

Risks and benefits of salmon hatcheries



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Why is salmon biodiversity important?

Cultural, economic, spiritual reasons

Loss of population diversity limits evolutionary potential of the species

Life history diversity

- Promotes efficient use of natural resources
- Buffers productivity

Keystone species in terrestrial (and marine) ecosystems

Risks and benefits are context-specific

Goal 1: Use captive propagation to improve the status of wild populations (e.g., Redfish Lake sockeye; California condor).

Balance risks and benefits to *wild populations*

Goal 2: Use captive propagation to boost harvest

Balance risks to *wild populations* against benefits to *society*

Types of benefits to be considered

Goal 1

- Natural populations

Goal 2

- Natural populations
- Harvest
- Mitigation
- Treaty obligations
- Public education
- Jobs

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This study is focused on the state-of-the-science of novel intervention strategies to identify and compare potential ecological risks and benefits.

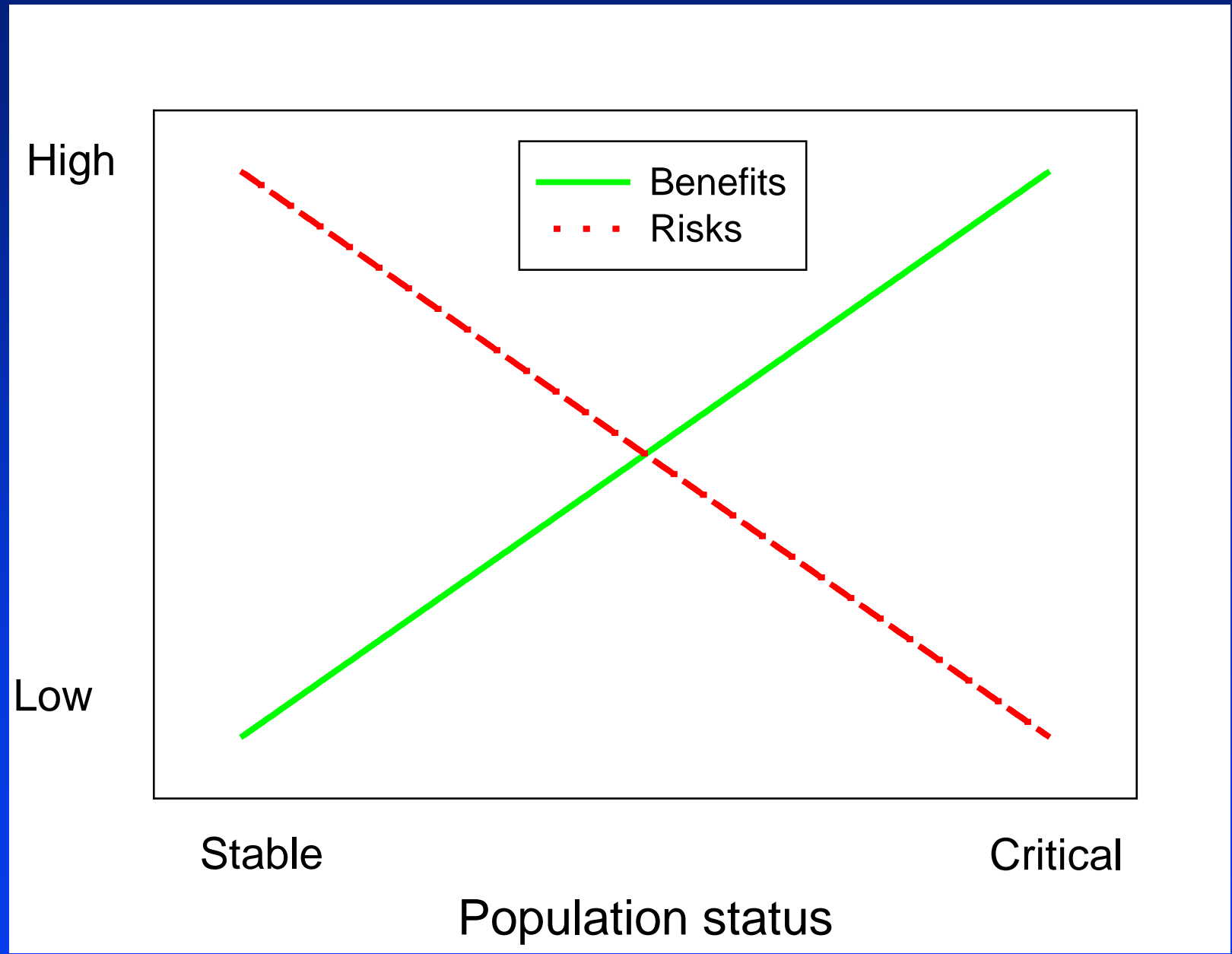
Although these interventions also raise societal, policy, legal, and likely ethical implications for decision making, these considerations are beyond the scope of this review.

Potential benefits of propagation for natural populations

1. Reduce short-term extinction risk*
2. Reseed vacant habitat*
3. Speed recovery

* Empirical evidence exists

Risks and benefits of supplementation

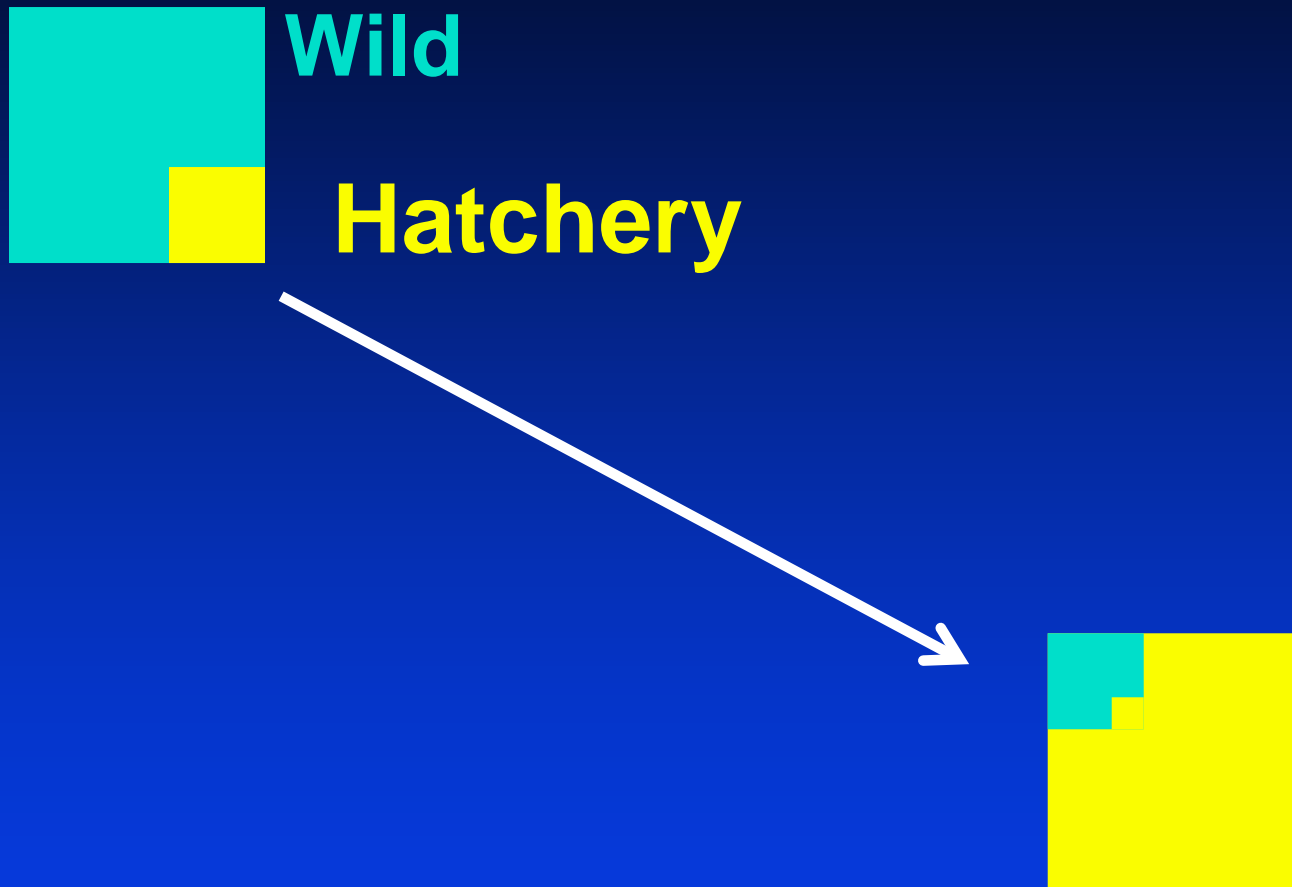


Genetic risks of captive propagation for natural populations

1. Loss of diversity within populations
2. Loss of diversity among populations
3. Loss of fitness

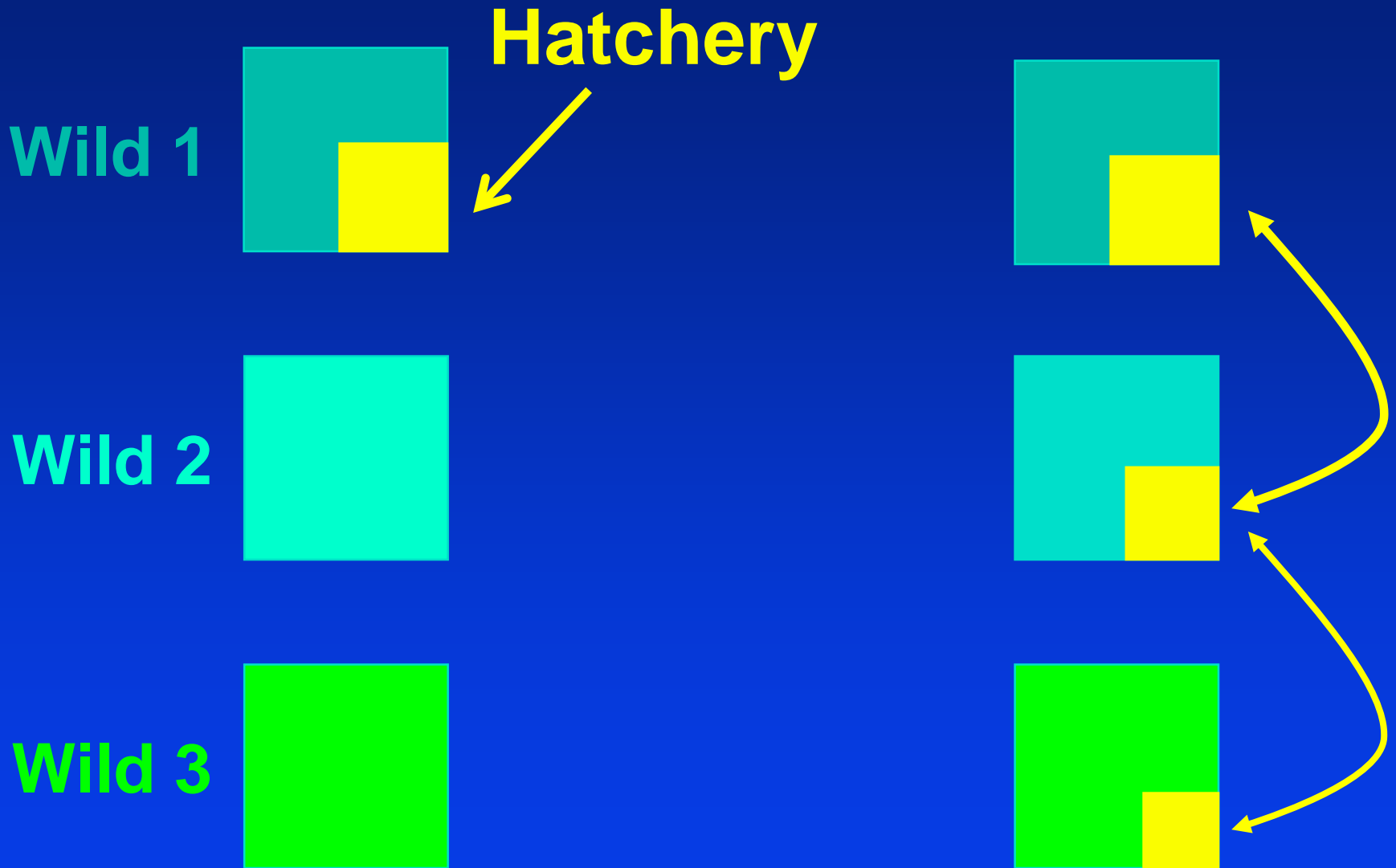
Ecological effects

Diversity within populations



Ryman-Laikre effect

Diversity among populations



Fitness and local adaptation

Stock transfers of *O. nerka*:

	<u>Percent successful</u>
Kokanee	90
Sockeye	<5

Wood 1995

Kokanee are ecologically exchangeable
Sockeye are not

Fitness

Hatchery vs. wild environments

Similarities

Water

Differences

Food

Substrate

Density

Temperature

Flow regime

Competitors

Predators

Objective of artificial propagation is to create a benign environment that allows high survival through early life stages

Theory and empirical data agree:

This creates strong selection for traits that perform well in captivity (domestication)

This increases fitness in captivity but reduces fitness in the wild

Fitness: Some Key Points

Effects are cumulative across generations

Few programs have a scheduled date for termination

Tradeoffs in minimizing risks of supplementation

- Broodstock collection
- Release strategies
- Program scale
- Population mixing
- Marking

It is impossible to eliminate all risks

What shapes do risk and benefit curves take?

