Evaluation of lake sturgeon stocking strategies using an individual-based model

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Overview

- Stocking even small numbers can greatly improve population success
- Greater number of parents reduces inbreeding
- Stocking strategies should vary depending upon population size

Introduction

- Once abundant in Great Lakes Basin
- Reduced to 1% of historic levels
- Restoration Plans
- Stocking is a component of many plans

Concerns

- If habitat is limited, stocking may be only feasible method for maintaining abundance
- However, concerns exist about how stocking practices may influence genetic integrity
- Studies suggest that genetic integrity has not yet been compromised

Objectives

- Determine stocking strategies for lake sturgeon that maintain population growth across a range of initial population sizes

- Determine implications of stocking strategies on the accrual of inbreeding

Methods

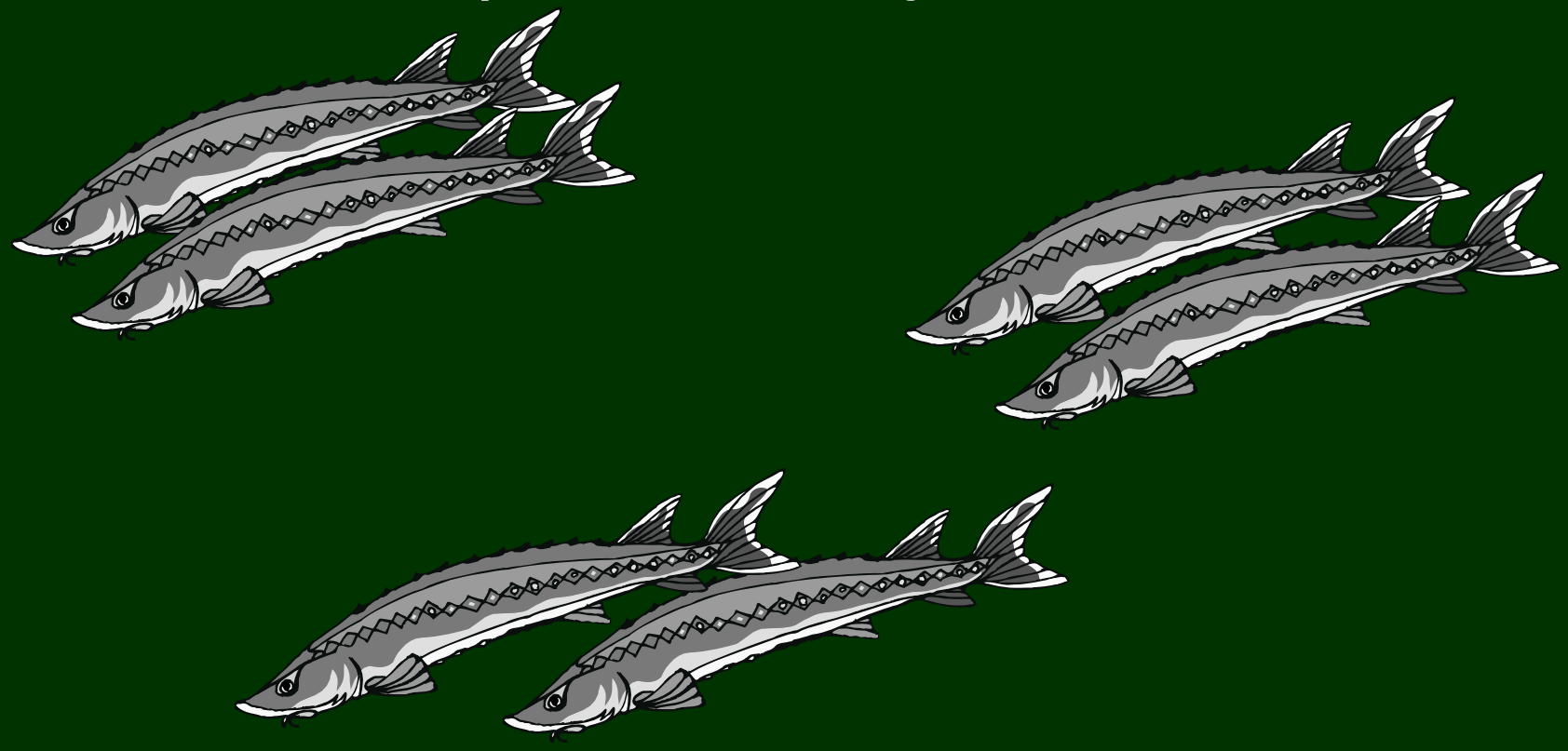
- Individual based modeling approach
  - Southern bluefin tuna
  - White sturgeon
- Represents demographics and genetics of lake sturgeon

Methods

- Age specific mortality rates

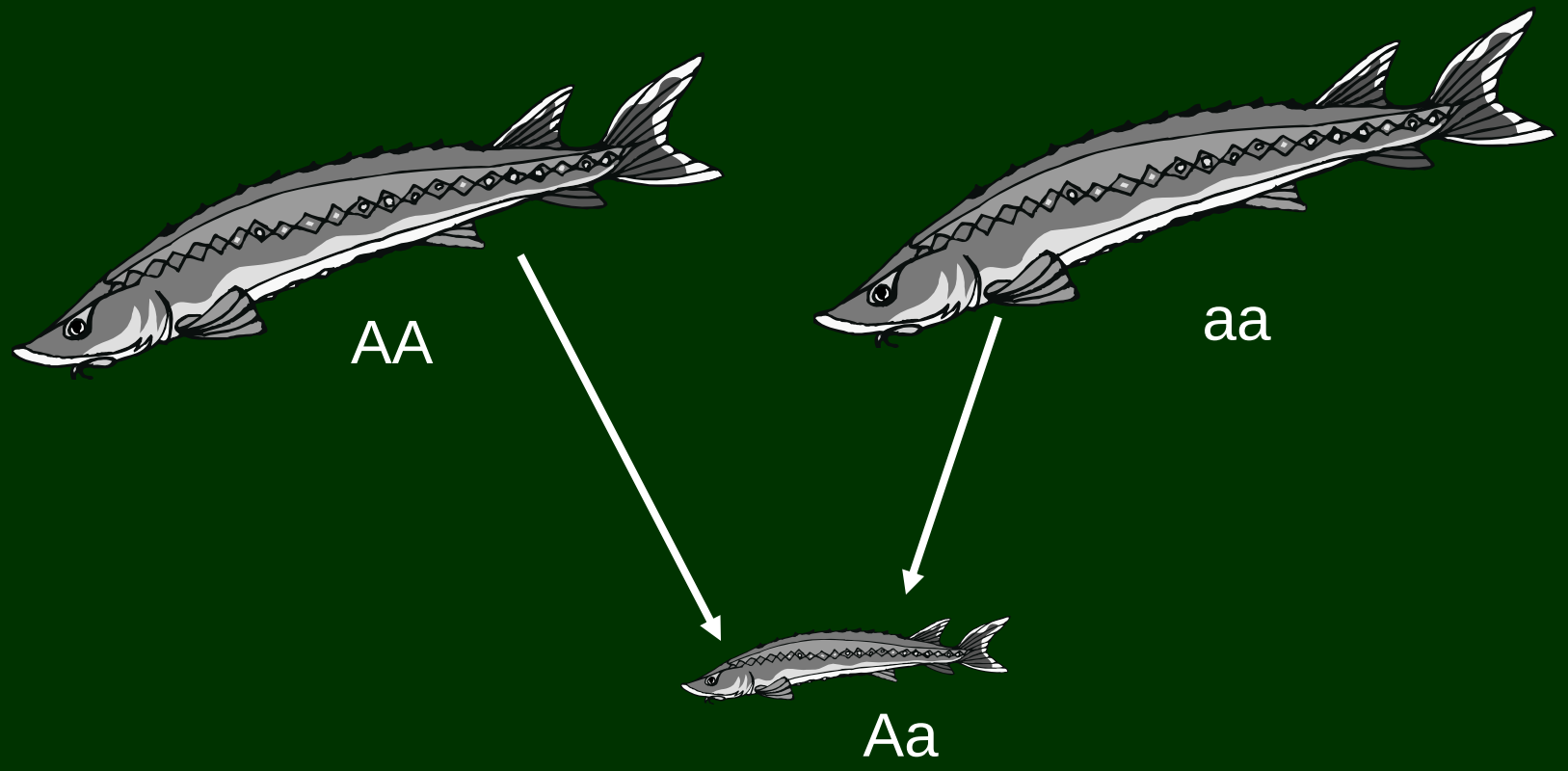
Methods

- Polygamous mating system mimicking natural reproductive cycle



Methods

- Markers have Mendelian modes of inheritance



Methods

- Inbreeding coefficient was tracked using INBREED procedure in SAS:

$$f_x = \sum_{i-1}^{P} \left[\frac{1}{2} \right]^n (1 + f_A)$$

Model Parameters

Age at first breeding(years)	Males: 15 Females: 20
Probability of spawning	Males: 0.50 Females: 0.33
YOY Mortality	Varied
Adult Mortality	5% per year
Number of batches per spawning season per adult	Negative exponential with mean=2.5 and std=1.9
Number of young produced per batch	Negative exponential with mean=0.55 and std=0.9

Methods

- Range of initial population sizes
- Varied YOY mortality rate
- Tested stocking strategies
- Looked at:

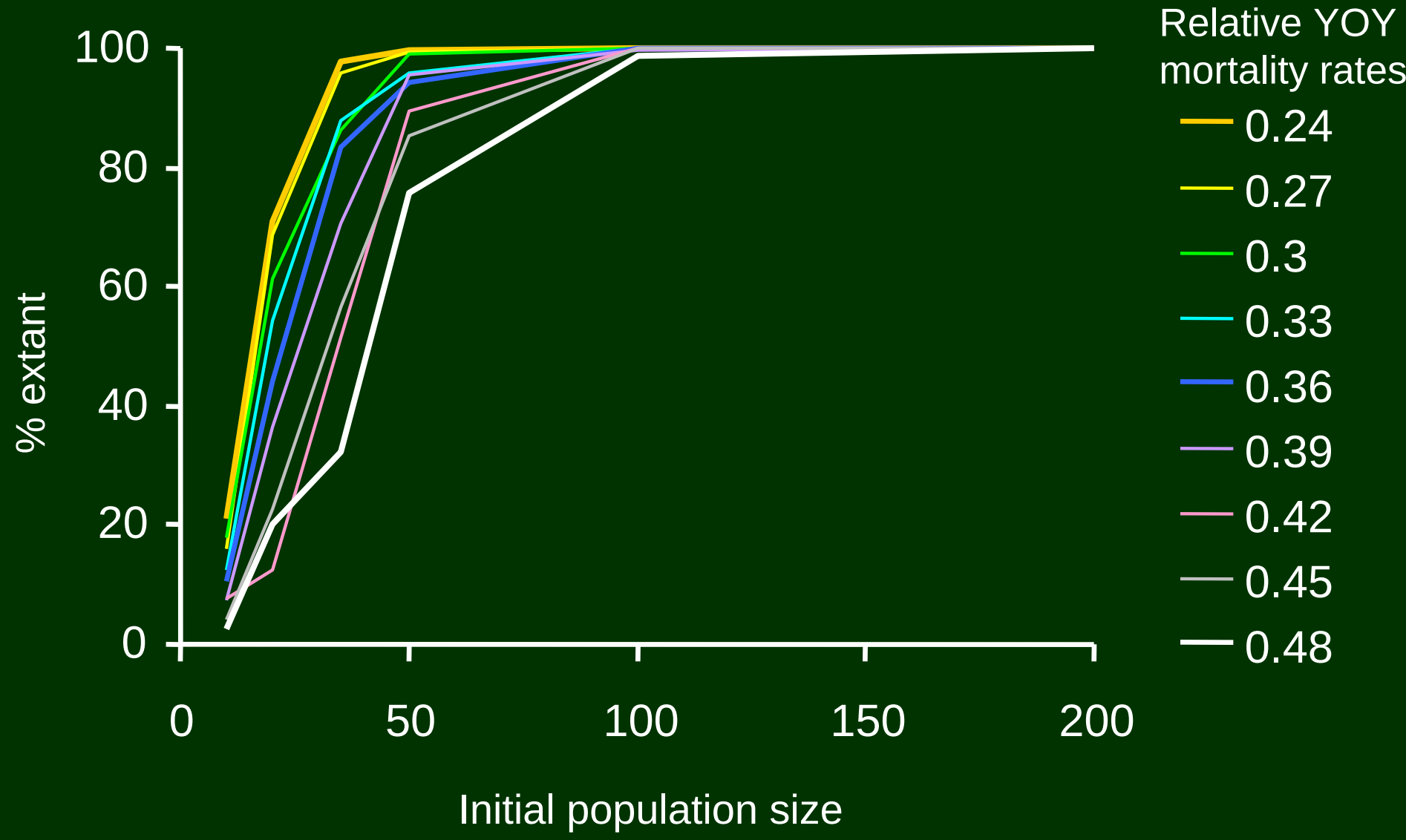
  -% extant

  -% increasing population

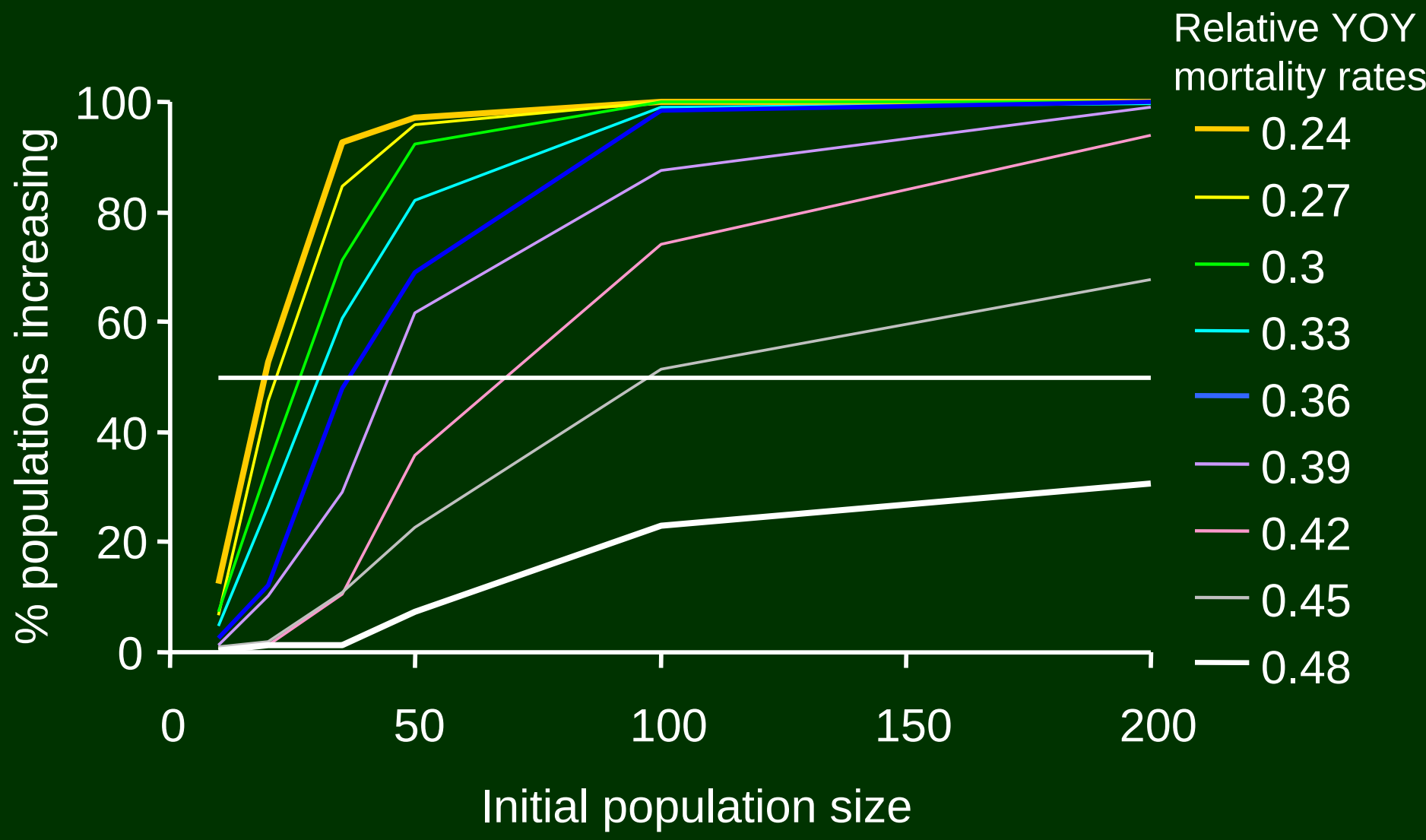
  -mean inbreeding

  -% genes retained

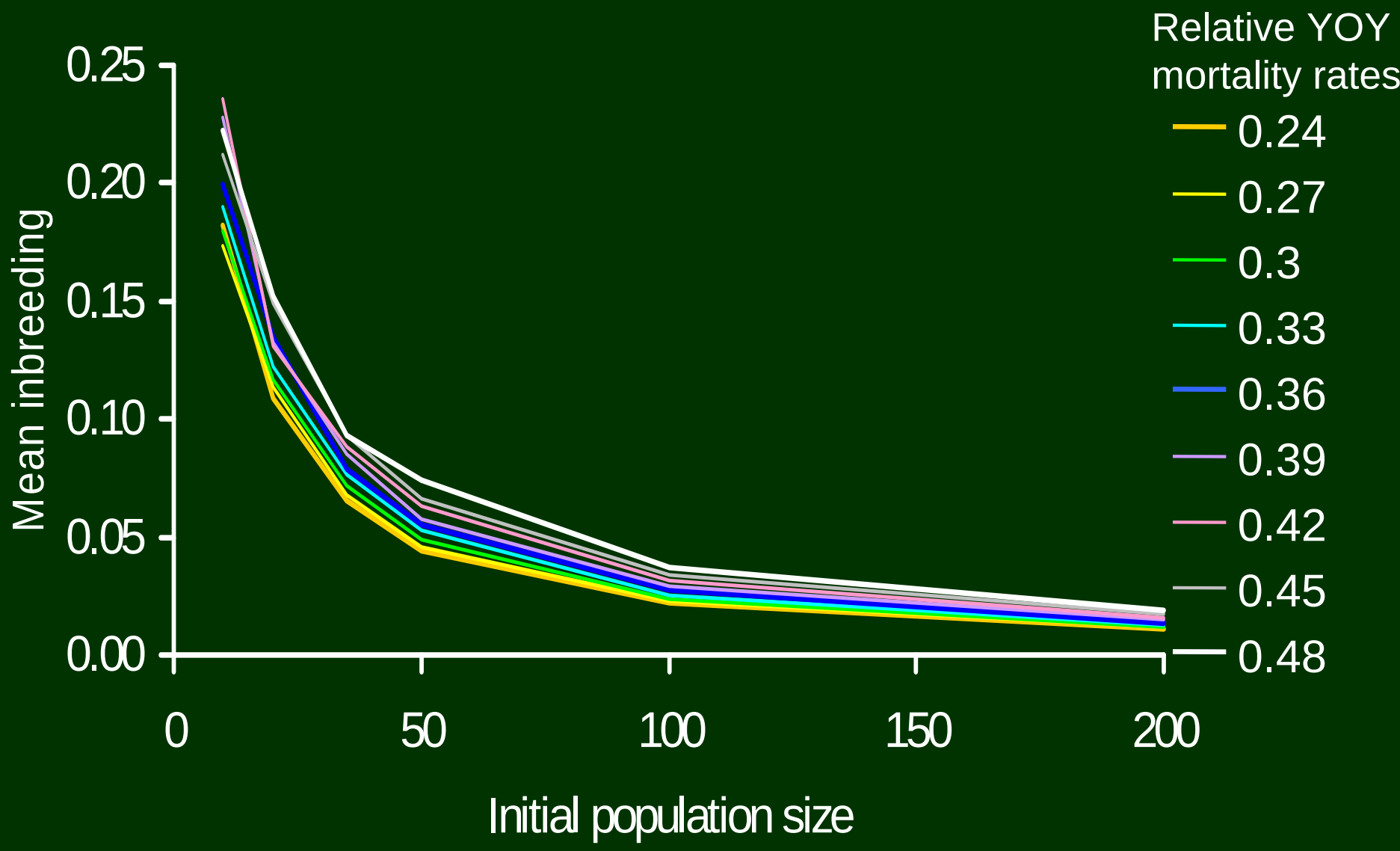
Extant populations



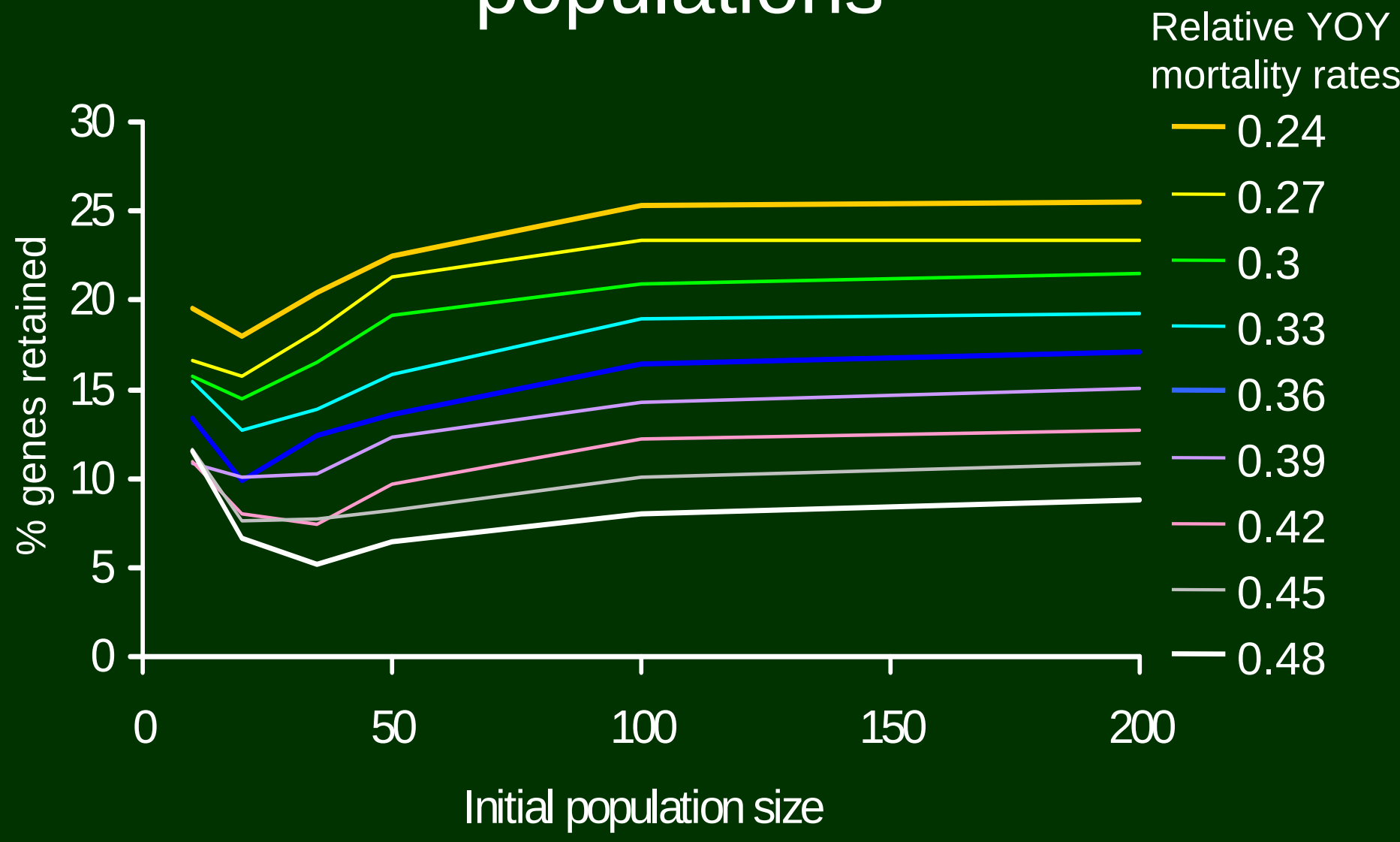
Percent of increasing populations



Inbreeding for extant populations



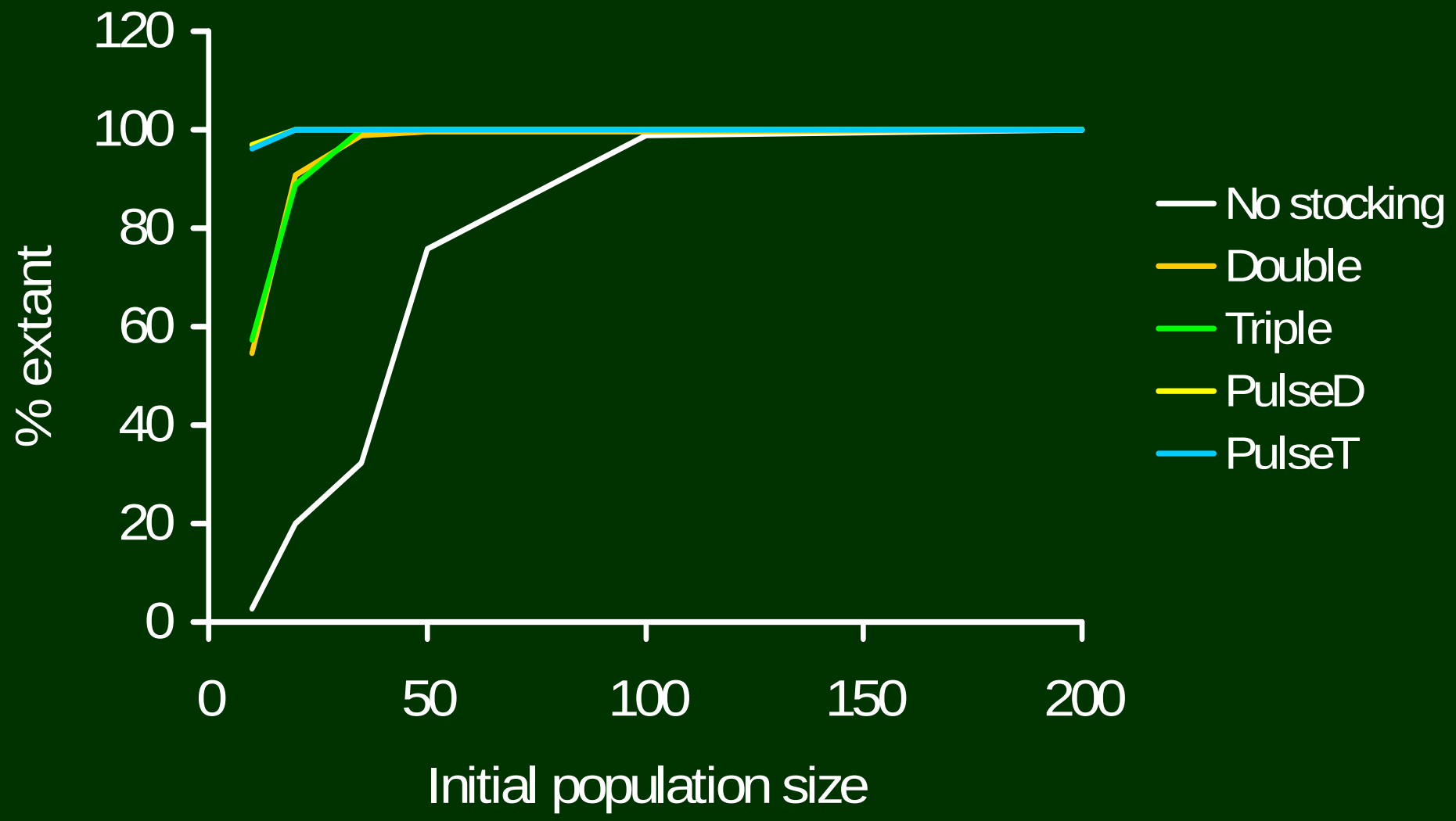
Retention of genes in extant populations



Stocking Strategies

- Stocking strategies:
  - Double
  - Triple
  - PulseD
  - PulseT
- All stocking strategies tested at a YOY mortality=0.48 – basically a situation where populations would tend to decline without intervention

Extant populations



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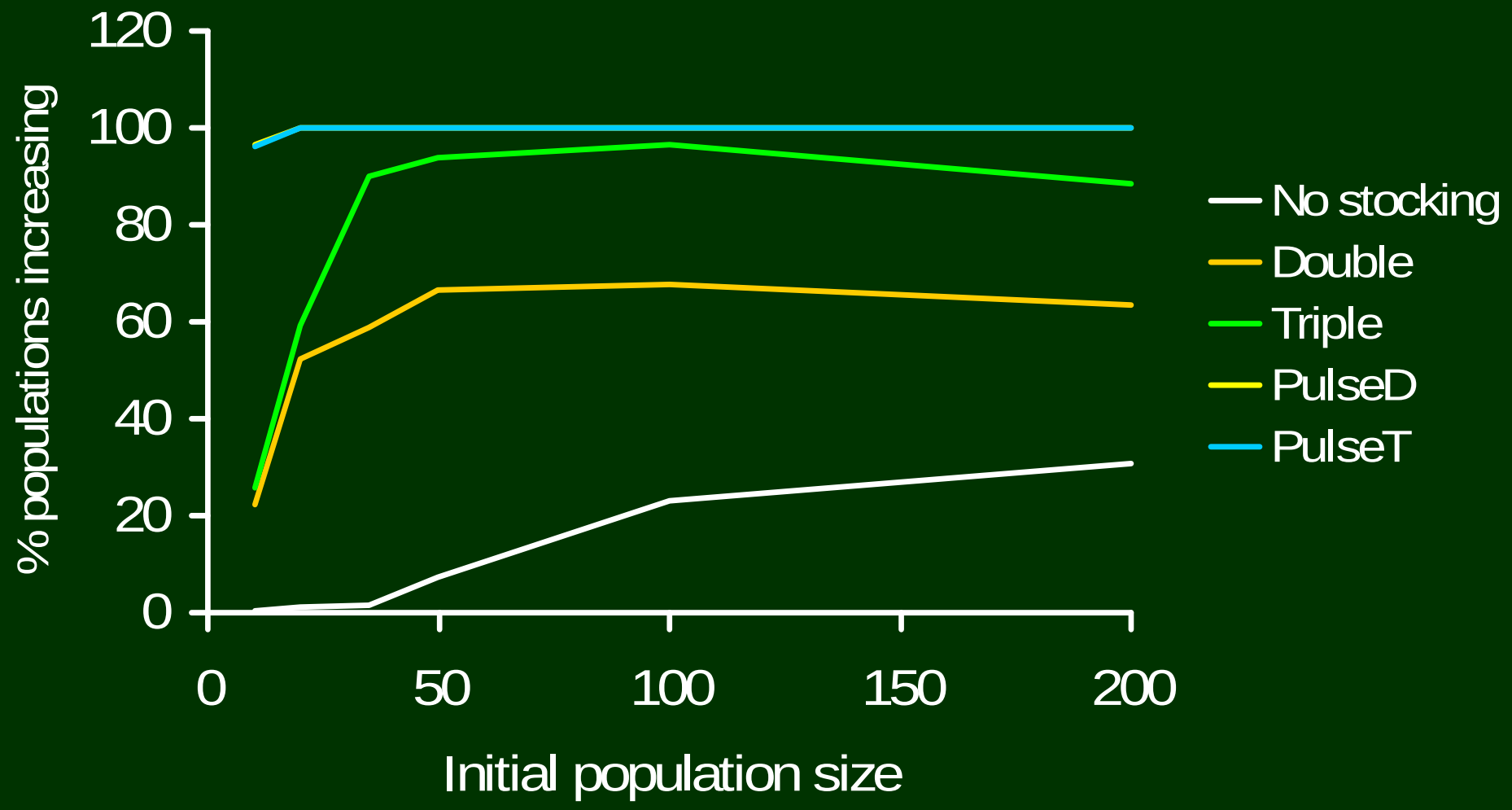

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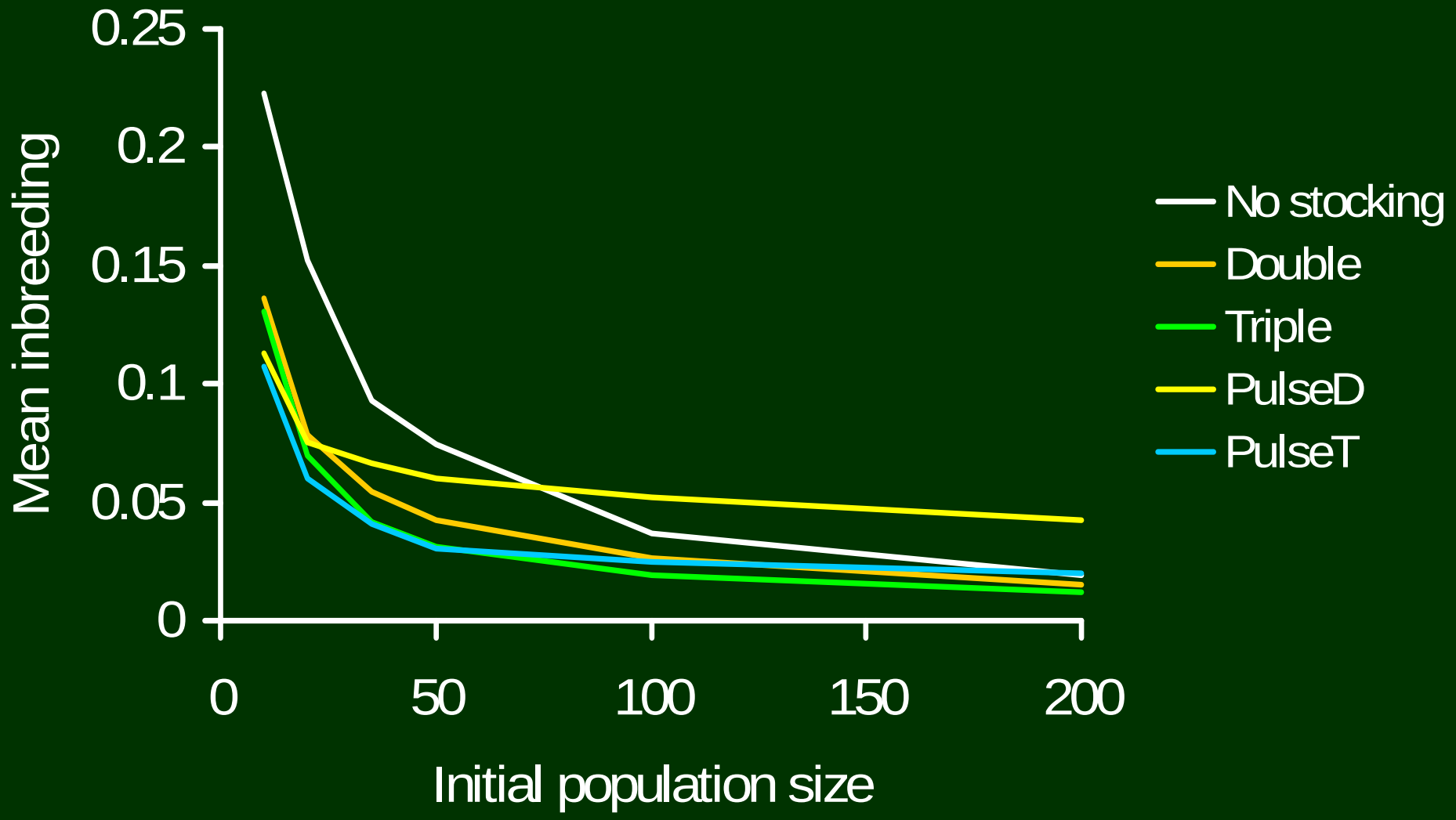

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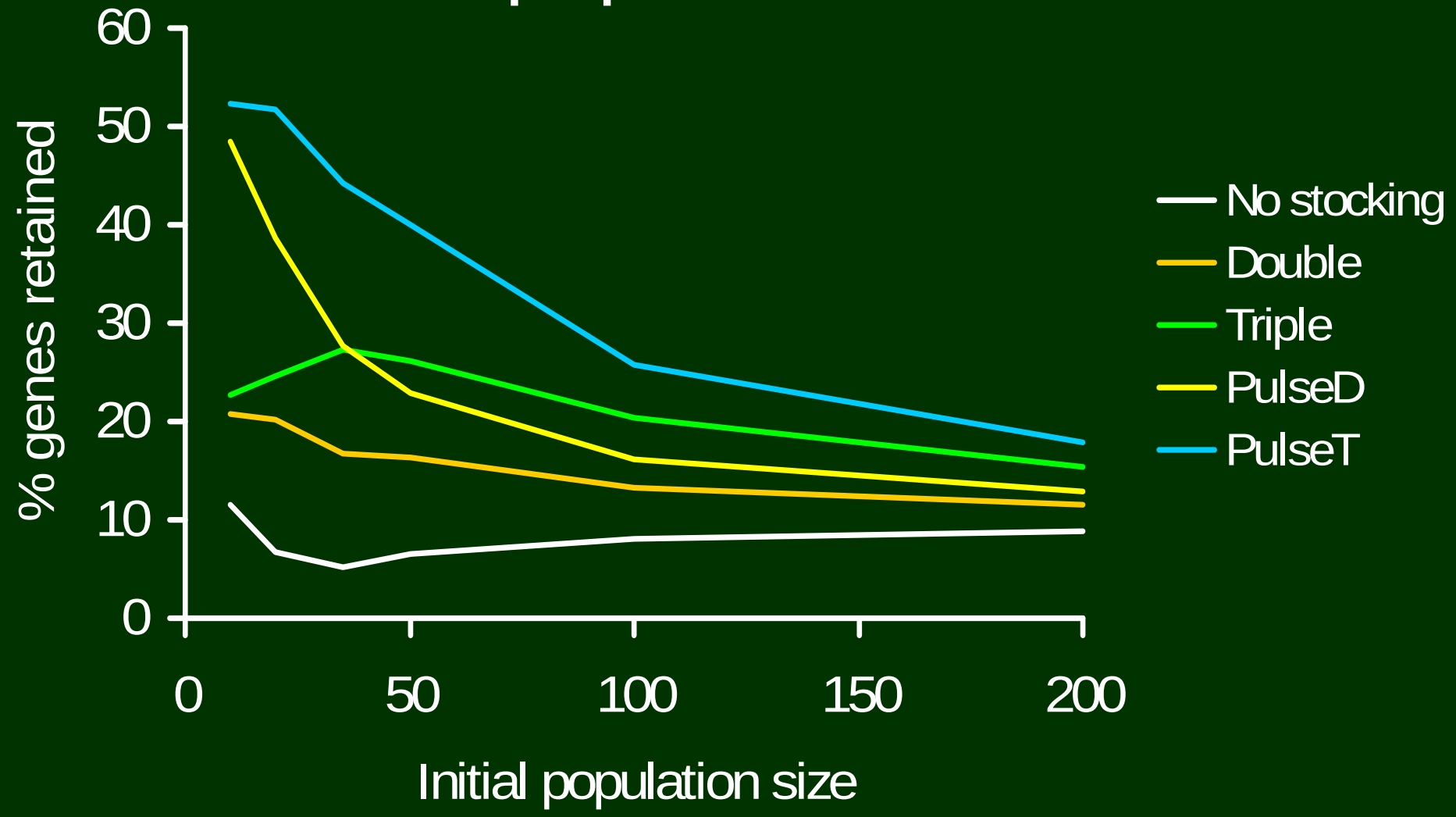

Implications

- Stocking even small numbers can improve population success
- Greater number of parents reduces inbreeding
- Stocking strategies should reflect individual population needs
- Stocking strategies should differ between small and large populations

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Great Lakes Fishery Trust

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Questions?