# Extinction

# Learning objectives

1. Introduction
2. Deterministic Models
3. Stochastic Models
4. Allee effects

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https://vimeo.com/42592260

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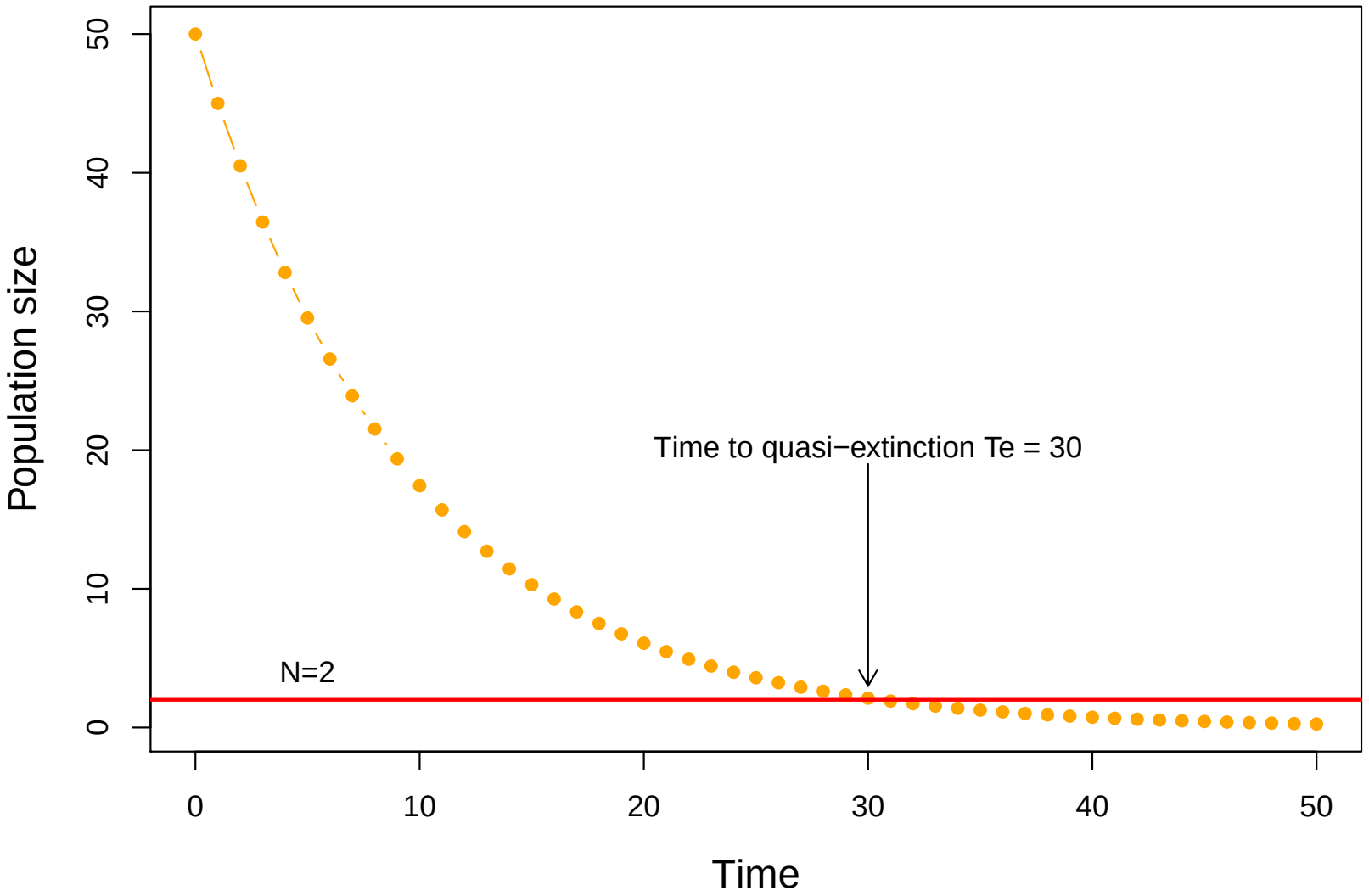
Threshold usually based on genetic considerations, Allee effects, etc...

# Geometric growth example



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Calculating extinction risk requires a specification of the time horizon of interest.

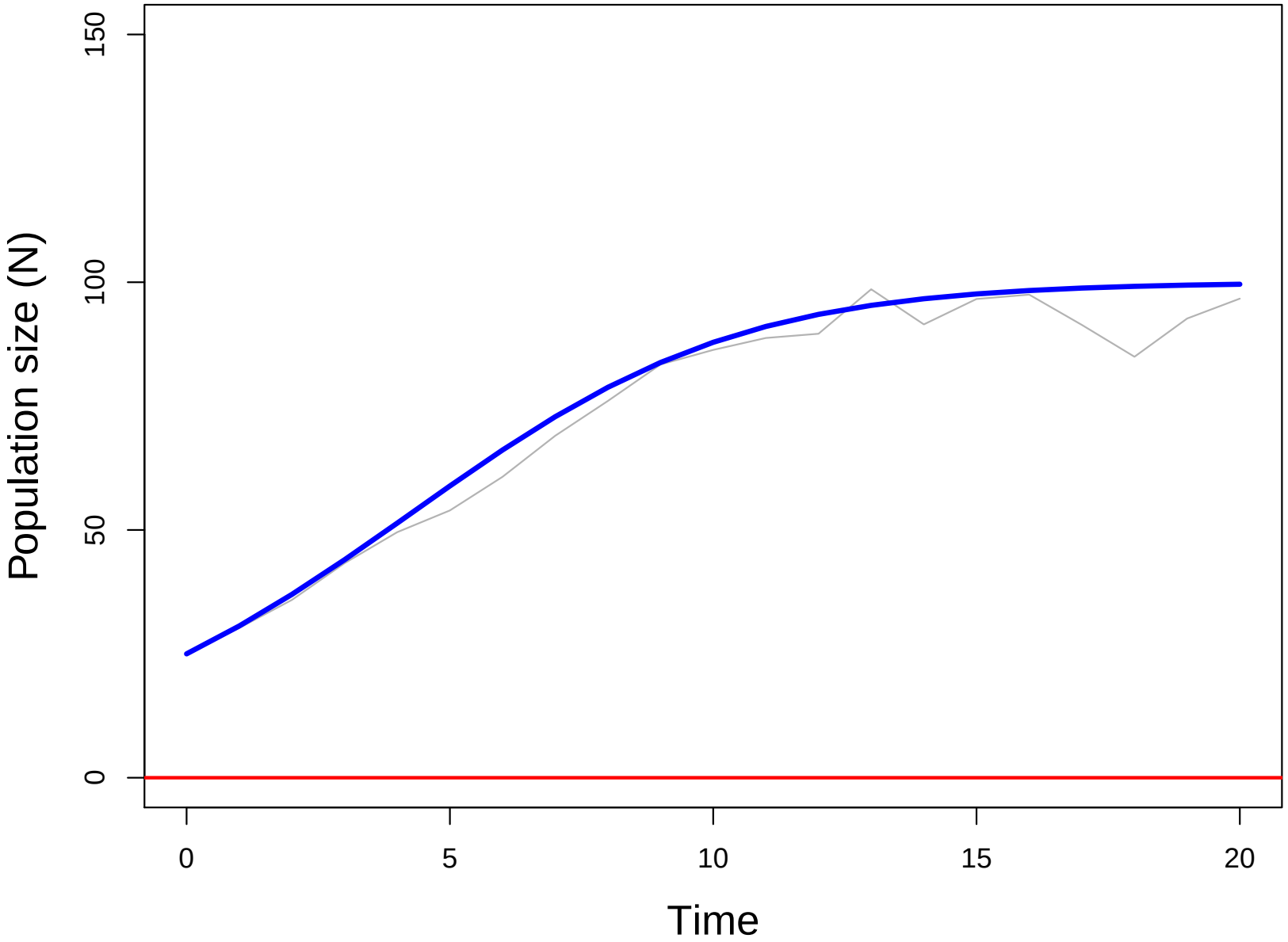
# Logistic growth with stochastic carrying capacity

$$N_{t+1} = N_t + N_t r_{max}(1 - N_t/K_t)$$

where

$$K_t \sim \text{Normal}(\bar{K}, \sigma_e^2)$$

# Logistic example, $r_{max} = 0.3$, $\bar{K} = 100$, $\sigma_e^2 = 400$



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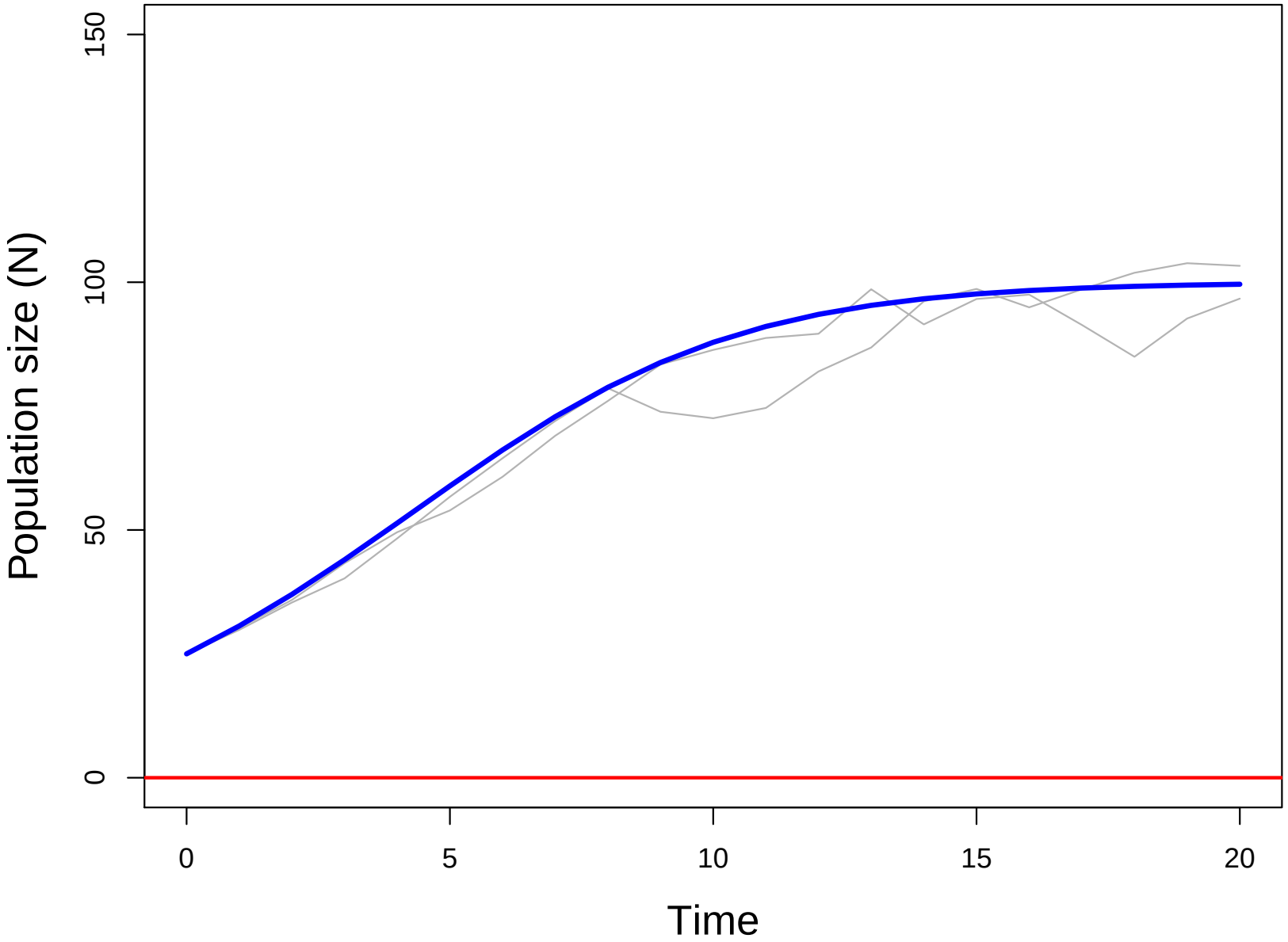

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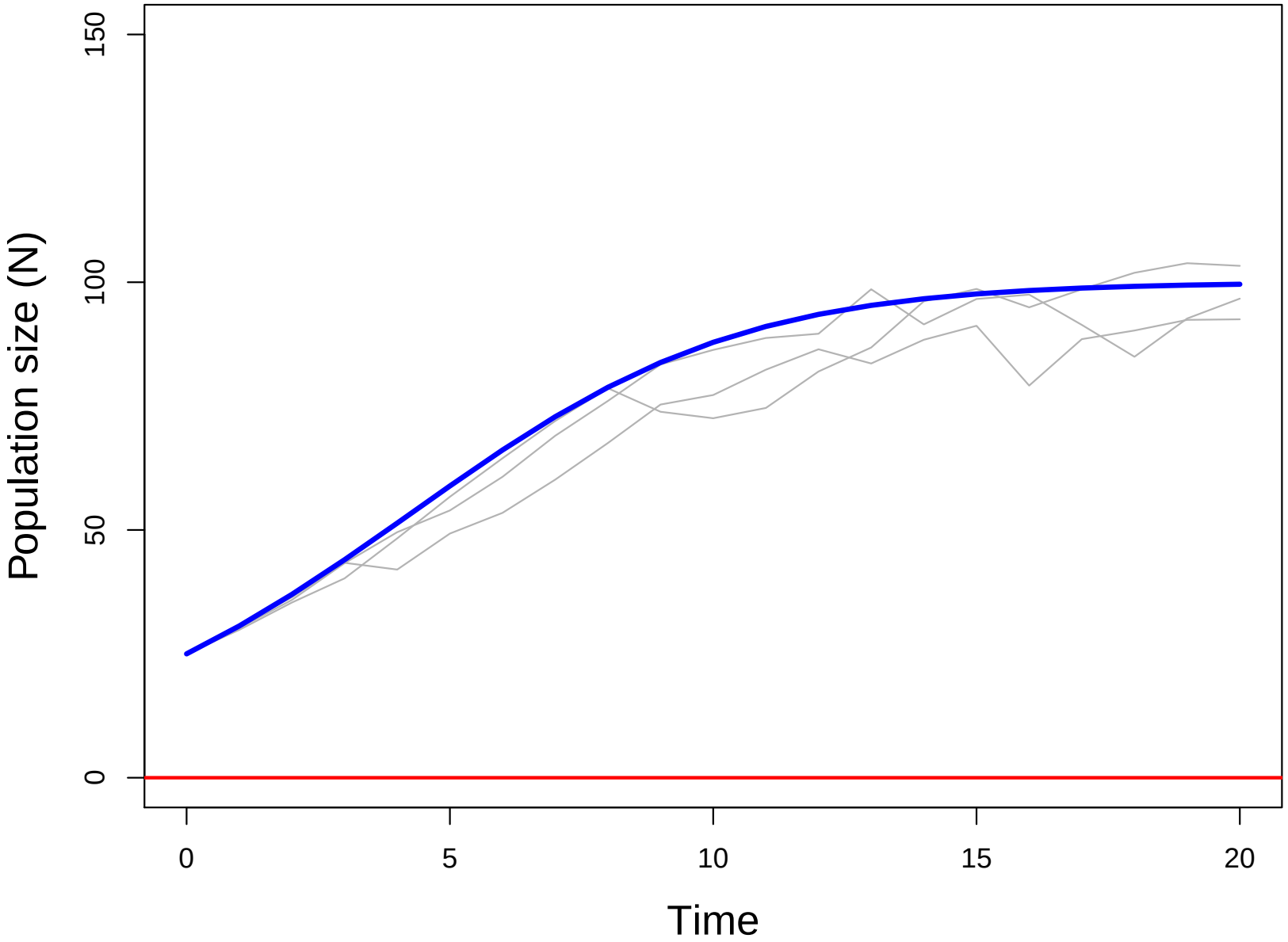

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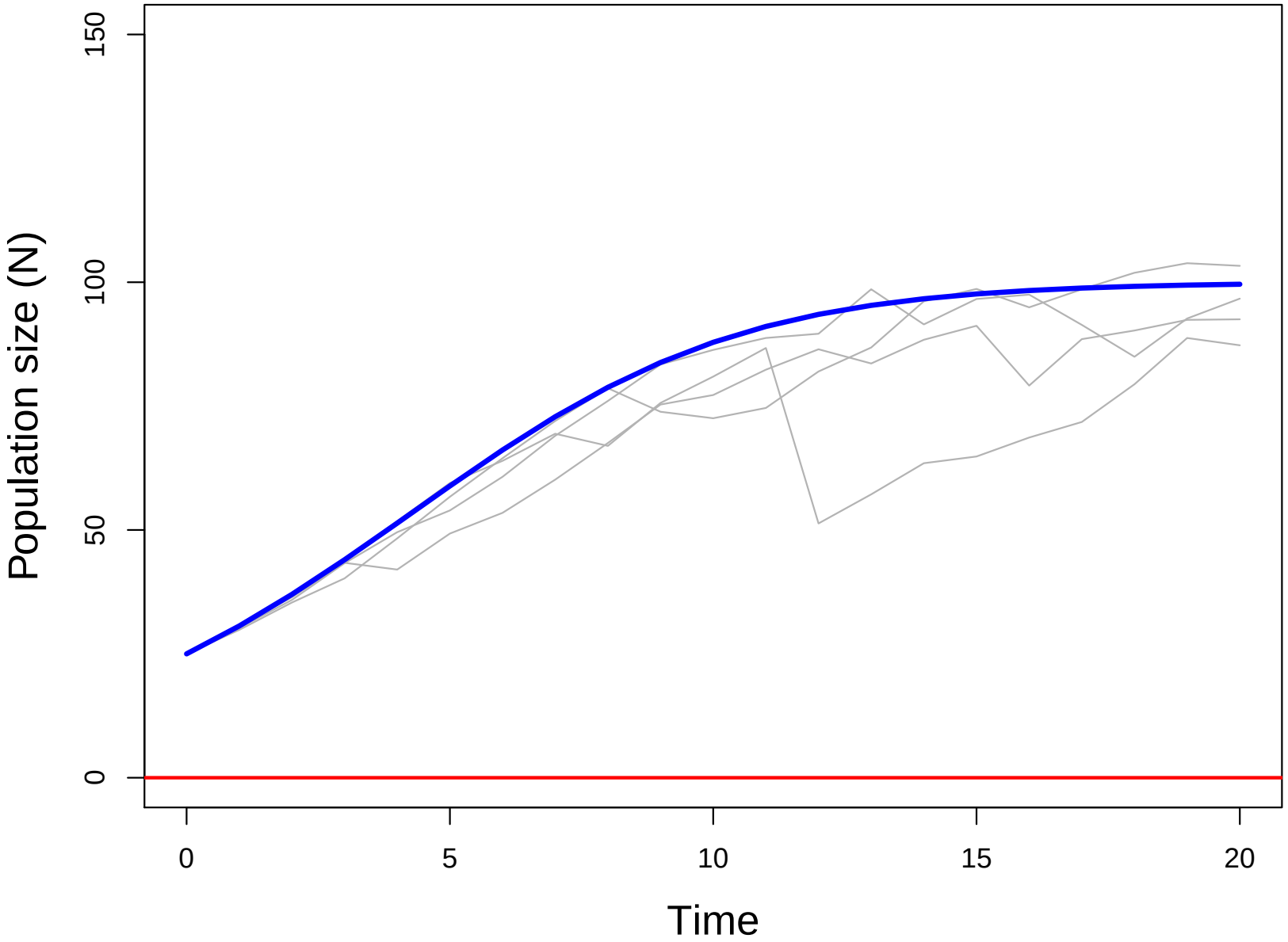

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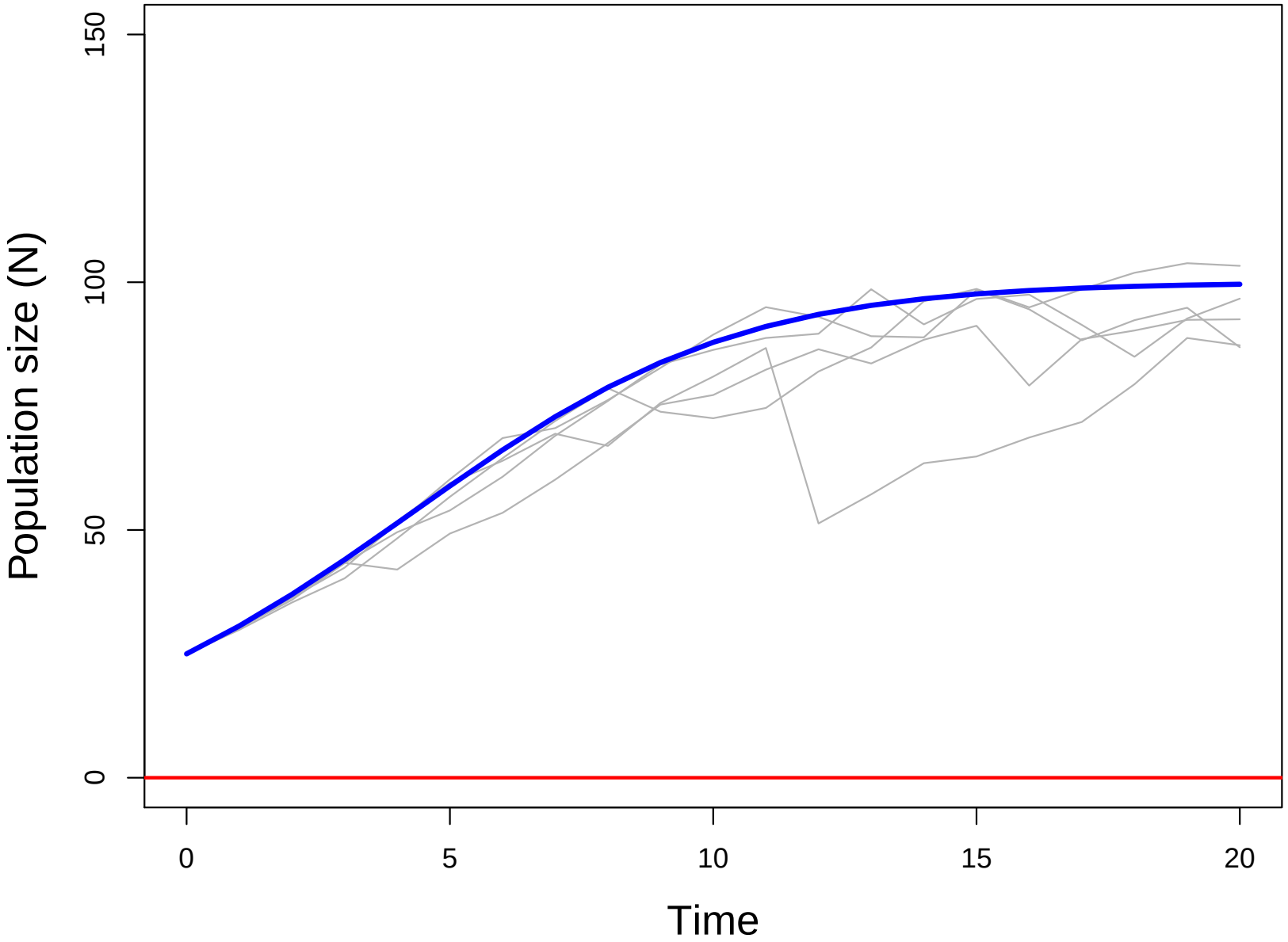

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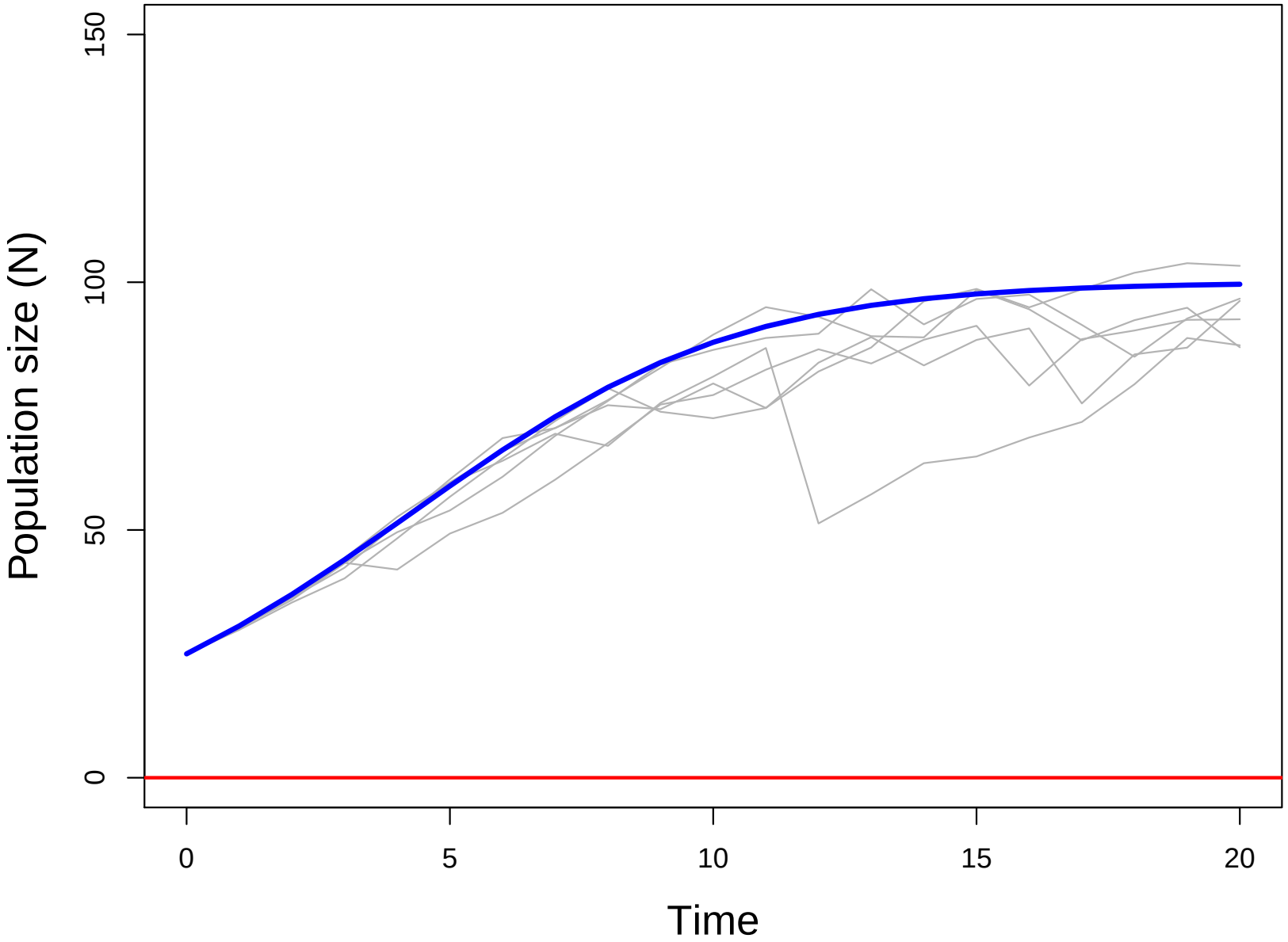

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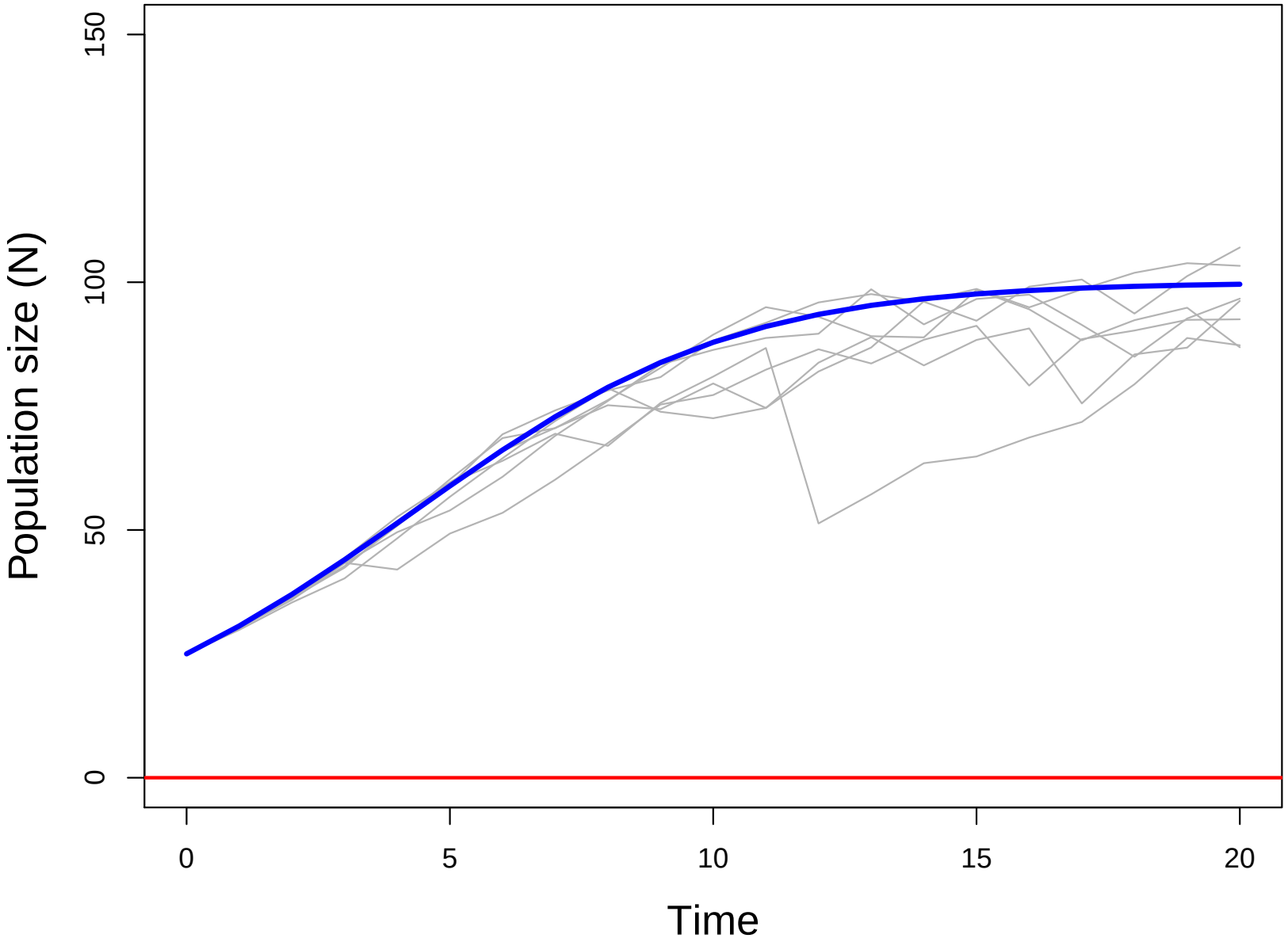

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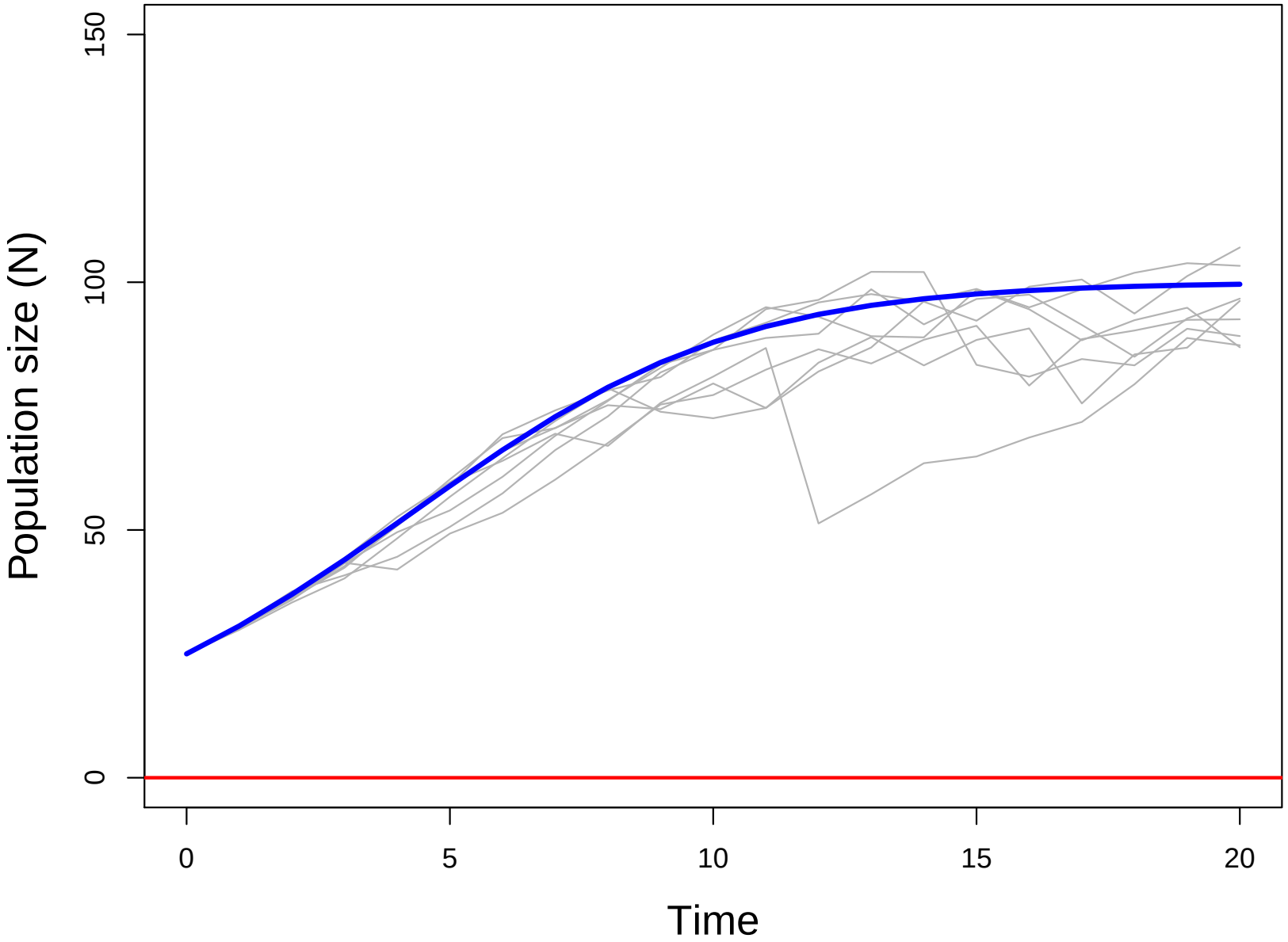

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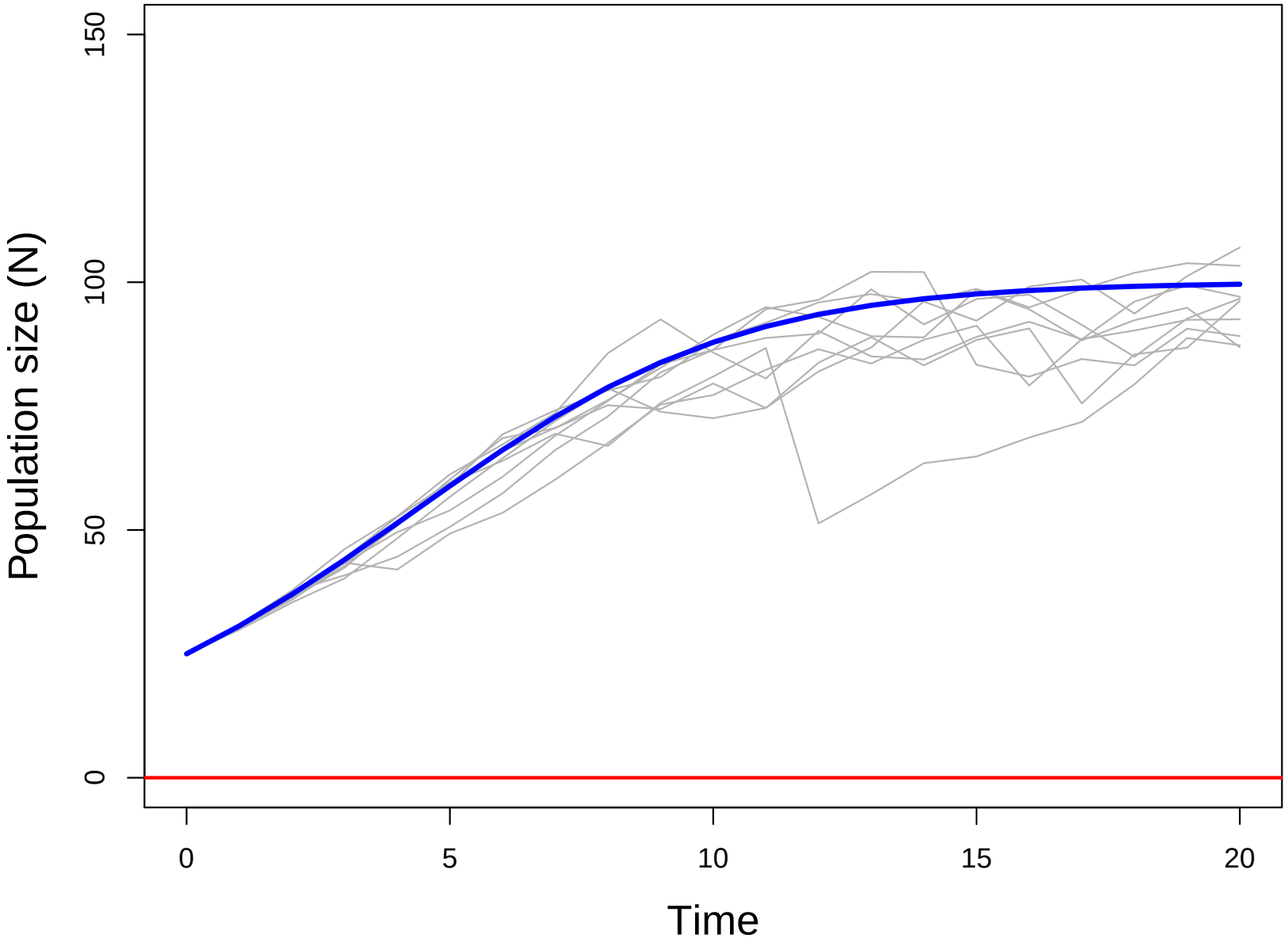

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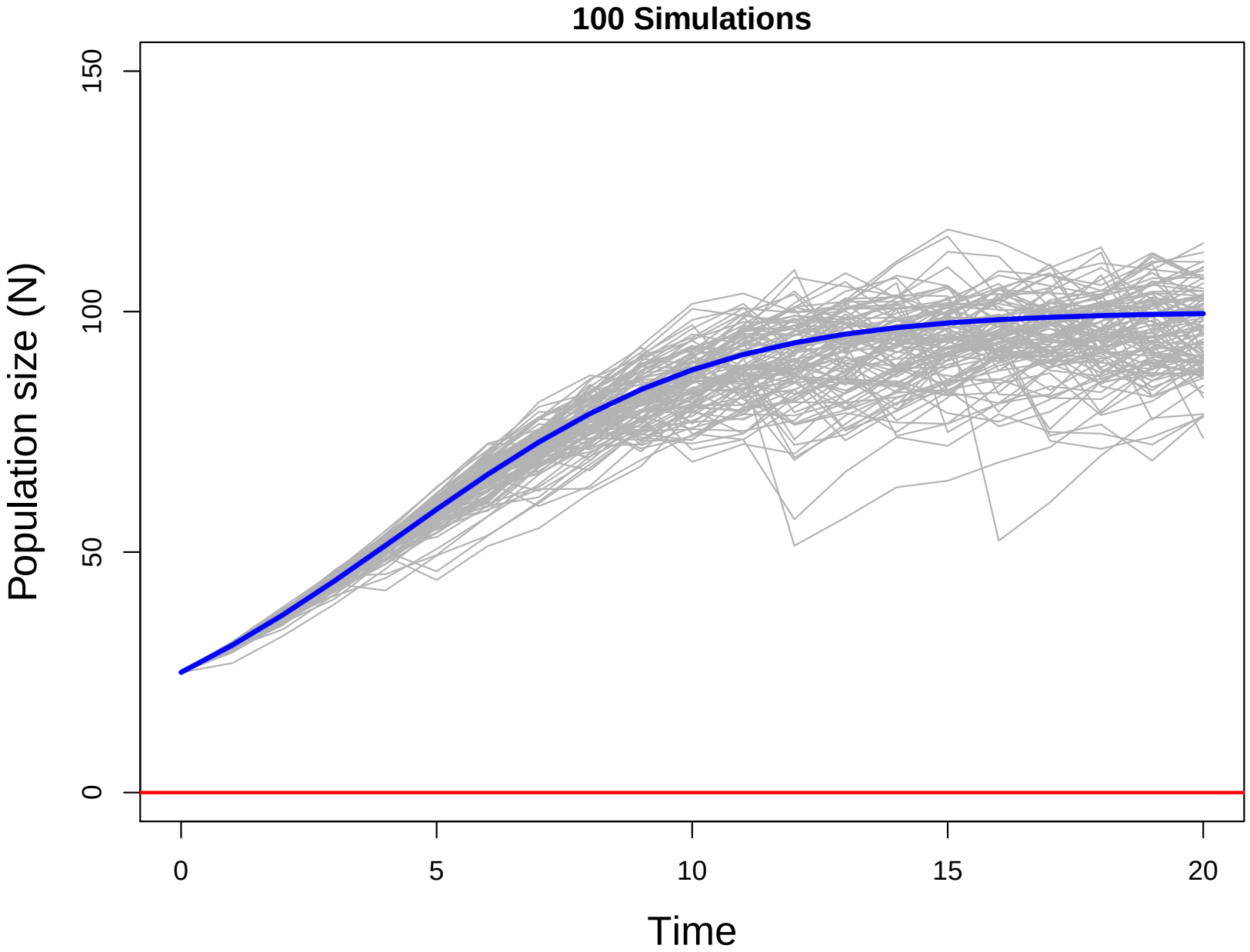

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Assumptions

- We have the correct model
- We know the parameters with certainty

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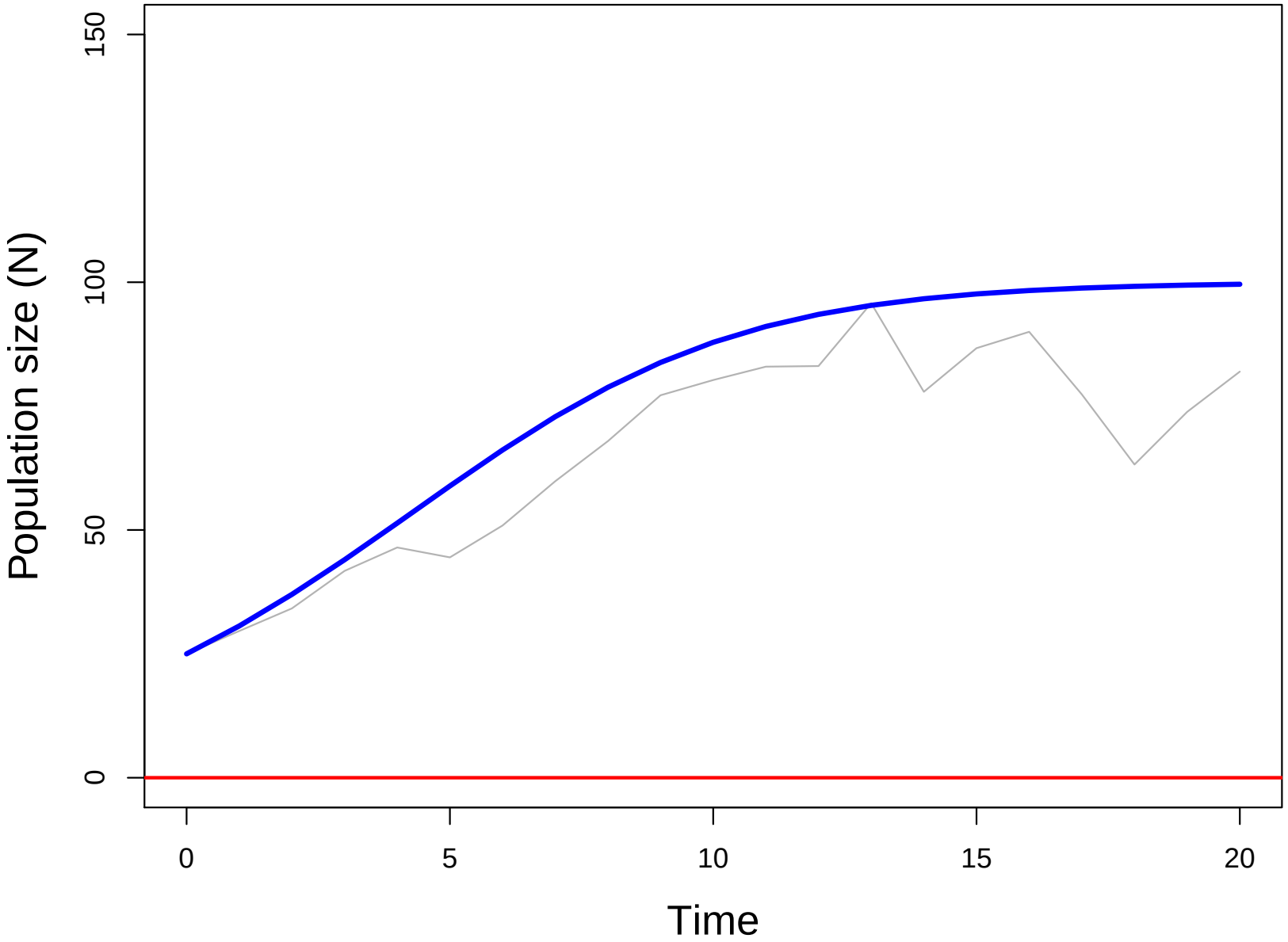

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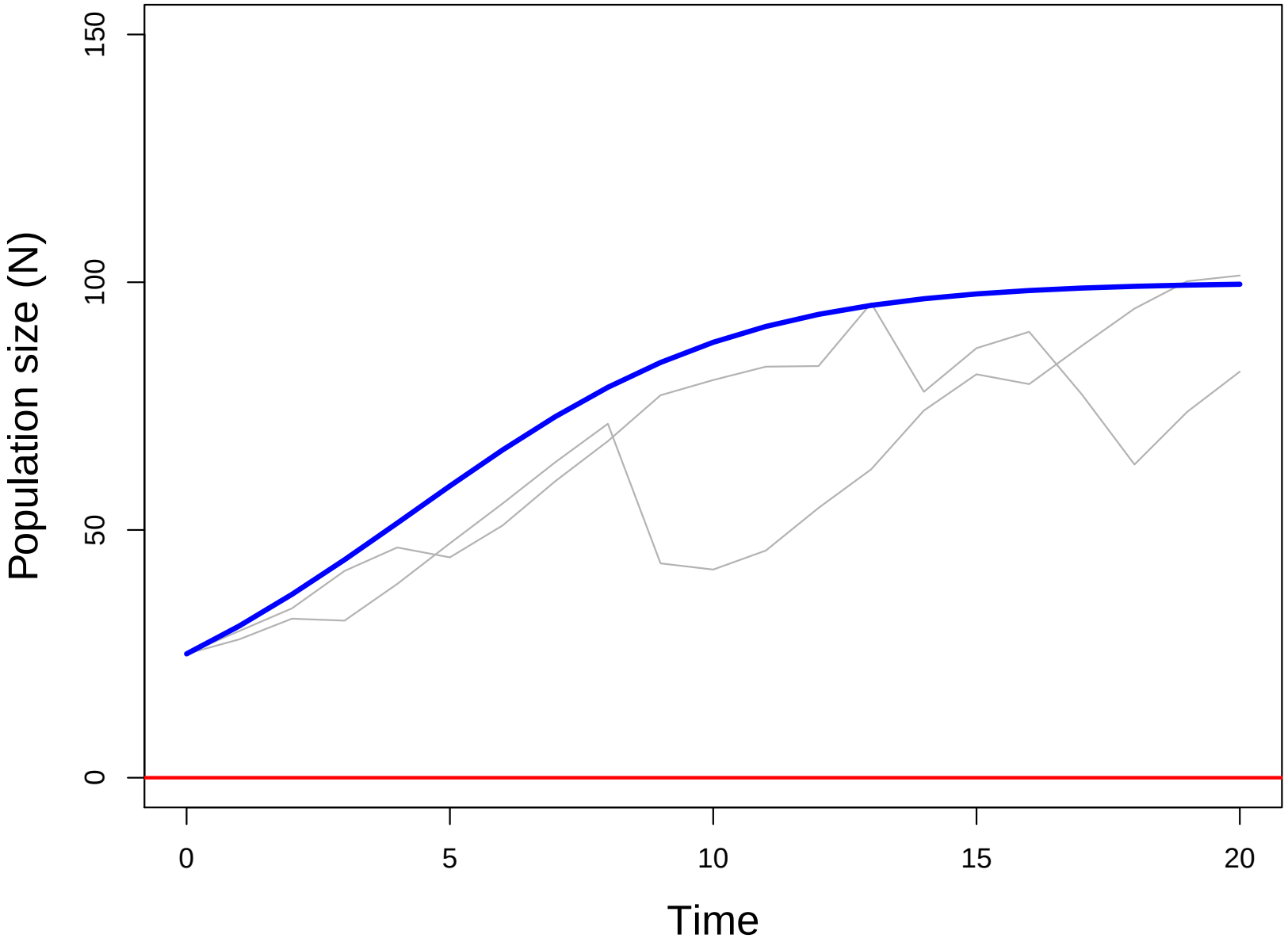

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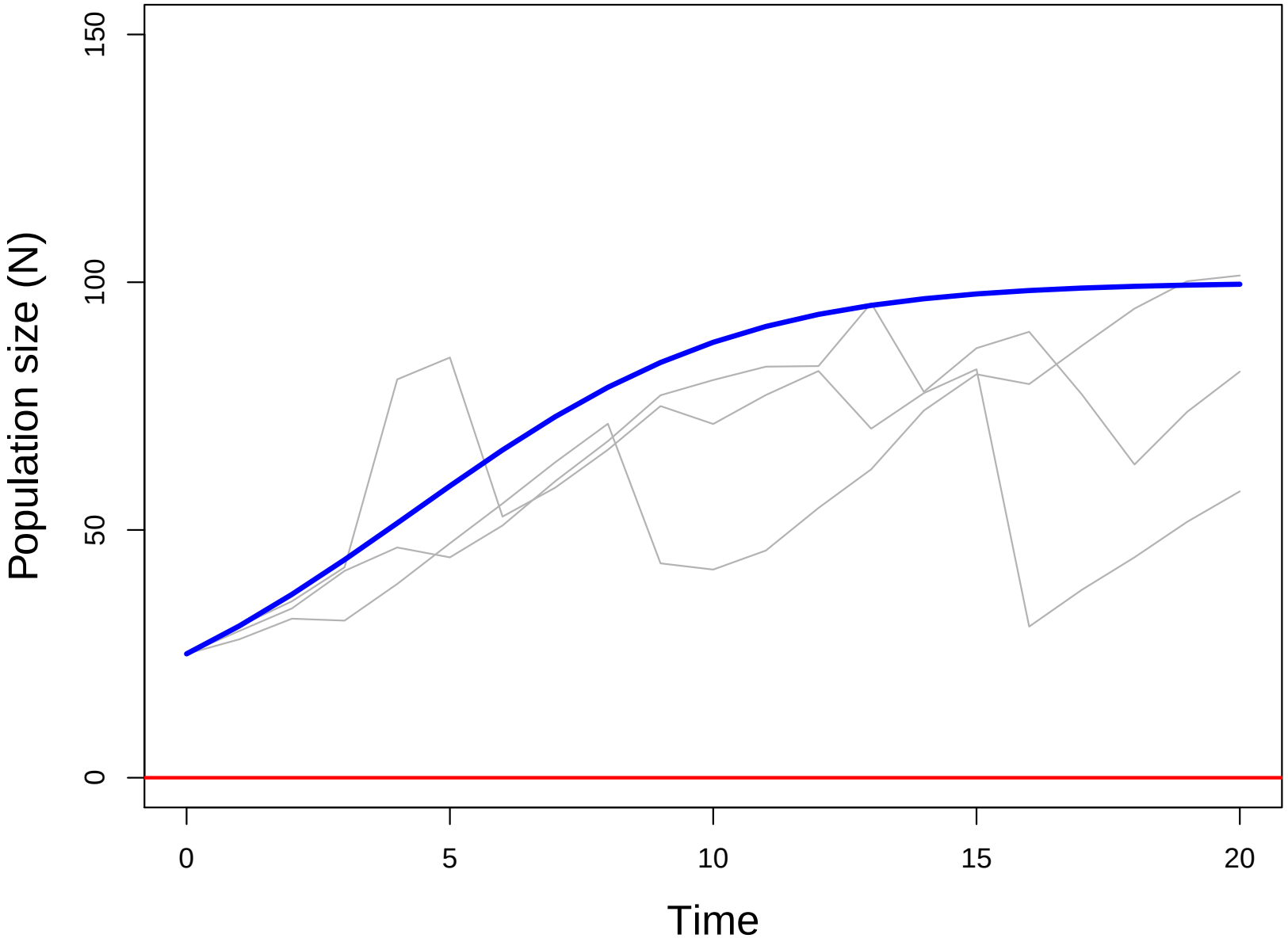

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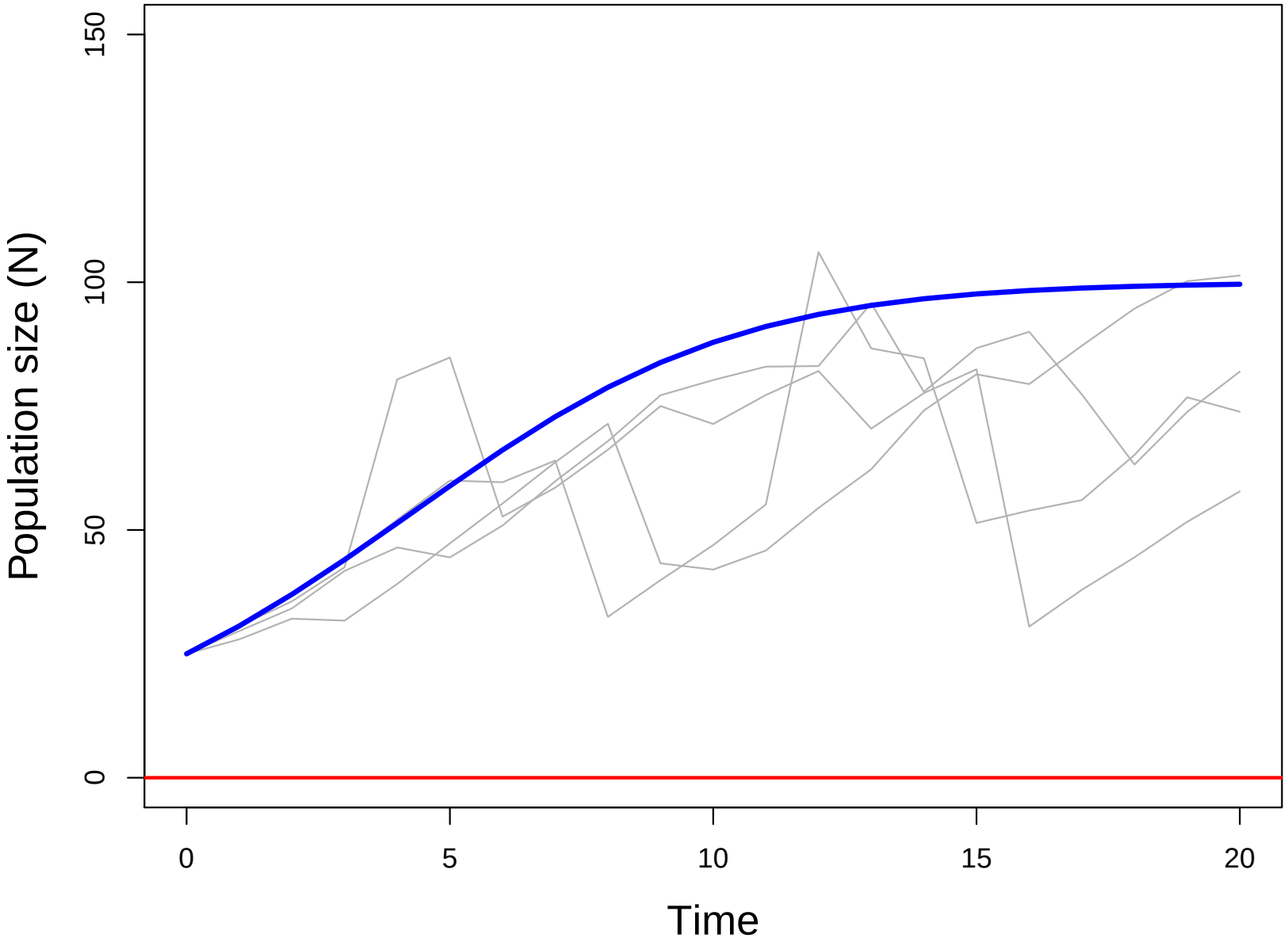

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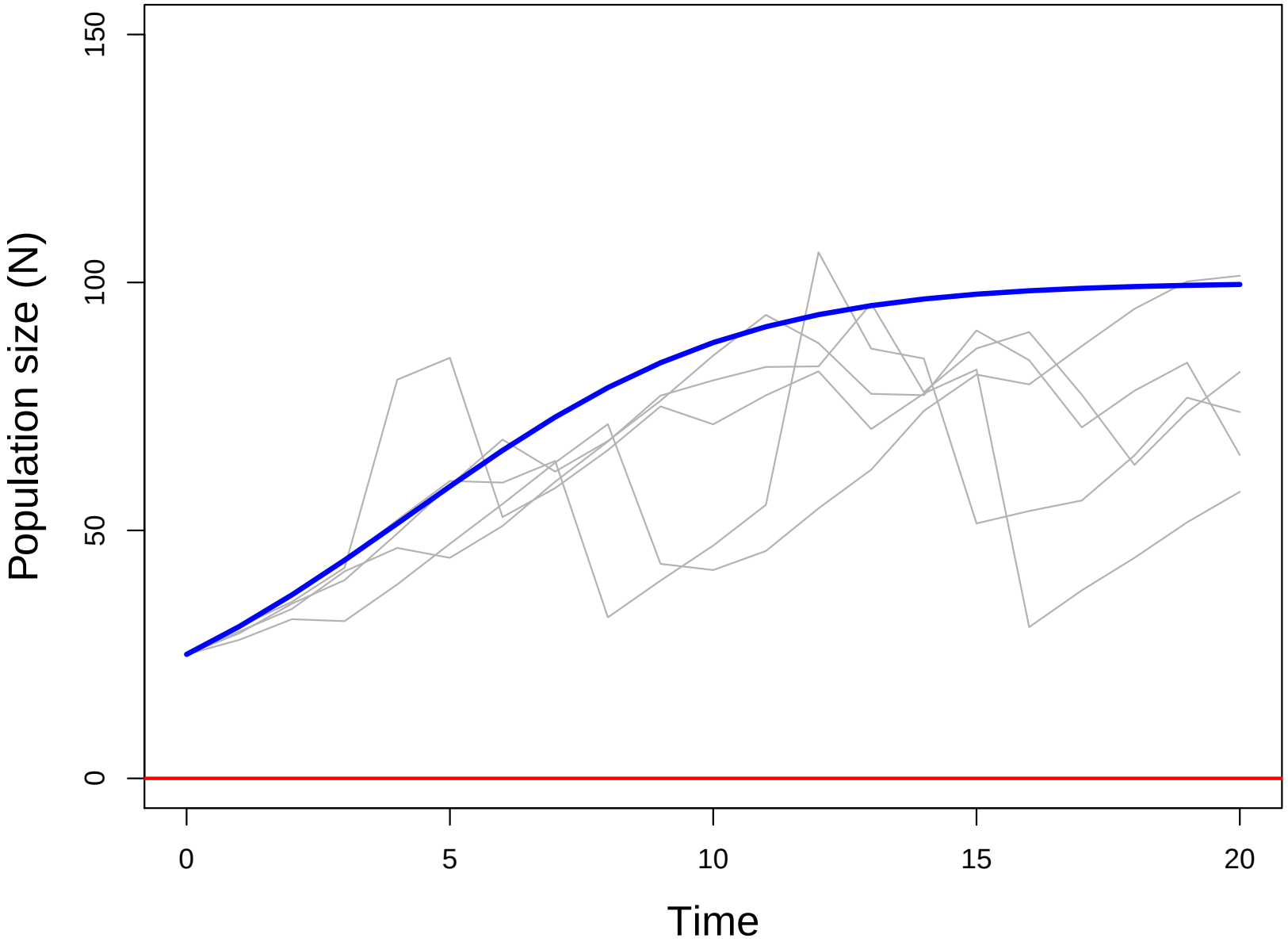

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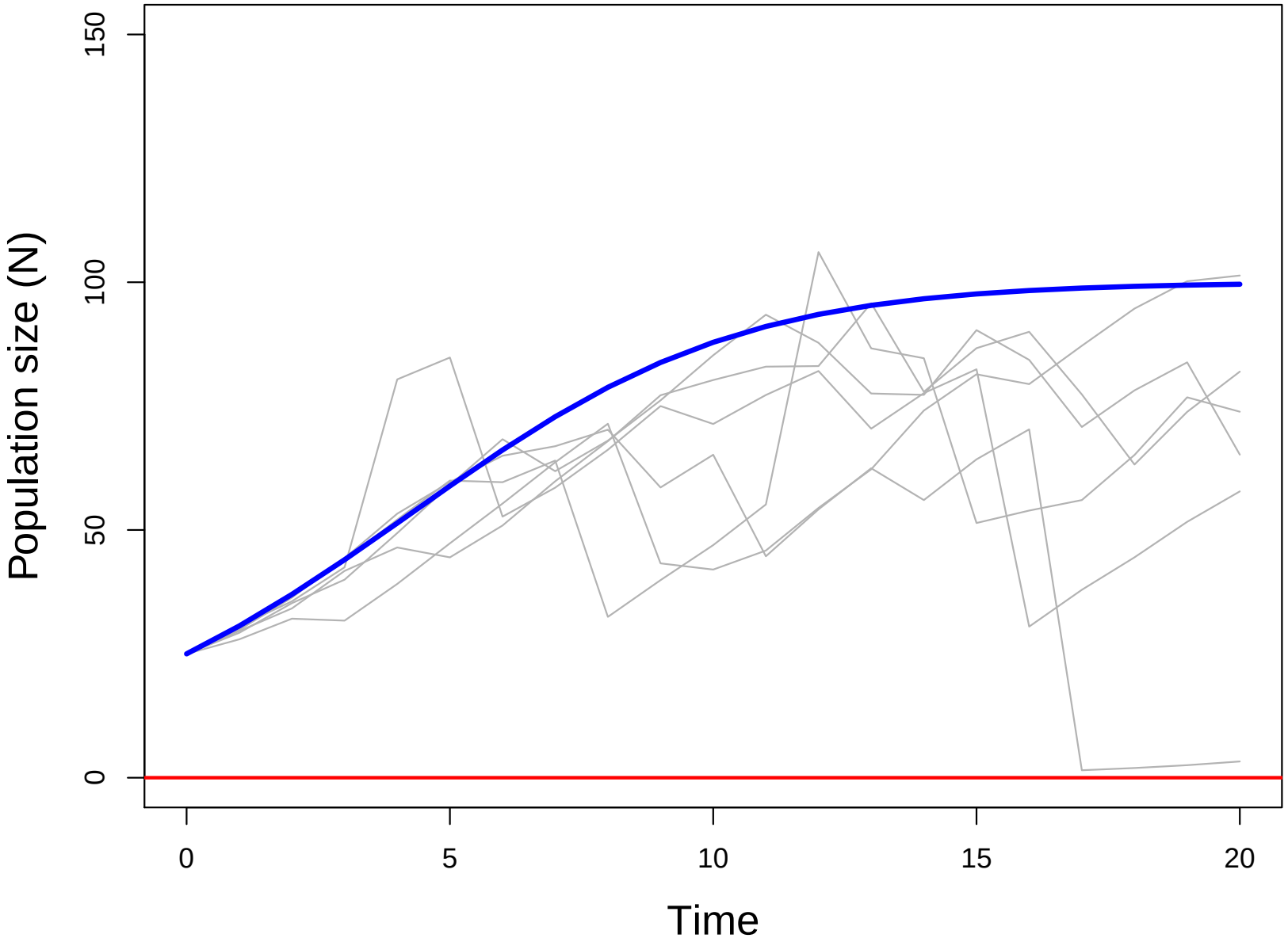

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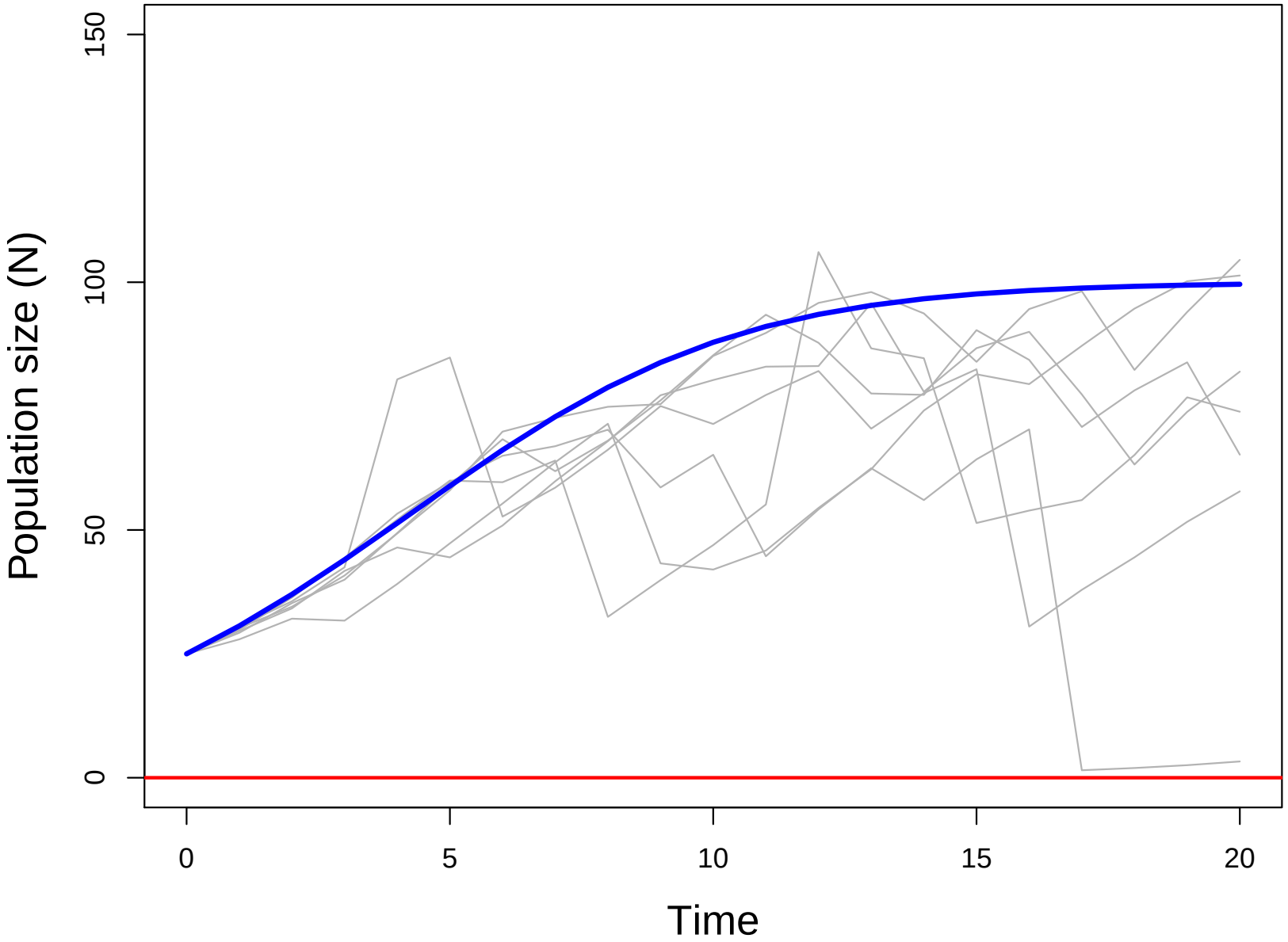

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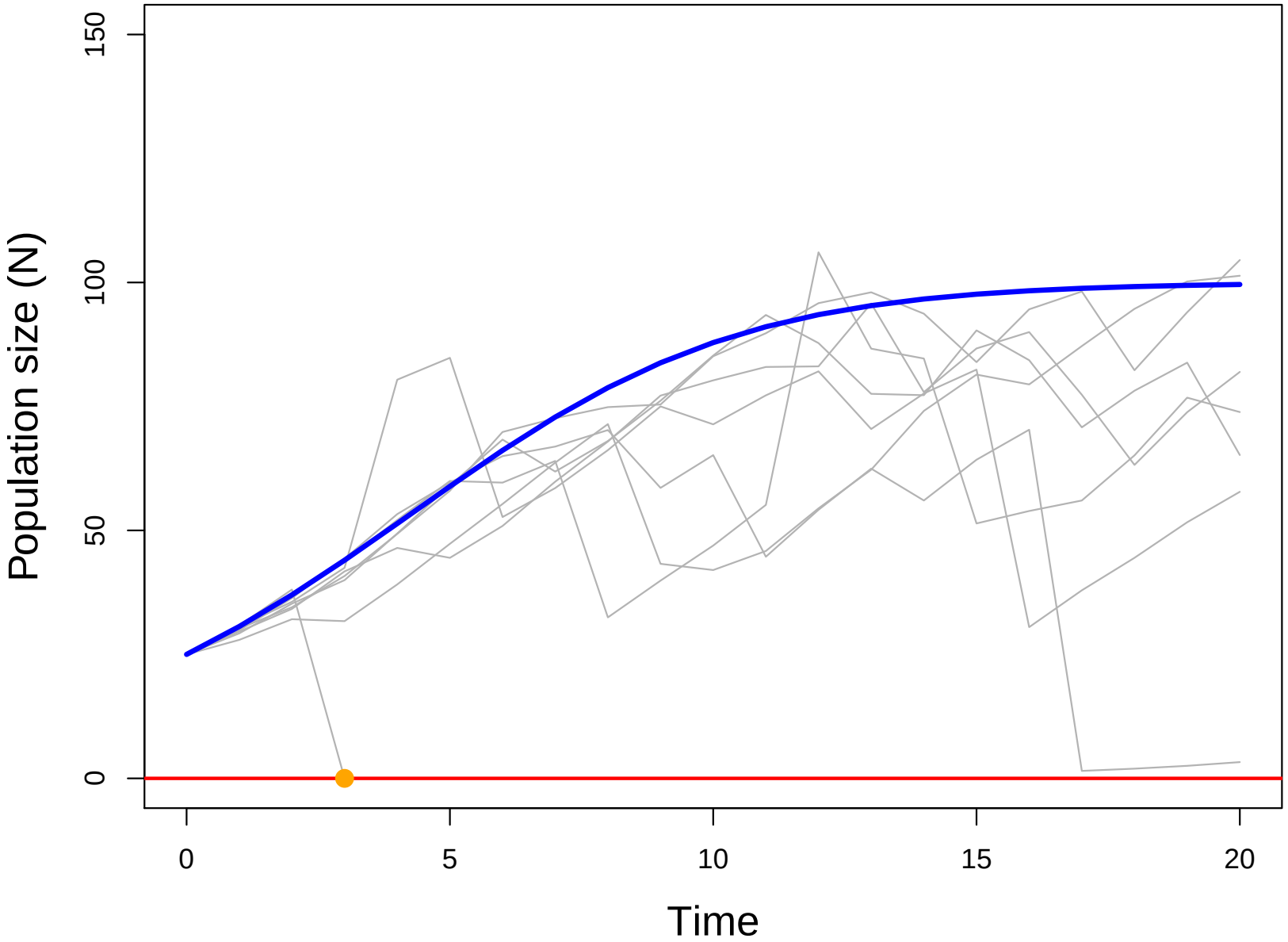

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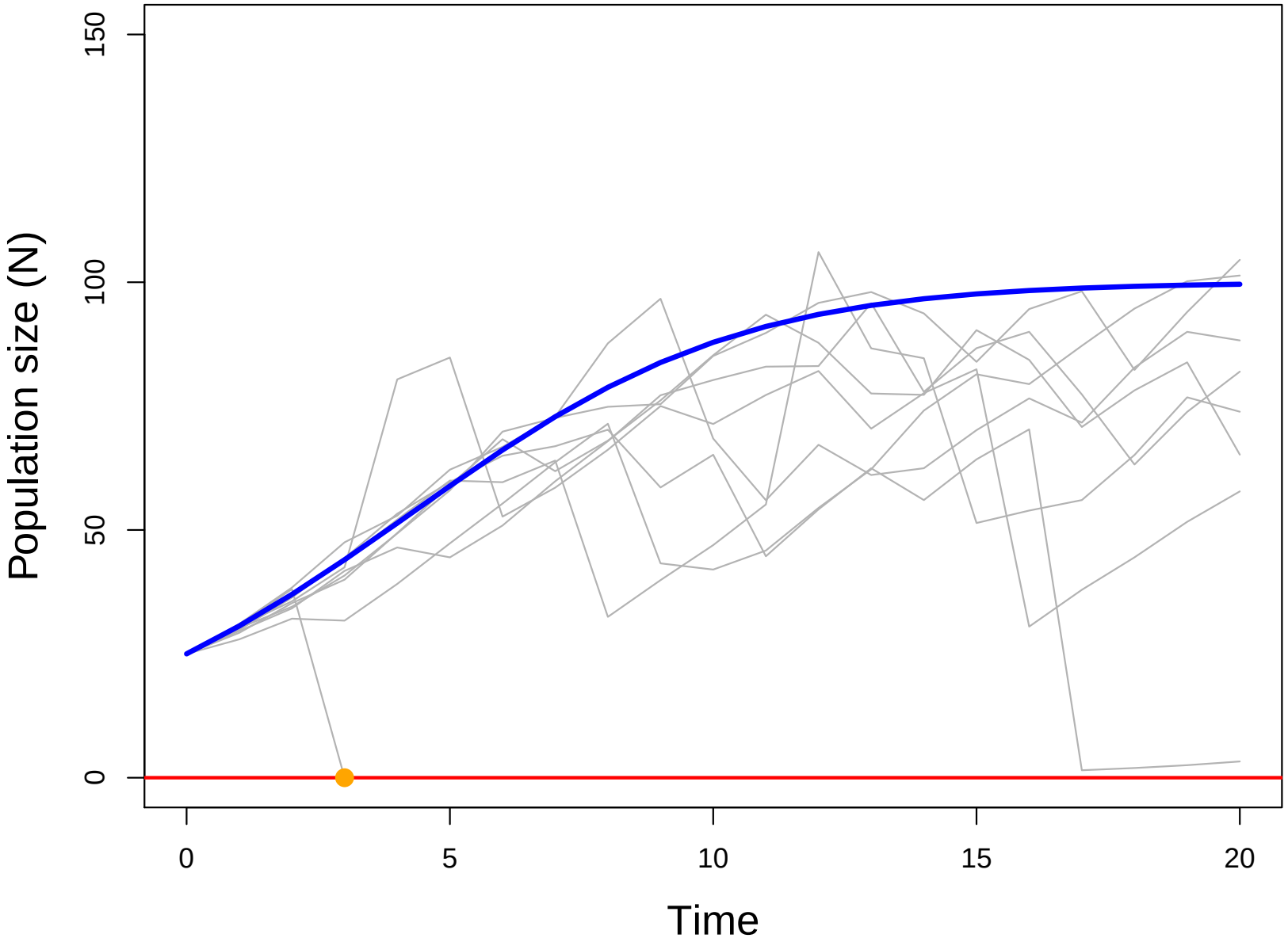

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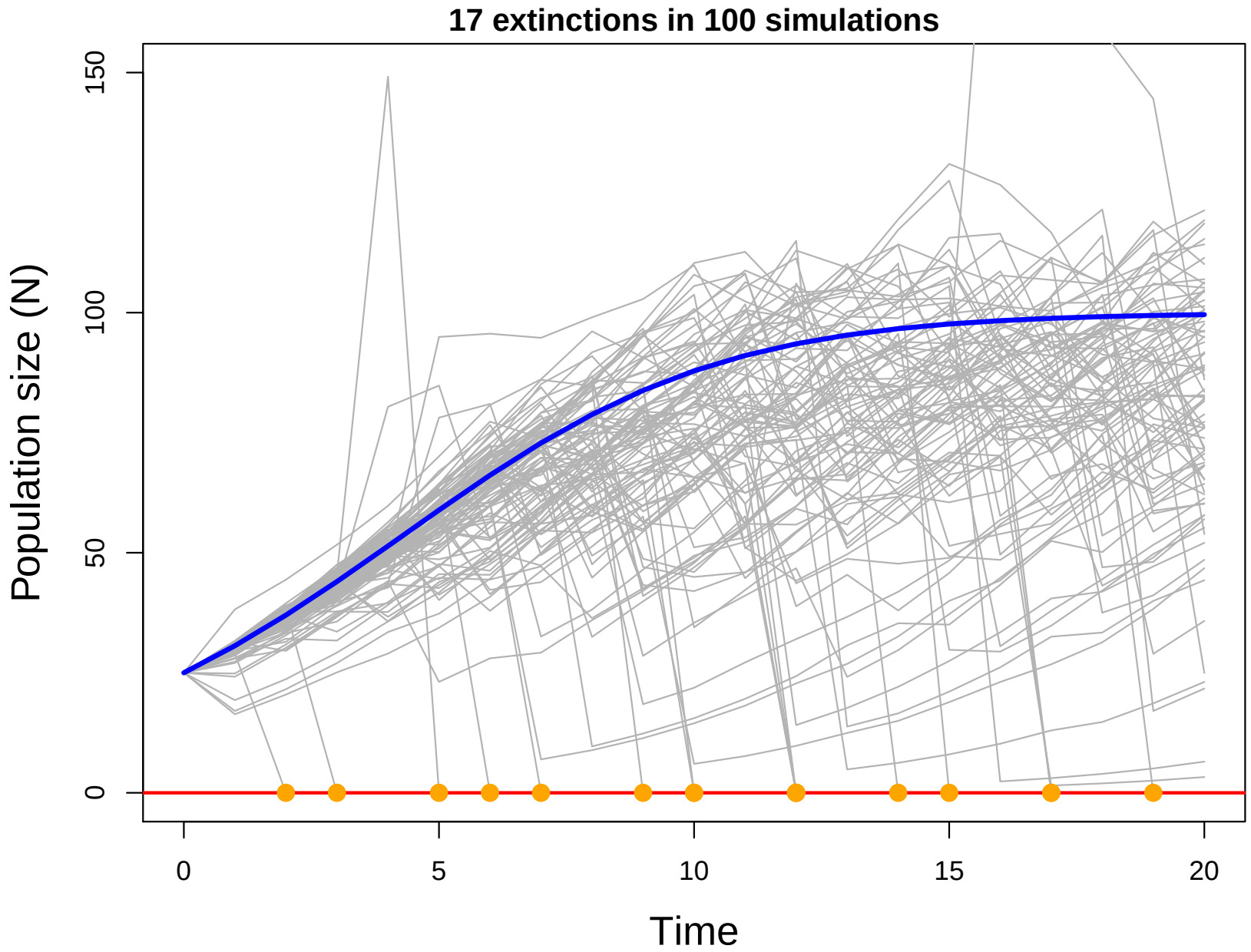

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Allee effects can greatly increase extinction risk for small populations

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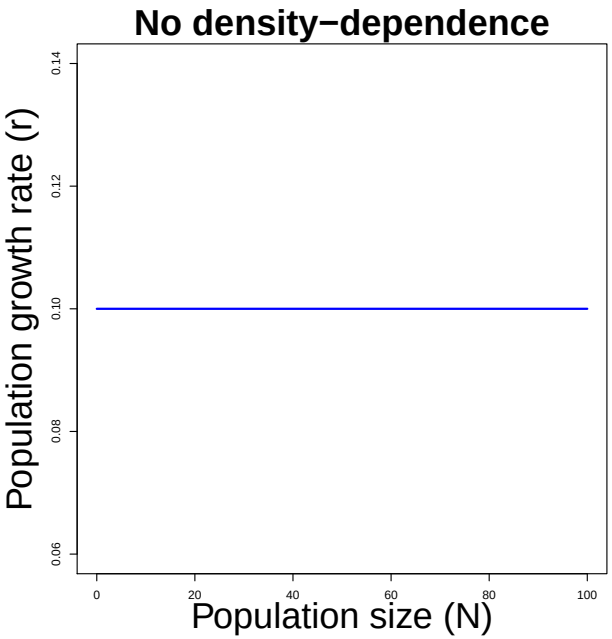


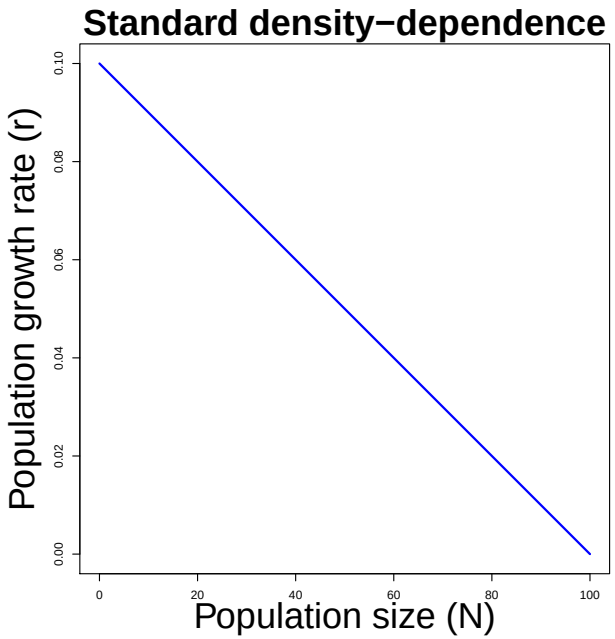


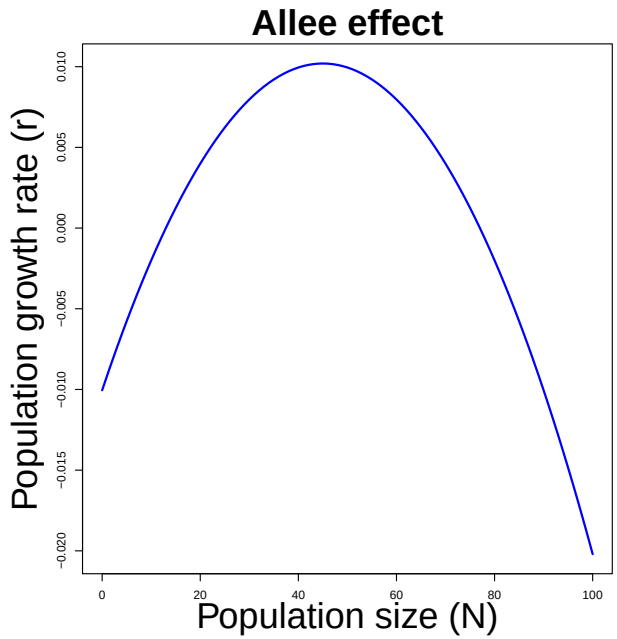

# Summary

Humans have increased extinction rates dramatically.

Models allow us to predict time to extinction and extinction risk.

Models can be used to assess effects of management actions on extinction risk.

Read pages 27–31 in Conroy and Carroll