

The invasive *Dikerogammarus villosus* - a threat for benthic communities in European rivers?

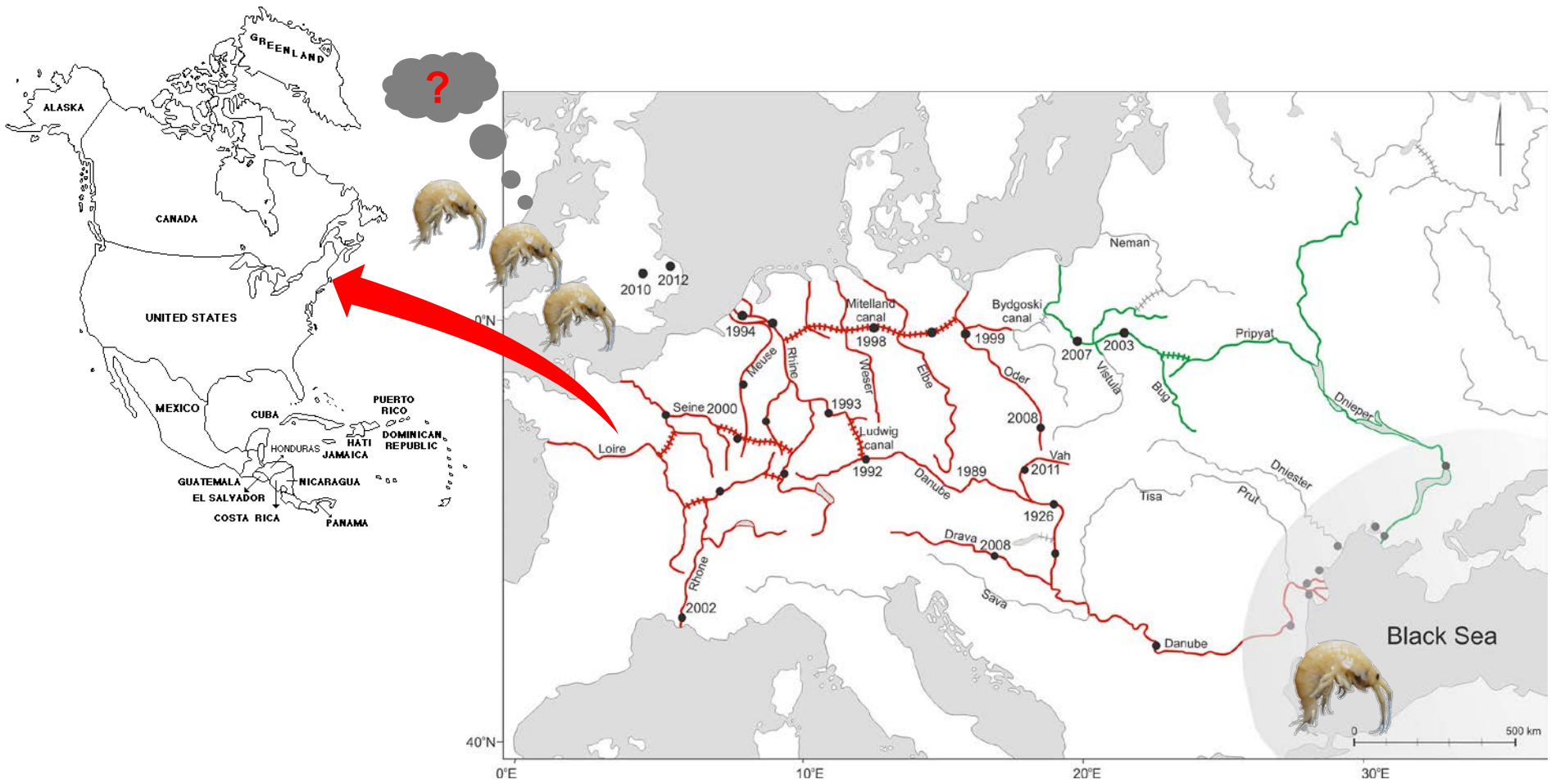
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The Invasion

D. villosus – one of the most invasive species in Europe



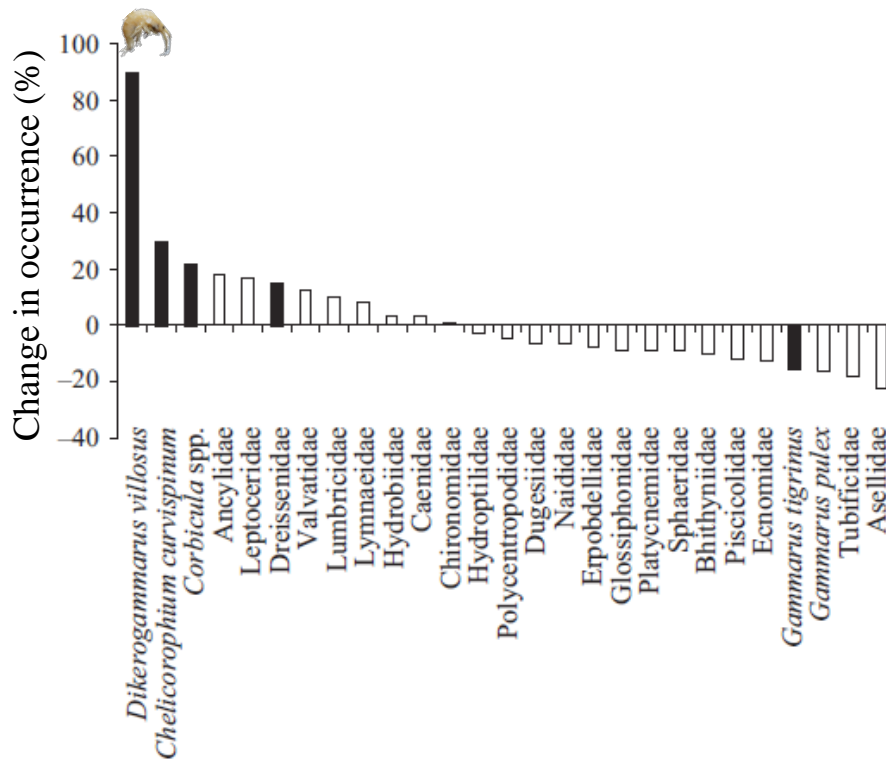
The 'killer shrimp' *D. villosus*

(Crustacea, Amphipoda)

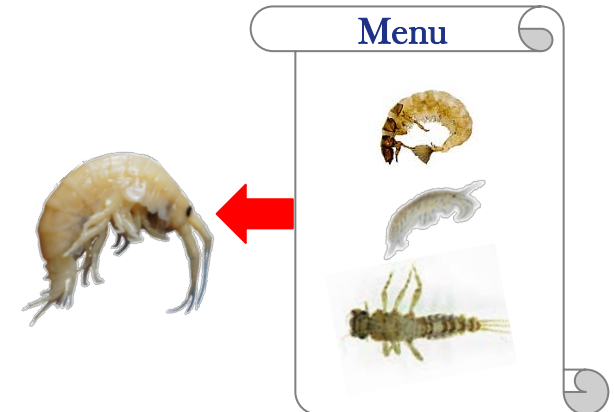


- Body size up to 30 mm
- Lakes, rivers, brackish water
- High reproduction, fast growth, high consumption rate, high densities
- Omnivore: detritus, algae, macrophytes, fish eggs, invertebrates, carrion, conspecifics...
- High predation potential in laboratory

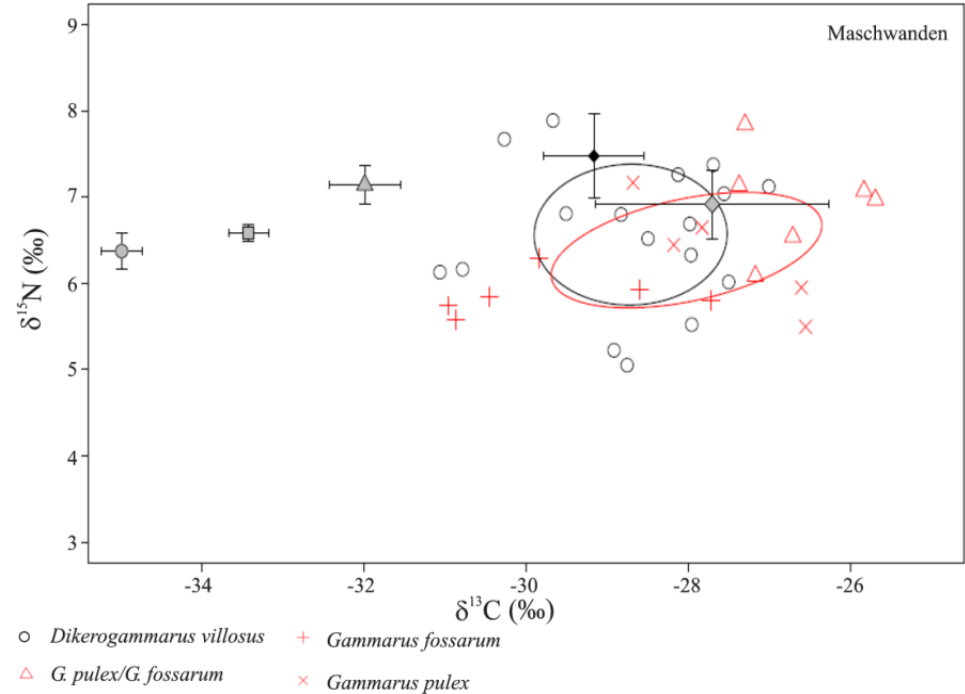
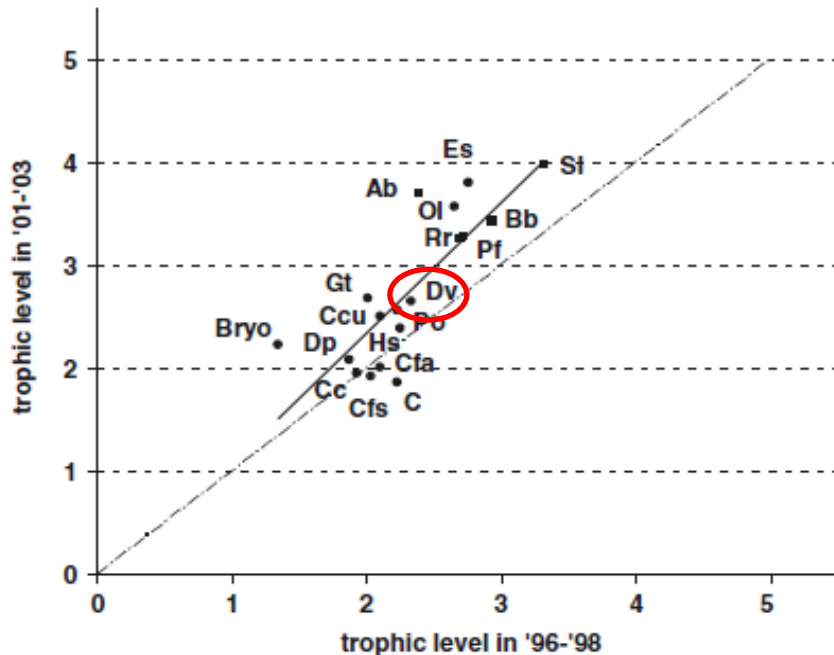
Concurrently decrease of species number and densities e.g. in rivers in Netherlands



➔ **Predaceous behavior**

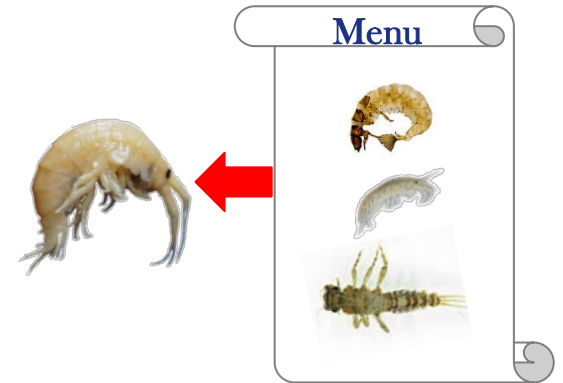


Trophic function in field is unclear and variable



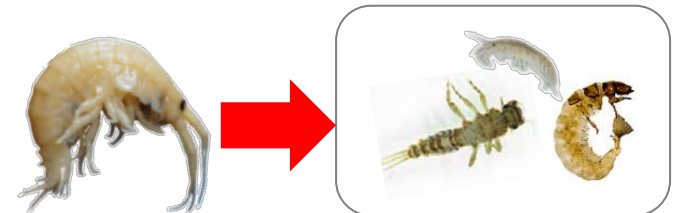
1. Is the invader *D. villosus* a predator in benthic communities of large rivers?

- Stable isotope analysis (SIA) of benthic invertebrates
- Diet analyses with SIAR (after Parnell et al. 2010: PLoSOne 5)



2. Did the invasion of *D. villosus* cause changes in the benthic invertebrate communities?

- Long-term data of benthic monitoring (since 1990)

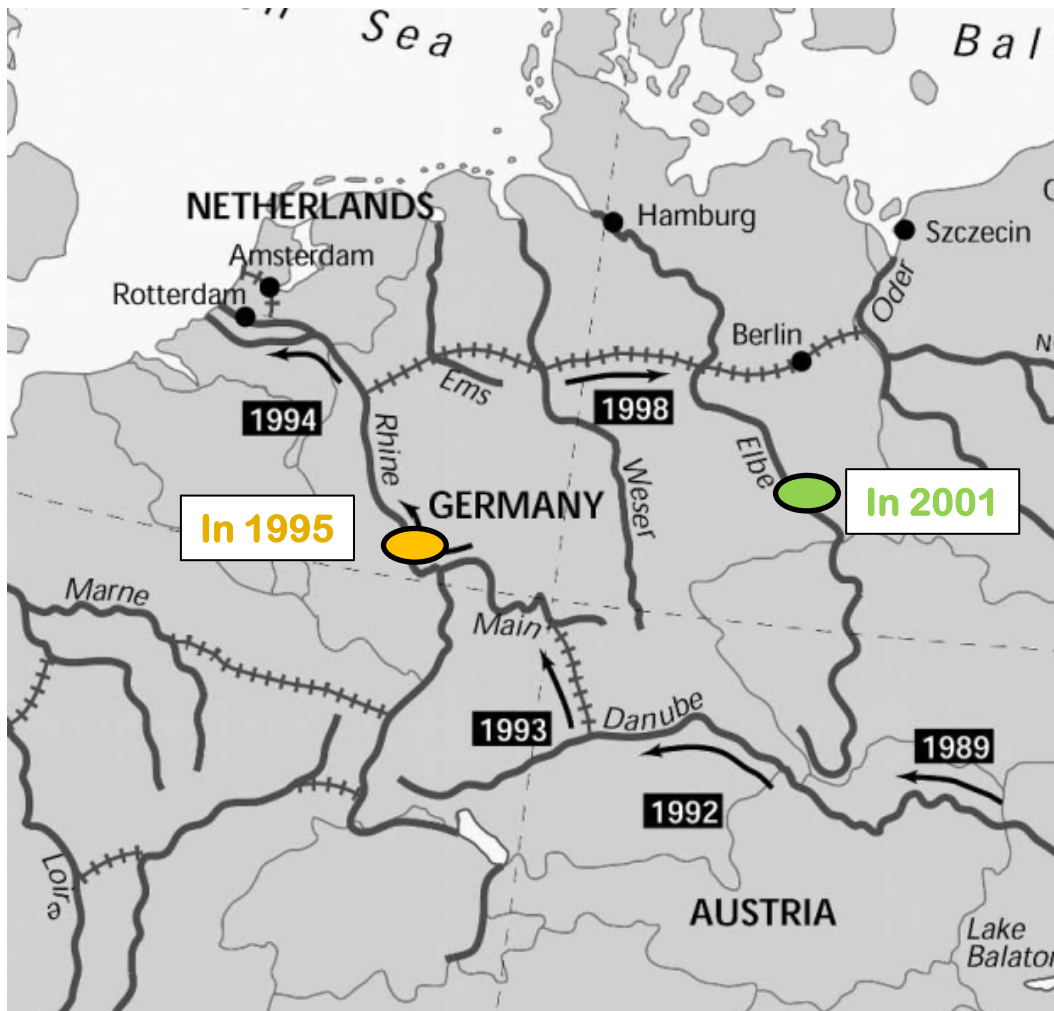


Sampling sites

Elbe – Dresden, river-km 66



Rhine – Koblenz, river-km 660



SIA sampling (autumn)



Long-term benthic sampling at
7 transversal positions, annual



River Elbe:

1992-2013

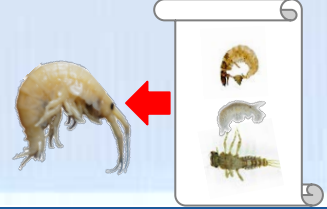
421 samples along 65 km

River Rhine:

1990-2013

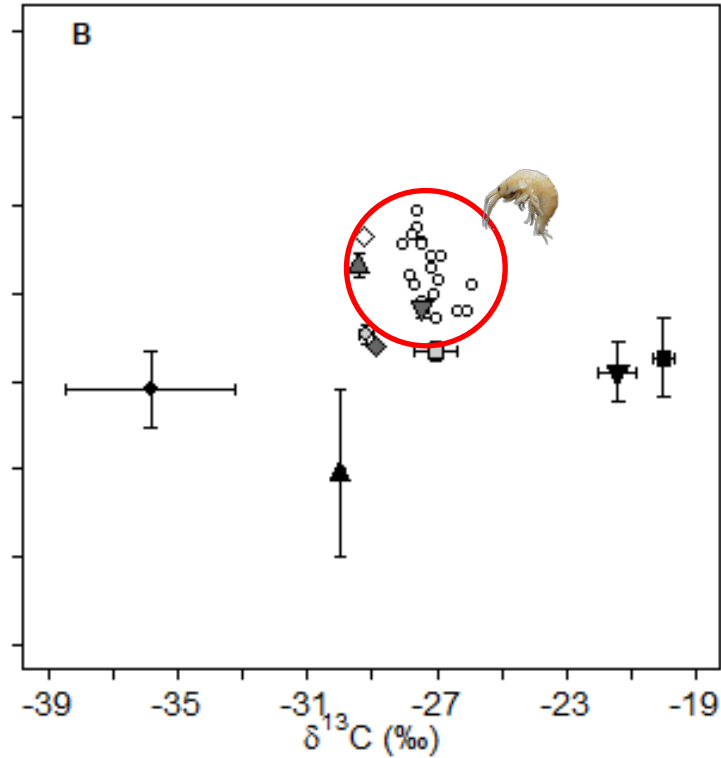
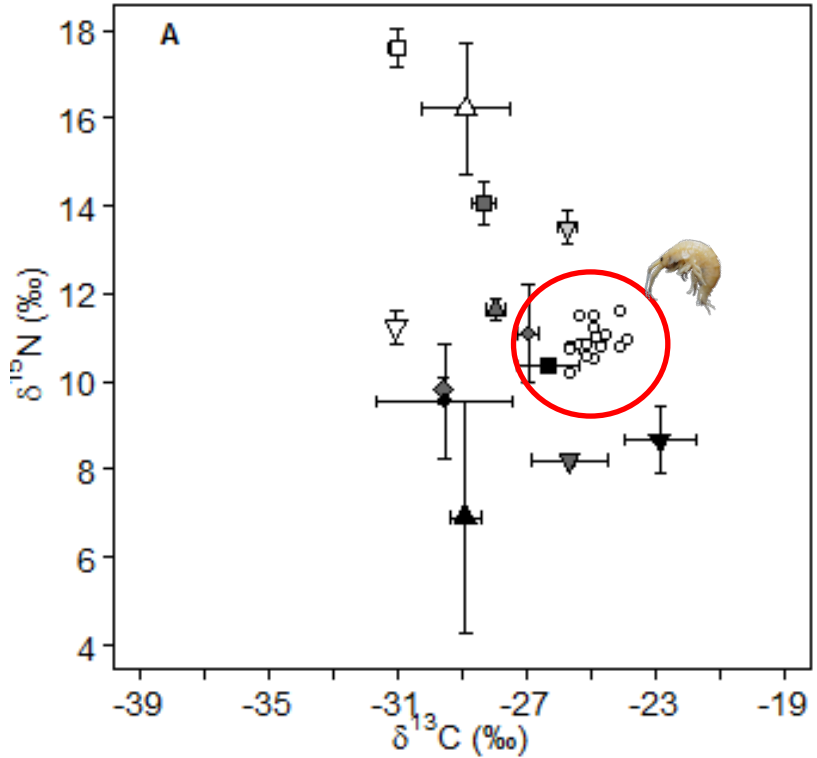
898 samples along 90 km

Results



River Elbe

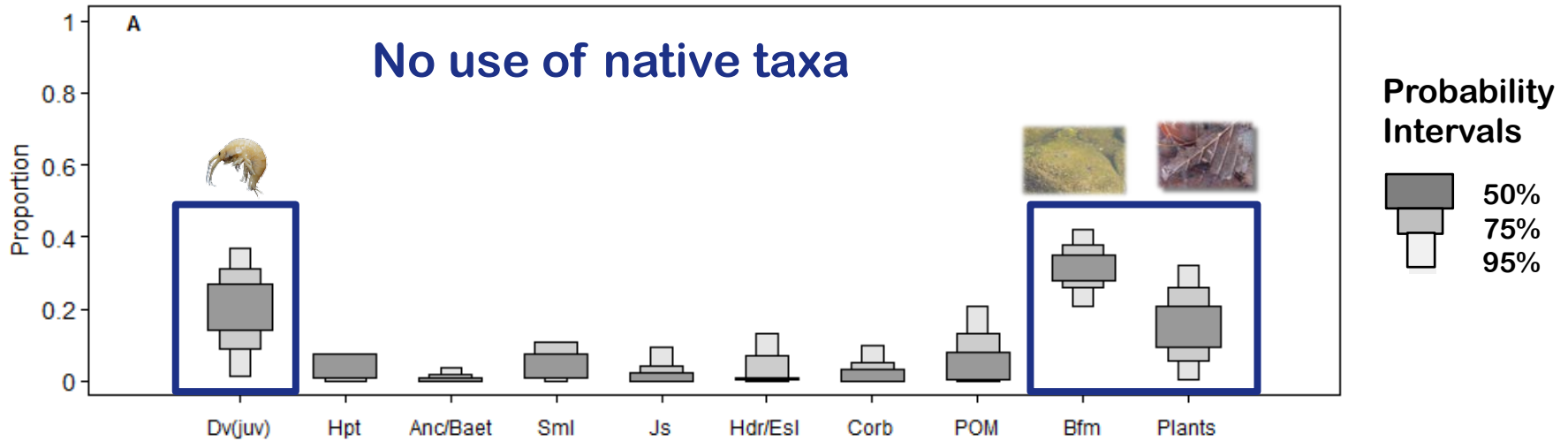
River Rhine



- *D. villosus*
- POM
- ▼ Biofilm
- ▲ Leaf litter
- ◆ Macrophytes
- ▽ *D. villosus (juv)*
- ▲ *Hydropsyche*
- ◆ *Simulium*
- ▽ *J. sarsi*
- ◆ *E. tetraedra*
- *H. sulphurea*
- ◇ *Chelicorophium*
- *E. ischnus*
- ▽ *C. fluminea/fluminalis*
- *B. fuscatus*
- △ *A. fluviatilis*
- ◇ *T. fluviatilis*

D. villosus had similar signatures to other primary consumers → no indication for a predator

Results



River Elbe

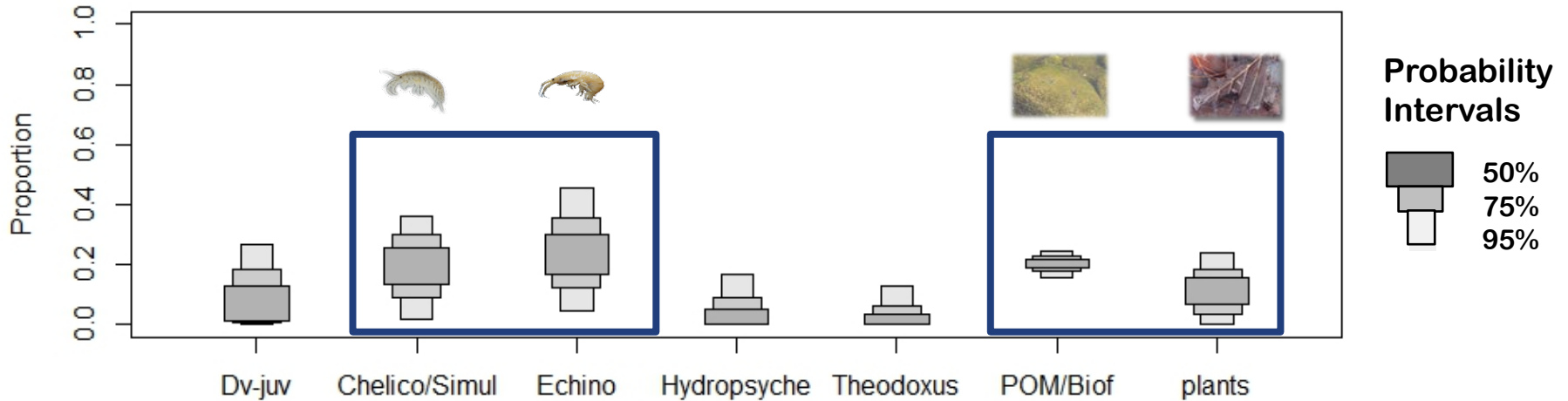
Biofilm

Leaves/macrophytes

Juvenile *D. villosus*

TP = 1.9

Results



River Elbe

Biofilm
Leaves/macrophytes
Juvenile *D. villosus*

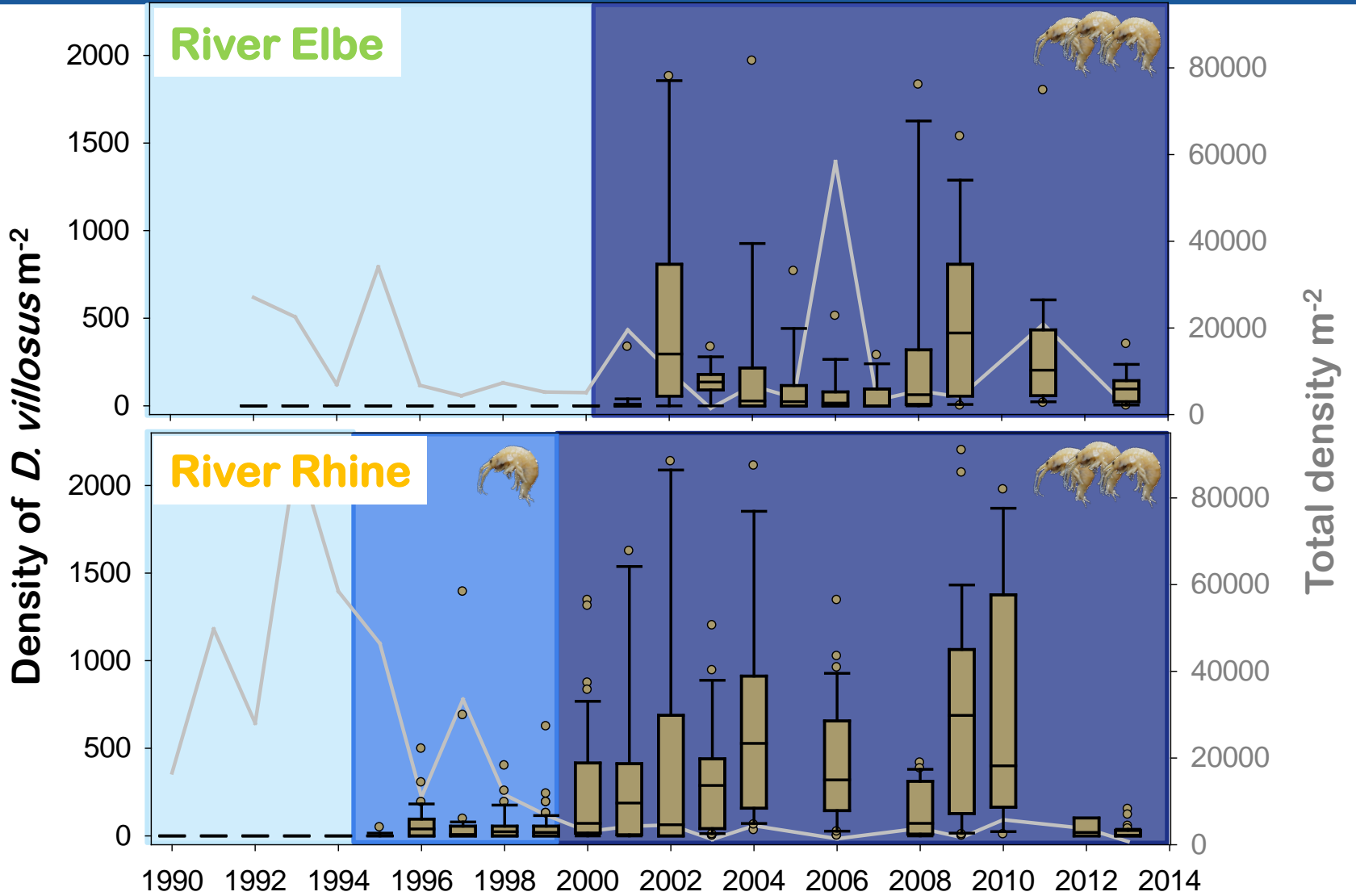
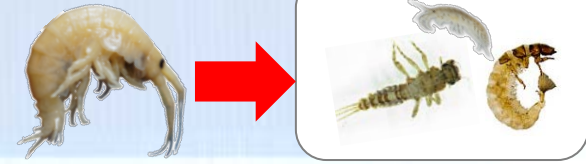
TP = 1.9

River Rhine

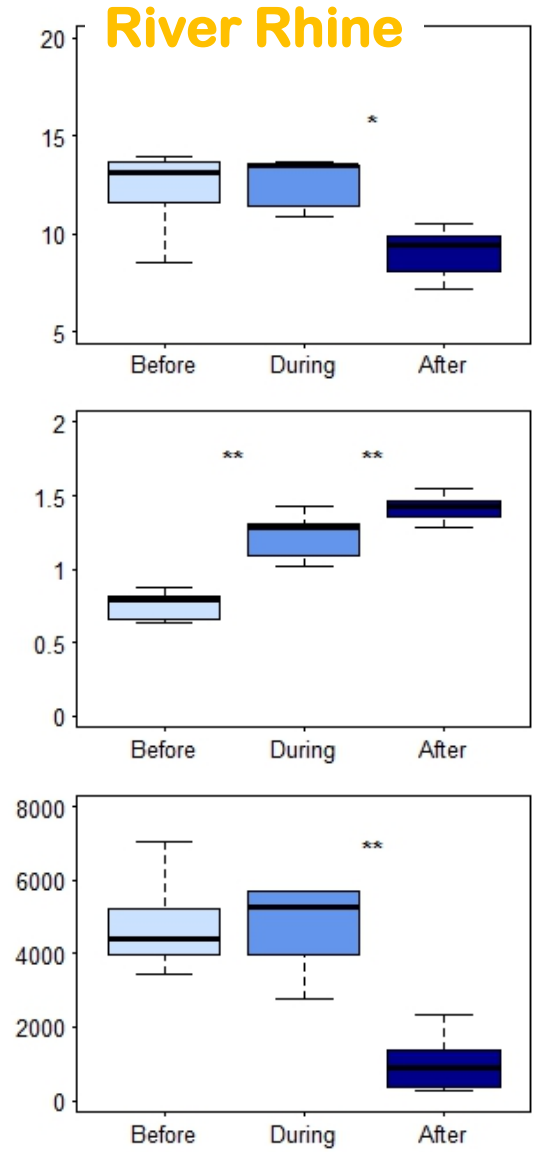
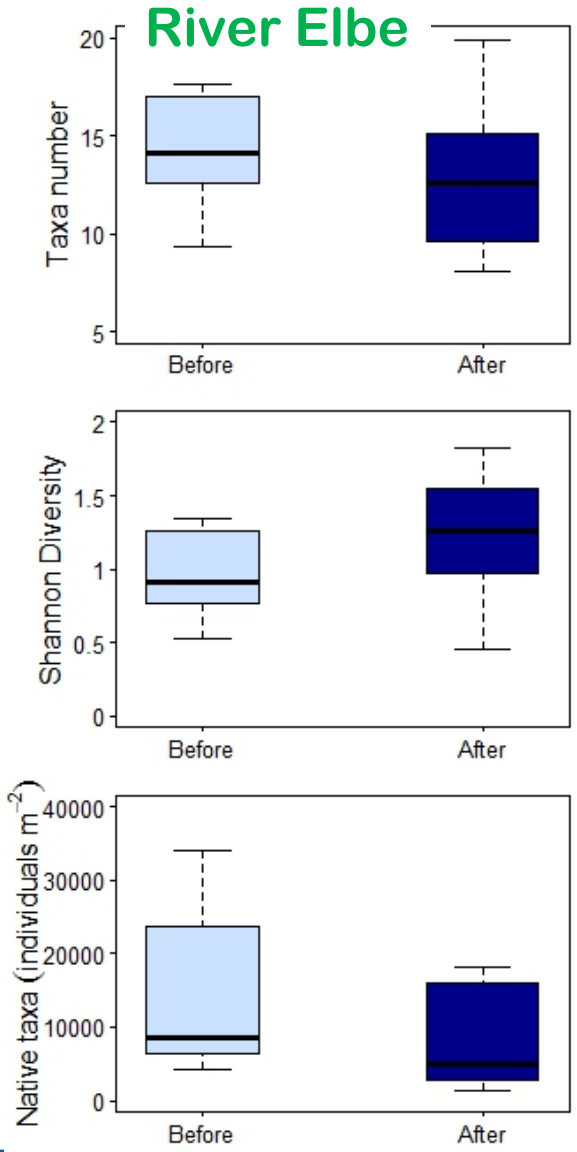
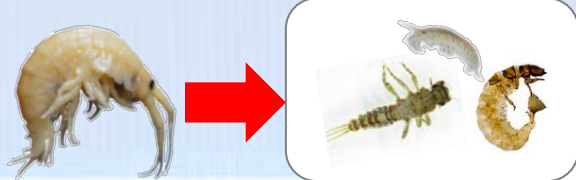
Biofilm/particulate material
Leaves/macrophytes
Invasive amphipods:
Echinogammarus ischnus
Chelicorophium

TP = 2.6

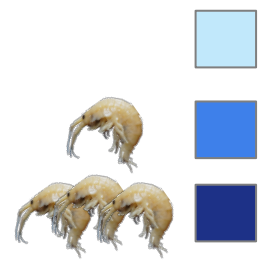
Results



Results

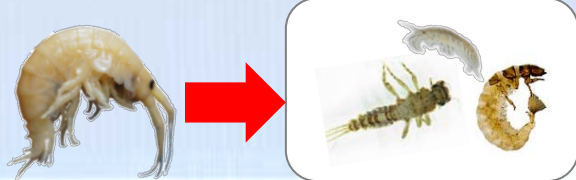


- Variable community effects
- River Elbe: no effects
- River Rhine:
 - no effects at low density
 - strong effects at high density

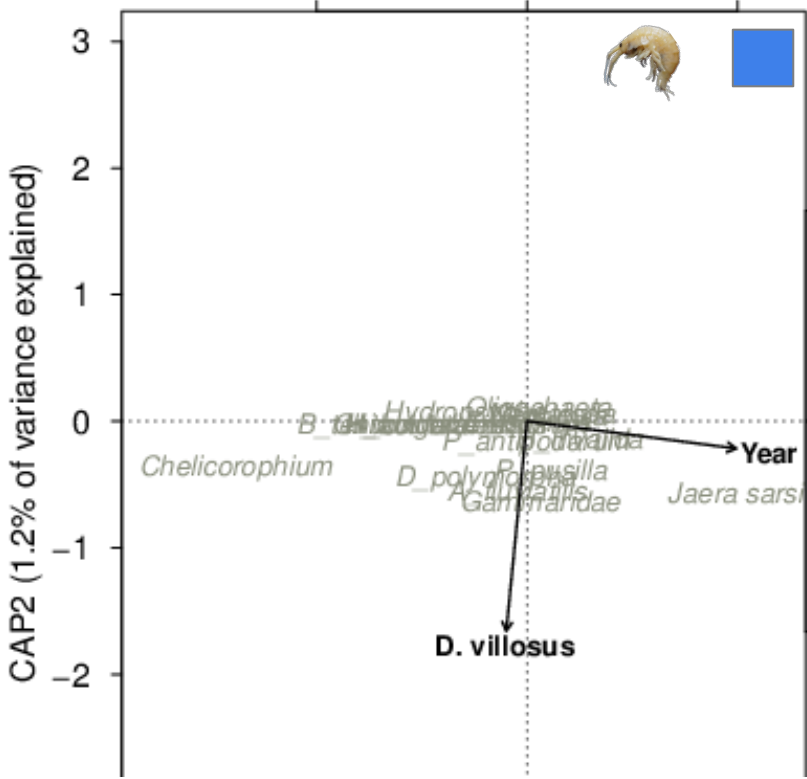


Statistics: permutation tests

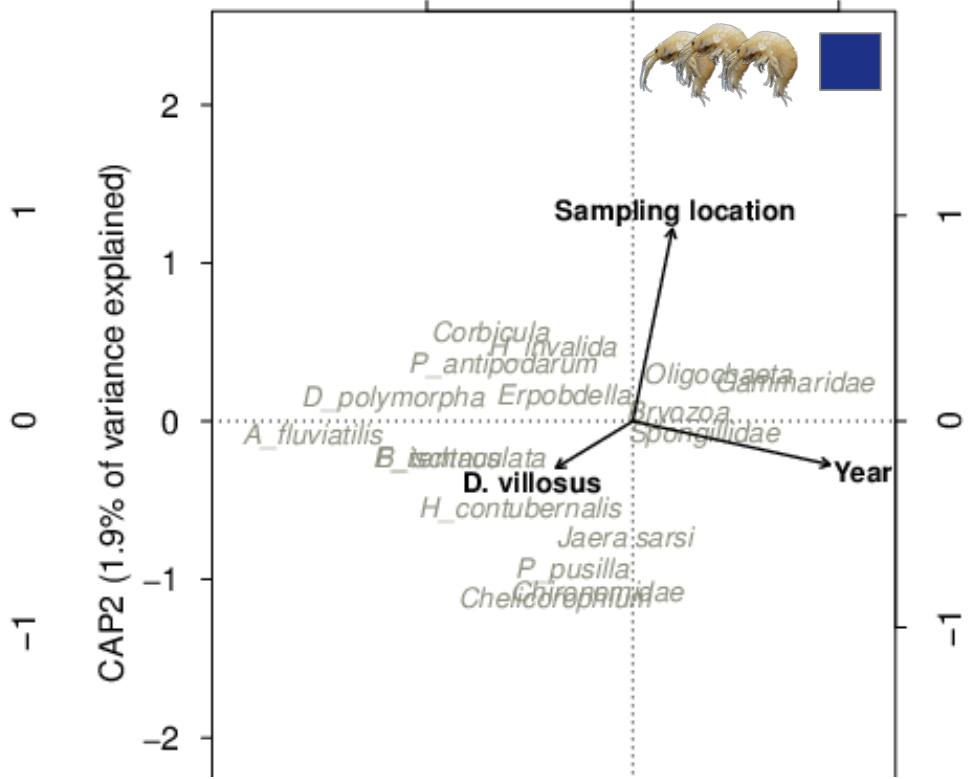
Results



River Rhine

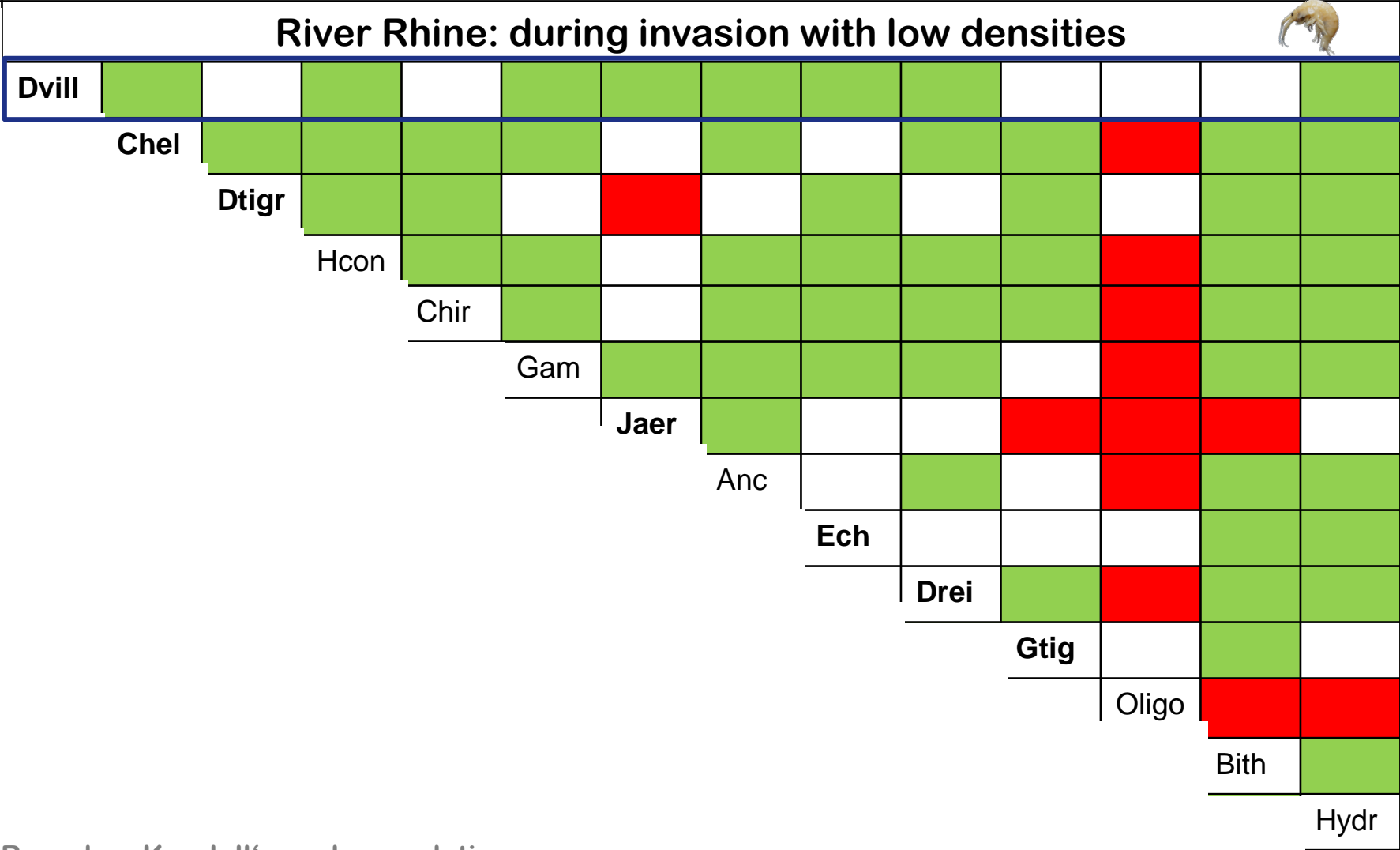
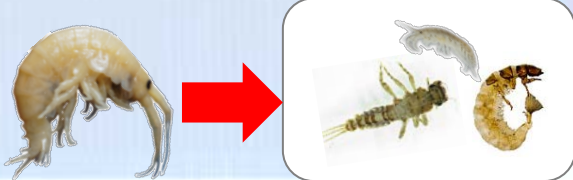


Statistics: Distance-based RDA



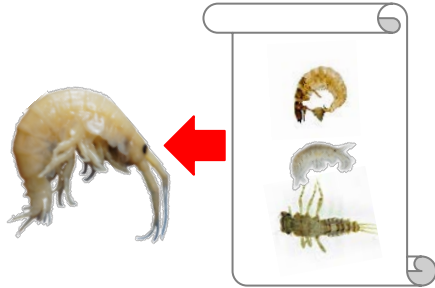
Species-specific effects seems to be stronger with high densities of *D. villosus*

Results



Based on Kendall's rank correlations
Hellmann et al.: submitted to Biol Invasions

Summary



X

River Elbe

(✓)

River Rhine



X

(✓)

- River-specific trophic function: primary consumer to omnivore, but no general predator
- River-specific effects on the community structure and species densities, but generally weak effects

Special thanks to

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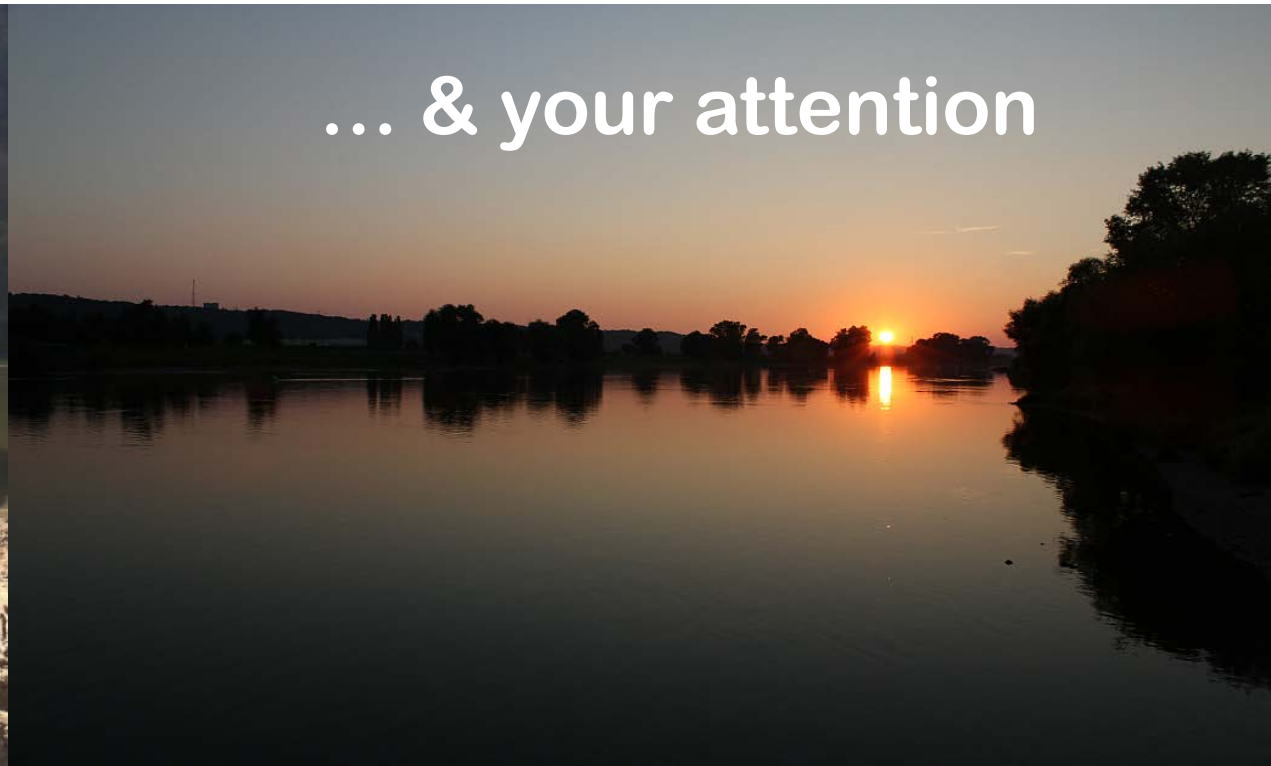
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Noether-
Programm**

Deutsche
Forschungsgemeinschaft

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... & your attention