The Freshwater Pearl Mussel: Threats and Conservation

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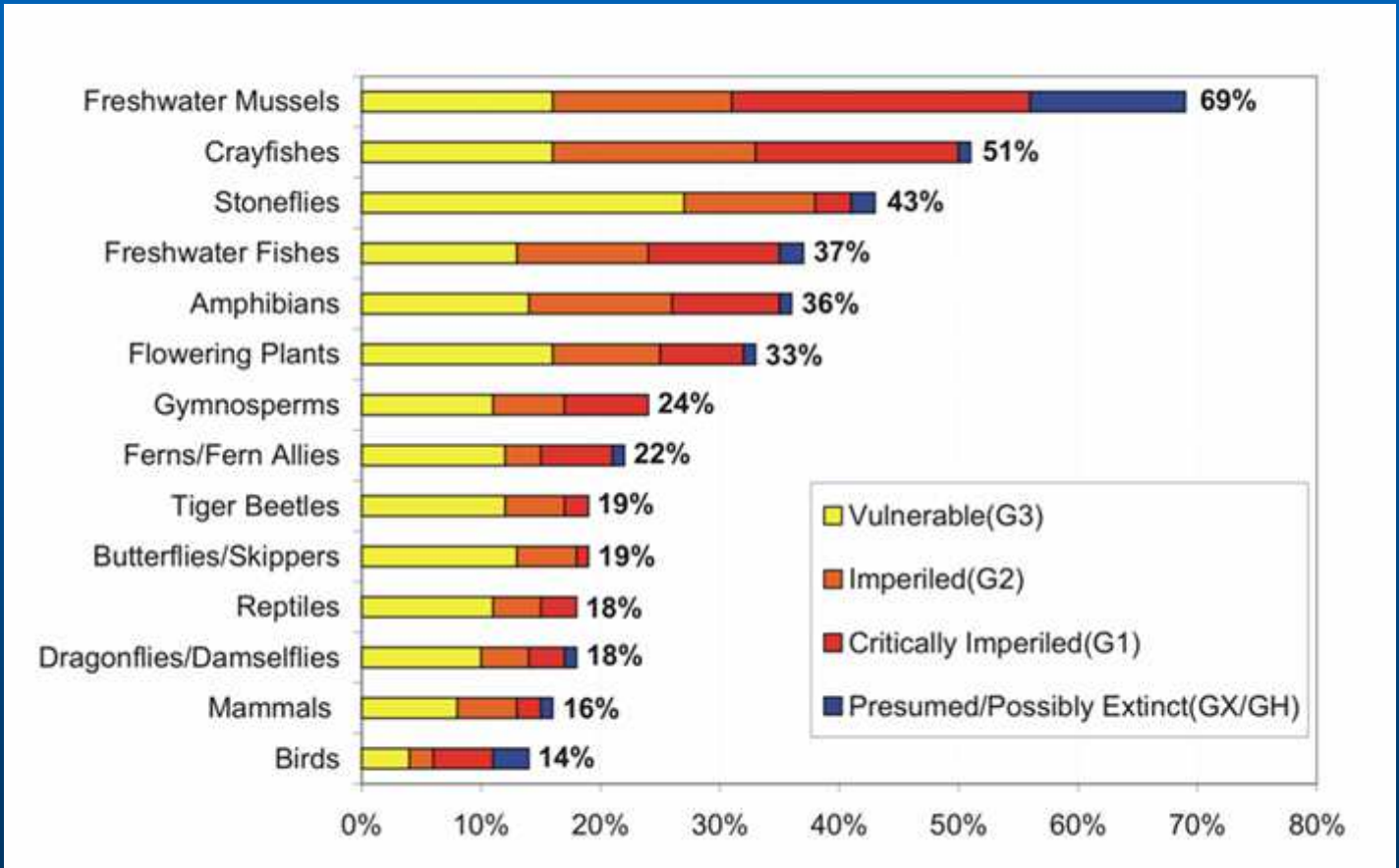
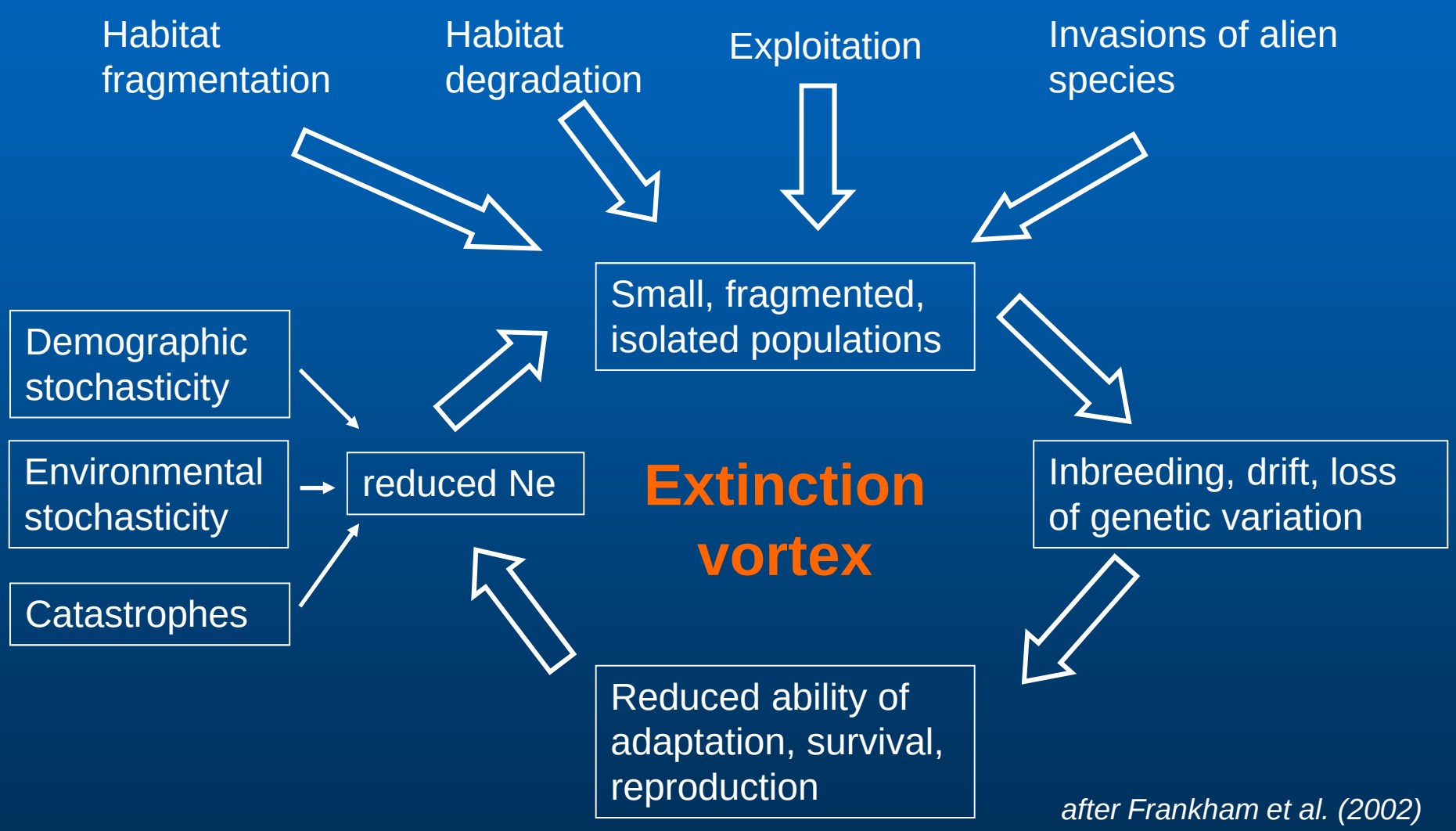
TECHNISCHE UNIVERSITÄT MÜNCHEN

Freshwater Mussels in Peril



Redrawn from „The Nature Conservancy and NatureServe“

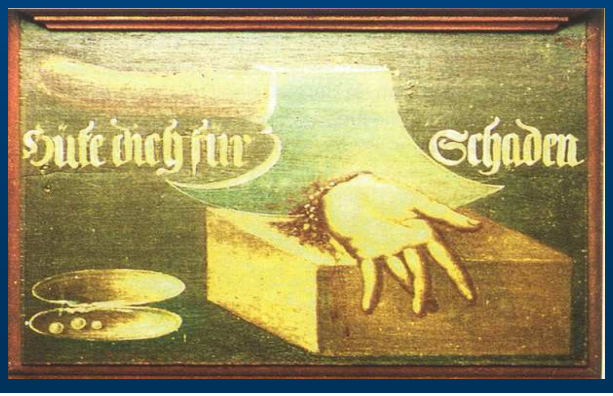


after Frankham et al. (2002)

The Freshwater Pearl Mussel: Target Species for Conservation

- Indicator species
- Keystone species
- Umbrella species
- Flagship species

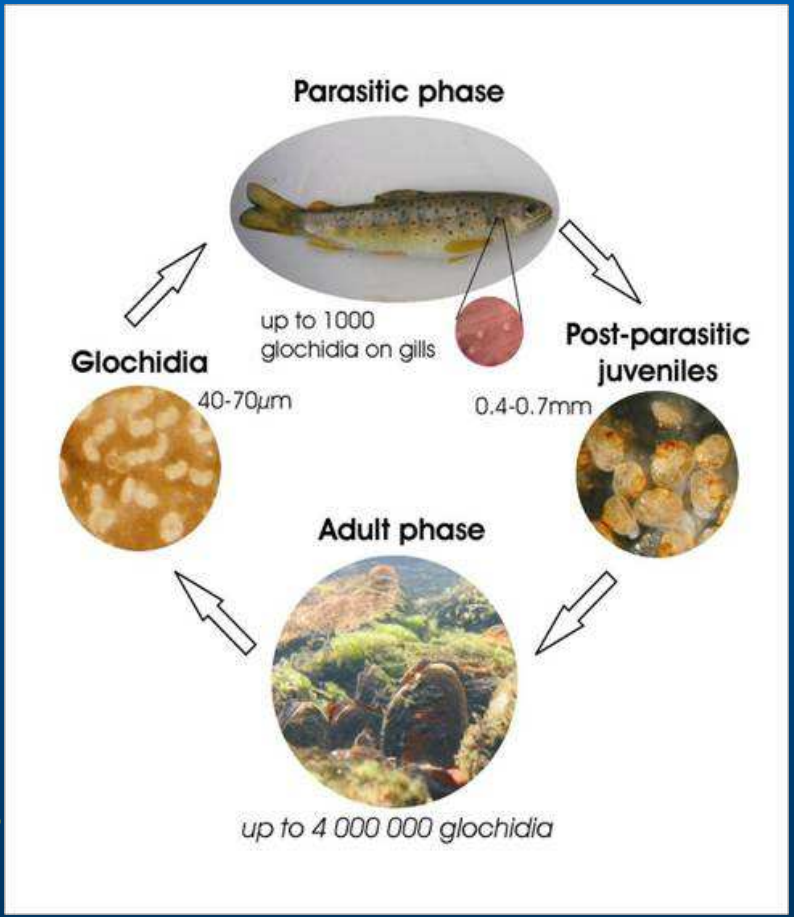
- Core problem: recruitment



Geist (2010) *Hydrobiologia*

Environmental and Genetic Factors

Status of host fish stocks?



Habitat for juveniles / substratum?

+ Genetics?

+ Environmental change?

Fertility / Gravidity?

Geist (2010) *Hydrobiologia*

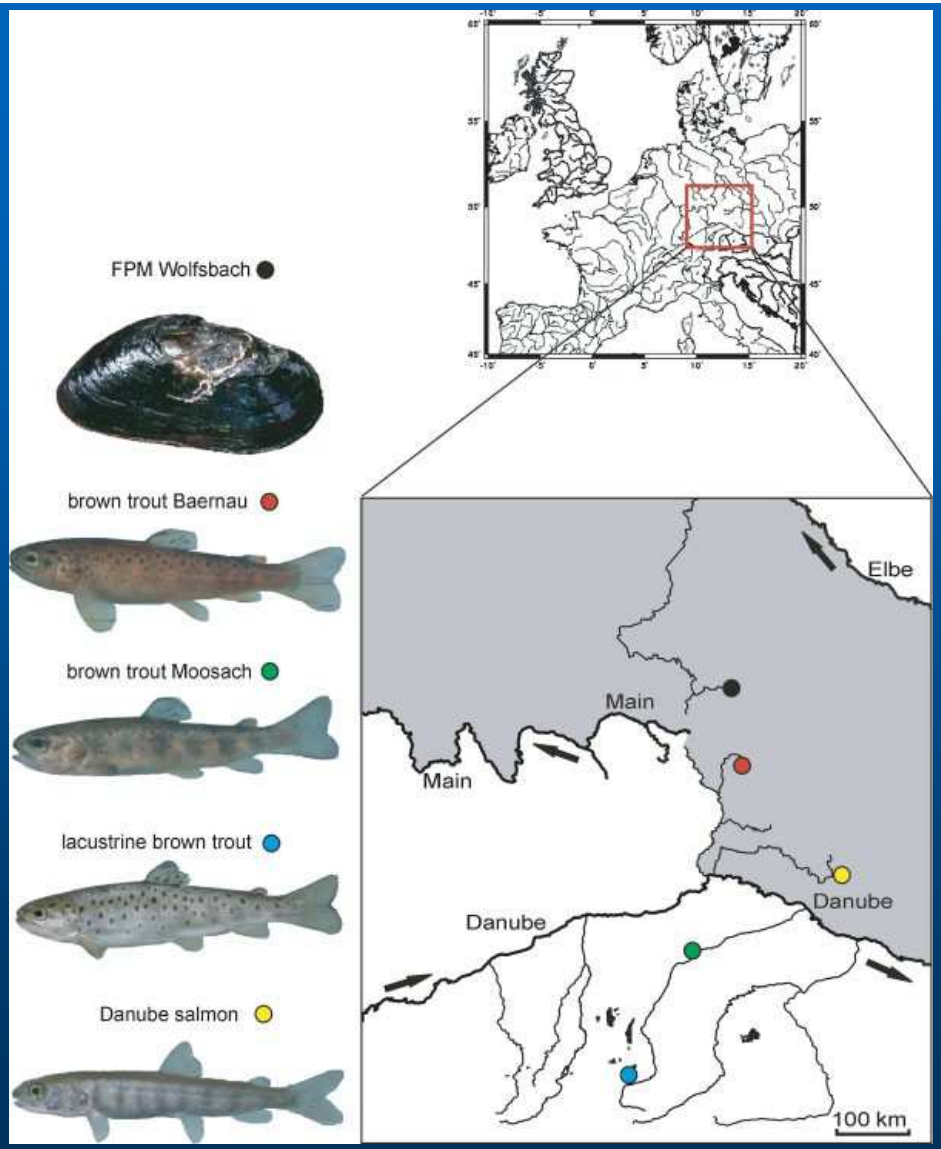
The First Step: Gravidity of Populations

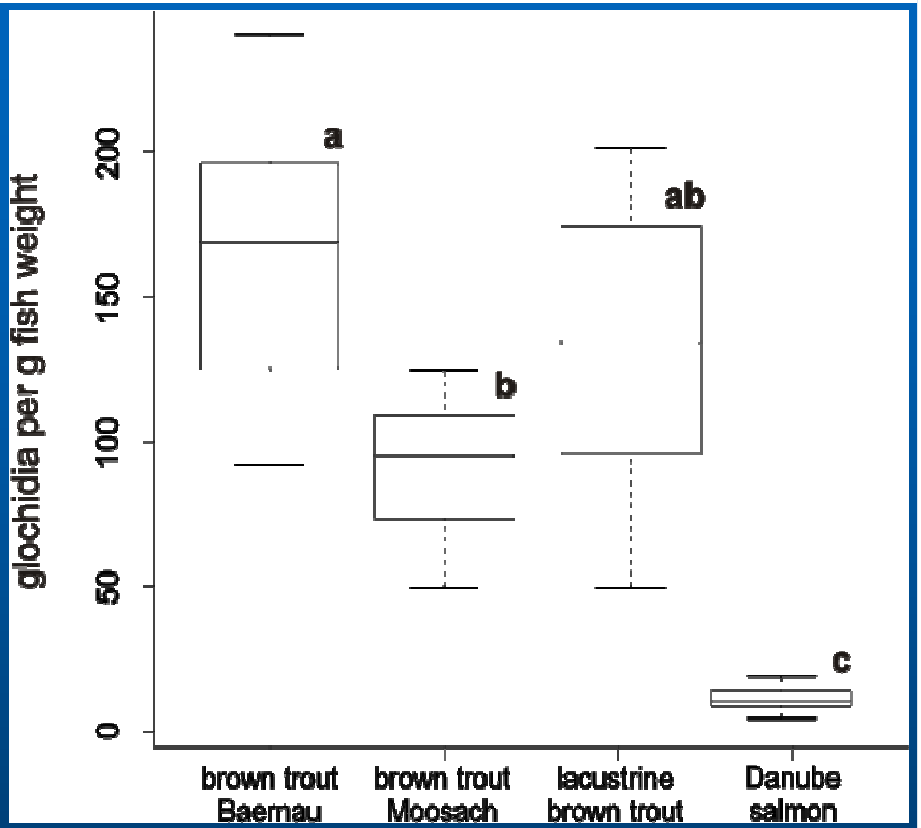
- Normal levels of gravidity in most streams
- No decrease of gravidity with age
- High reproductive potential
- Induced release of glochidia

The Parasitic Phase on the Host Fish

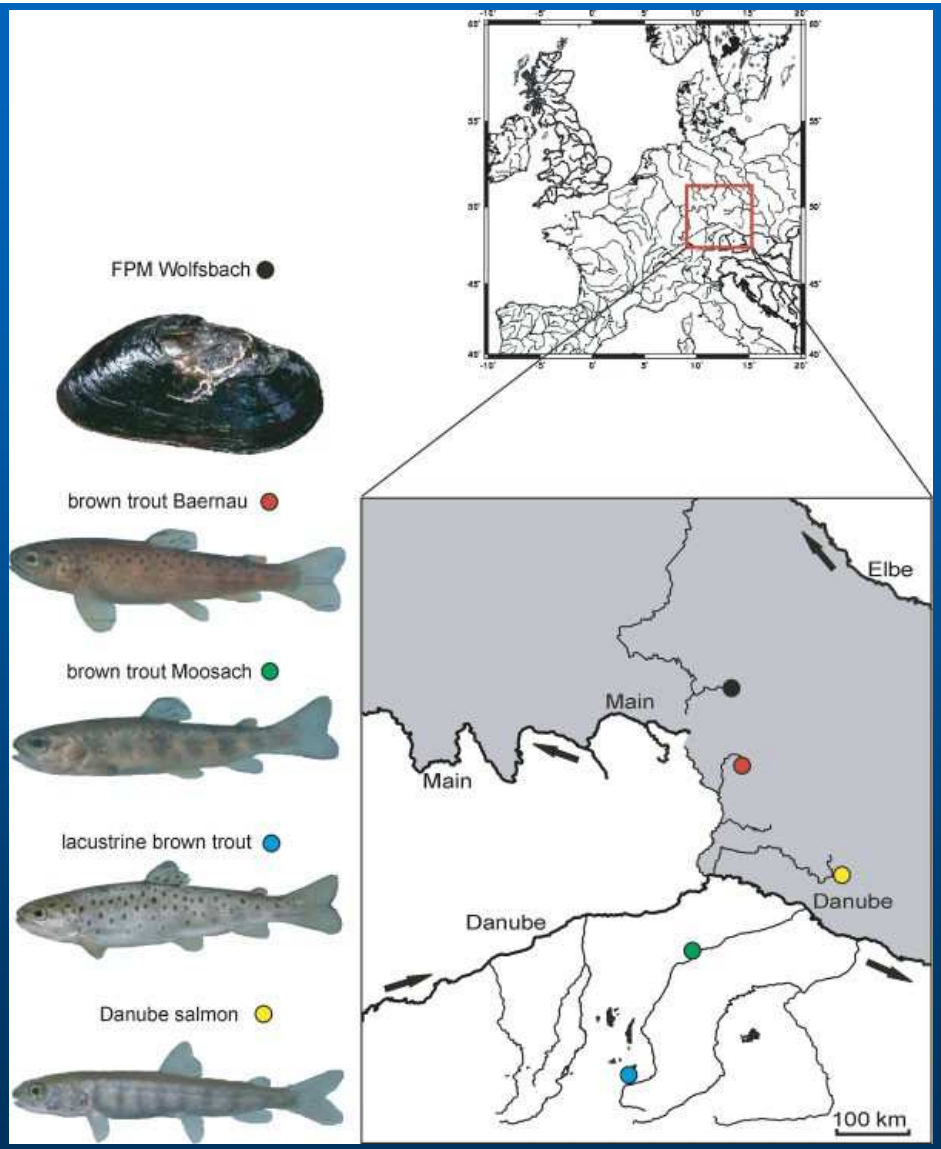
Salmo trutta

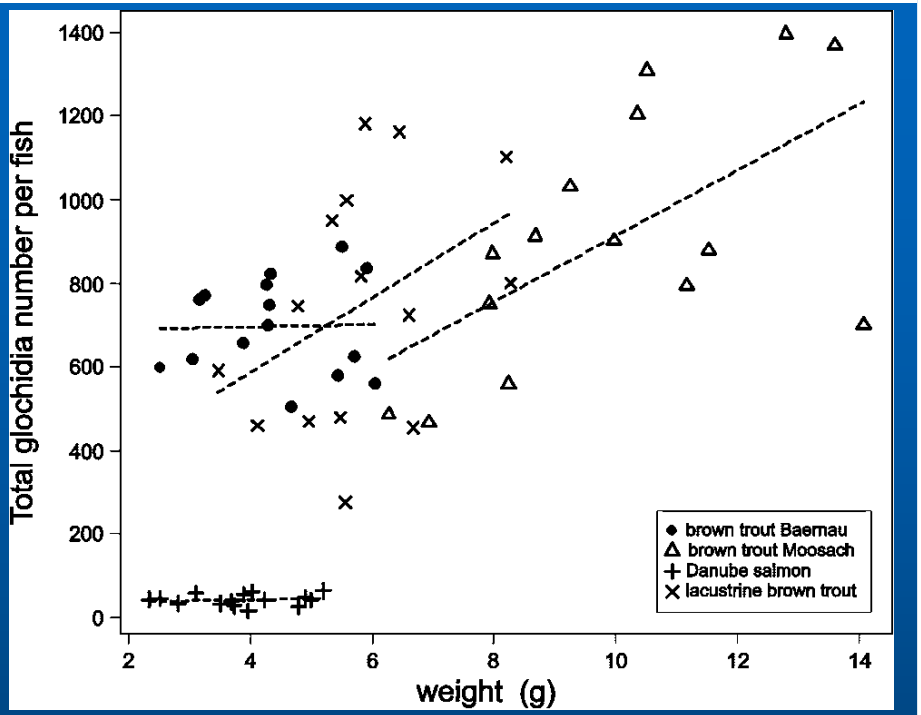
Gill of *S. trutta* with encysted glochidia





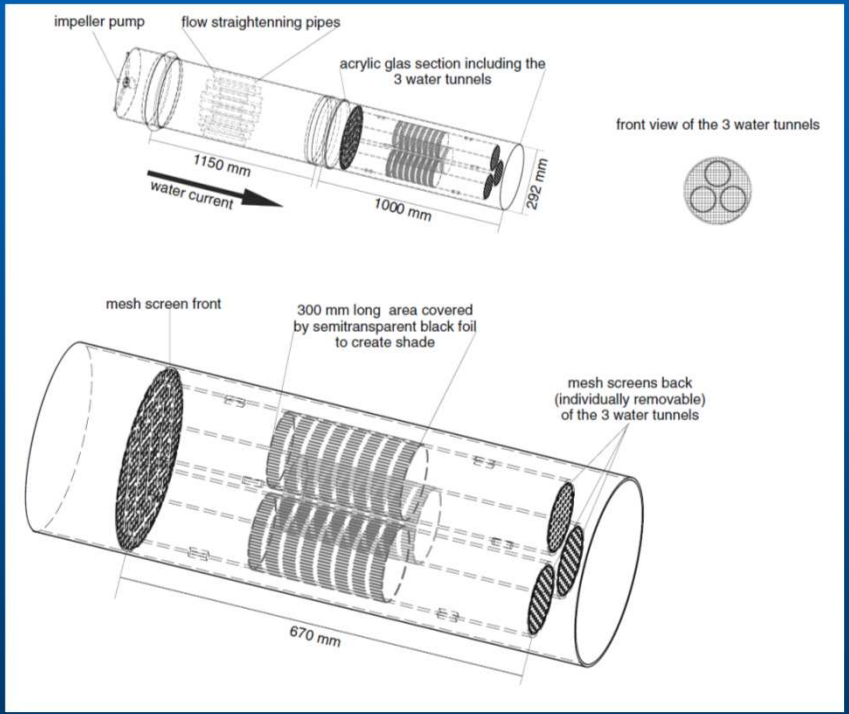
Taeubert et al. (2010) *Aquatic Conserv.*

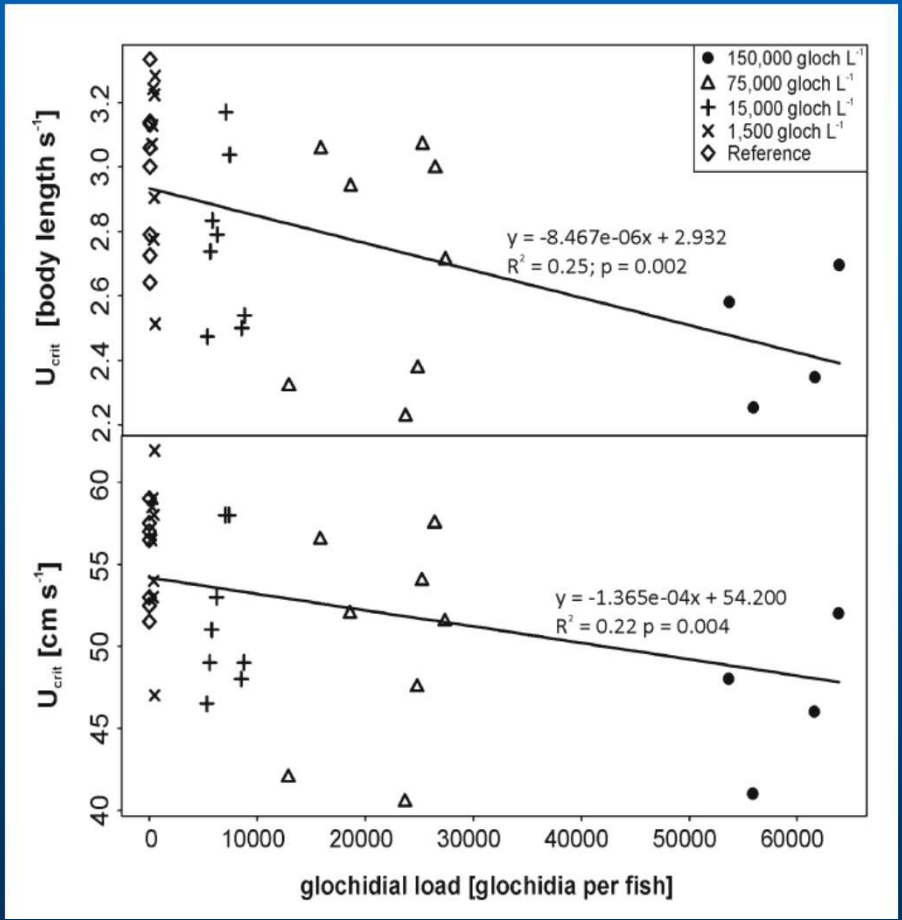




Taeubert et al. (2010) *Aquatic Conserv.*

Determination of Optimal Infestation Rates





Taeubert & Geist (2013) *Parasitol. Res.*

Stream Bed – the Core Problem for Juvenile Recruitment

Elez, France

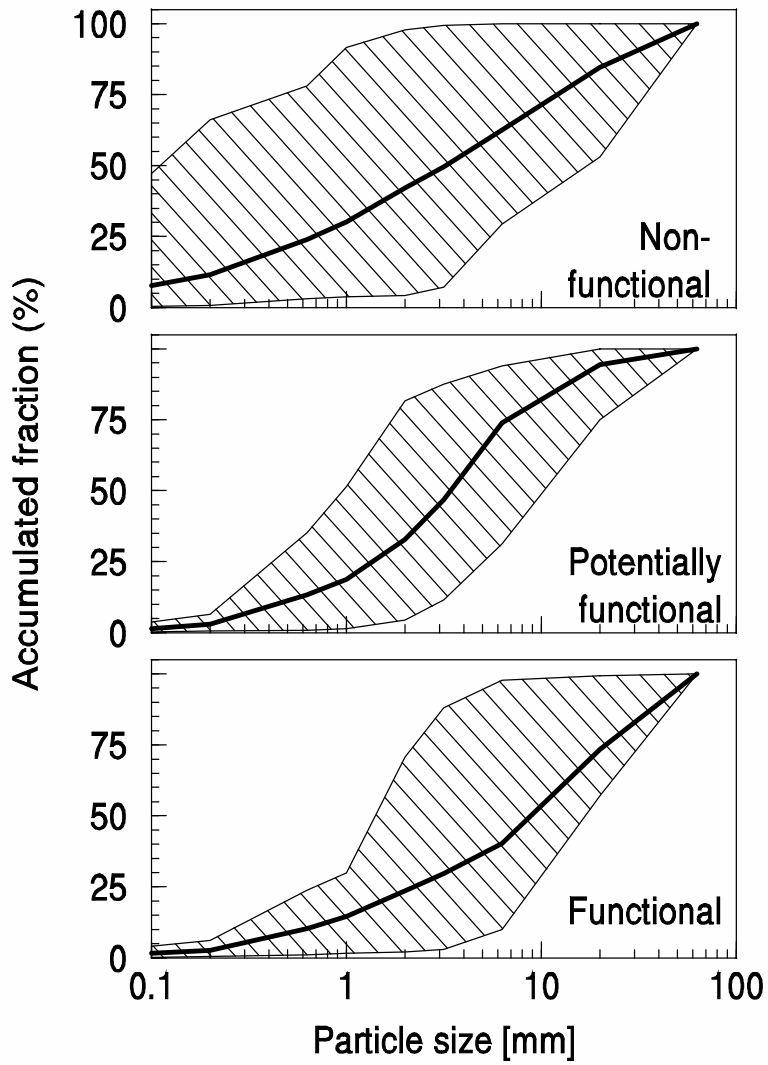
Pikku-Luiro, Finland

Zinnbach, Germany

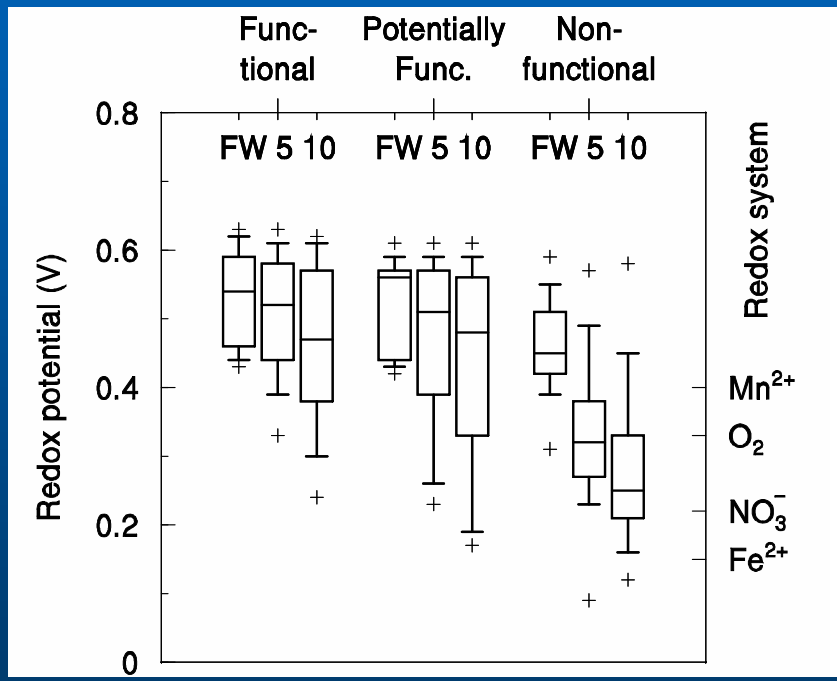
Texture

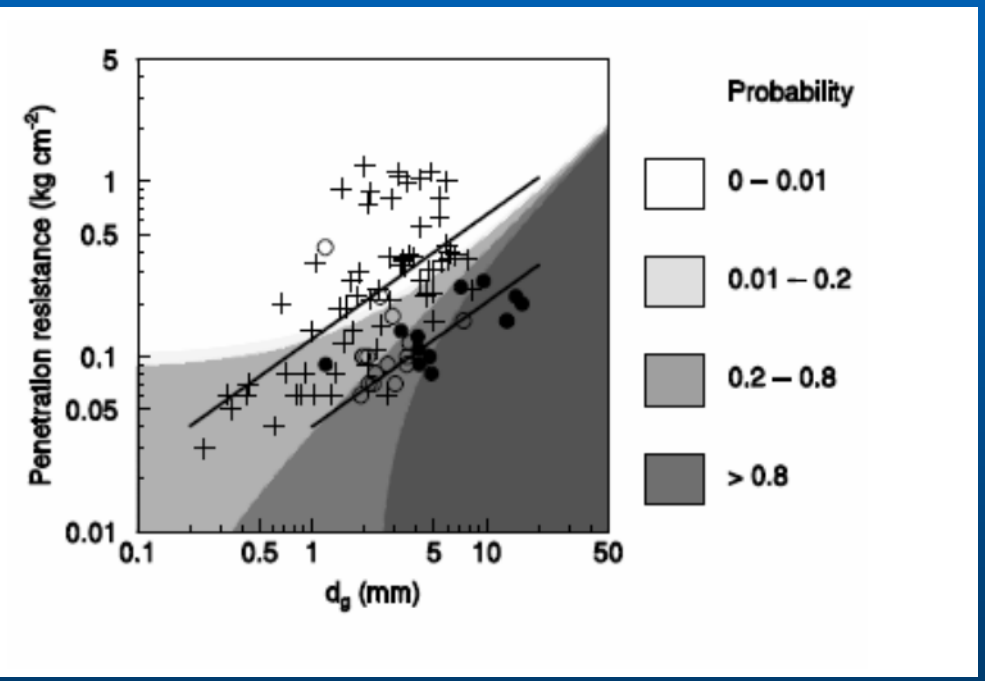
- Functional Populations:
  - Well-sorted gravel
  - Low percentage of fines
- Non-functional Populations:
  - Mixed texture
  - High percentage of fines

Geist & Auerswald (2007) Freshw. Biol.



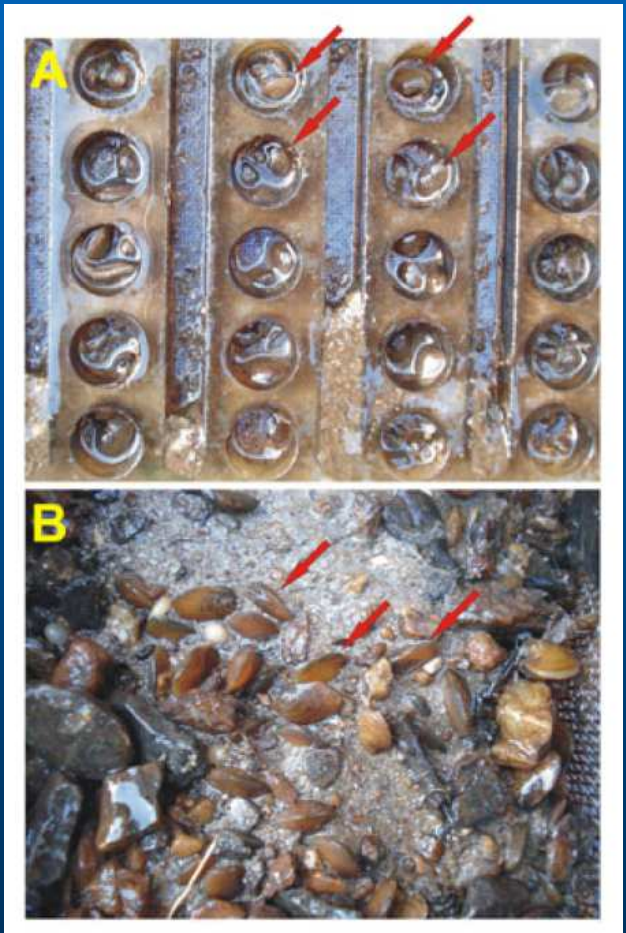
Determining Functional Substrate Conditions



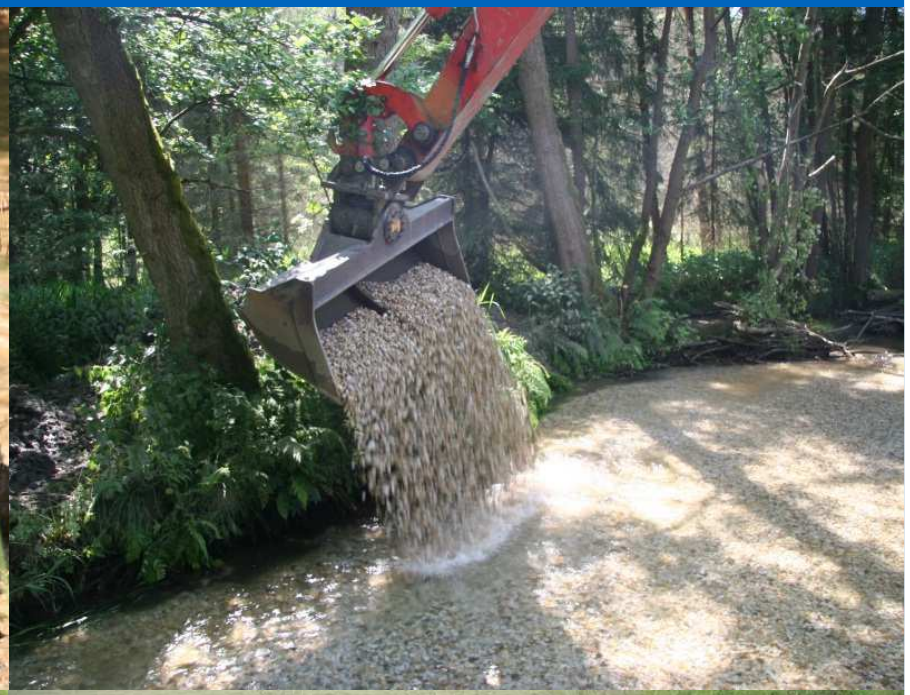


Geist & Auerswald (2007) Freshw. Biol.

Artificial Culturing in Cages and Boxes

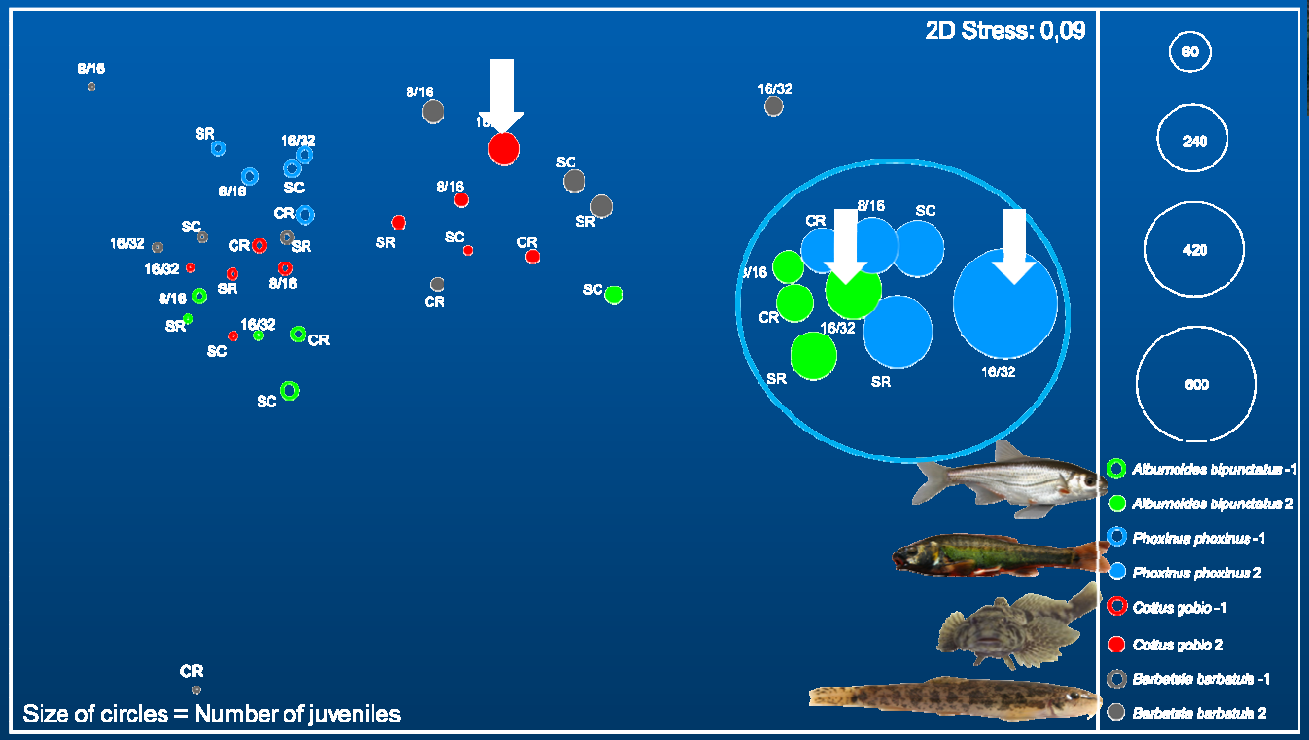


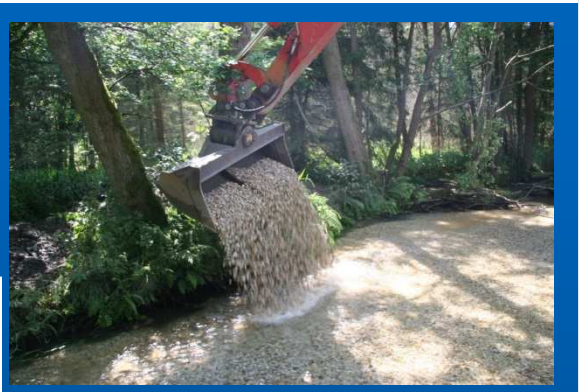
Gum, Lange & Geist (2011) Aquatic Conserv.



Restoration of the Stream Bed

Change in fish length-frequency and abundance

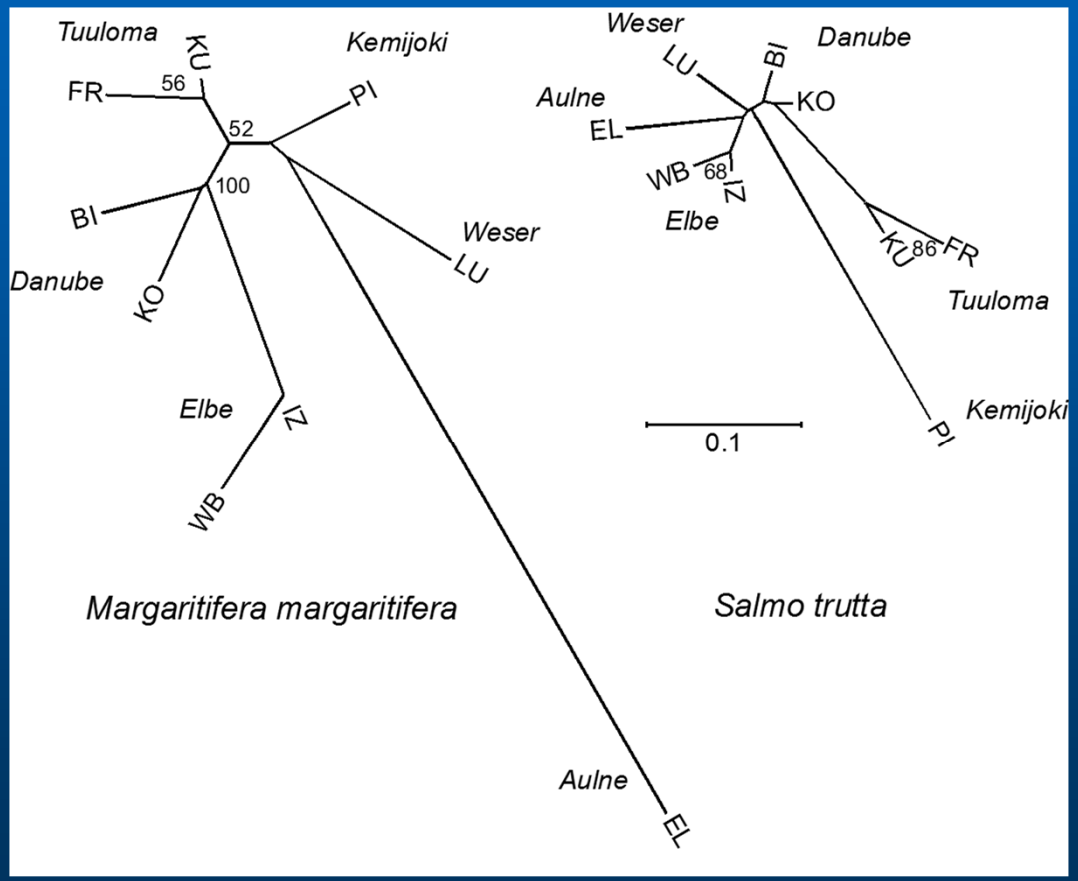




Mueller, Pander & Geist (in press) Ecol. Engineering

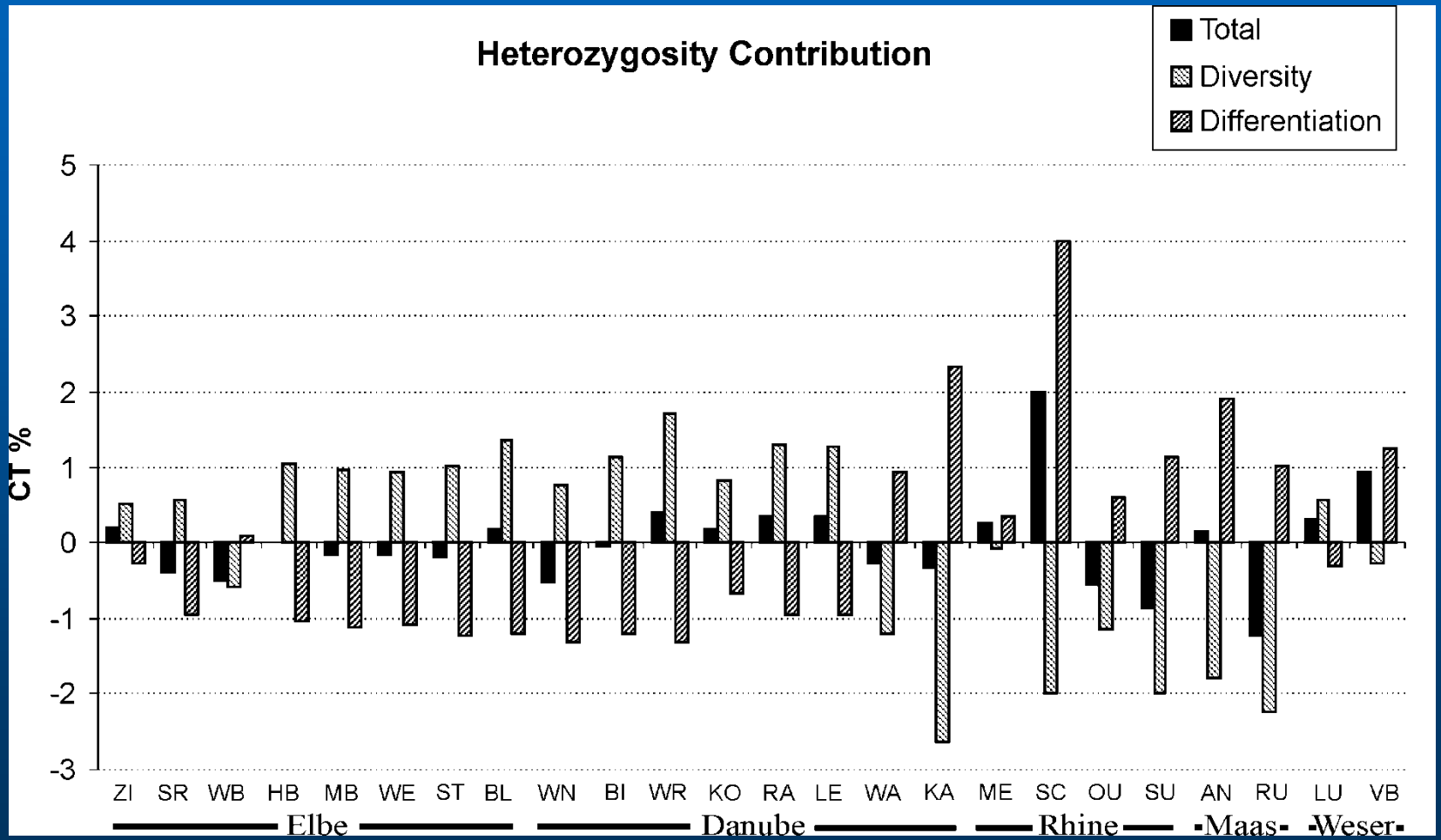
Pander, Mueller & Geist (in prep.) Riv. Res. Appl.

Population Genetic Information



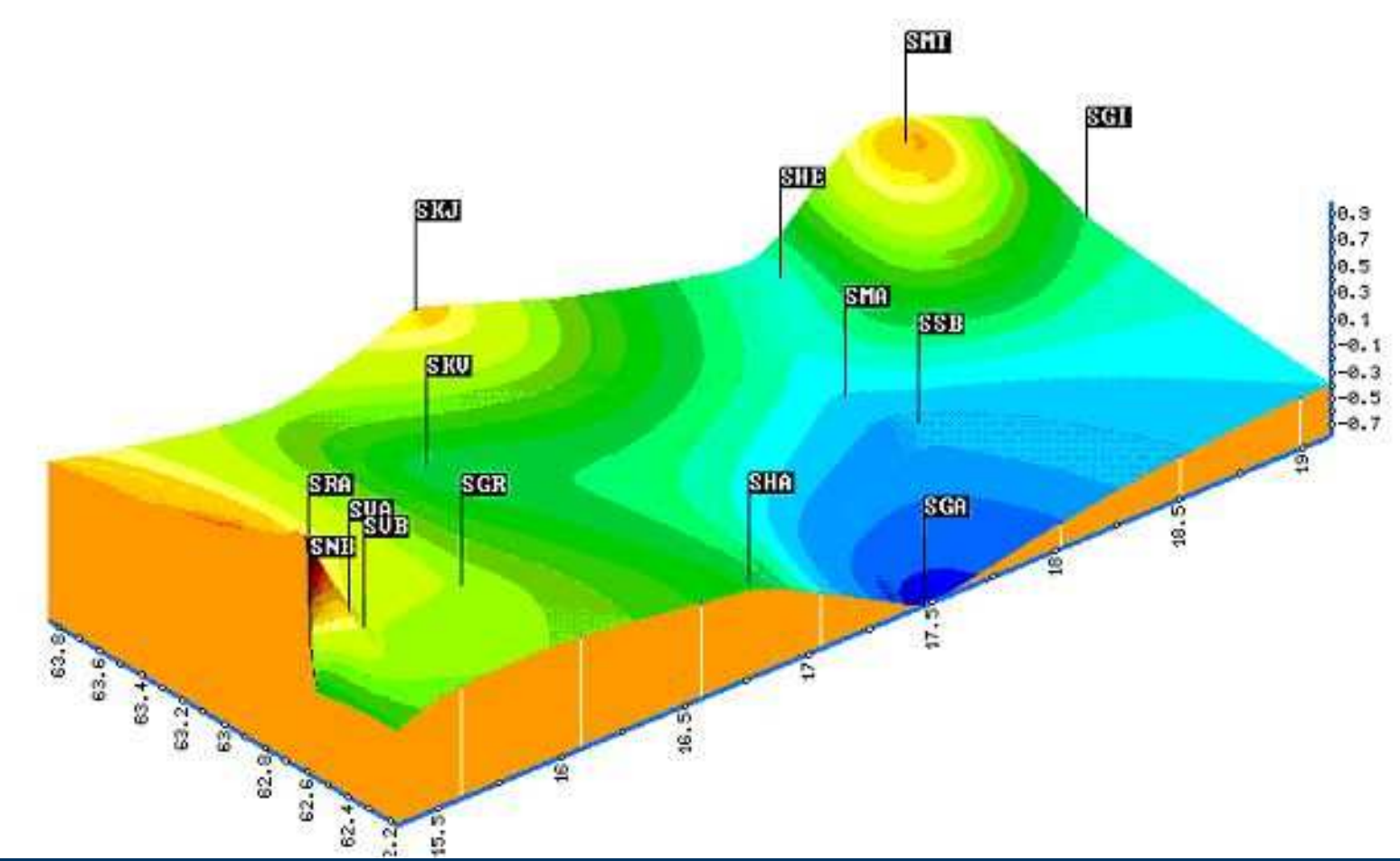
Geist & Kuehn (2008) Mol. Ecol.

Identification of Priority Populations



Geist & Kuehn (2005) Mol. Ecol.

Landscape Genetics

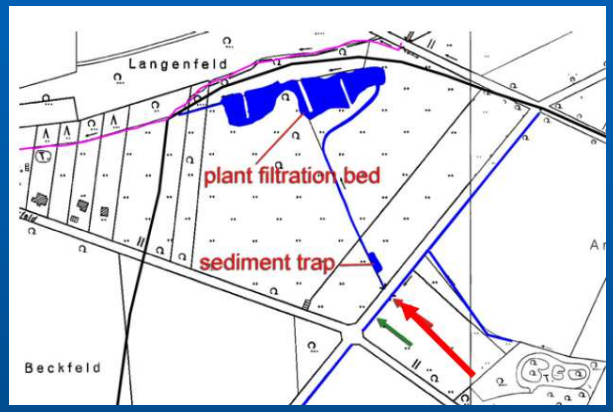


Geist et al. (2009) Con. Gen.

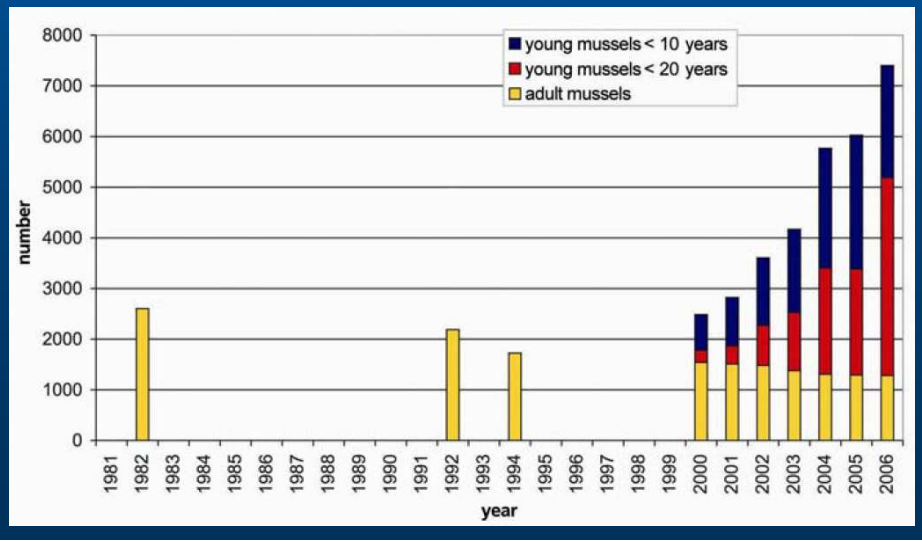
Examples of Currently Applied "Conservation" Approaches and their Problems

Approach	Problem
Infestation and release of host fishes from hatcheries into natural populations	Does often not address the bottleneck Low persistence of allochthonous fishes Possible gene swamping, disease
Release of early post-parasitic juveniles into wild populations	Trial and error based Poor monitoring possibilities
Population surveys / counts of mussels, Water quality control	Only a monitoring tool No conservation action
Gradivity monitoring of adult mussels	Not a powerful indicator No conservation action

Only Few Successful Examples of Restoring Freshwater Mussel Populations:



Dr. Reinhard Altmüller and the Lutter Project



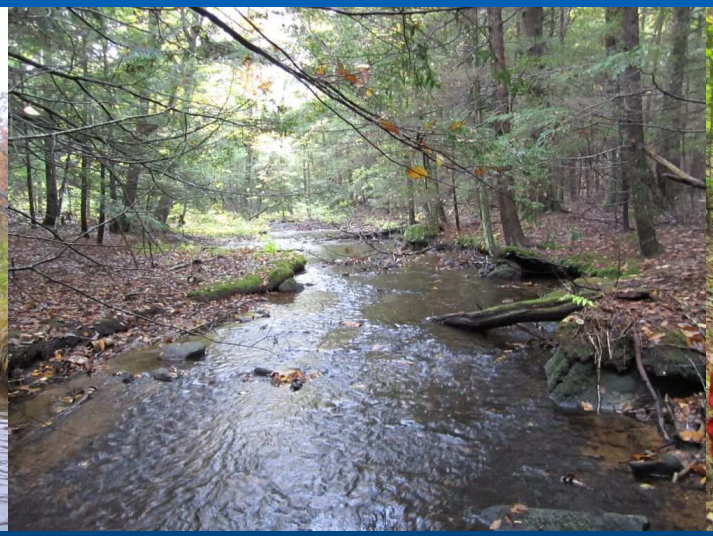
Altmüller & Dettmer (2006)

Effective Conservation Management Needs a Step-wise Approach

- Step 1: Decisions on conservation objectives
- Step 2: Determination of status quo
- Step 3: Identification of bottlenecks and problems
- Step 4: Decisions on conservation action with stakeholders and sponsors
- Step 5: Conservation action
- Step 6: Evaluation and adaptive management
- Step 7: Publication of results

Conservation of Functionally Intact Populations (Kola peninsula)

Conservation of Functionally Intact Populations (North America)



Public Awareness and Communication

Motto of the Freshwater Mollusk Conservation Society Meeting 2009

in Baltimore, USA

Conclusions

- Freshwater pearl mussel populations continue to be in trouble, despite of knowledge on the limiting factors for recruitment
- Prioritization of populations / areas of conservation based on ecological and genetic data is important
- Catchment conservation in functionally intact populations should have highest priority
- Combination of short-term remediation (culturing) with long-term objectives (catchment restoration) is essential
- Conservation needs to be more systematic and requires evaluation plus publication of positive and negative results

Thank you very much for your attention!

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