Predicting and Monitoring the Effects of a Habitat Restoration Project on Metapopulation Viability of Two Federally Listed Species in a Tributary of the Columbia River

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ECOANALYSTS, INC.

- EcoAnalysts
  - Leading algal and benthic macroinvertebrate taxonomy labs in U.S.
    - Freshwater, estuary, and marine
  - Primary and secondary production studies
  - Food web studies
  - Biodiversity and IBI analysis and development
  - MPVAs

- This presentation part of a nine year Idaho Power Company- FERC relicensing project on mid-Snake River

Introduction

Loss of habitat and invasive species are the leading causes of extinction worldwide

- Habitat restoration/reduced impact of invasive species critical for survival of many T and Es
- Most T and Es now occur as isolated or metapopulations
- Spatially explicit predictive models that incorporate metapopulation dynamics can be useful tools: pre- restoration of habitats

What is a metapopulation?

"Populations within a population"

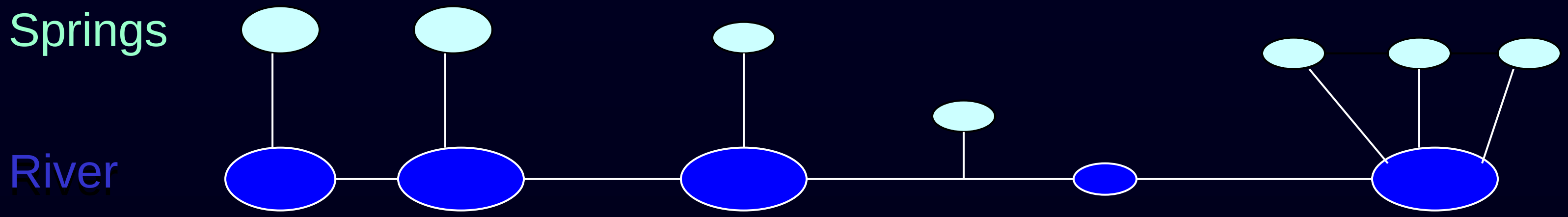
Fragmented populations

- Limited dispersal
- Anthropomorphic disturbance (populations are becoming more fragmented)

Viability mostly affected by:

- Habitat <u>environmental correlation</u>
- <u>Dispersal</u> (connectivity)

In a metapopulation, populations "blink in and out of extinction" (Hanski 1999)



There are several threatened and endangered freshwater gastropods, mid-Snake River, Idaho, a tributary of CR

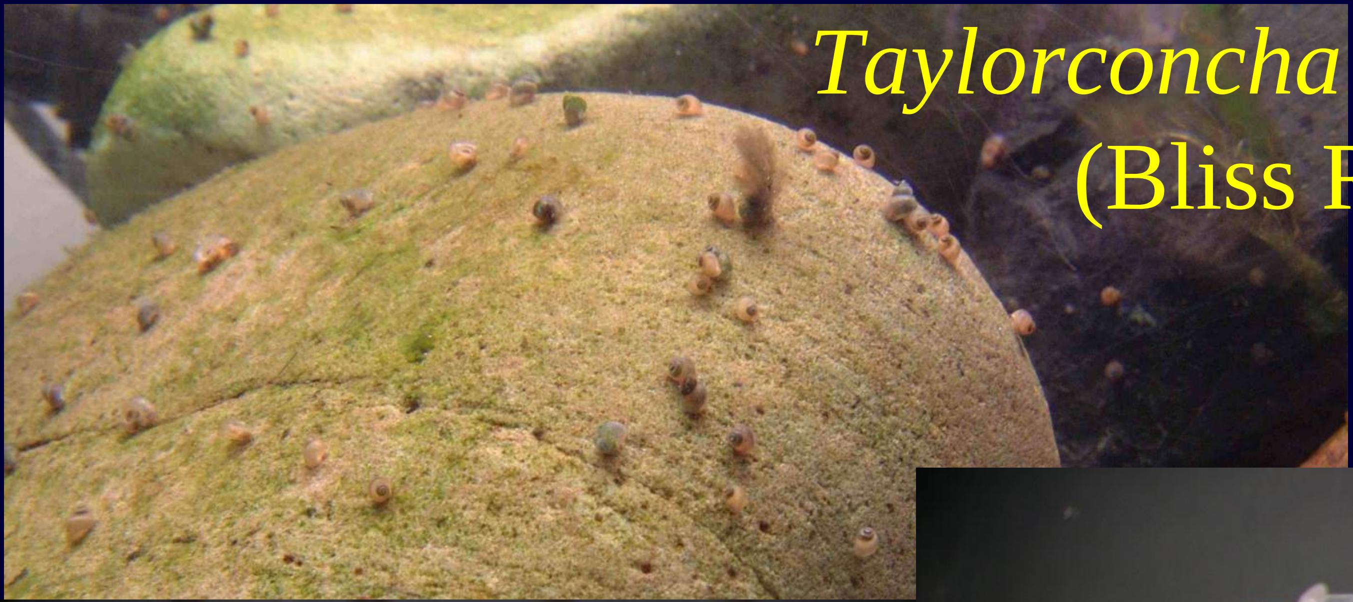
Lanx sp.
(Banbury Springs limpet)

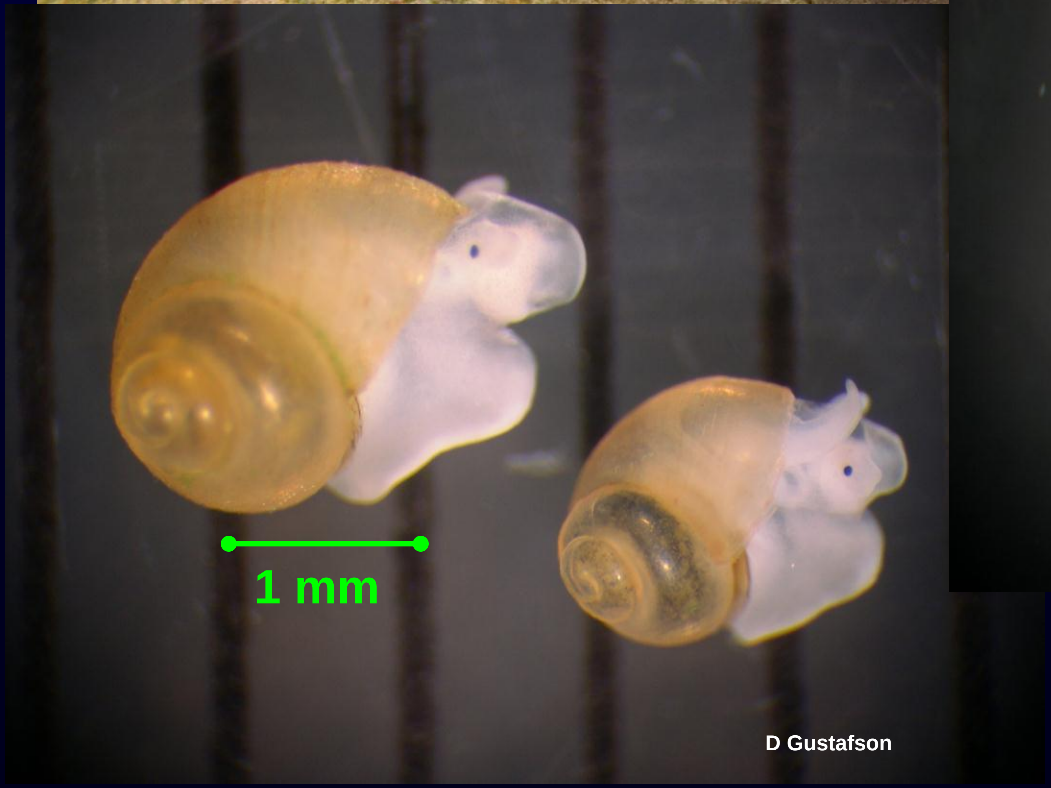
Taylorconcha serpenticola
(Bliss Rapids Snail)

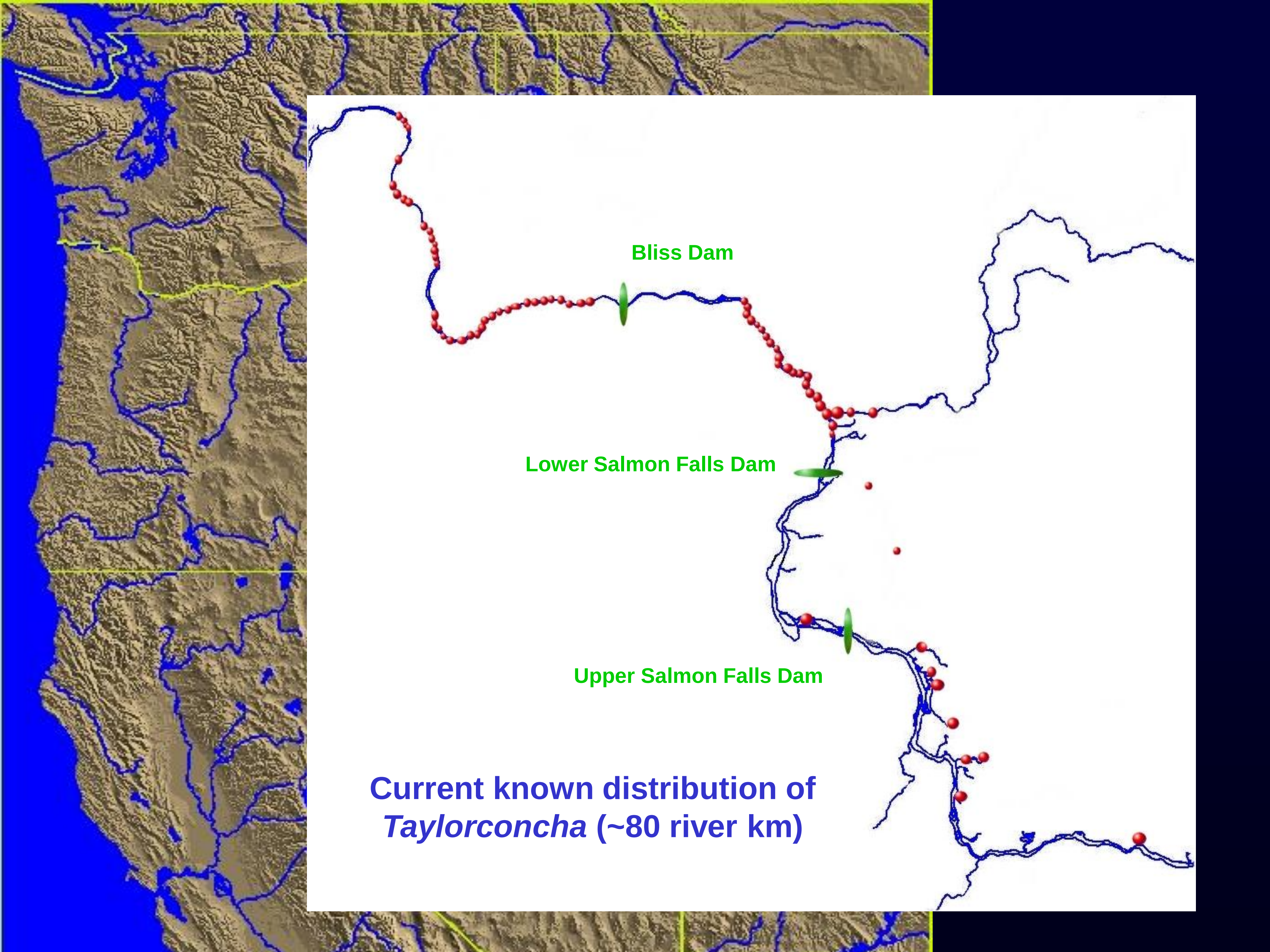
There is also this bad girl

***Potamopyrgus antipodarum* (NZMS)**

Taylorconcha serpenticola
(Bliss Rapids Snail)

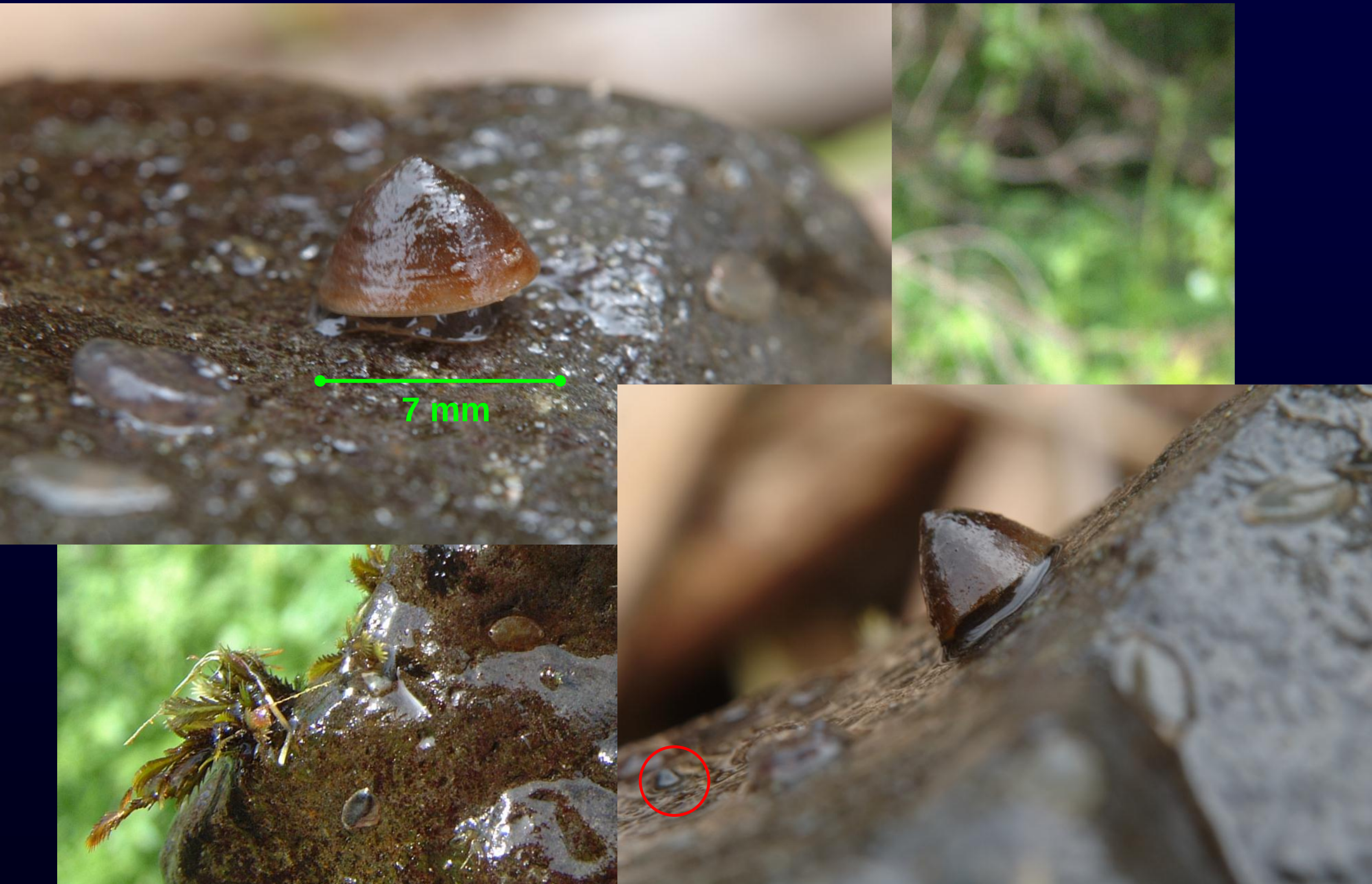


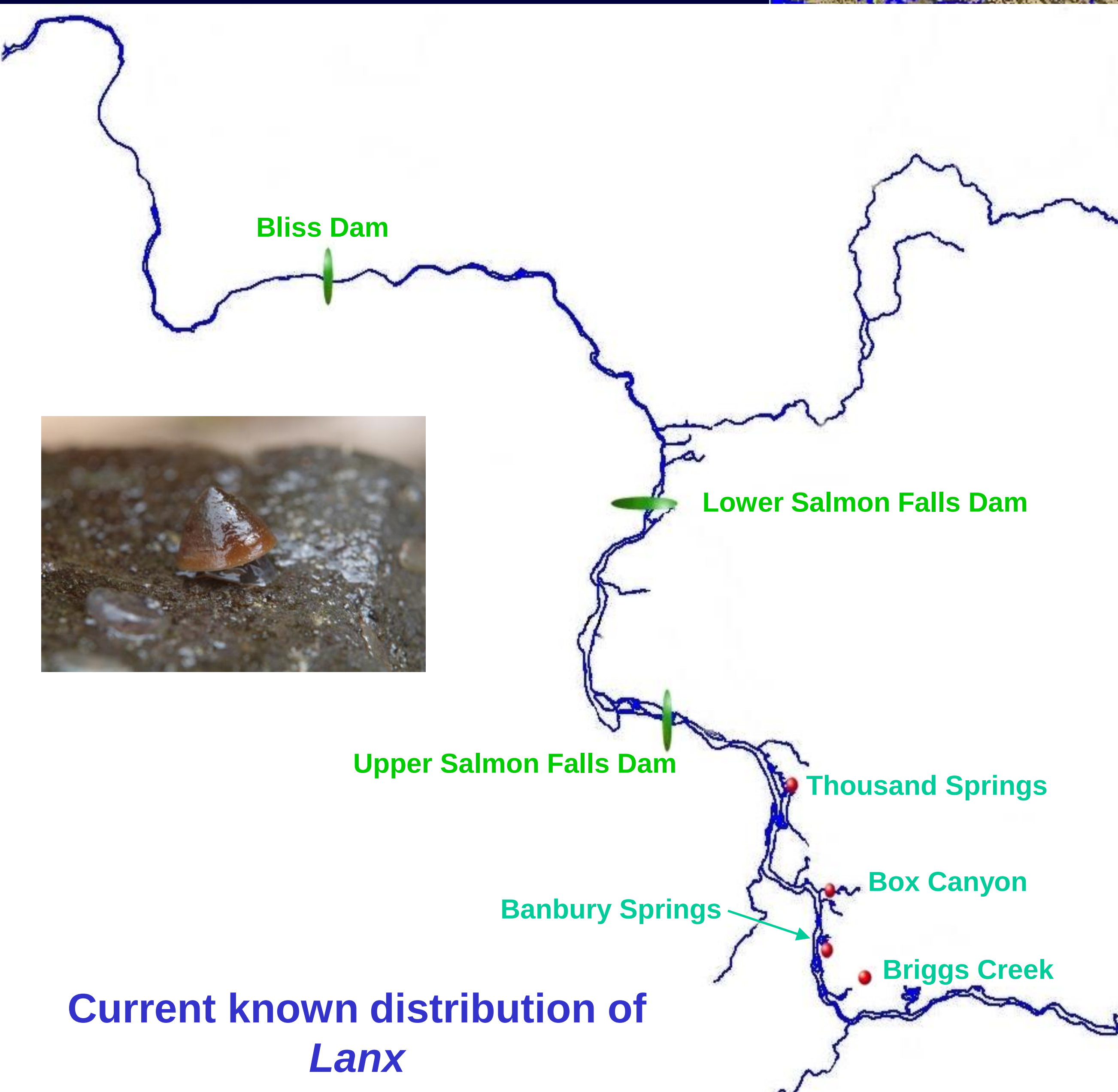


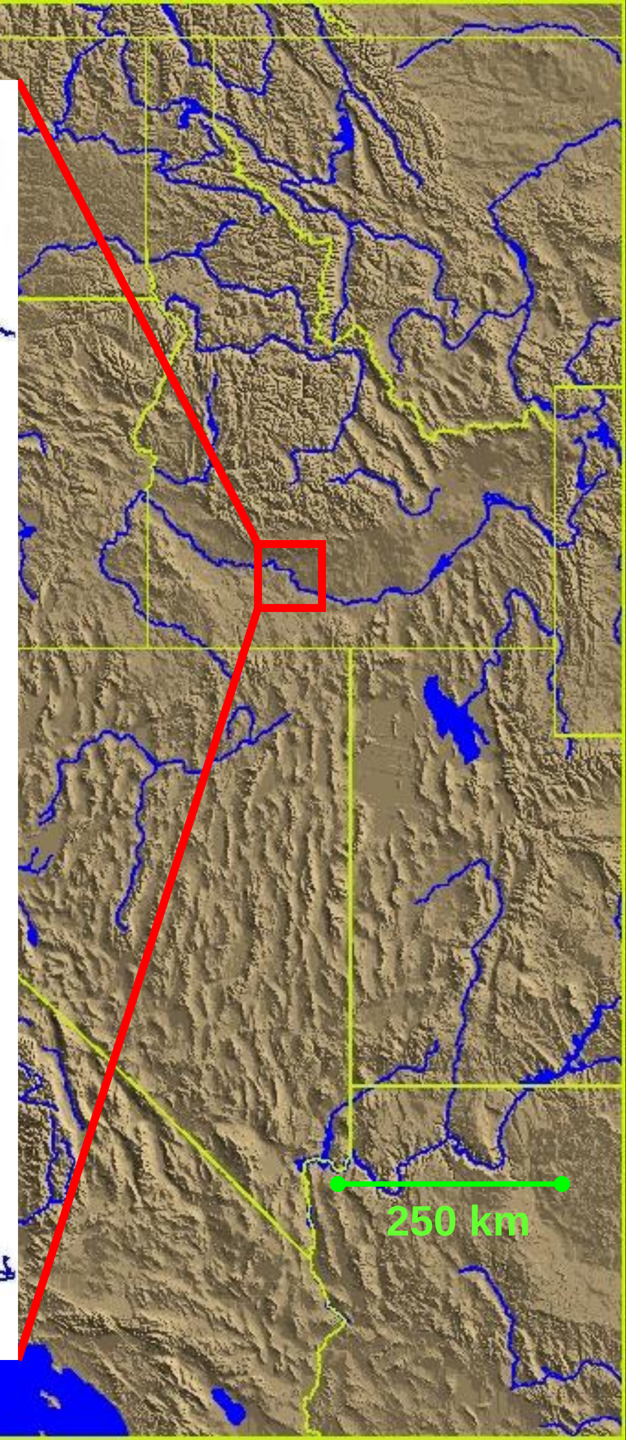


Current known distribution of *Taylorconcha* (~80 river km)

Lanx sp. (Banbury Springs limpet)







Current known distribution of *Lanx*

- Both BRS and Lanx prefer cold-water, lotic, cobble habitats

New Zealand Mudsnail (Potamopyrgus antipodarum)

HIGHLY INVASIVE

3 mm

Objective

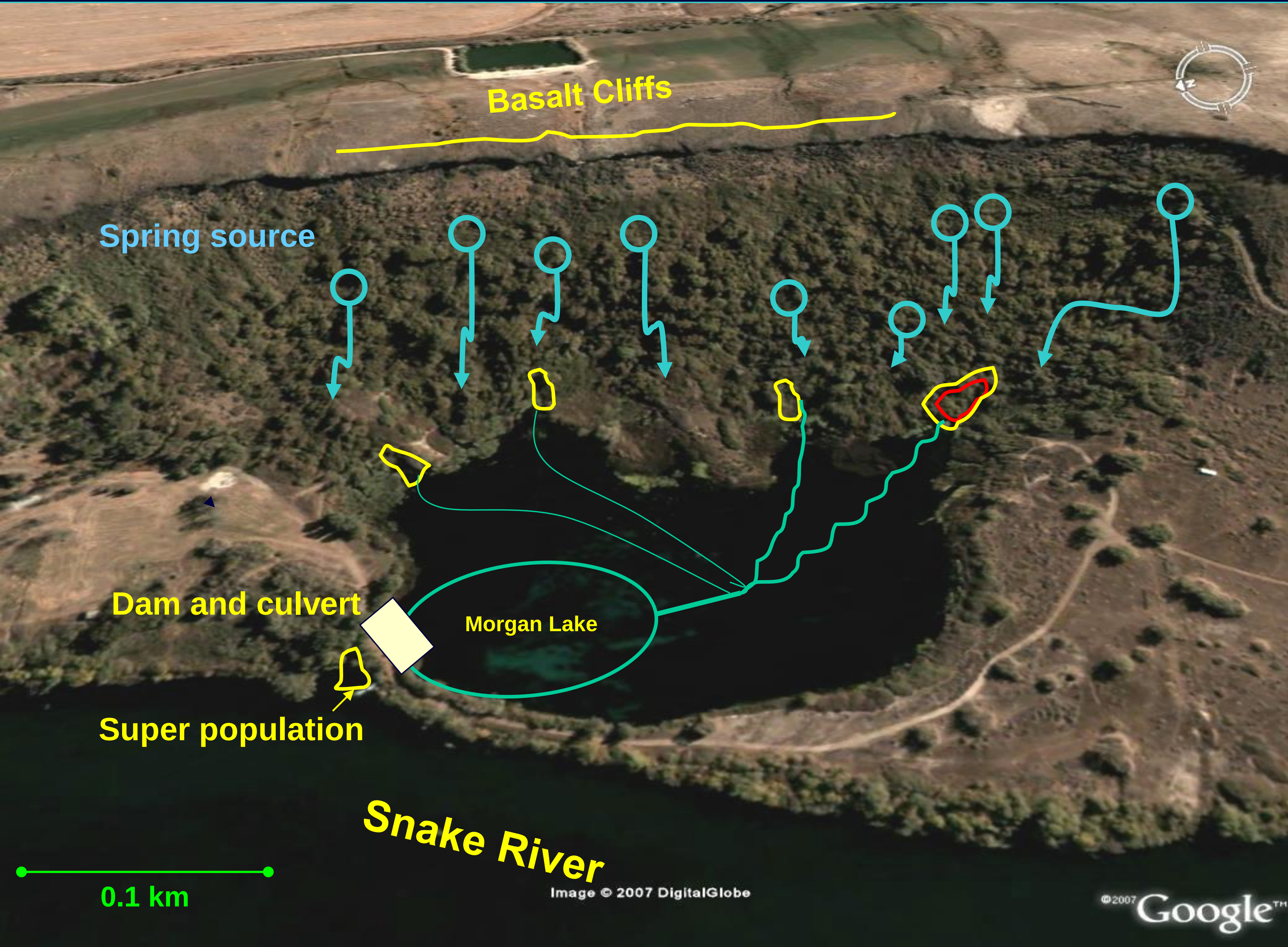
Model the effect of the reduction of Morgan Lake on the viability of *Bliss Rapids Snail* and *Lanx* by:

Altering dispersal rates

Increasing habitat

Decreasing invasive *Potamopyrgus* densities

Recommend management strategies


Basalt Cliffs
Spring source
Dam and culvert
Morgan Lake
Super population
Snake River
0.1 km
Image © 2007 DigitalGlobe
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Morgan Lake at Banbury Springs

Methods

RAMAS Metapop

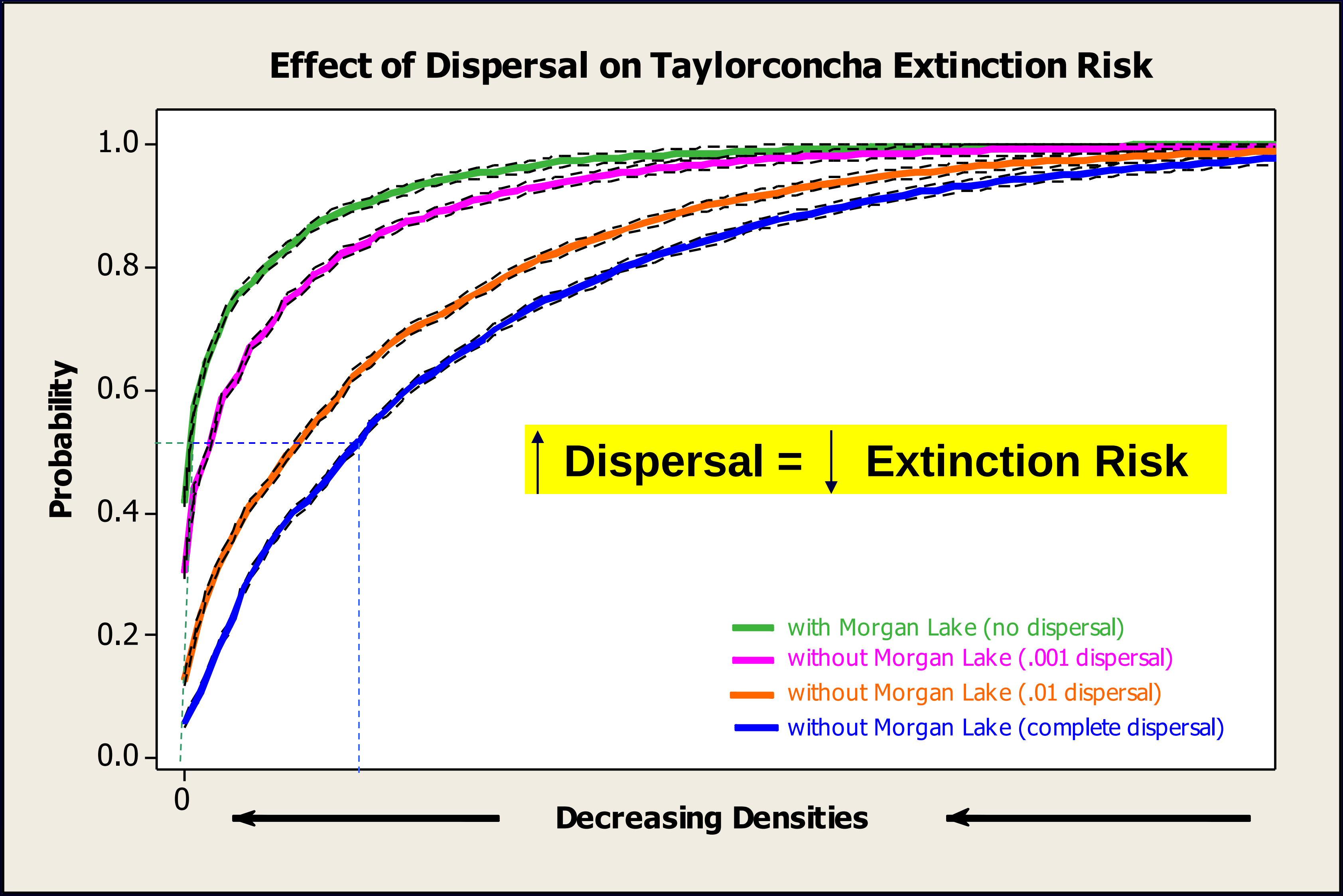
- Parameters held constant
  - ✓10,000 simulations (replications)
  - ✓200 time steps (generation time)
  - ✓Correlation (habitat/environmental)
  - ✓Density dependence
    - – *Taylorconcha* density dependent (scramble competition)
    - – *Lanx* density independent (perhaps Allee effect)
- Parameters modified (scenarios/sensitivity)
  - ✓Dispersal
  - ✓Increased habitat (population abundance)
  - ✓Reducing std dev. of *r* of *Taylorconcha* (surrogate for *P.a.* densities)

Interval Extinction Risk (IER) defined:

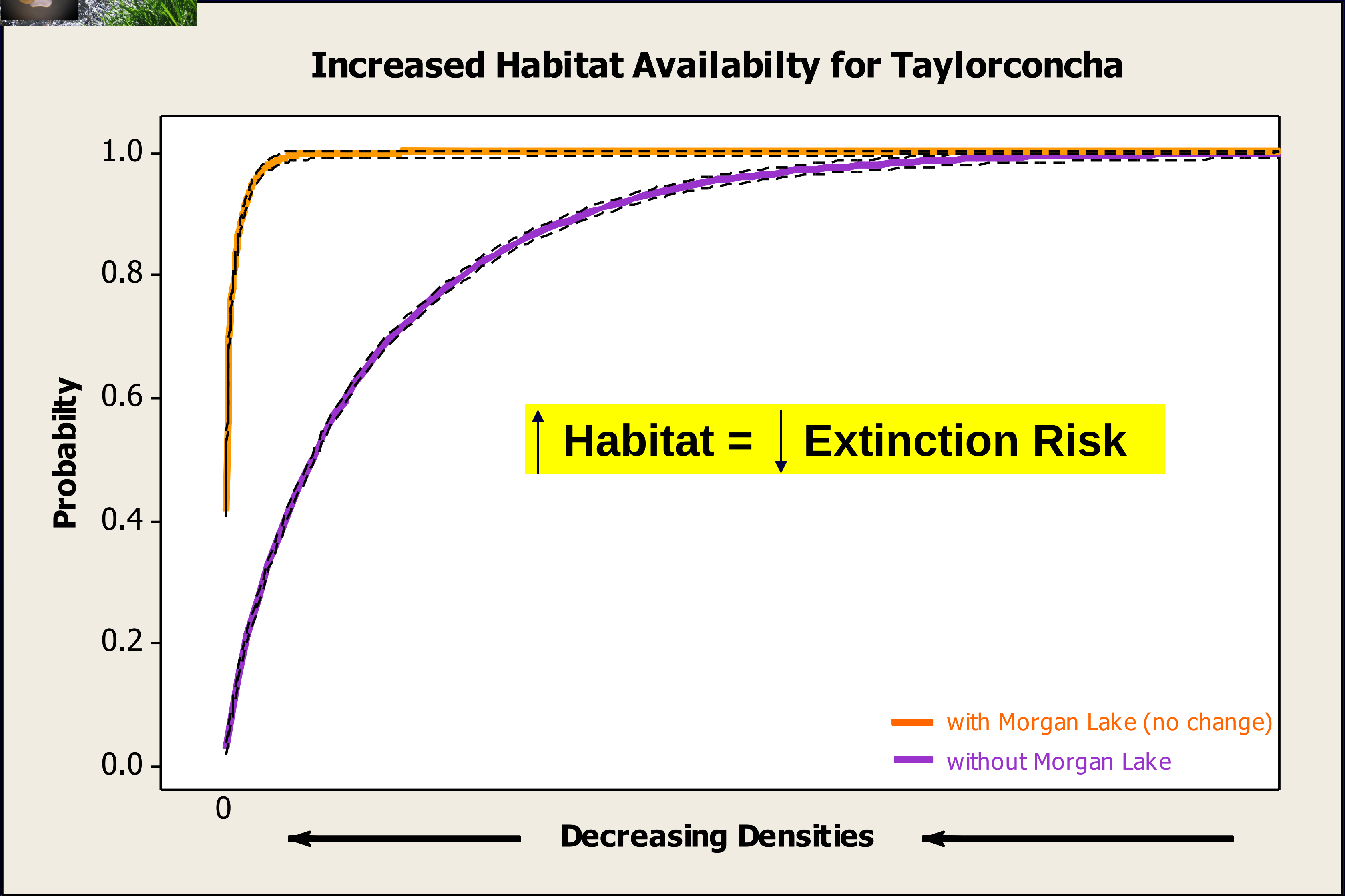
IER is the probability that *BRS* or *Lanx* metapopulation density will fall below a range of densities at least once during the 200 time steps.

Each point in the curve can be interpreted as "there is a Y% risk that the metapopulation density will fall below X (density) at least once during the 200 time steps".

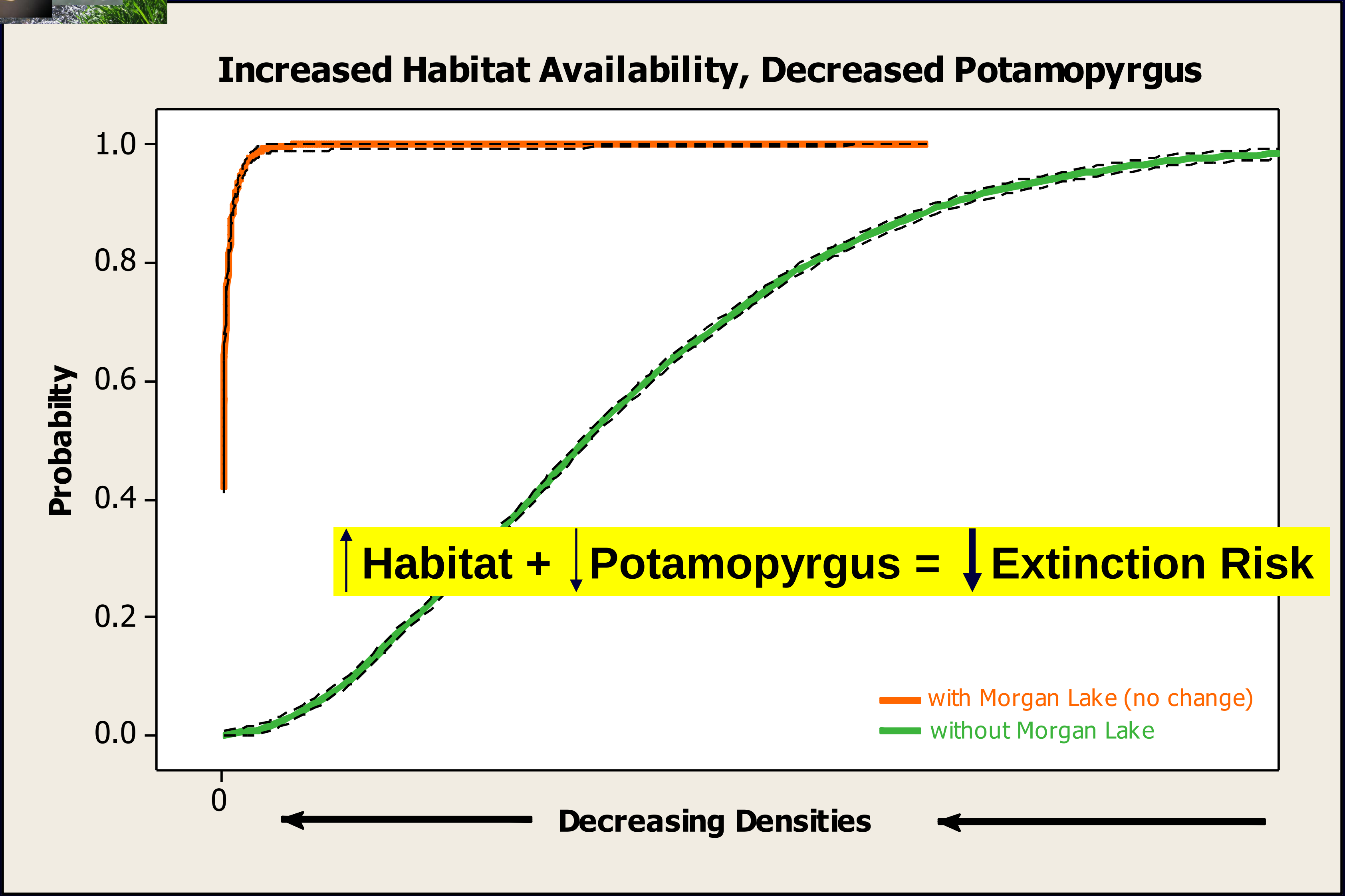
Increased Dispersal of Taylorconcha



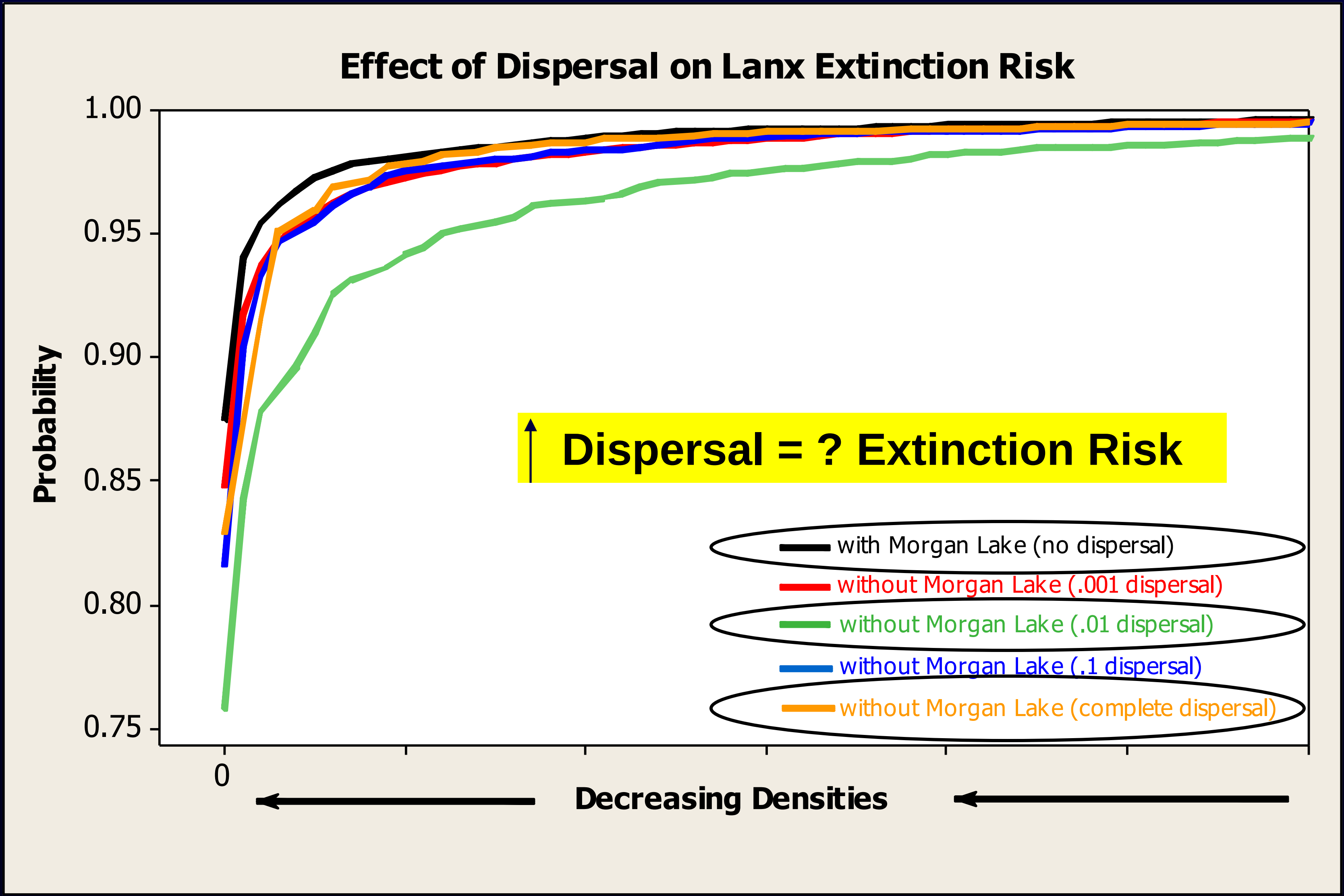
Increased habitat for Taylorconcha



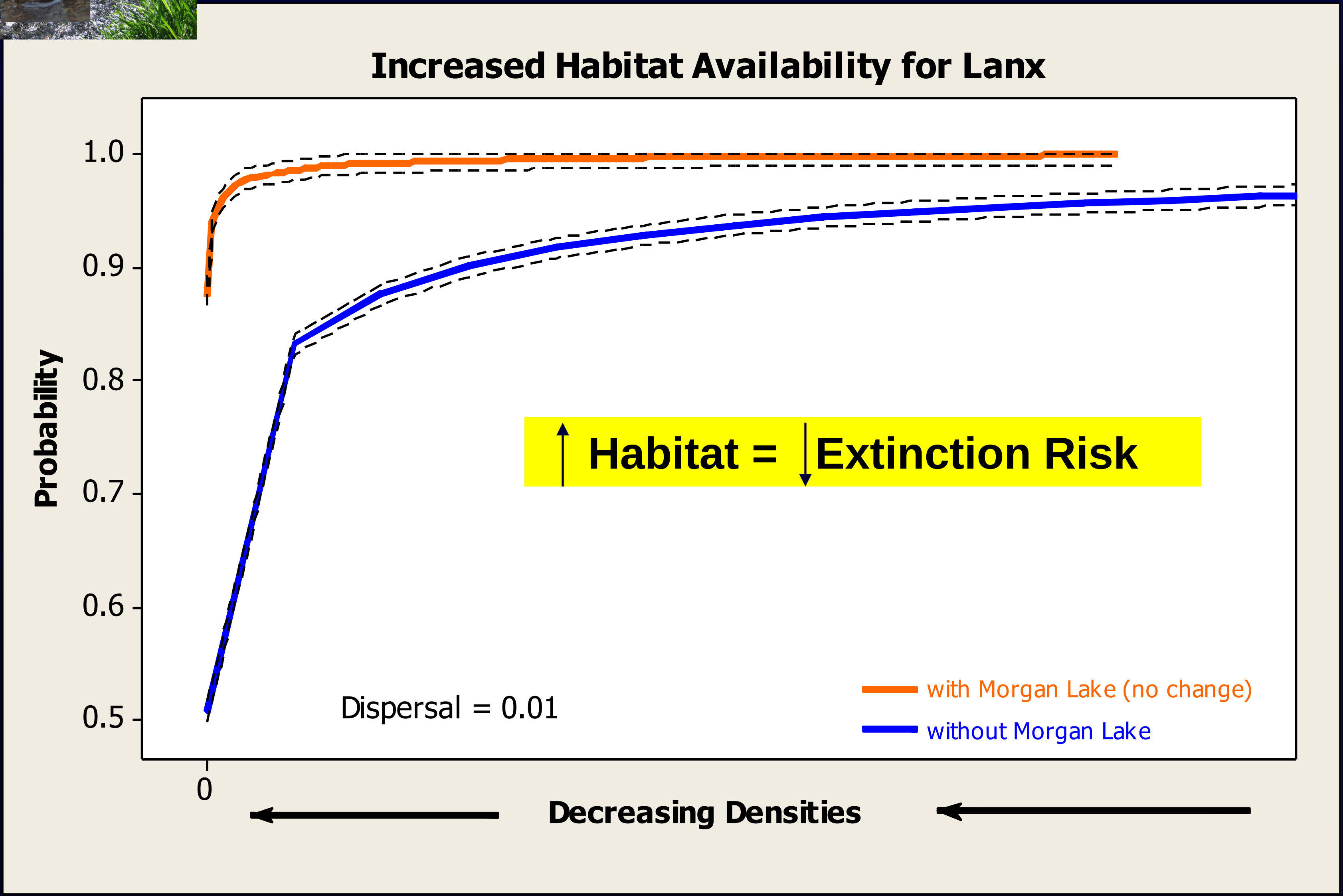
Increased Habitat, Decreased Potamopyrgus



Increased Dispersal of Lanx



Increased habitat for Lanx



Conclusions

 For *BRS*:

Increased dispersal
Increased habitat
Decreased *Potamopyrgus*

= reduced Extinction Risk

 For *Lanx*:

Increased habitat = reduced Extinction Risk

Increased dispersal = does not always reduce Extinction Risk

Viability is more sensitive to dispersal rates because of initial low densities.

There is an optimal dispersal rate for *Lanx*, which needs to be determined

Recommendations

- Reduction of Morgan Lake is beneficial to *Taylorconcha* and *Lanx* viability: however, careful planning is necessary
- Slow drawdown of ML may be better
- Trans-locate super colony (genetic considerations)
- Add cobble habitat to restored sections
- Monitor all three species populations before and after restoration

Relevance to CRE

- MPVAs often used for salmonid management but rarely used for mollusks
- MPVAs best used to compare management/restoration strategies not as absolute predictors of viability
- Understanding and incorporating metapopulation dynamics is important for most T and E restoration projects in CRE

Acknowledgments

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