

Is the aquatic *Dikerogammarus villosus* a ‘killer shrimp’ in the field?



– a case study on one of the most
invasive species in Europe

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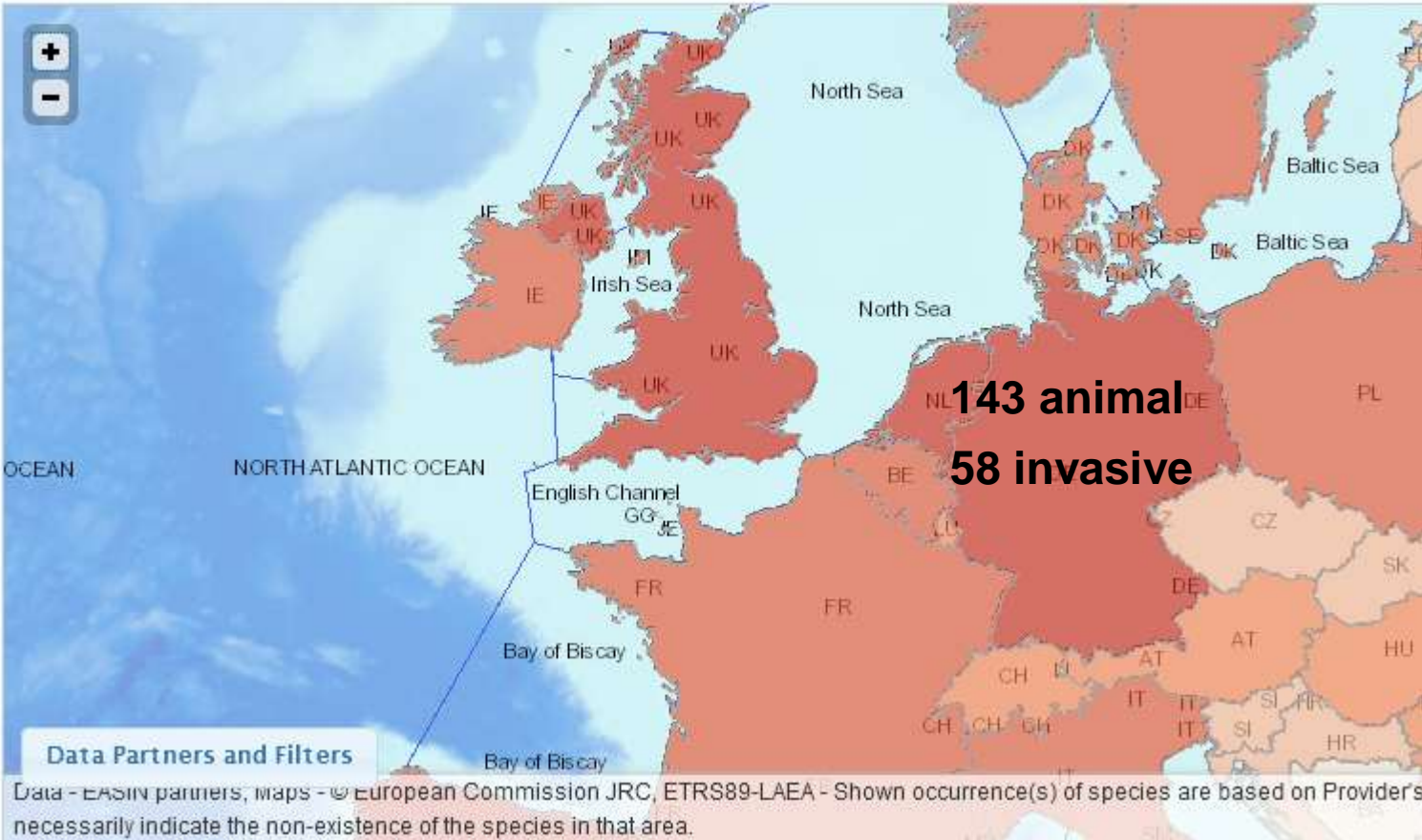
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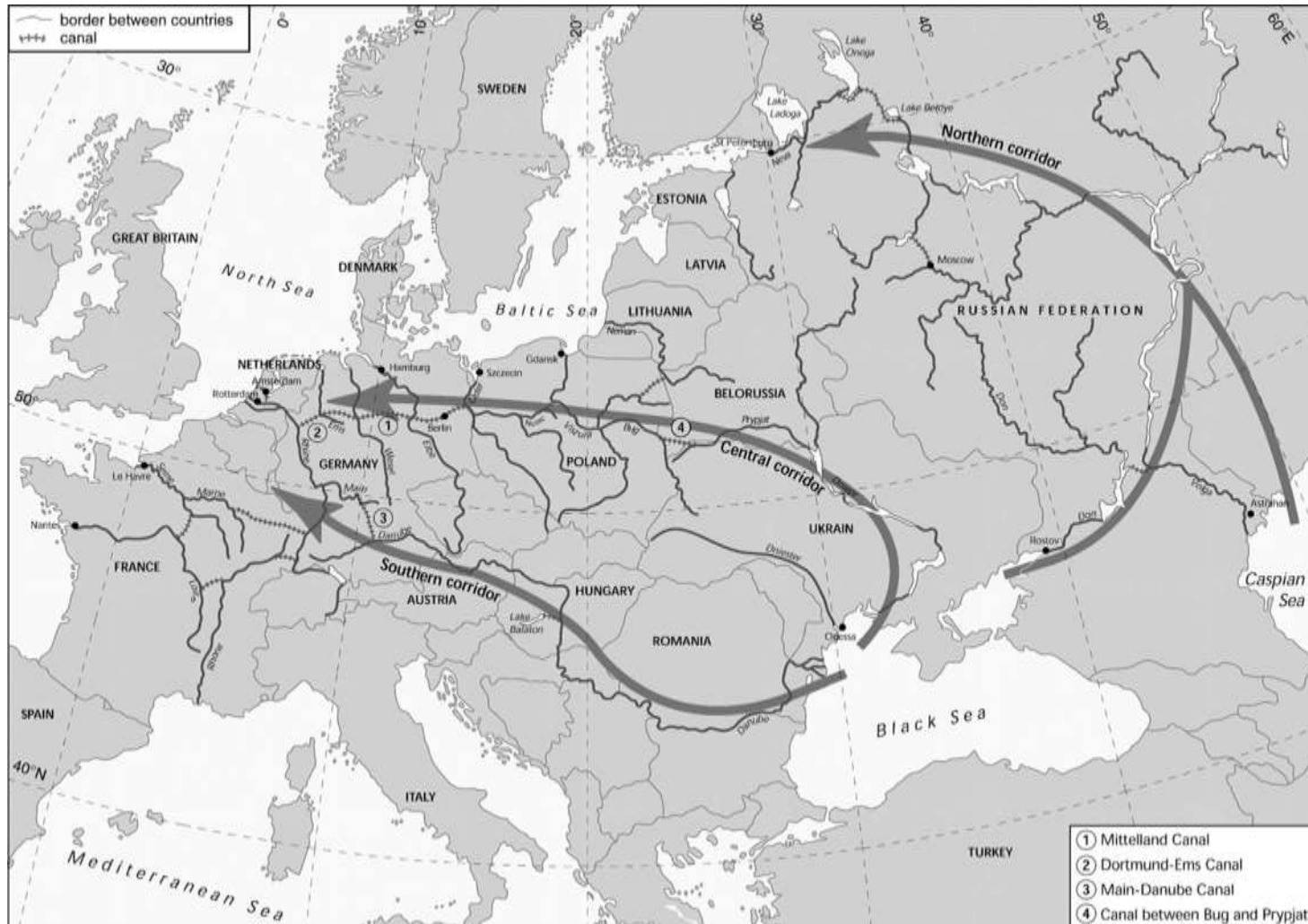
Introduction

EASIN Species, Maps & Services LSID: [EASIN:ENV:FW]

Maps Species About Maps User Guide

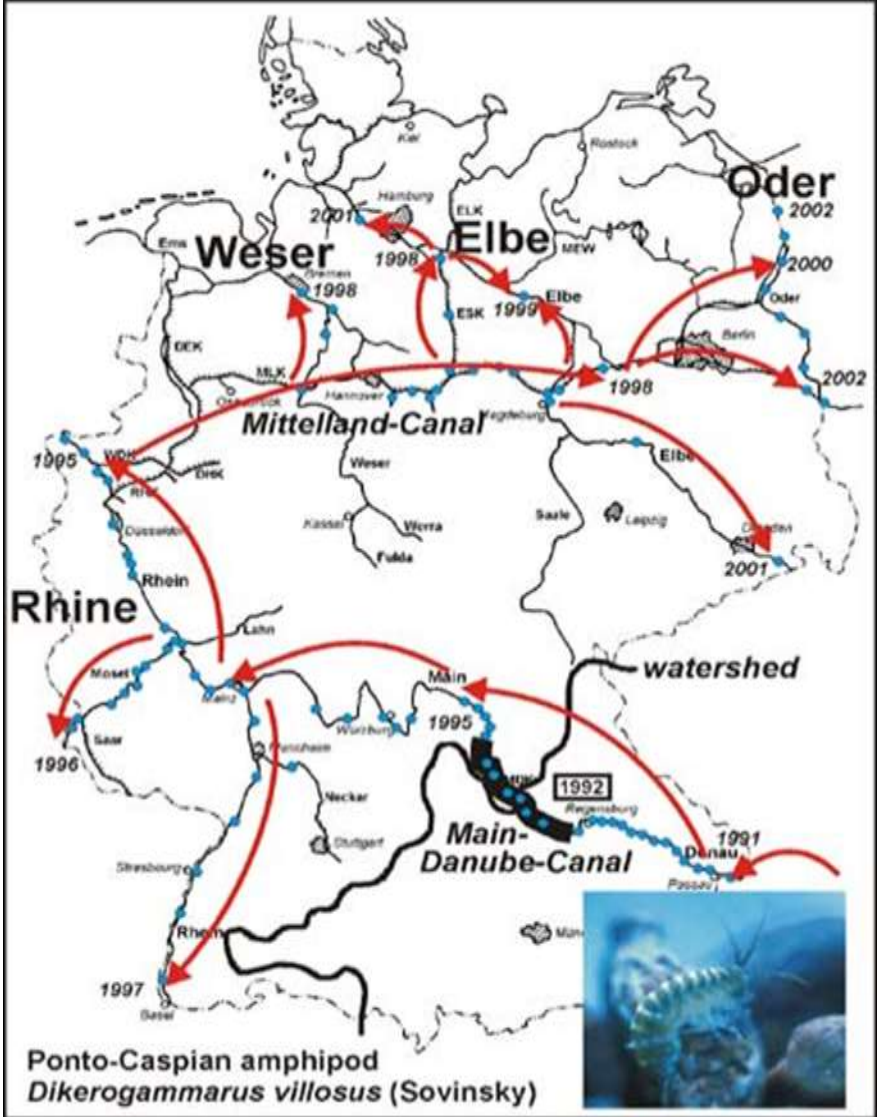


Introduction



Bij de Vaate et al. (2002)

Introduction

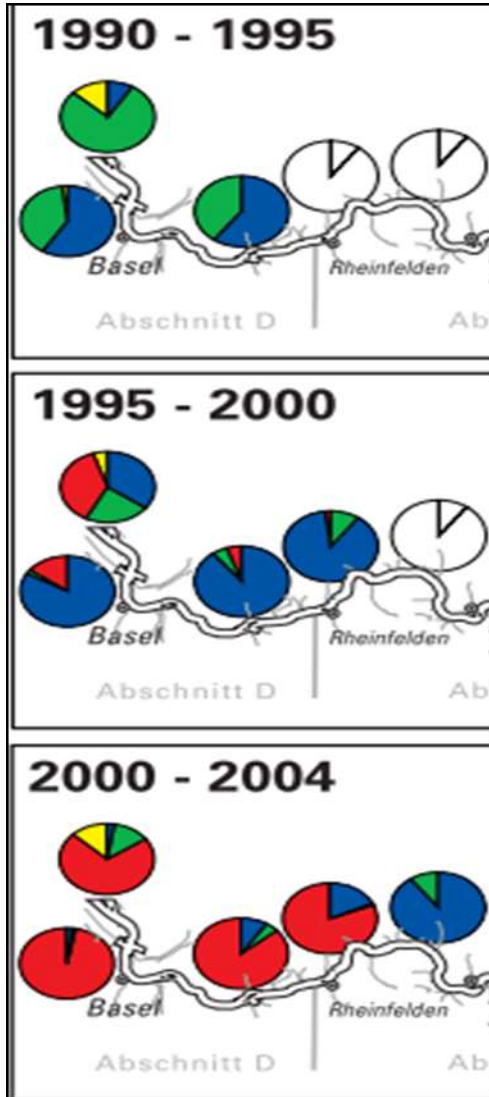


- 1994/95 first record from the River Rhine
- Colonised most major European rivers within 2 decades

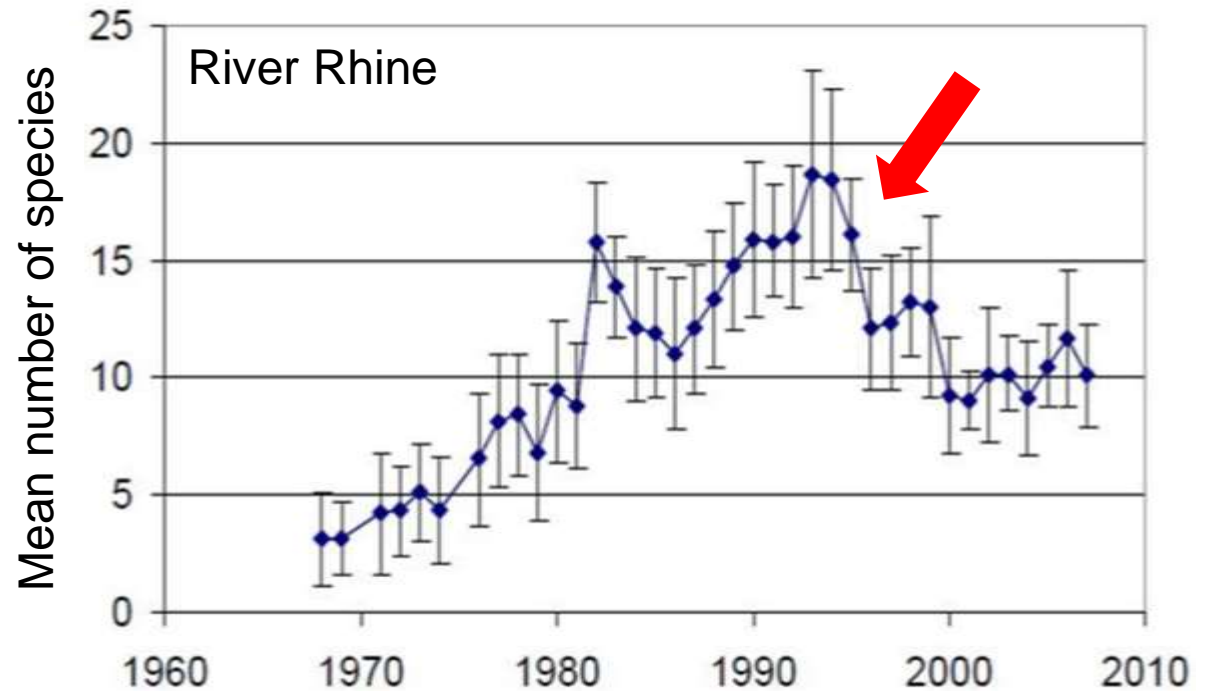
- Larger than native amphipods
- High reproductive potential & growth rate
- Colonises different substrates
- Highly tolerant towards various environmental conditions
(e.g. T, O₂, salinity)
- Feeding behaviour



Introduction



after Rey et al. 2005



Schöll, BfG-report Nr. 172

- other gamarids
- Dikerogammarus villosus*
- Gammarus roeselii*
- Gammarus pulex/fossarum*

Predatory impact of the freshwater invader *Dikerogammarus villosus* (Crustacea: Amphipoda)

Jaimie T.A. Dick, Dirk Platvoet, and David W. Kelly

Can. J. Fish. Aquat. Sci. 59: 1078–1084 (2002)



Ischnura elegans



Sigara sp.

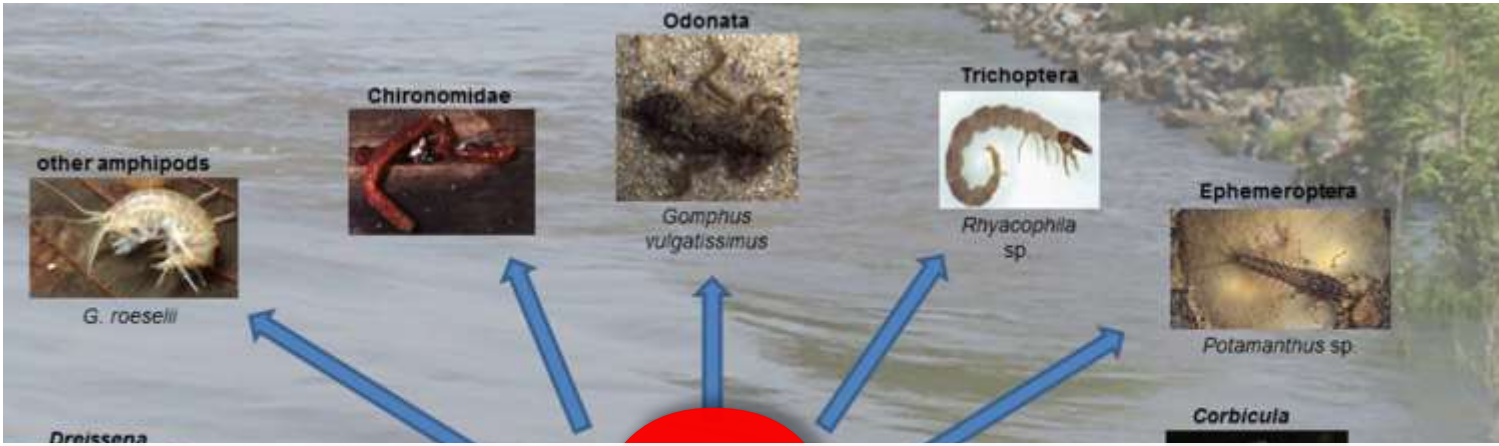


Caenis robusta

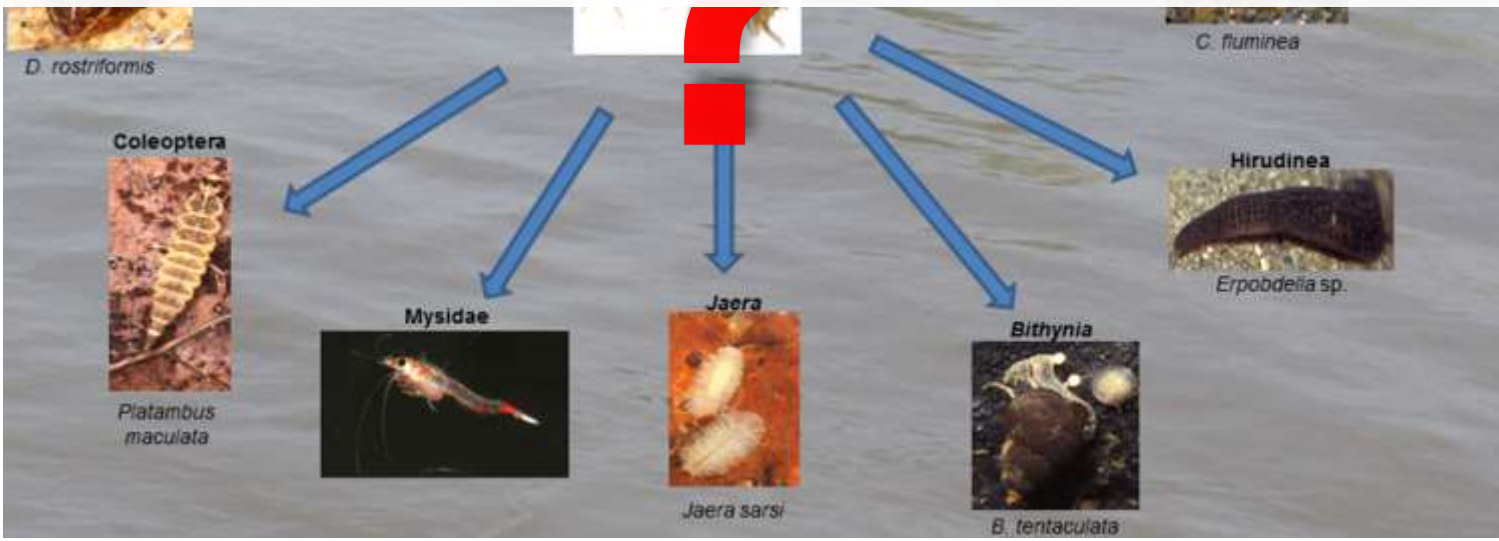


Asellus aquaticus

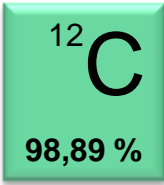
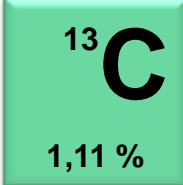
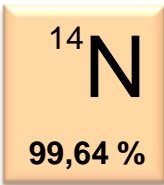
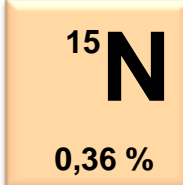
Hypothesis

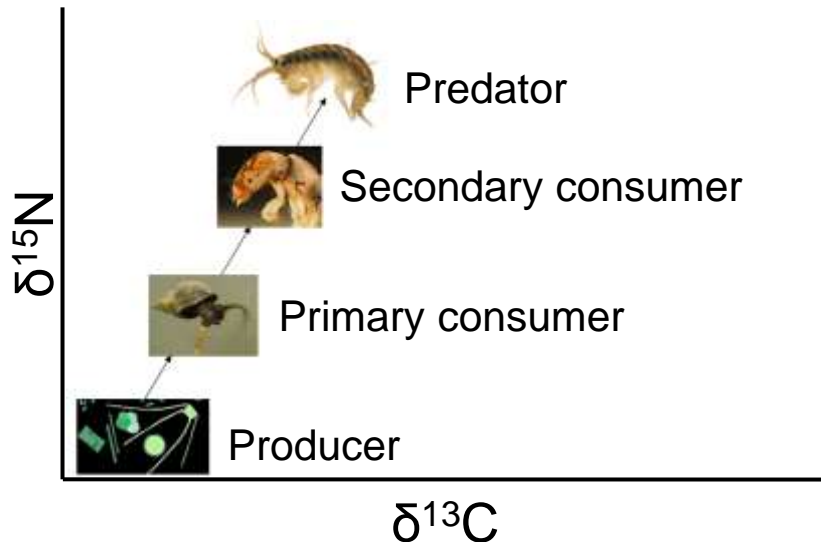


➤ *D. villosus* is also strongly predacious in the field



Stable Isotope Analyses (SIA)

Carbon	 ^{12}C 98,89 %	 ^{13}C 1,11 %	$^{13}\text{C}/^{12}\text{C}$
Nitrogen	 ^{14}N 99,64 %	 ^{15}N 0,36 %	$^{15}\text{N}/^{14}\text{N}$



$\delta^{15}\text{N}$: strong accumulation

1 Trophic Level ca. 3.4 ‰

$\delta^{13}\text{C}$: less accumulated

C-source of the food

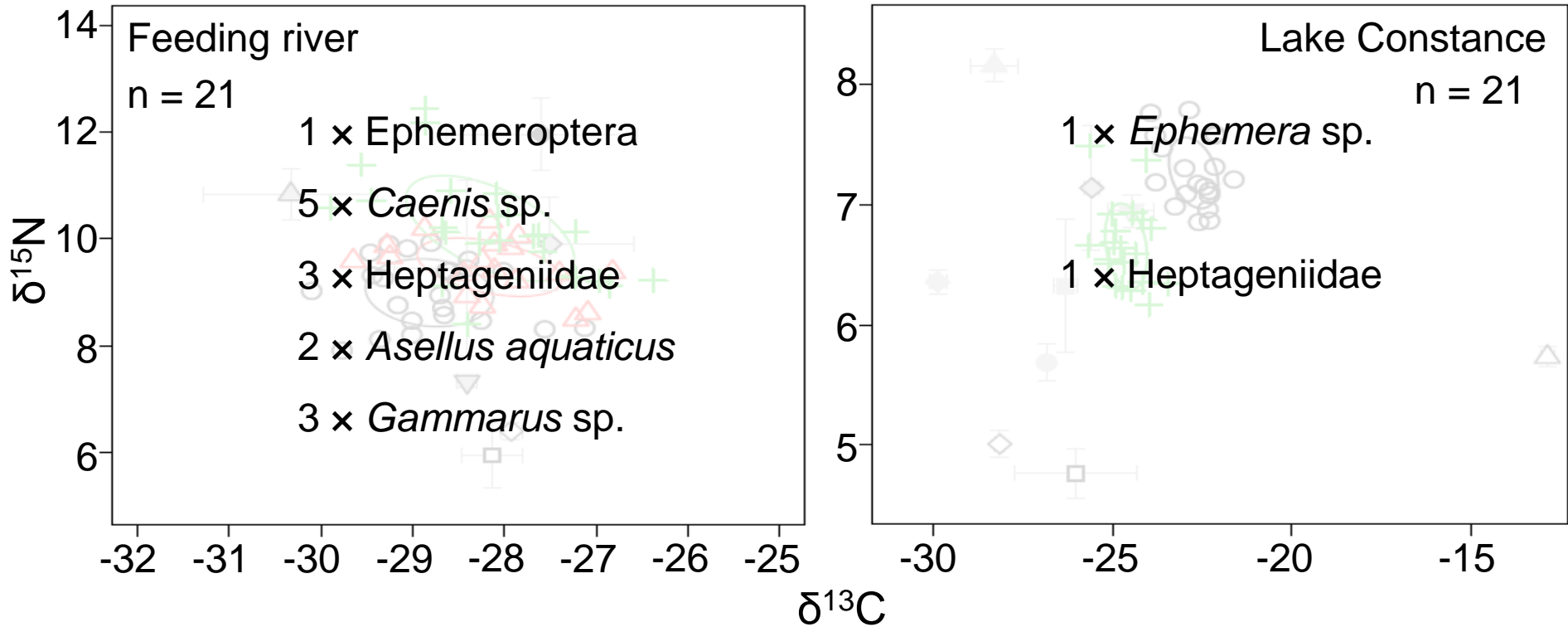
Sampling areas of the River Rhine and its tributaries



- Bulk analyses $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$
- SIBER-Analyses comparing amphipod species
- Genetic gut content analyses with group-specific rDNA primers (Koester et al. 2013)

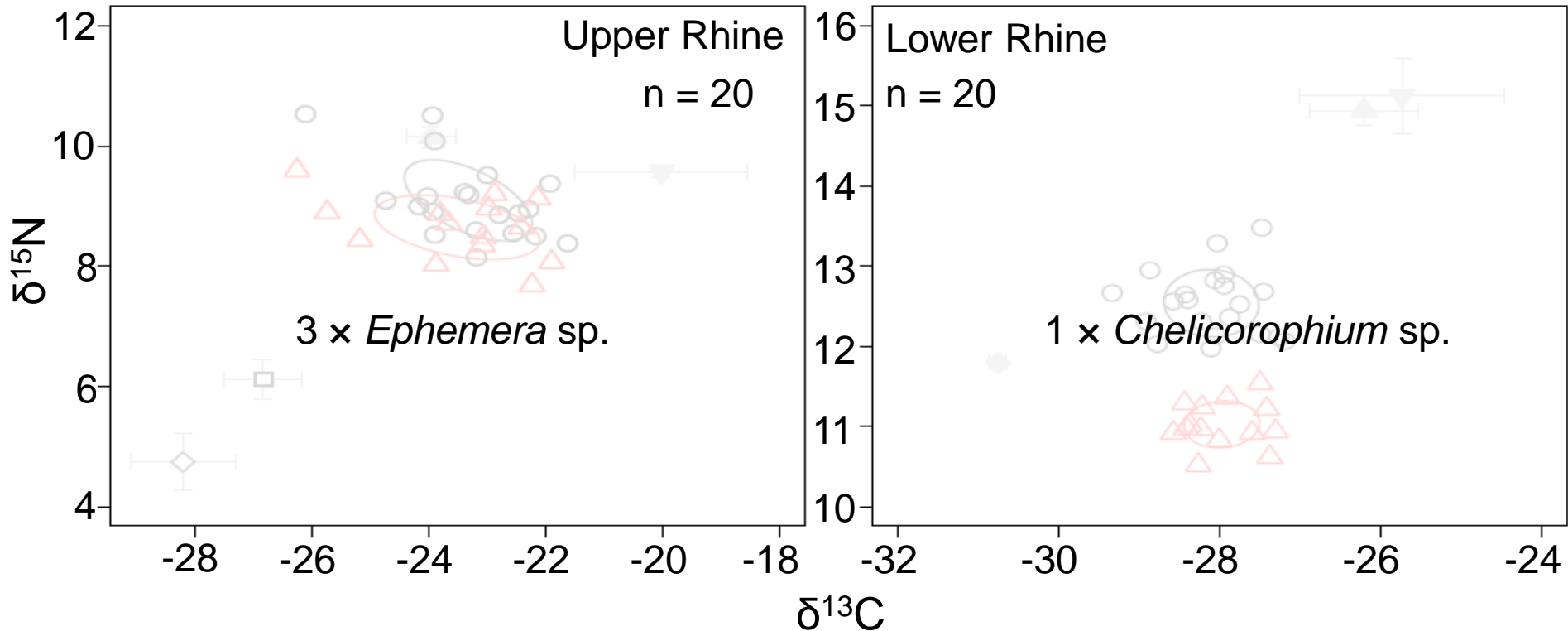


A. Feeding river vs. Lake Constance



- | | | |
|-----------------------------------|-------------------------------|-----------------------------------|
| ○ <i>Dikerogammarus villosus</i> | ● <i>Caenis</i> sp. | ▲ <i>Limnomysis benedeni</i> |
| △ <i>Echinogammarus berelloni</i> | ◇ Chironominae | ▼ <i>Potamopyrgus antipodarum</i> |
| + <i>Gammarus roeselii</i> | ◆ <i>Dreissena polymorpha</i> | ▽ Simuliidae |
| ○ <i>Asellus aquaticus</i> | △ <i>Hydropsyche</i> sp. | △ <i>Characea</i> sp. |
| ■ <i>Bithynia tentaculata</i> | ◆ Hirudinae | □ Periphyton |
| | | ◇ Seston |

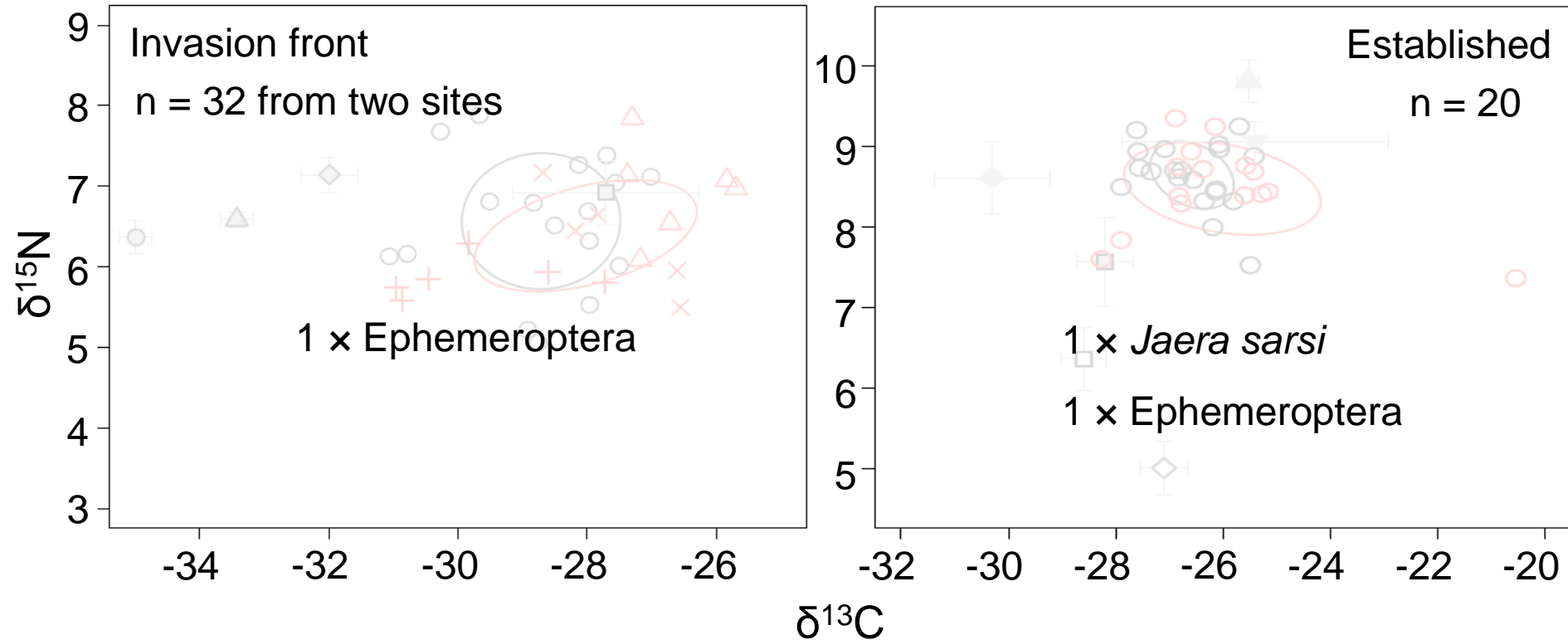
B. Upper Rhine vs. Lower Rhine



- *Dikerogammarus villosus*
- △ *Echinogammarus ischnus*
- ◆ *Corbicula fluminea*
- ▲ *Jaera sarsi*

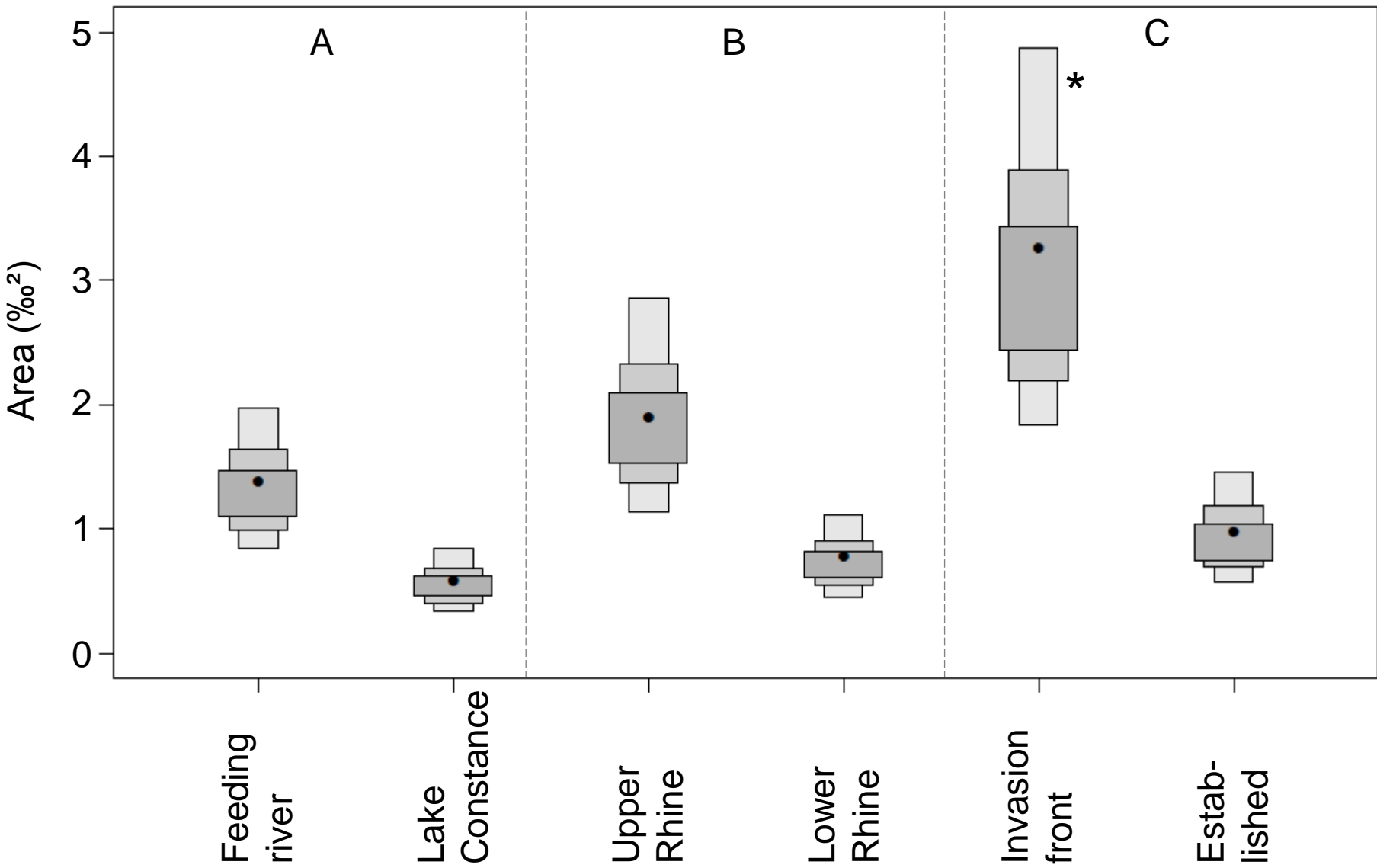
- ▼ *Potamopyrgus antipodarum*
- Periphyton
- ◇ Seston

C. Invasion front vs. Established



- | | | |
|----------------------------------|--------------------------|-----------------------------------|
| ○ <i>Dikerogammarus villosus</i> | ● Diamesinae | ○ <i>Echinogammarus ischnus</i> |
| + <i>Gammarus fossarum</i> | ◇ Simuliidae | ◆ <i>Dreissena rostriformis</i> |
| × <i>Gammarus pulex</i> | △ Orthoclaadiinae | ▲ <i>Jaera sarsi</i> |
| △ <i>G. pulex/G. fossarum</i> | ◆ <i>Rhyacophila</i> sp. | ▼ <i>Potamopyrgus antipodarum</i> |
| ■ <i>Ancylus fluviatilis</i> | □ Periphyton | ◇ Seston |

Isotopic niche width *D. villosus*



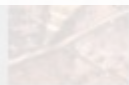
Hypothesis

D. villosus is also strongly predacious in the field

‘killer shrimp’?

- less predatory in the River Rhine system
- supported by SIA and genetic analyses
- more opportunistic at an invasion front

– apparently not



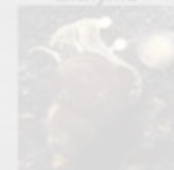
Platambus maculata



Mysidae



Jaera sarsi



Bithynia

B. tentaculata

Odonata

Chironomidae

Trichoptera

Thanks...

... for your attention

... to Andreas Hirsch

... to Peter Rey, Uta Mürle and Johannes Ortlepp

... and numerous other people



Need more details?

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