

Monitoring and restoration of *Unio crassus* habitats in Switzerland

an overview

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- Monitoring of *Unio crassus* (Suhre)
- Monitoring and measures for *Unio crassus* (Furtbach)
- Monitoring and measures for *Unio crassus* (Seegraben)
- Conclusions

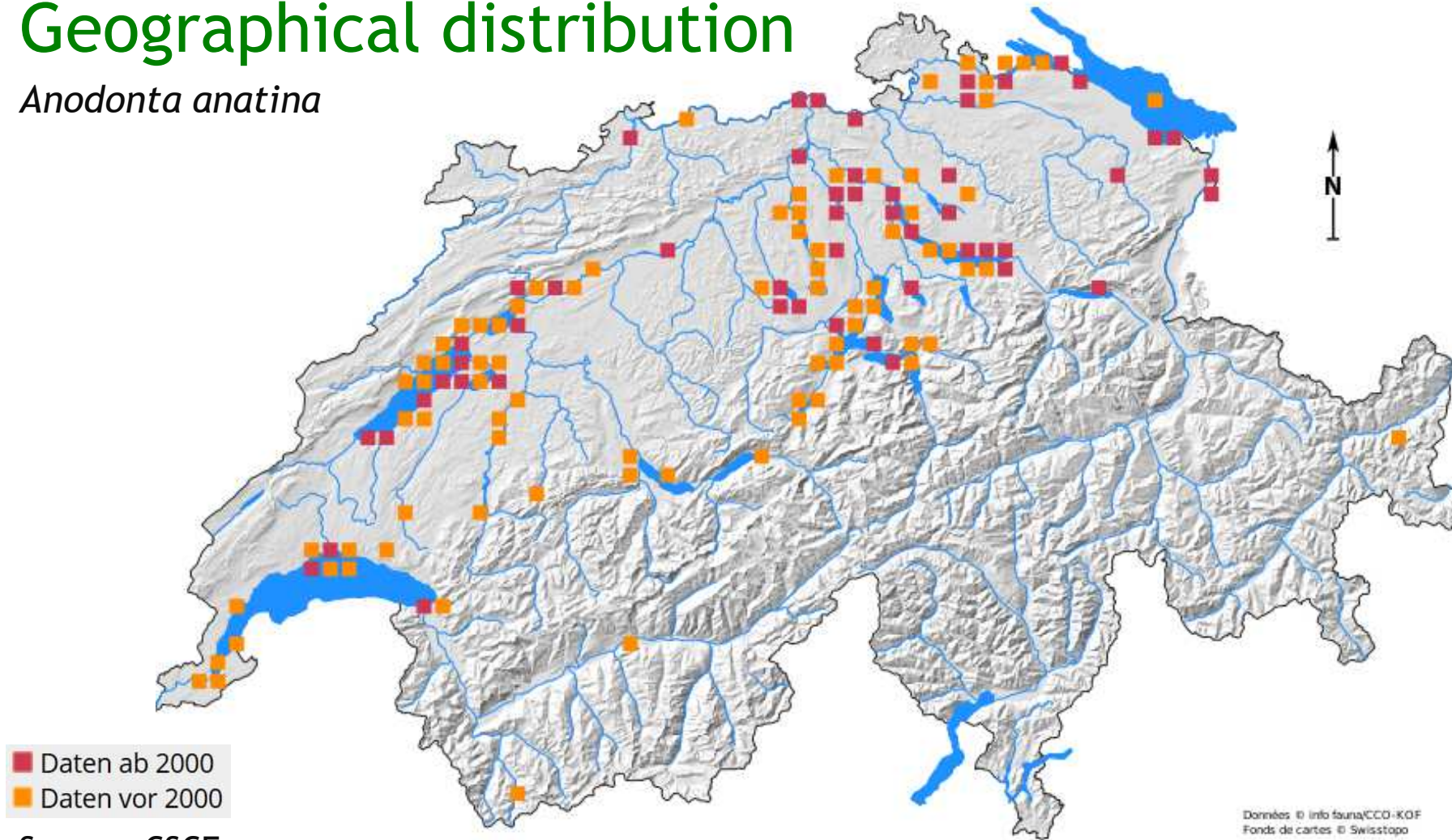
Present situation

8 species of Unionidae

- *U. crassus* (CR) is present mainly in brooks and rivers.
- *U. tumidus* (EN), *U. mancus* (EN), *U. elongatulus* (no status yet), *U. pictorum* (EN), *A. anatina* (VU), *A. exulcerata* (no status yet), *A. cygnea* (LC) are mainly present in lakes and ponds.
- *Microcondylaea compressa* (RE): lived in the southern of the alps

Geographical distribution

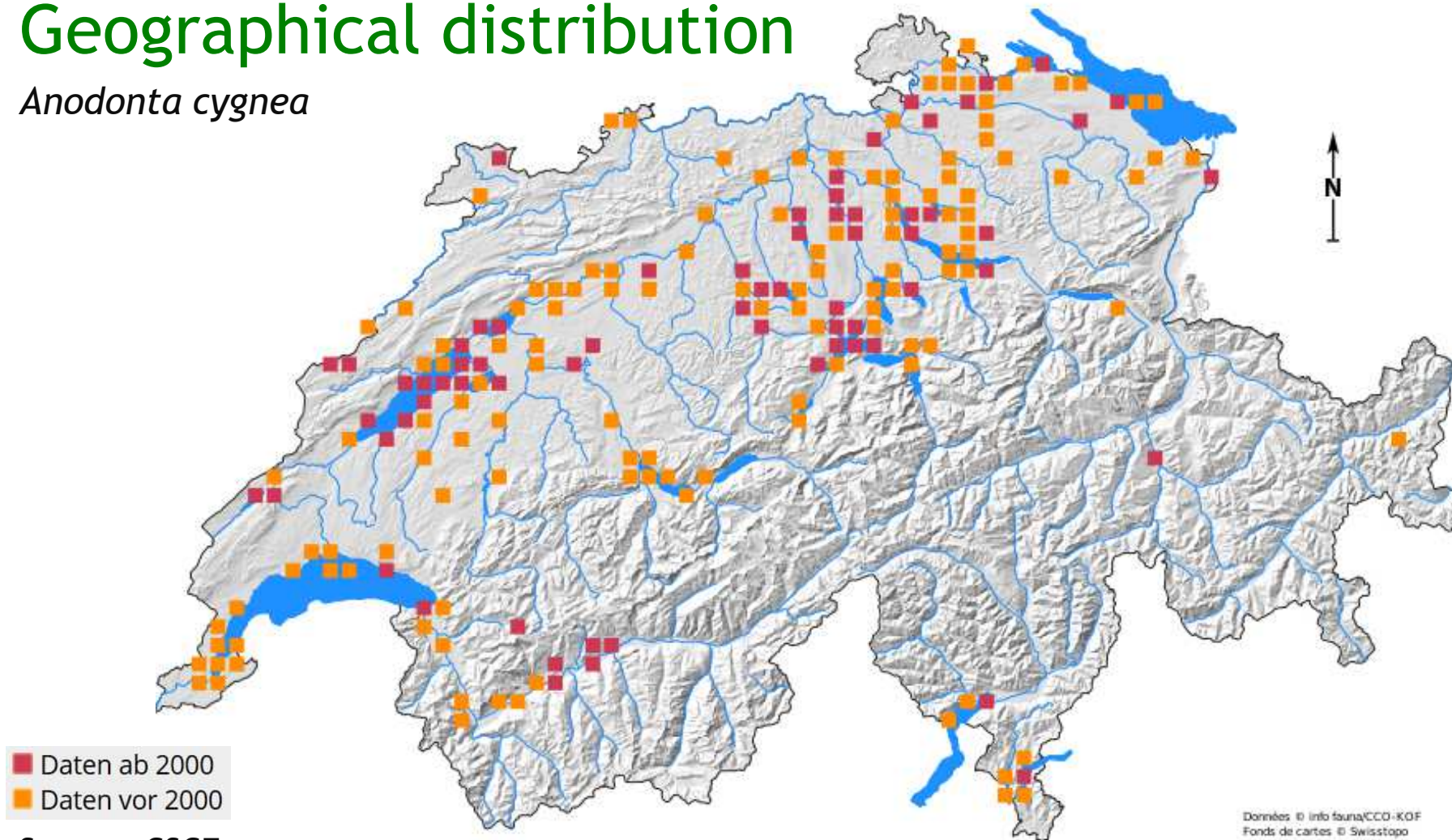
Anodonta anatina



Source: CSCF

Geographical distribution

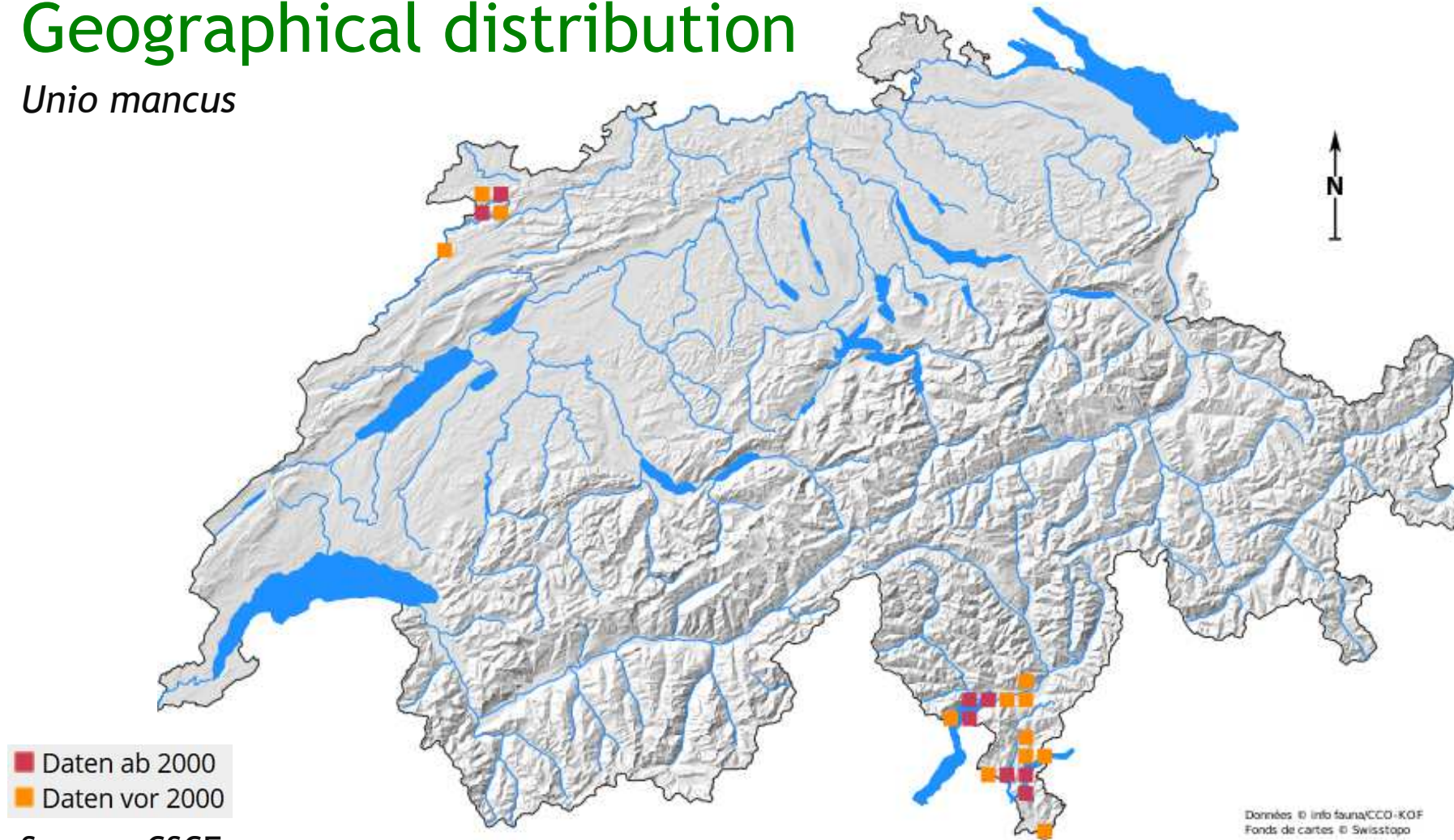
Anodonta cygnea



Source: CSCF

Geographical distribution

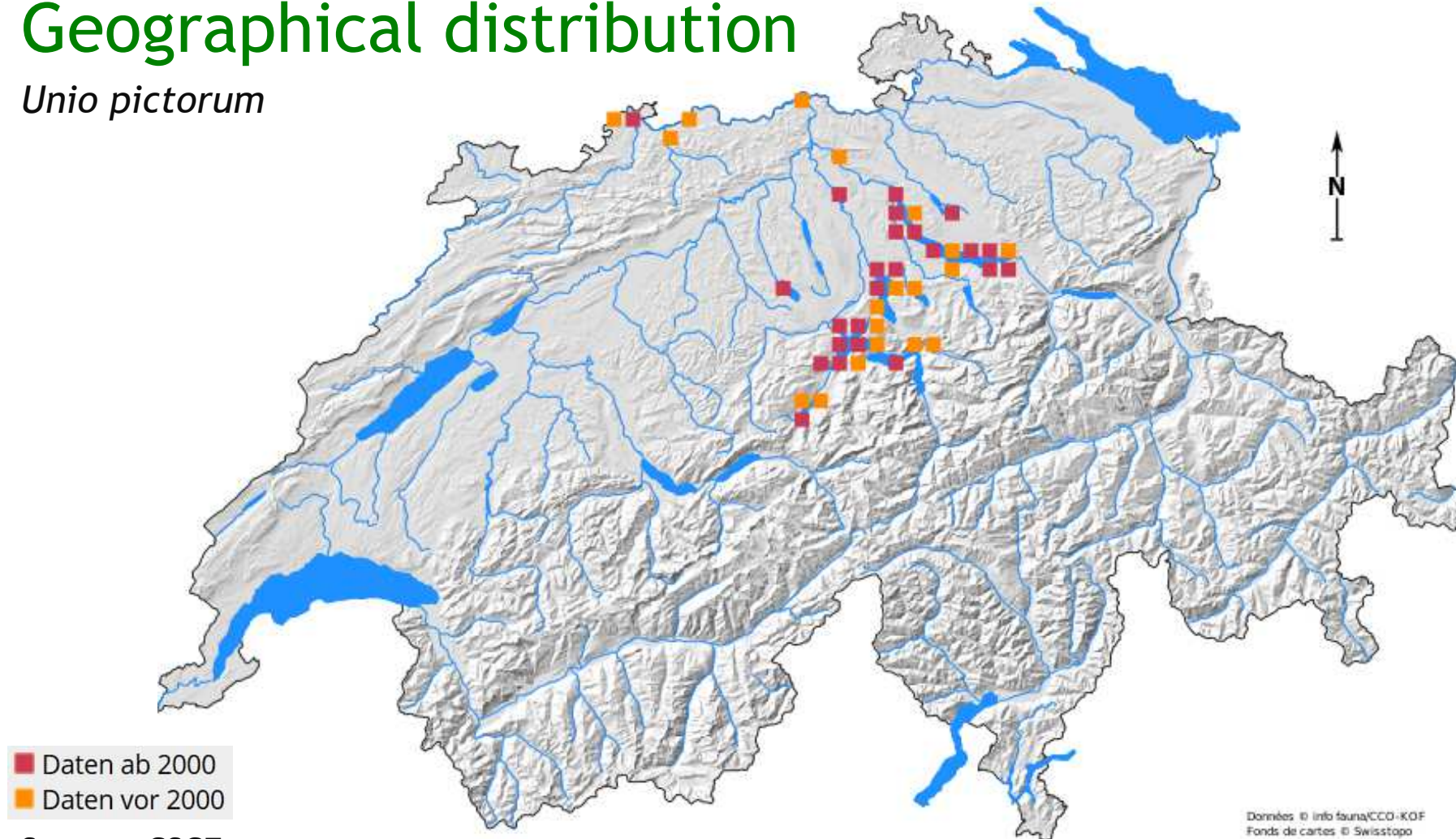
Unio mancus



Source: CSCF

Geographical distribution

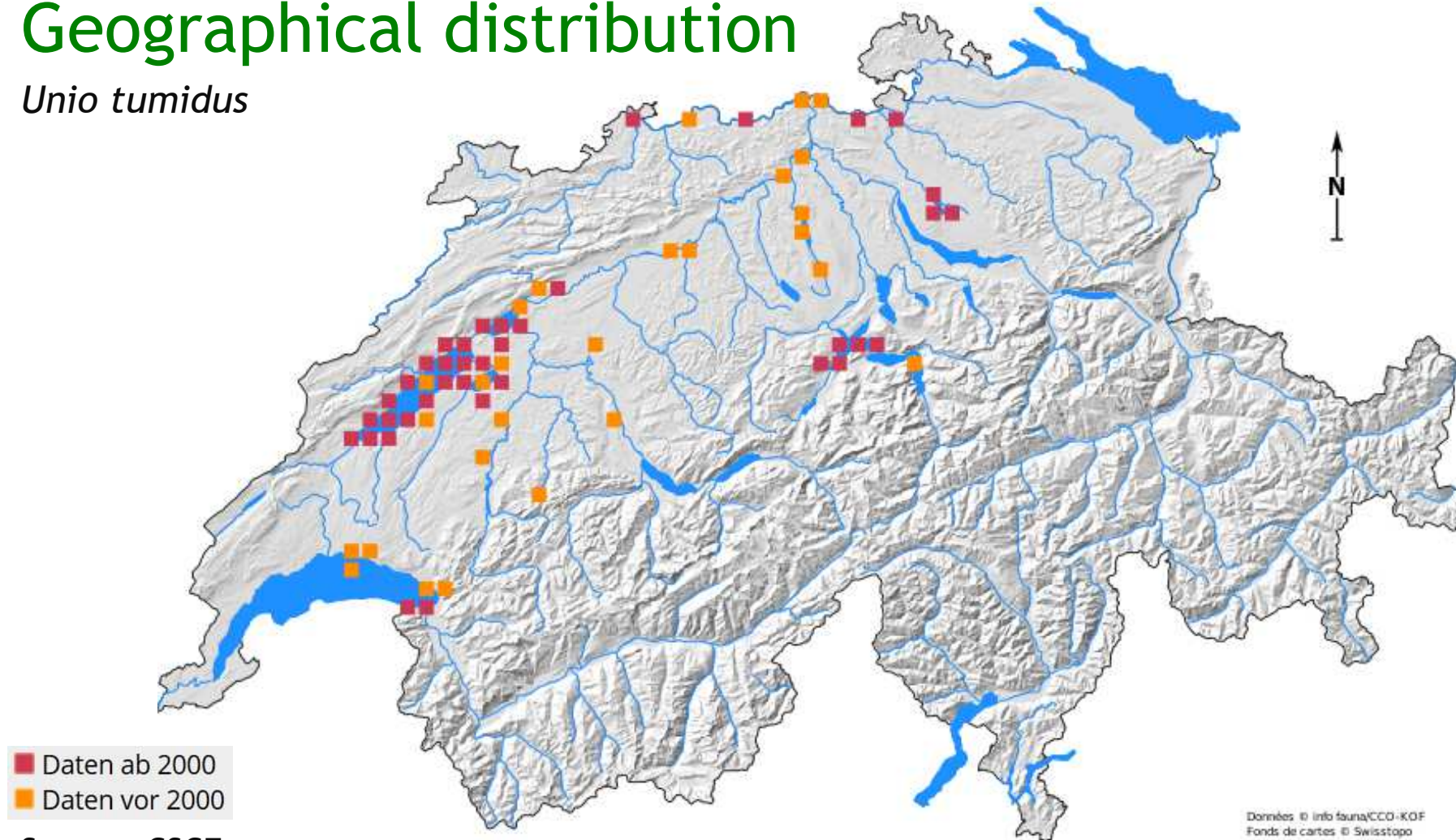
Unio pictorum



Source: CSCF

Geographical distribution

Unio tumidus



Source: CSCF

Legal framework

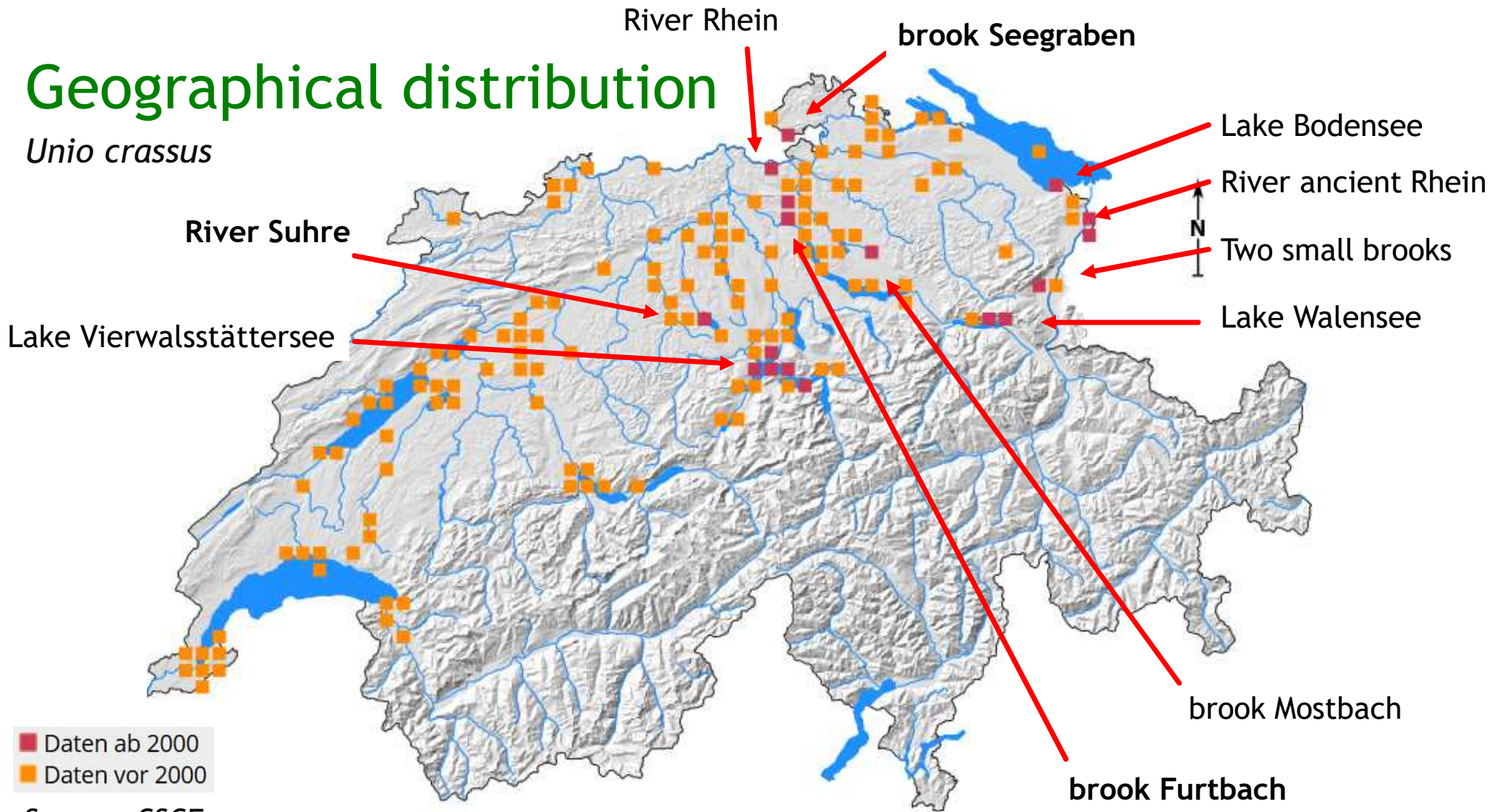
- Local governments (cantons) are responsible for management and protection of freshwater bodies (fishery, restorations, hydropower, monitoring, wastewater, etc.).
- The national government is supporting different restoration campaigns:
 - River and lakeshore restoration
 - Restoration of alluvial plains
 - Mitigation measures to reduce hydropeaking impacts
 - Restoration of fish migration
 - Bed load restoration
- Local governments (cantons) have to plan and implement the measures

Legal framework of *Unio crassus*

- Protection status of *Unio crassus* is described in the Swiss Ordinance on the Protection of Nature and Cultural Heritage (NCHO) (=highest protection status)
 - Biotope protection (Art. 14)
 - Species protection (Art. 20)
- Local governments (cantons) have also own lists of endangered/protected species as well as “action plans” with goals and measures to protect and/or restore habitats of *Unio crassus*.
- If mussels are in a protected area, it is easier to protect. This is the case for only one population!

Geographical distribution

Unio crassus



Monitoring of *Unio crassus*

Monitoring methods are selected on the basis of:

- Size of the population
- Length of the studied river/brook or size of the lake
- Purpose of the project
- Budget

Monitoring in the Suhre (Canton Lucern)



Monitoring of the population in the Suhre (Canton Lucern)

History

- 1922: First written testimonial of *U. crassus* in the effluent “Suhre”
- 1995: First monitoring with no evidence of living *U. crassus*, only shells
- 2003: Some old *U. crassus*
- 2007: Some old *U. crassus* and one young mussel (ca. 3 years old)
- 2015: Mark & recapture method. 77 mussels different ages

Monitoring of the population in the Suhre (Canton Lucern)

Sampling design

- Snorkelling
- The marking was a number scratched into the periostracum
- Age estimate with growth rings (max 10 years)



Monitoring of the population in the Suhre (Canton Lucern)

Results

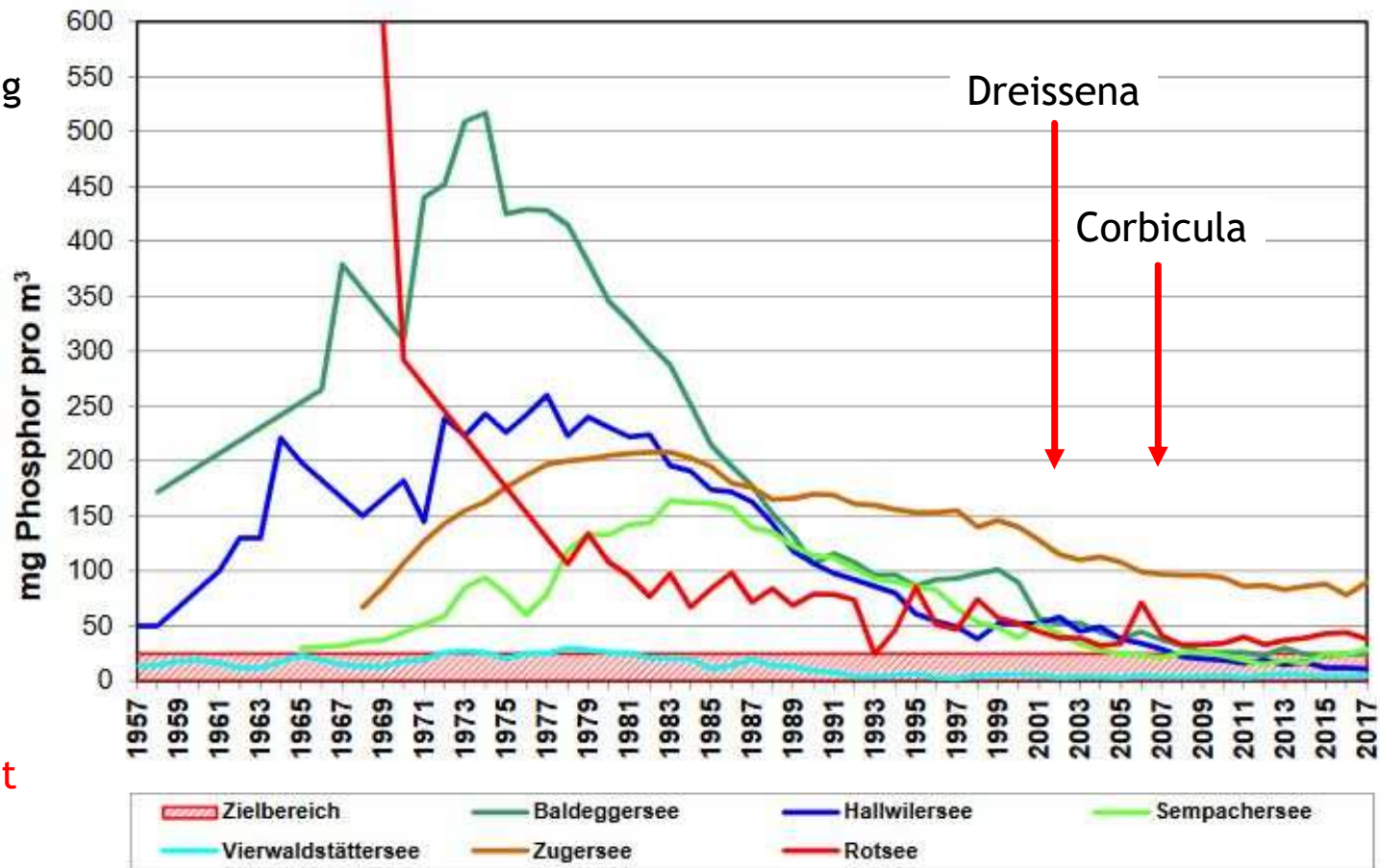
- Population is slowly recovering resp. recruiting is functioning again
- Mark & recapture: due to budget constrains, we could carry out only the mark-phase. The size of the population is not known
- The geographical distribution of the population is known
- Interesting facts: substrates consists mainly of corbicula and dreissena-shells.

Restoration measures

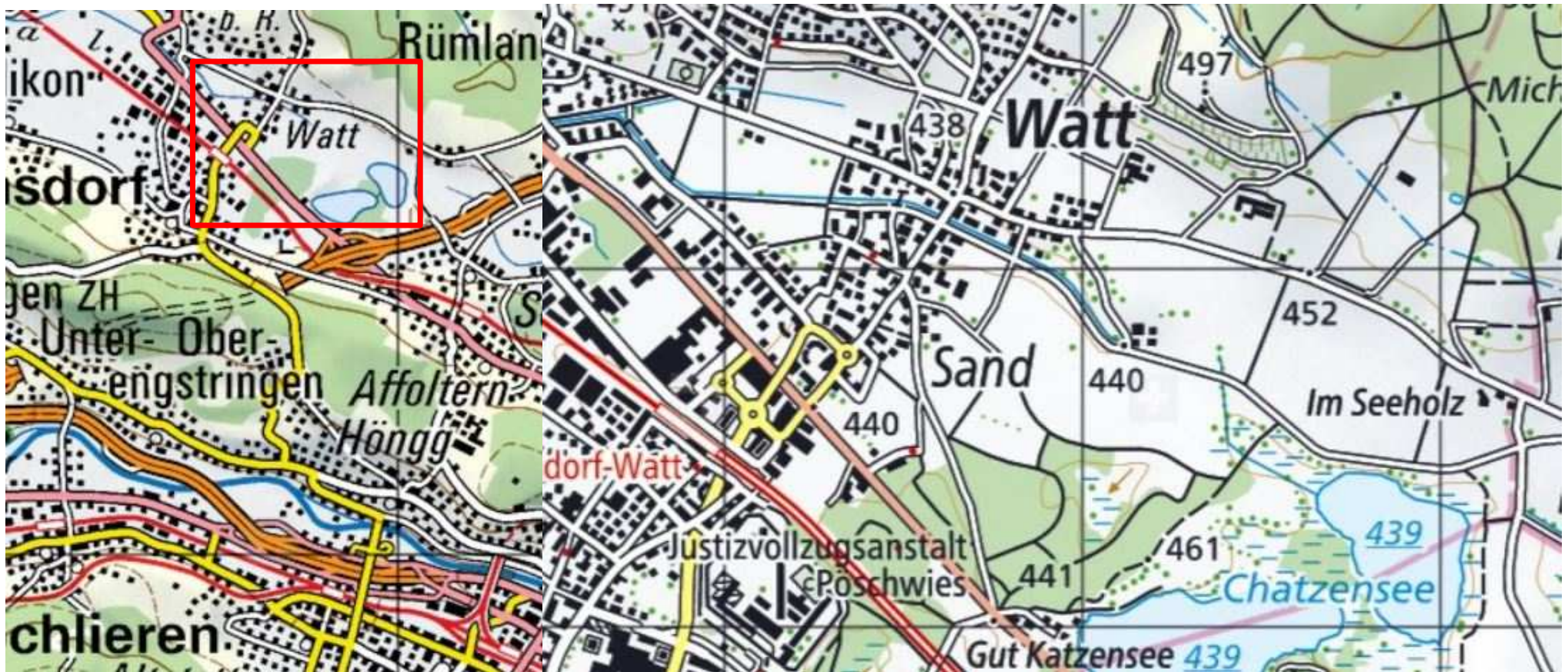
- Regional efforts for decreasing contaminant input in the Sempachersee catchment: “Phosphor Project” include measures for agriculture (reduction and retention of nutrients) and wastewater treatment
- Restoration measures in the lake: artificial mixing and oxygenation of the hypolimnion (implemented in 1984)
- *Indirect positive effect on U. crassus*
- *No specific measures for protection or conservation of U. crassus*

Lake conditions (Sempachersee)

Conc. during spring circulation



Monitoring of the Furtbach population (Canton Zurich)



Monitoring of the Furtbach population (Canton Zurich)

History

- 1994: 54 mussels
- 2002: 115 mussels
- 2013: 126 mussels
- 2016: 158 mussels (ca. 1 km)

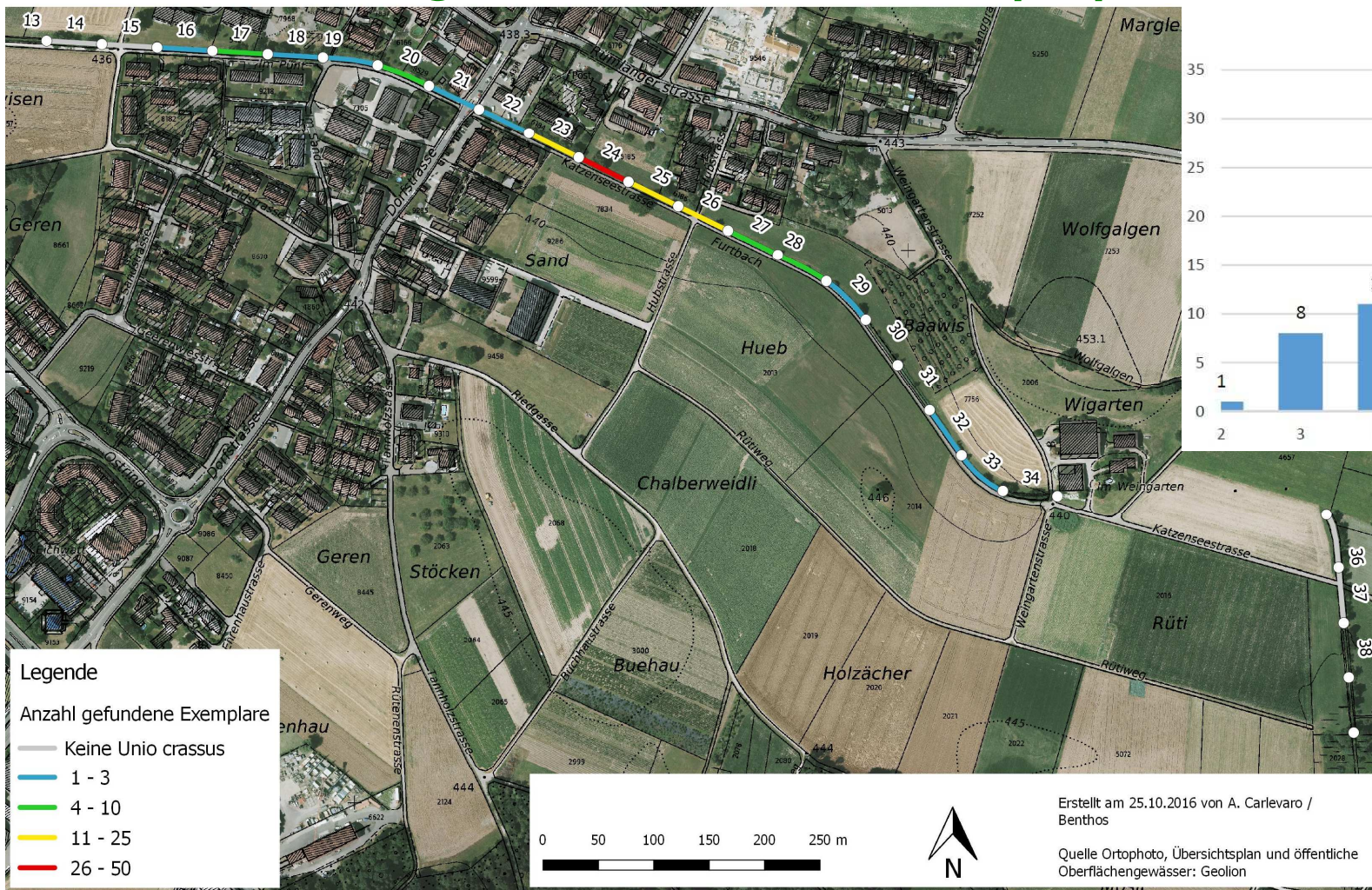


Monitoring of the Furtbach population

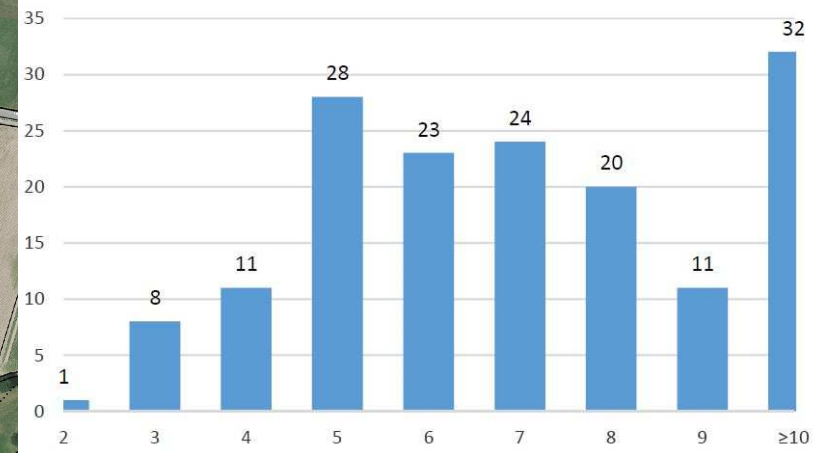
Sampling design and evaluation:

- Collection of mussels in sectors with a length of 50 metres: Method is similar to the standard crayfish-method (300 m length)
- Sectors limits where defined with GIS (Geodata)
- Age estimate with growth lines (max. 10 years)
- Photos on mm-paper were taken for length estimation

Monitoring of the Furtbach population 2016



Altersverteilung 2016



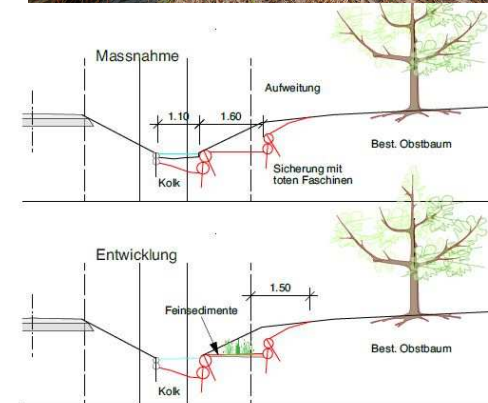
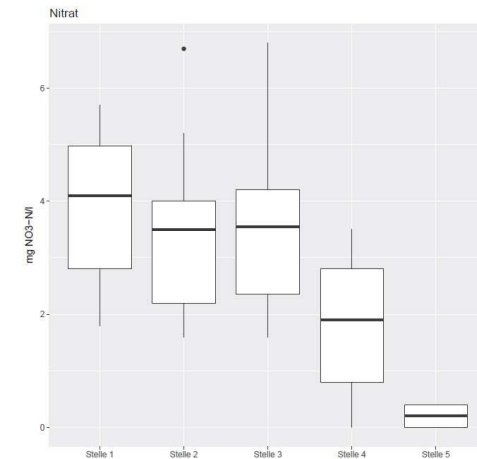
Monitoring of the Furtbach population

Results

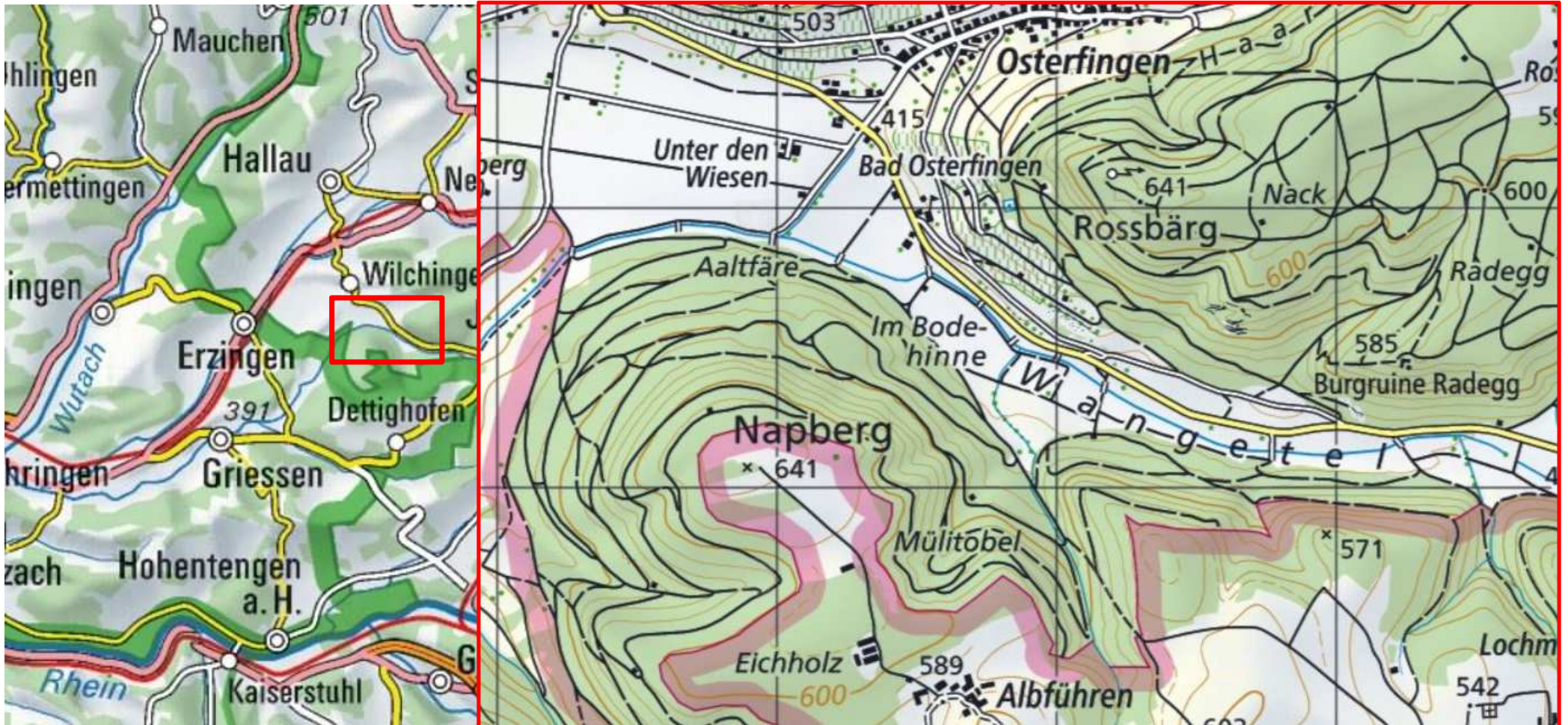
- Population stays stable over the years in his geographical distribution
- Recruitment is functioning
- Population growth?
- Interesting facts: Fish monitoring (2018) highlighted a critical situation regarding the hostfish population. No fishes found at the hot spot during *U. crassus* reproduction period. Fish habitats were unsatisfactory

Restoration measures

- Release of fishes with glochidia: spreading upstream (1998, 2004, 2007)
- Joint venture with a protected aquatic plant *Potamogeton coloratus* (2018): spreading downstream
 - Small awareness-raising campaign
 - Water quality assessment over 1 year to assess situation along the brook
 - Punctual assessment of discharge tubes > no evidence of a “main” trouble-maker
 - Planning of measures for fishes and habitats downstream



Monitoring of the Seegraben population (Canton SH)



Monitoring of the Seegraben population (Canton Schaffhausen)

History

- 1997: monitoring and estimation of population size: 25'500 (\pm 6'000)
- 1998: during the winter the population has been decimated by muskrat (*Ondatra zibethicus*): about 4'000-6'000 mussels left
- 2002: Monitoring and estimation of population size: 13'000 (\pm 8000)
- 2006: Monitoring and estimation of population size: 65'000 (min. 35'000, max. 135'000)
- 2014: Monitoring and estimation of population size: 110'000 (min. 86'000, max. 135'000)



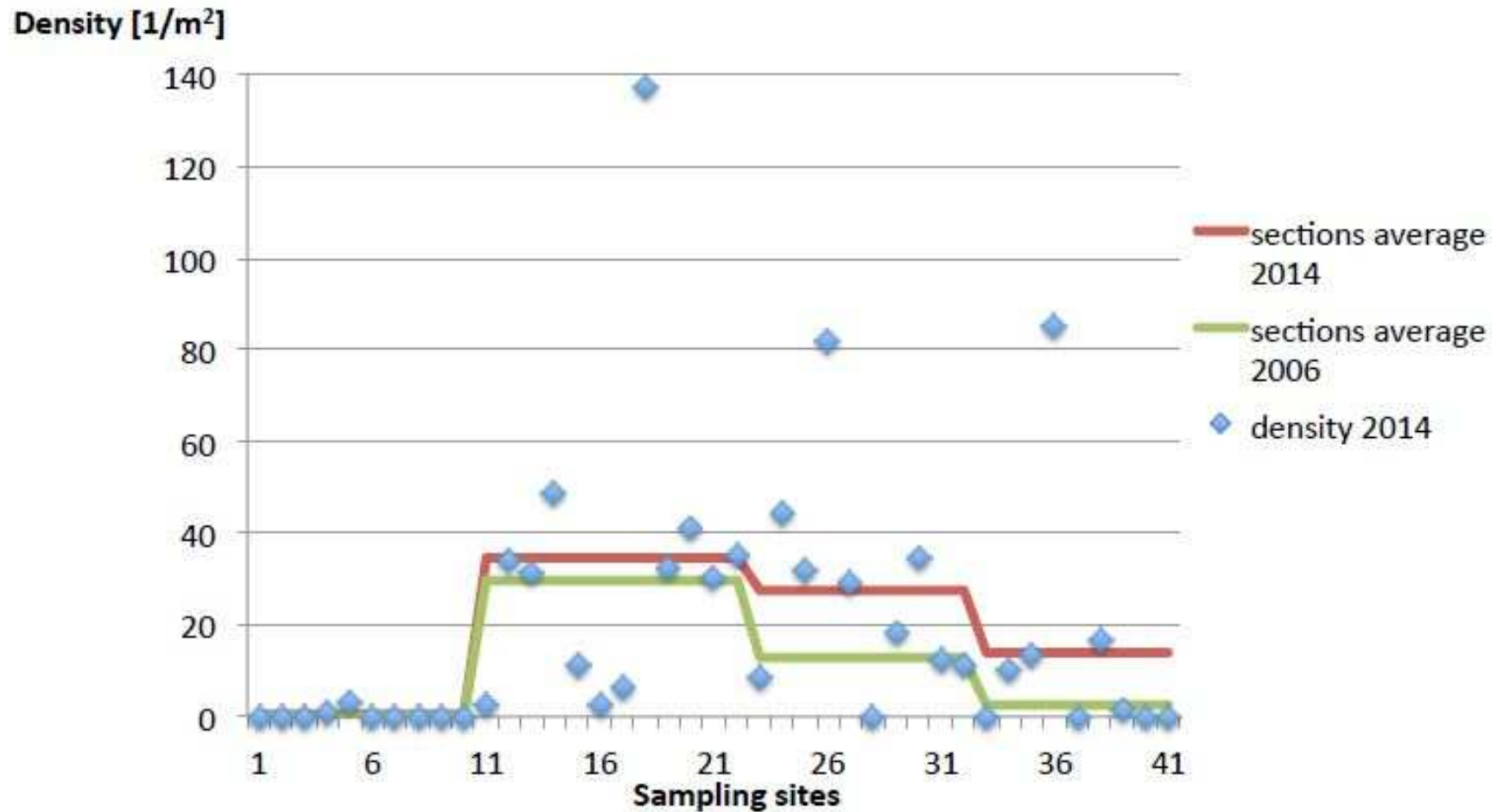
Monitoring of the Seegraben population

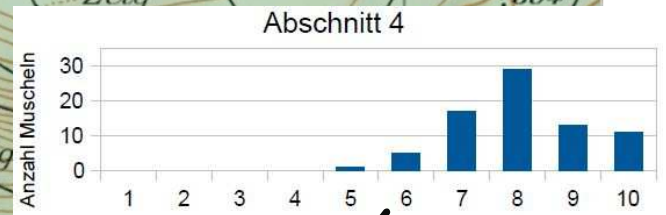
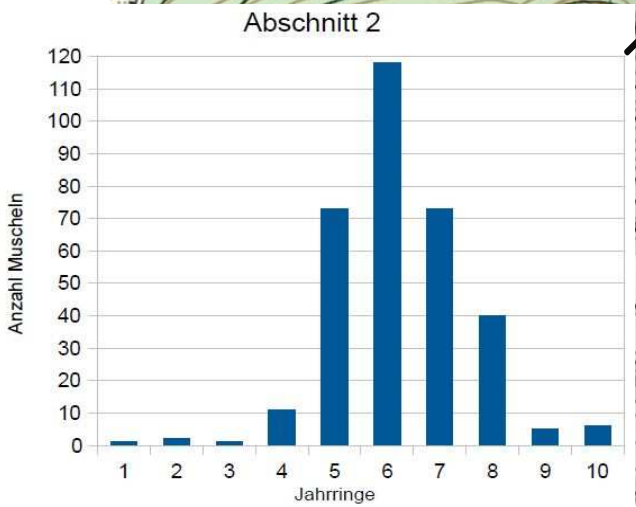
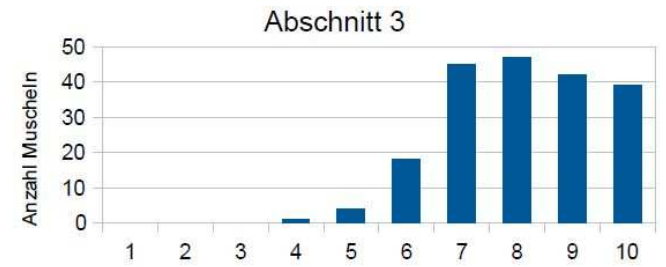
Sampling design and statistical evaluation:

- 41 samples on a length of 2.9 km (4 main sections with different dominant substrate and flow velocity)
- 1 sample consist of a stream cross-section of 40 cm width (mussel collection)
- The mesh size of the net: 9 mm

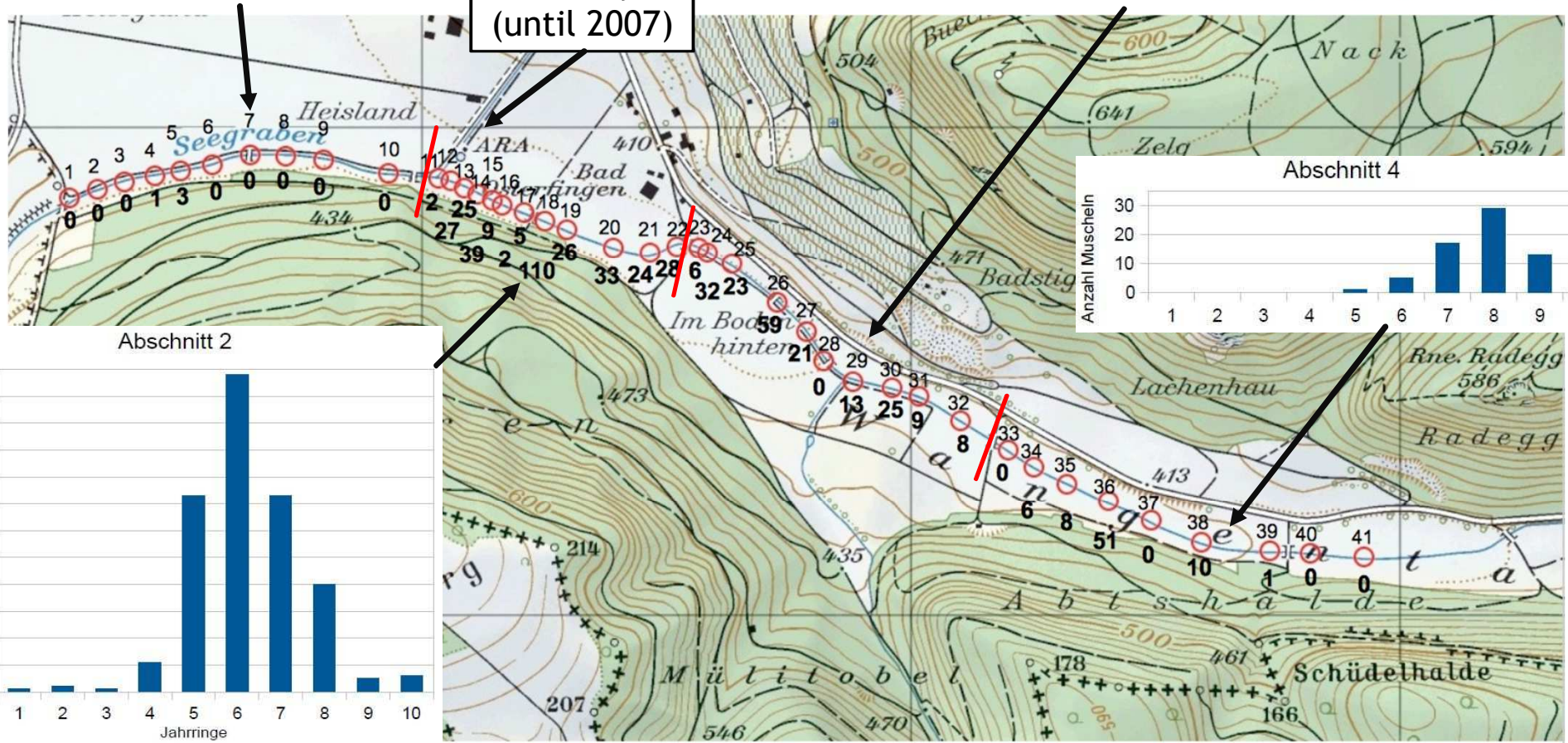
- Statistical method developed by the ETH Zurich (Dr. Werner Stahel, Seminar für Statistik)

Monitoring of the Seegraben population





Wastewater facility (until 2007)



Monitoring of the Seegraben population

Results

- Population recovered very well
- Results with a very high range (difference between min and max) due to non gaussian distribution
- The geographical distribution is known
- No spread downstream of the wastewater facility

Restoration measures

- New fish resting and hiding microhabitats
 - Shut down of the wastewater treatment plant in 2007
 - Hunting of muskrat
- *Indirect positive effect on U. crassus downstream (Germany) but no spread in the immediate vicinity of the wastewater treatment plant*

Conclusion

- Different monitoring methods makes difficult to compare results
- Big differences in budgets of the local cantons makes the work difficult (no continuity)
- No research institutions active in Switzerland
- Status Quo is usually considered to be the best strategy for conservation

Thank you for your attention!

