Testing whether conservation action works:

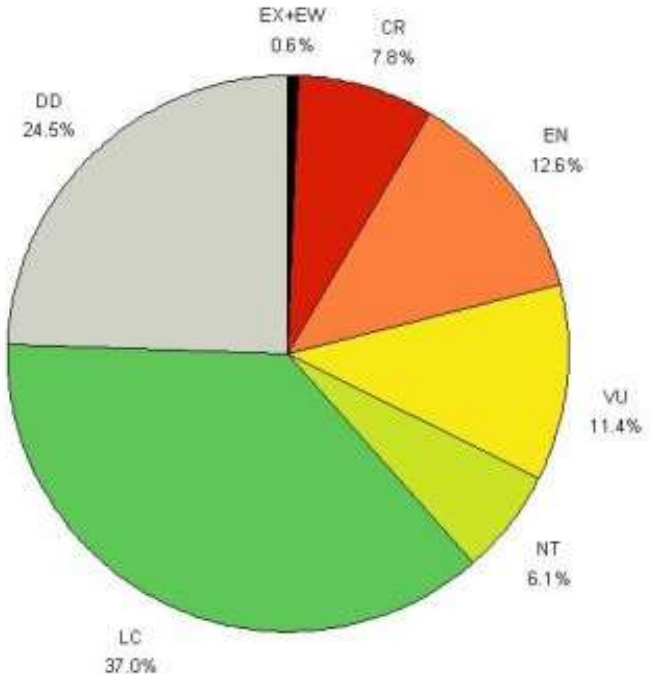
Does the creation of stepping-stone ponds increase dispersal?

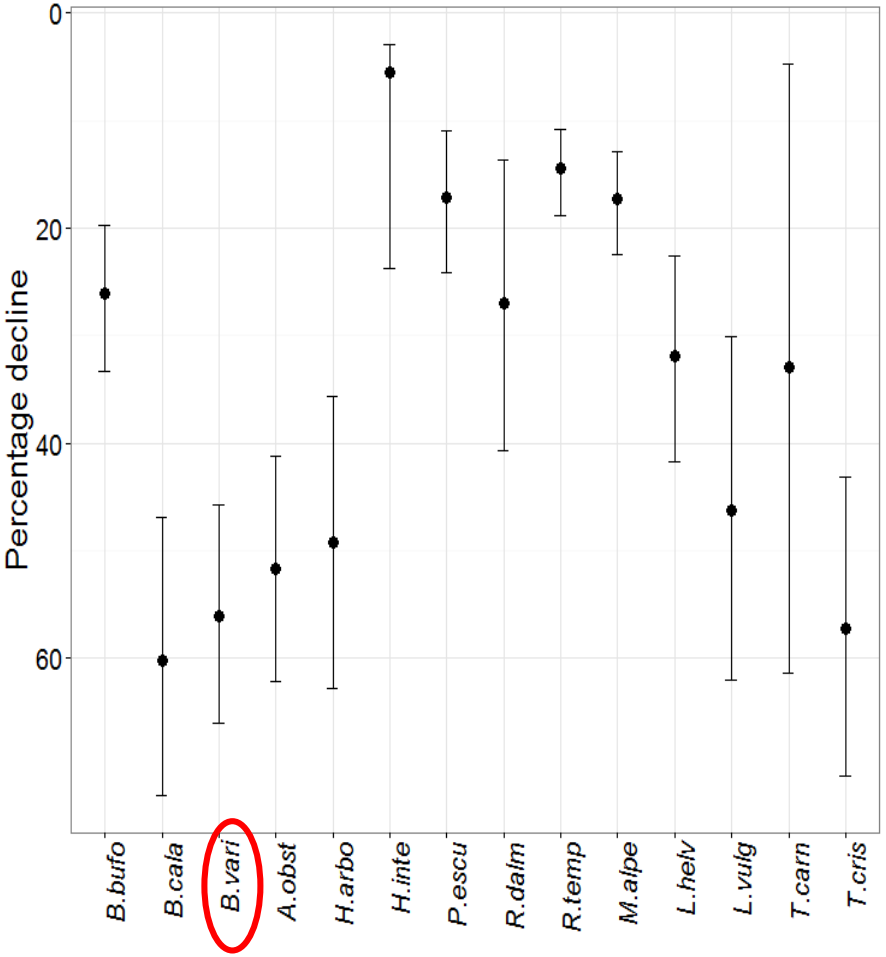
Sam Cruickshank

Conservation Biology of Amphibians Research Group

Amphibian Declines

- Most threatened vertebrate group
  - >32% species threatened
  - 25% species data deficient (also threatened?)
- Many different threats
  - Switzerland: habitat loss/fragmentation





Amphibian Conservation

1. ~1990 global declines noticed
   - Focus on documenting declines

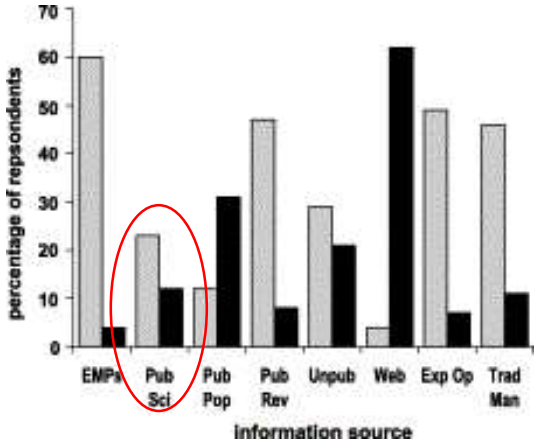
2. Describing/understanding threats
   - Habitat loss and fragmentation
   - Infectious diseases
   - Overharvesting
   - Pollution
   - Invasive species

Next:

3. Use understanding to improve conservation success

➢Evidence-based conservation

Evidence-based Conservation



- Often a disconnect between scientists and practitioners
  - Scientists like to generalise
  - Practitioners want specifics
  - Research is inaccessible

Solutions:

- More relevant research
  - Evaluating success of conservation projects
  - Establishing why interventions succeed/fail
- More accessible research
  - E.g. systematic reviews of conservation success
  - Direct contact with practitioners

Benefits of evidence-based conservation….

- Improve recommendations for future work
- Improved cost-effectiveness of conservation
- Demonstrating success vital for funding and stakeholder support
  - Vital for projects relying on landowner support

Project Aim:

To evaluate the success of habitat connectivity project:

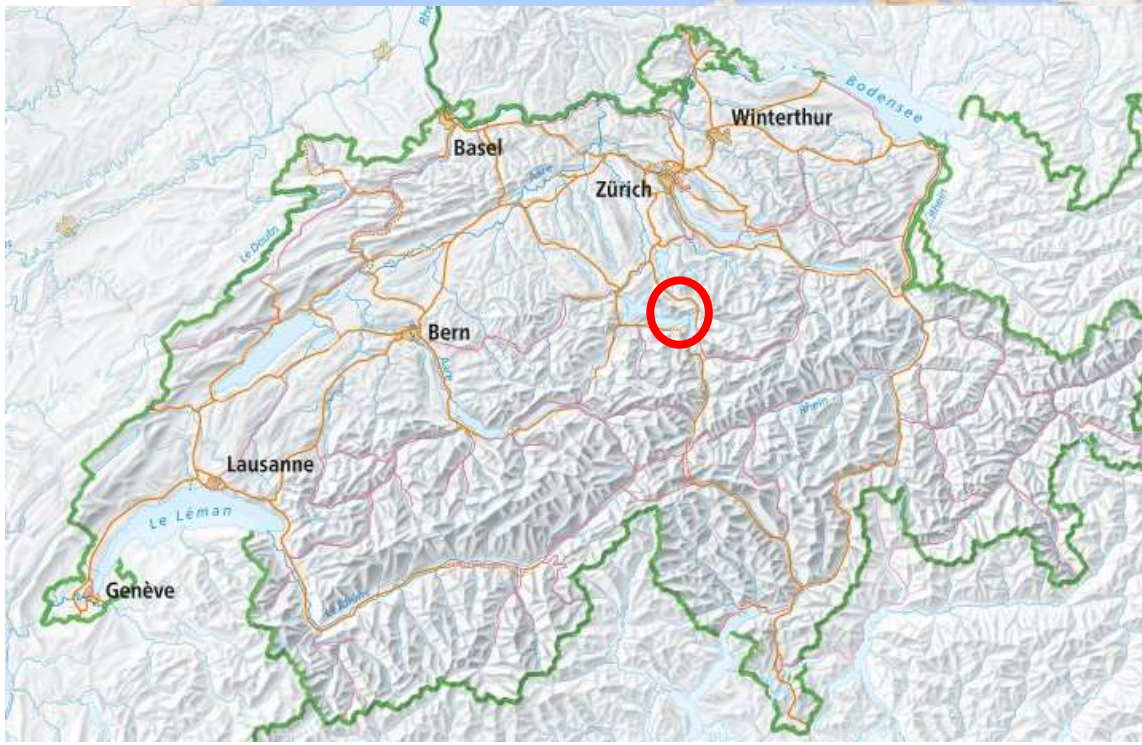
- Are stepping stones used?
- Does this increase dispersal?
  - ➢ Quasi-experimental metapopulation

Yellow-Bellied Toad

(Bombina variegata)

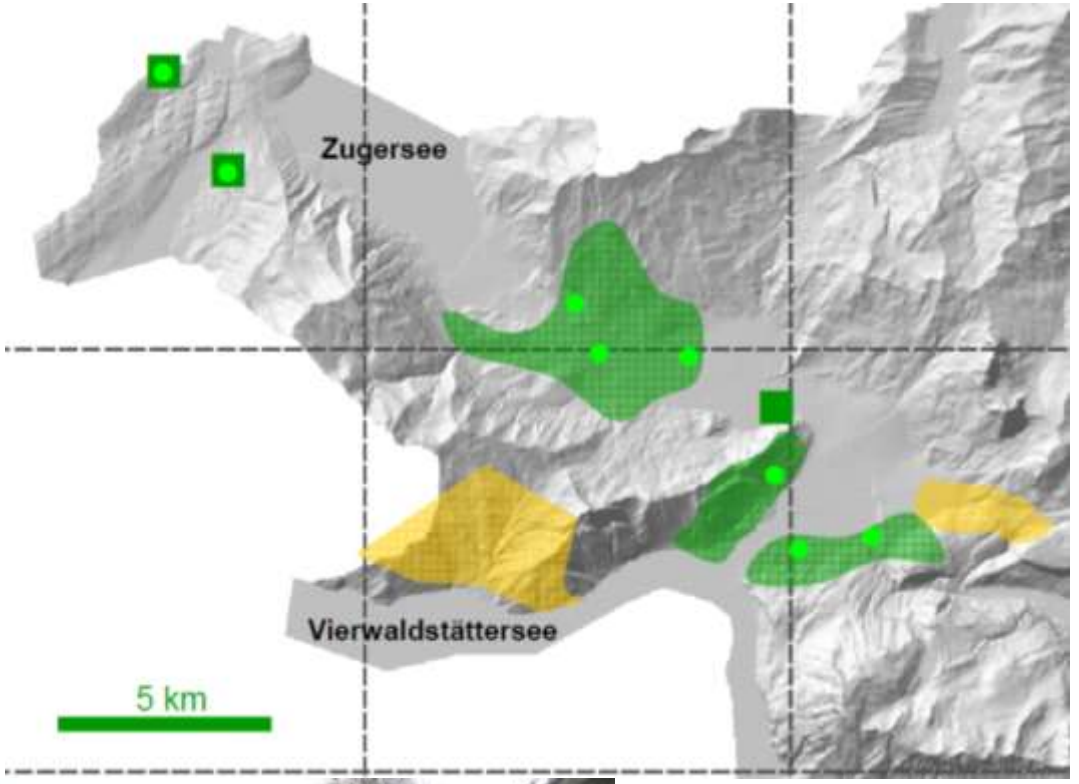
- 60% decline in 10 years within Switzerland
- Considered a good coloniser

- Study area is one of the largest remaining populations
- Conservation project initiated in 2011



The conservation project

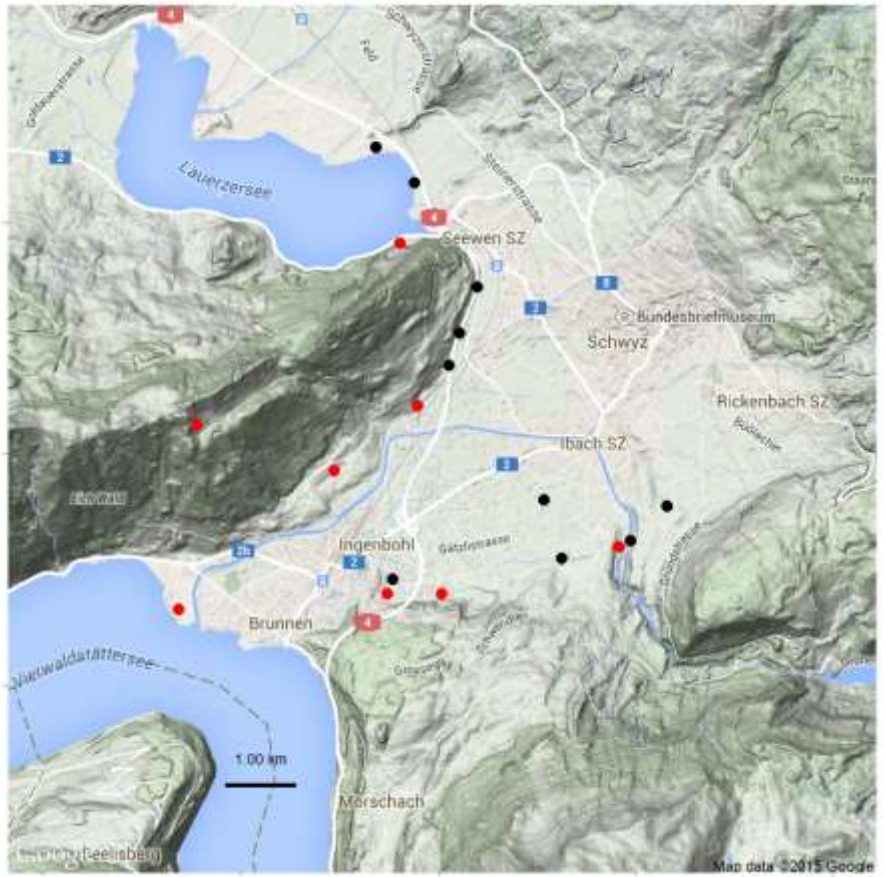
- Several large populations in region
  - Strong isolation between populations
- Autumn 2011: 10 new pond groups dug
  - Specifically to reconnect large population



Study Sites

- Comprehensive survey in Spring 2011

- Mark-recapture started in 2011
  - Prior to pond construction
  - Counts of adult population
  - Individual capture histories



Methods

- Ventral patterns allow photo-ID

So far:

- 13 surveys
- 19 sites

- 2665 adults captured over 4 years
  - 863 individuals captured >1 survey

CJS recapture model

- Migration rates
- Survival probabilities
- Recapture probabilities

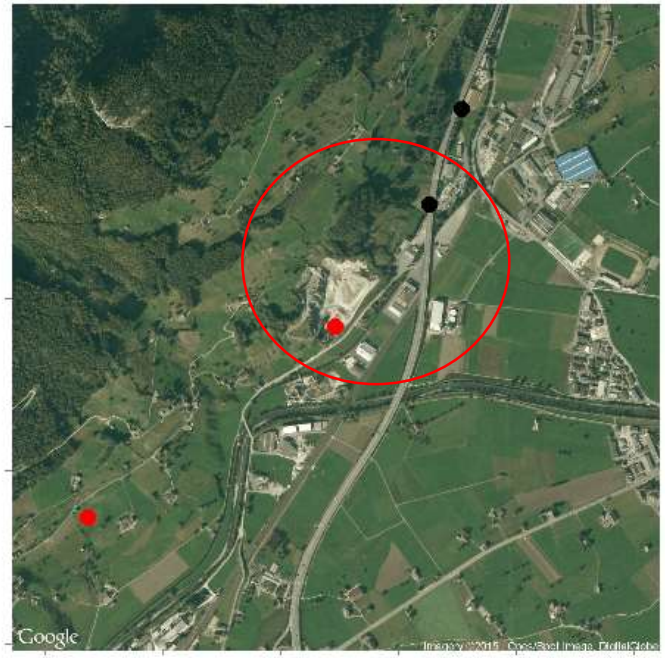
	May	June	July
2011		▲1	▲2 ▲3
2012			▲4 ▲5
2013	▲6	▲8	▲8 ▲9
2014	▲10 ▲11		▲12 ▲13
2015	▲14 ▲15		▲16 ▲17
2016	▲18 ▲19		▲20 ▲21

Results- Dispersal

Only 4 recorded dispersal events

- 2 way exchange between 2 sites
- Old ↔ New
- 270m distance

Study area range 100-4800m

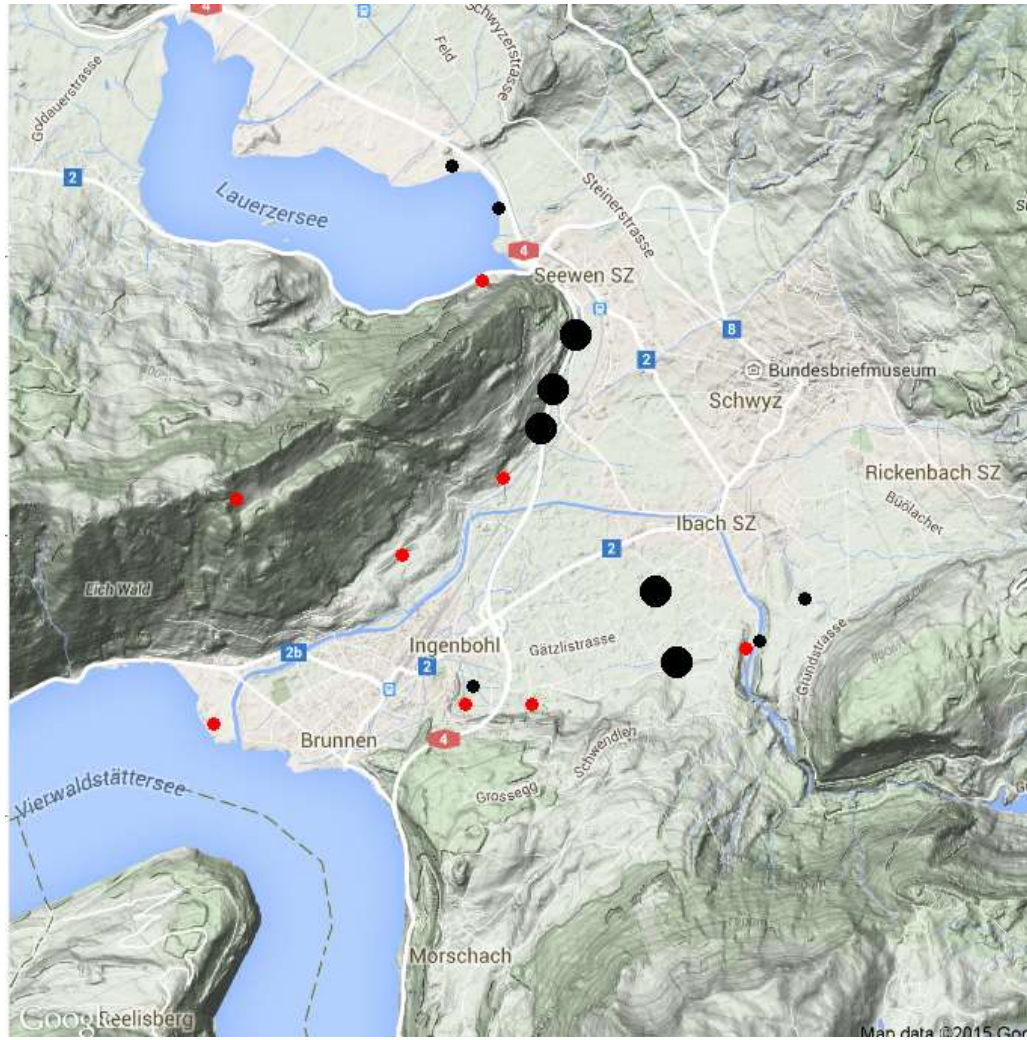


However…

Results- Colonisation

- 5 of 10 new ponds colonised
  - All in the year following pond creation
  - Only 2/4 maintained any individuals beyond the first year (one pond only 1 year old)

- 77 colonisers were new to the study



Overall “colonisation” pattern:

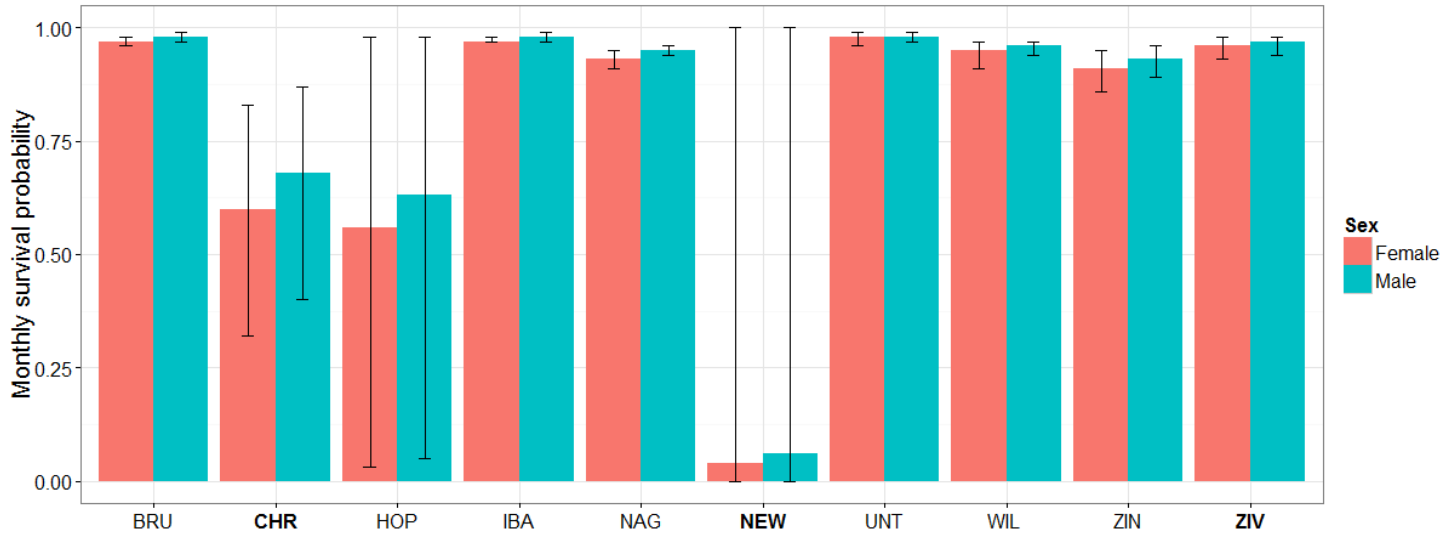
Year 1: transient pioneers

Year 2: some transients, but new individuals resident for the year

Year 3: less immigration, higher site fidelity (sometimes!)

Results- Survival

- High monthly survival (>95%)



Conclusion so far:

- Toads don't move much!
  - Few dispersal events seen
  - High apparent survival suggests emigration rare

Apparent survival = true survival * (1-emigration)

BUT, ponds were colonised- so we're missing something……

- Possibly juveniles are colonising?
- Different approach needed

Genetic analyses (future work)

- 2012: 184 individuals sampled
  - Just after new ponds built

Microsatellite analysis:

  - characterise genetic structure of the population
  - Identify population barriers

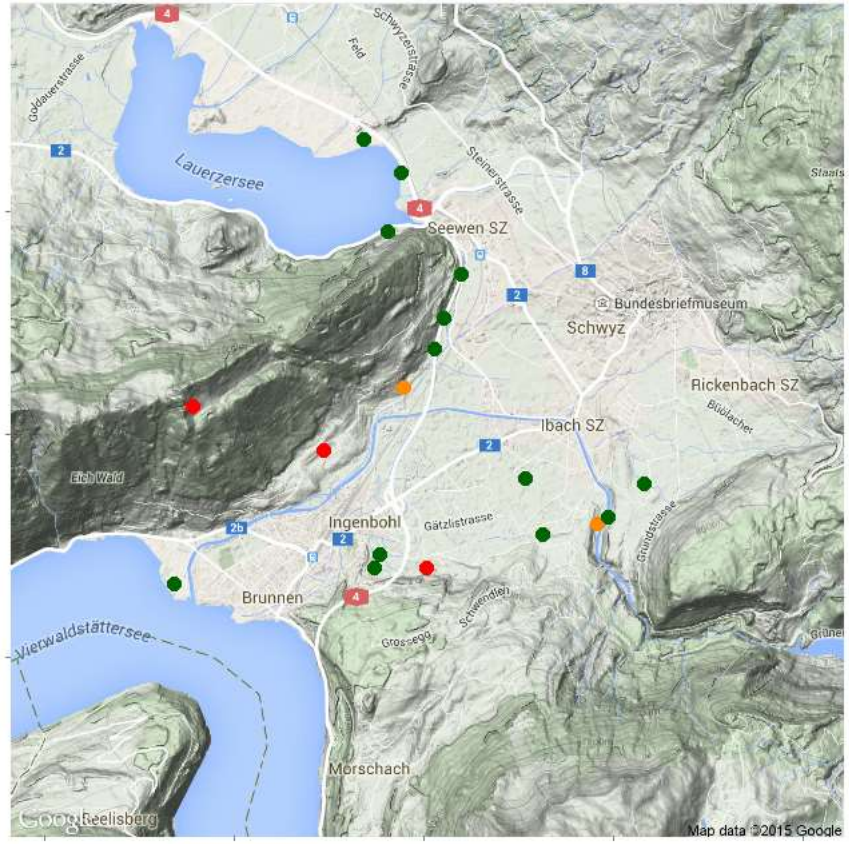
- 2014: Some colonisers sampled
- 2015: All captures at new sites sampled
  - Assignment tests to identify source populations

Effects of conservation work on infection spread

Batrachochytrium dendrobatidis (BD/chytrid)

- Pathogenic fungus of amphibians
- Implicated in declines and extinctions globally

- 2011: 100 swabs (6 ponds) no BD detected
- 2014: 150 swabs low prevalence of BD
- 2015: rigorous screening
  - Is BD spreading?
    - Does this relate to movements of Bombina?



Conclusions

- Evaluating success of conservation is important
  - We shouldn’t just assume things work. Scale for amphibians is often a big issue

- Toads do move, but generally they stay put.

- Movements only occur over short distances, and it’s often difficult to detect them

Conclusions

- Important to consider potential unintended consequences of conservation

  ->e.g. spreading infection.

- Paying landowners for doing conservation doesn't work without enforcement

- Bigger is not necessarily better- small "ponds" can work well

Acknowledgements

- Hannelore Brandt
- Daniel Hasen
- Martin Jordan
- Arpat Ozgul
- Benedikt Schmidt
- Thomas Hertach
- Tierpark Goldau
- volunteers

University of Zurich[UZH]

karch

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Office for the Environment FOEN
Bundesamt für Umwelt BAFU