

From outbreak to action

Multidisciplinary research on batrachochytrid threats to amphibians in the Netherlands

Charles Duchatel, Maarten Gilbert, Annemarieke Spitzen - van der Sluijs, Rein Brys, An Martel, Frank Pasmans, Wouter Beukema

Strasbourg, October 7, 2025

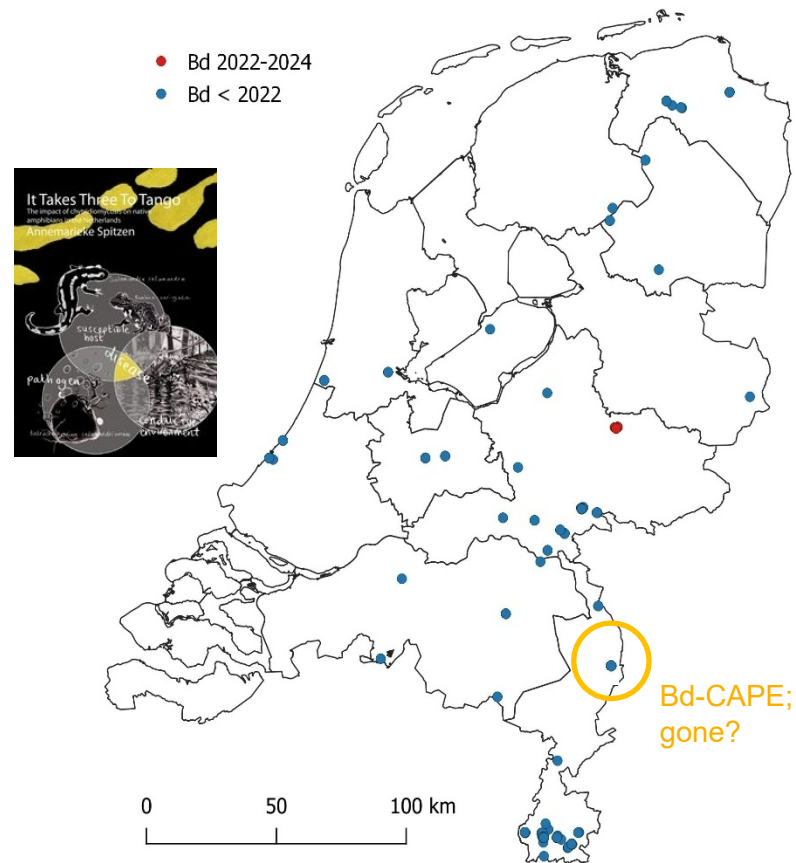


RAVON

Reptielen Amfibieën Vissen Onderzoek Nederland

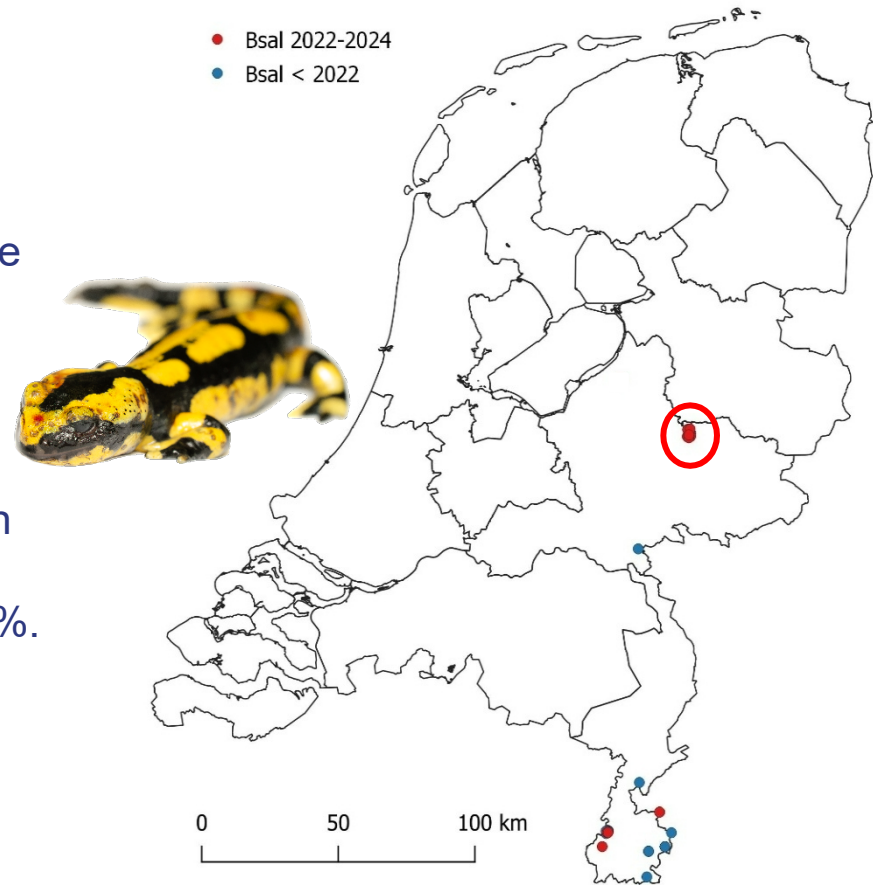
Bd in the Netherlands

- Widespread, known to affect populations of *Bombina* and *Alytes* in the southern Netherlands.
- In *Bombina*, **high recruitment** owing to conservation actions (creation of reproduction puddles) functions as a 'coincidental' **persistence mechanism**.
- Insufficient evidence that other amphibian species experience declines.



Bsal in the Netherlands

- Records from southern half of Limburg province and in Gelderland province.
- More challenging to detect when there are no *Triturus* or *Salamandra* present; distribution might be larger.
- Impact on newts unclear, but outbreaks in *Triturus* populations cause considerable mortality. Fire salamanders declined >95%.



Four main research lines

- Research in progress!



1. **Bsal impact on newt populations**; focus on *Triturus*.
2. Influence of **amphibian assemblage composition** on infection intensities.
3. Influence of local & landscape level (a)biotic factors; **focus on temperature**.
4. **Bsal-Bd coinfection**.



Bsal impact on newt populations; focus on *Triturus*

- Use of **(Bayesian) disease-structured multistate mark-recapture models** can account for uncertainty* > collaboration with Dr. Matthijs Hollanders (**Quantecol**).
- Quantifying chytrid impact on amphibian populations can be tricky due to **detection uncertainty**; states (infected, uninfected, dead) depend on imperfect field and diagnostic detection.
- **Open populations** (movement!) add further complexity to detection and state assignment.
- **Lower apparent survival in infected animals**, although **recoveries are observed**.

*Hollanders & Royle 2022, *Methods Ecol Evol* 13: 2827-2837 (<https://doi.org/10.1111/2041-210X.13993>)

Influence of amphibian assemblage composition

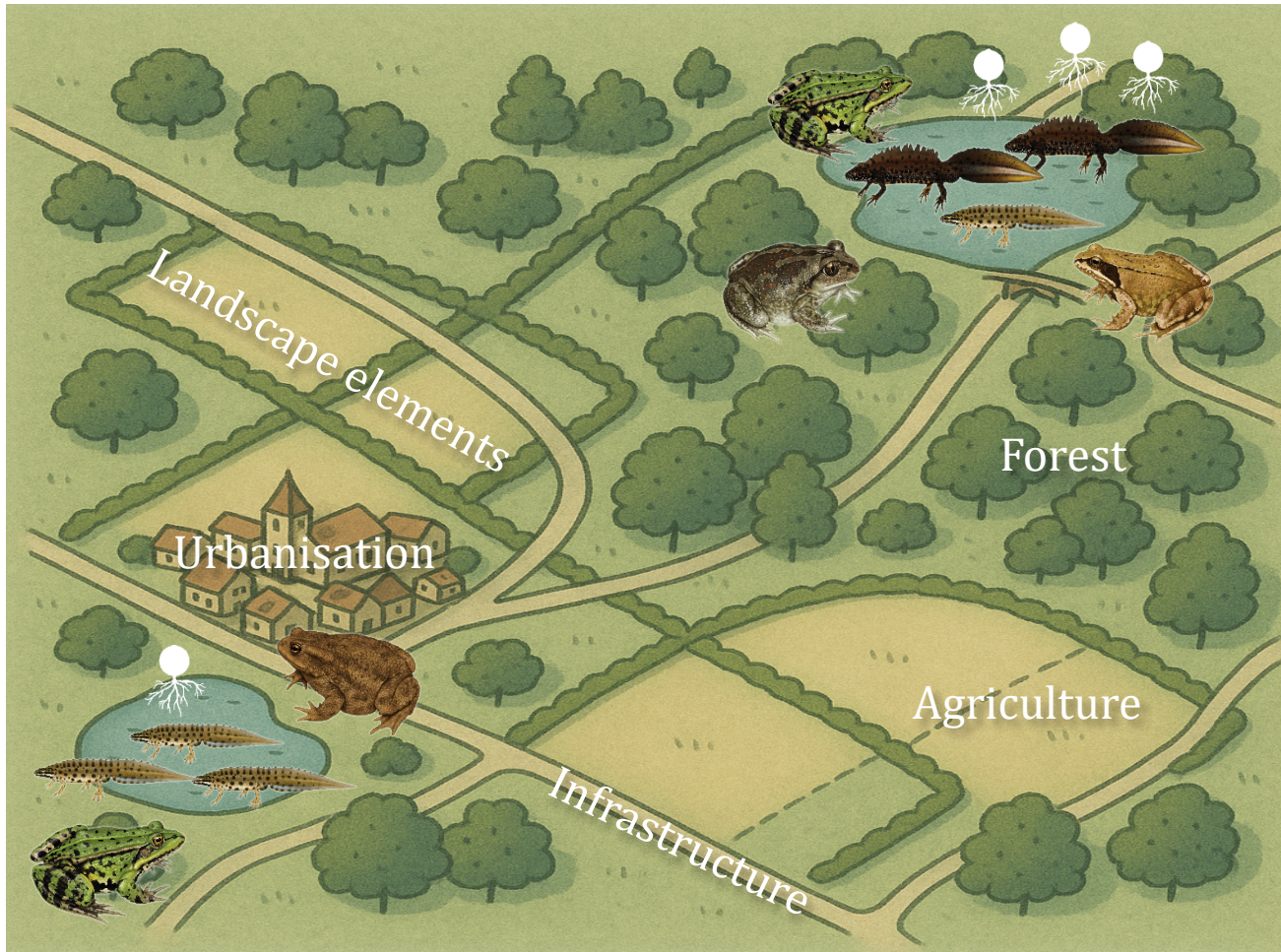


Influence of amphibian assemblage composition

- Does assemblage composition influence Bsal & Bd infection intensity?
- **40 ponds - eDNA metabarcoding** of 7 amphibian species + Bd & Bsal, and selected **quantitative eDNA analyses (ddPCR)** of *Bsal*, *Triturus*, *Lissotriton*.
- Together with **Research Institute for Nature and Forest (INBO, Belgium)**, Genetic Diversity Unit.
- First results pending; possibly followed up by experimental work.

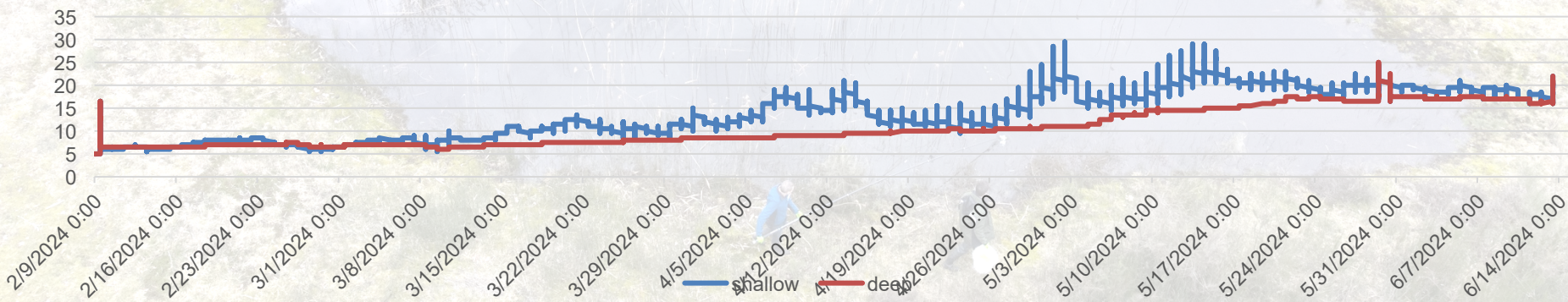


Influence of local & landscape level (a)biotic factors



Influence of local & landscape level (a)biotic factors

- Hand in hand with eDNA metabarcoding and ddPCR analyses.
- **Spatial analyses, landscape & local**; focus on land use, landscape features and pond characteristics in combination with eDNA results (temporal snapshot!).
- **Local time series analyses**; pond characteristics, in combination with swab and ddPCR eDNA results, focus on temperature incl. pond mixing.



Bsal-Bd coinfection

- Coinfection by both Bsal and Bd is known to occur (e.g. *Salamandra salamandra* in Germany, *Triturus marmoratus* and introduced *Mesotriton alpestris* in Catalunya).
- Low virulence chytrid fungi could protect European amphibians from more deadly strains*.
- How do such coinfections vary throughout the amphibian reproduction season? How does this influence disease outcome?
- First results; our focal amphibian assemblage is characterised by **temporal separation of Bsal and Bd**, with co-infection being (very) rare.



Partners & acknowledgements

Karin Akkers, Arwen Baggen, Niklas Banowski, Joyce Beenen, Jesper Berndsen, Wouter Beukema, Philipp Böning, David Broek, Sofie De Bruyckere, Rein Brys, Charles Duchatel, Max van Elsen, Teun Everts, Léa Fieschi-Méric, Maarten Gilbert, David Halfmaerten, Luc Haverhals, Jelger Herder, Matthijs Hollanders, Jan en Heleen Hoogland, Jöran Janse, Jan Kranenbarg, Naomi Lambrixx, Pieter de Leeuw, Stefan Lötters, Jesse Looren de Jong, Albert van de Maat, An Martel, Tom en Marleen van der Meulen, Kevin Mulder, Sabrina Neyrinck, Martin van Oosterhout, Rowen Post, Emily Louise Pascoe, Frank Pasmans, Erna Pieters-van Wageningen, Thijs Schippers, Wendy van Sligter, Annemarieke Spitzen, Ellen ter Stege, Tariq Stark, Erwin Virginia, Wouter de Vries, Ronald Zollinger & alle terreineigenaren in regio Zutphen



RAVON



Ministerie van Landbouw, Visserij,
Voedselzekerheid en Natuur



INSTITUUT
NATUUR- EN
BOSONDERZOEK

Thank you for you attention!



Questions?