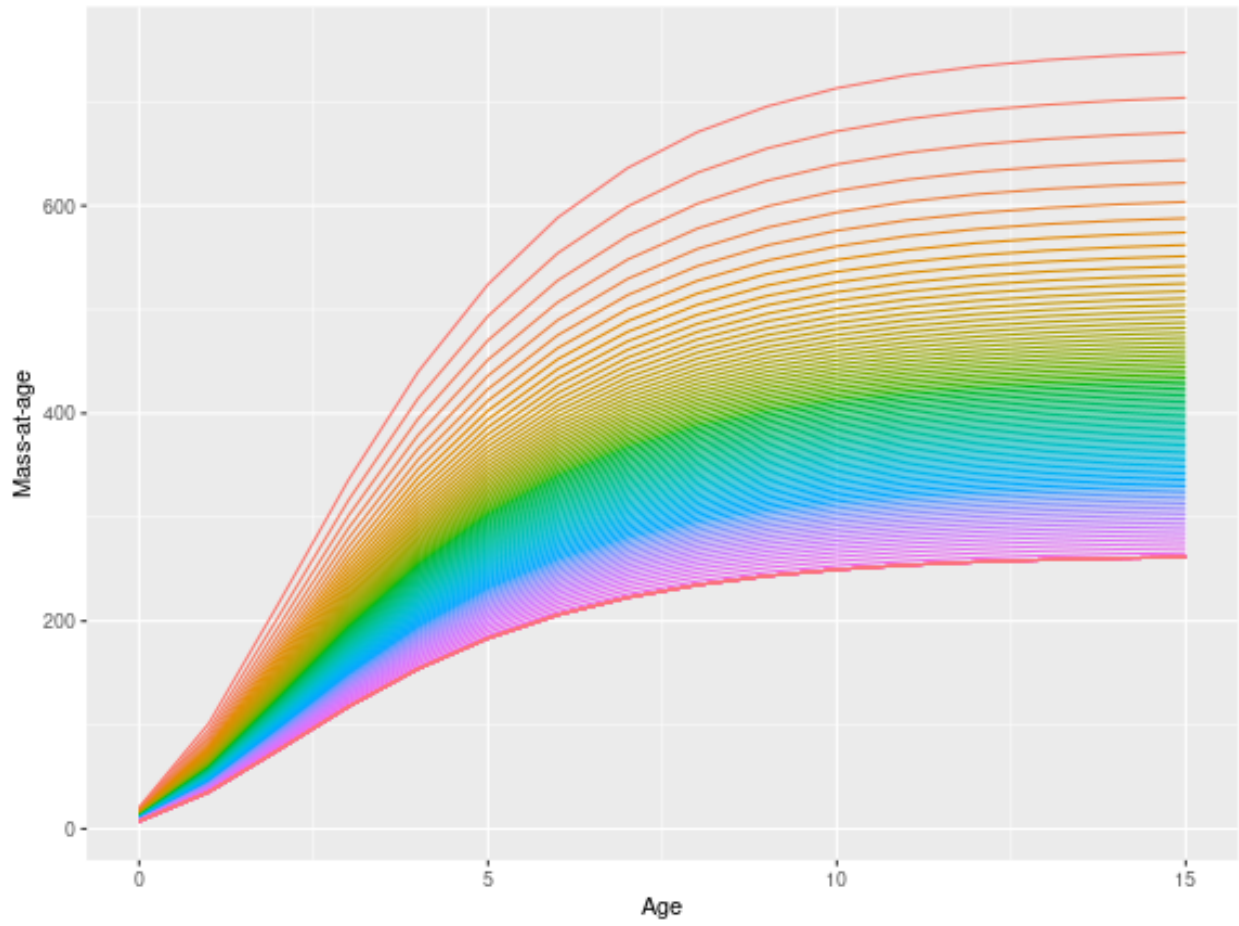


Figure 4 Simulation of density dependence in mass-at-age

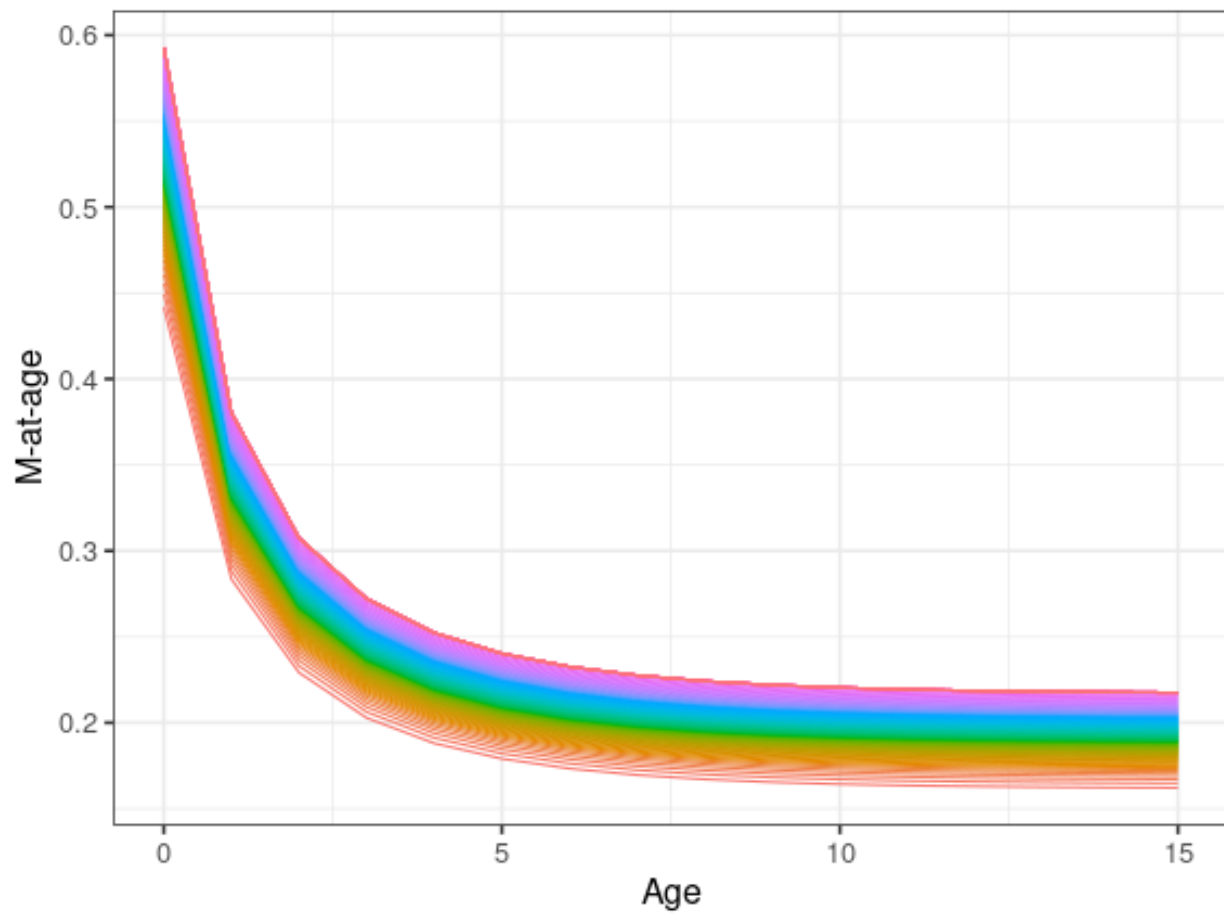


Figure 5 Simulation of density dependence in M-at-age

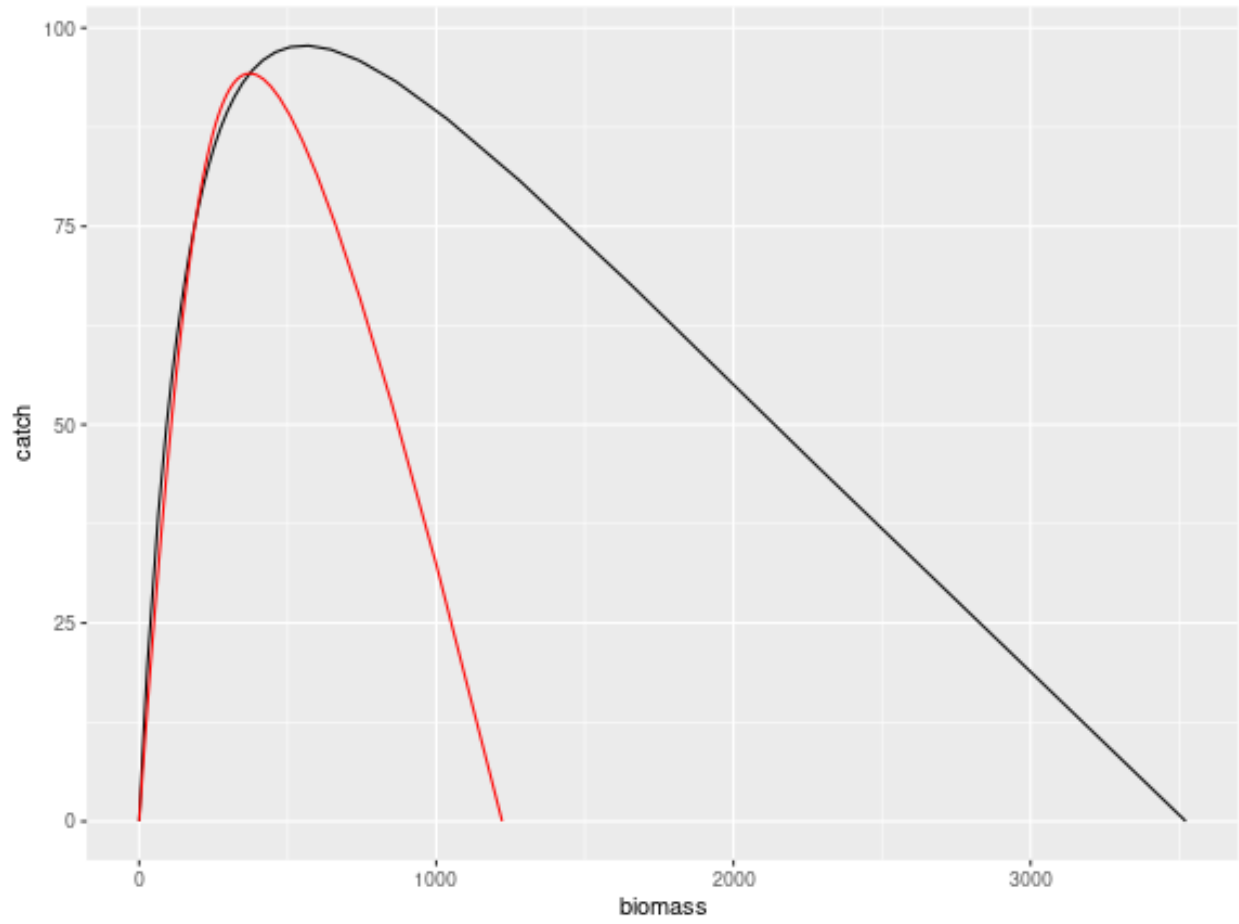


Figure 6 Comparison of equilibrium curves with (black) and without (red) density dependence.

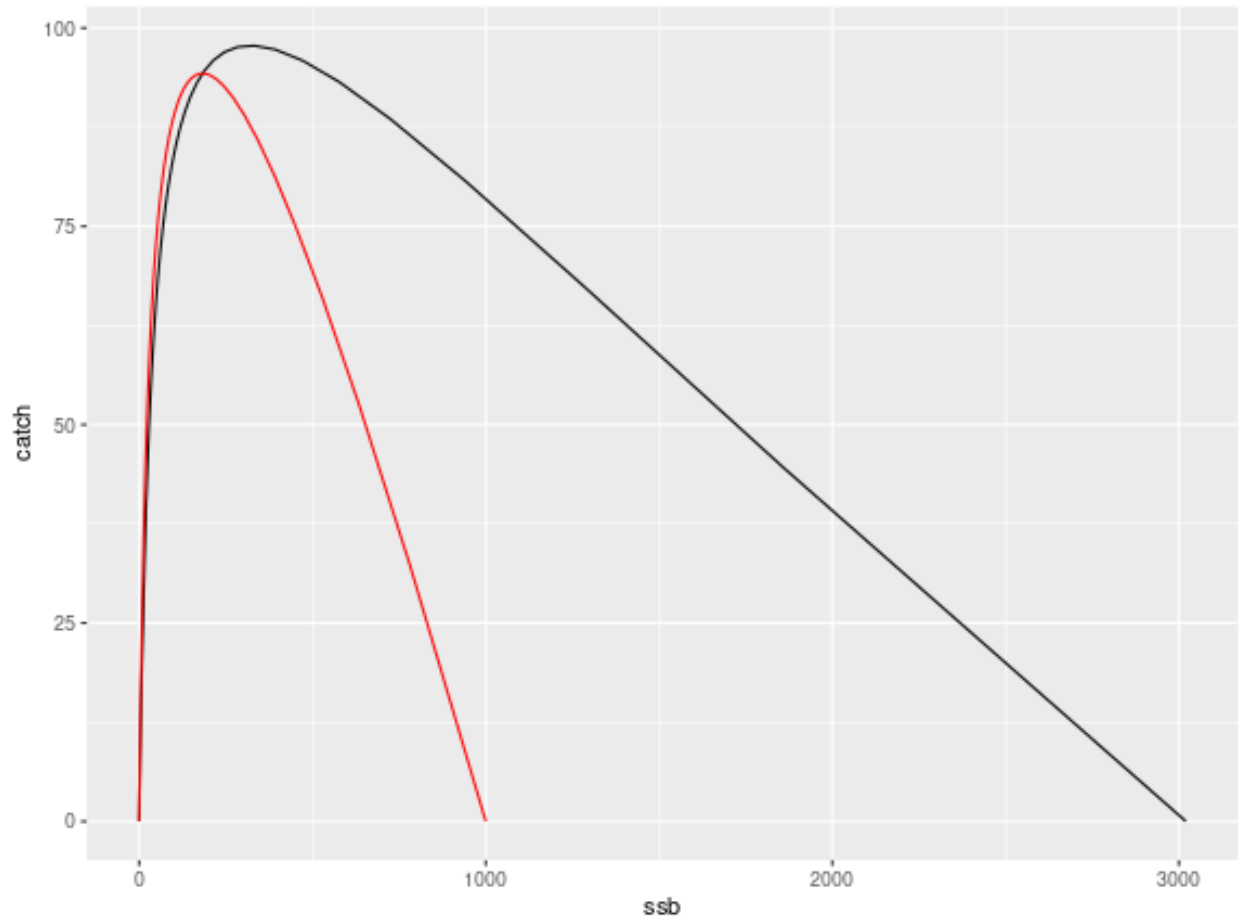


Figure 7 Comparison of equilibrium curves with (black) and without (red) density dependence.

Funding

References