

FISH AND WILDLIFE

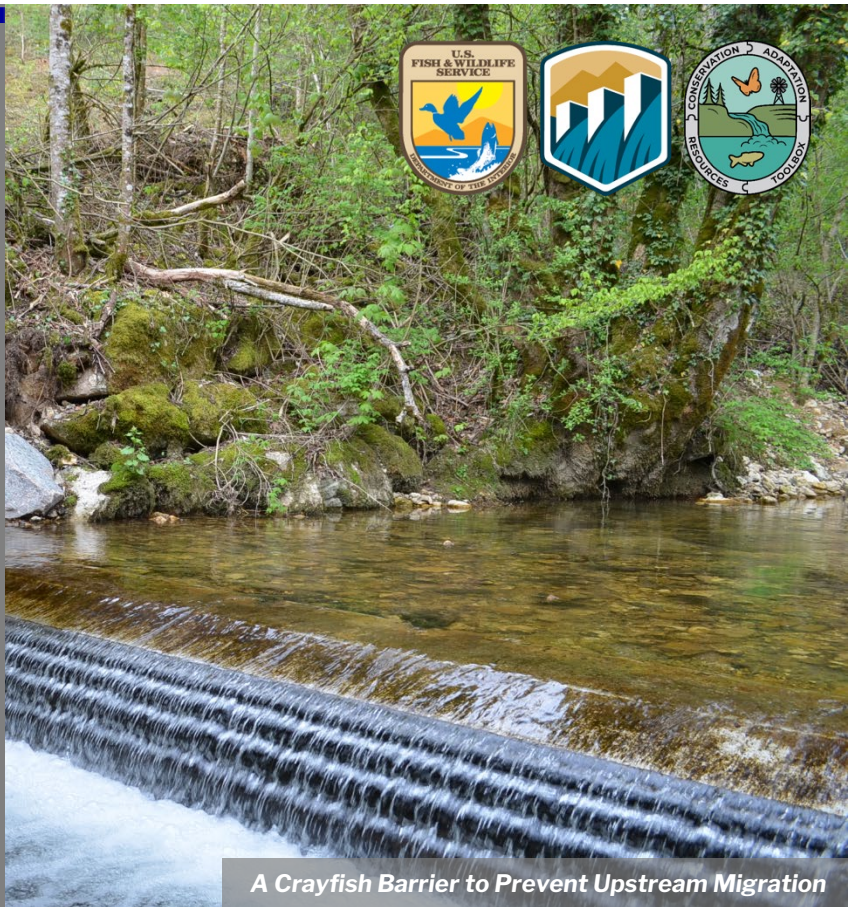
Determining Effective Strategies for Invasive Crayfish Management in Switzerland



In the 19th and 20th centuries, Europeans introduced three crayfish species from North America into Europe. These non-indigenous crayfish species (NICS) are now widespread in European waterways, displacing native species and causing ecological and economic damage. NICS are predicted to overtake Europe's indigenous crayfish species (ICS) without intervention. Since their arrival in Switzerland, NICS have threatened Switzerland's four ICS, all of which are internationally protected species. In response, the Swiss Federal Office for the Environment formed the Swiss Coordination Office for Crayfish/ Koordinationsstelle Flusskrebse Schweiz (KFKS) in 2014. The KFKS coordinates NICS management and ICS preservation by conducting research, providing counsel to local governments, and informing the public.



Project Location



A Crayfish Barrier to Prevent Upstream Migration

KEY ISSUES ADDRESSED

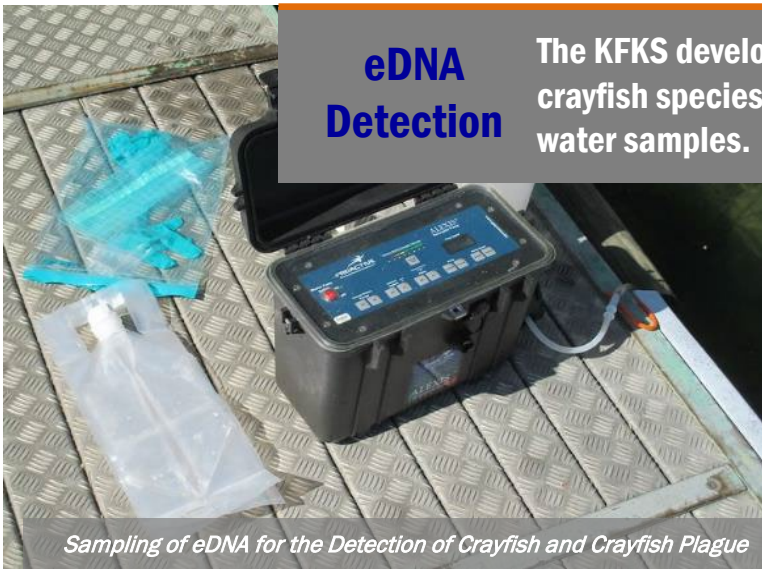
NICS have detrimental effects on ICS and their ecosystems. NICS outcompete ICS, spread swiftly, and quickly recover from population reduction measures. NICS also transmit the crayfish plague (*Aphanomyces astaci*), an invasive pathogen responsible for mass mortalities of ICS. To mitigate these threats, managers in Switzerland implemented measures for eradication, suppression, or containment of NICS populations. Because management strategies have limitations and side-effects, managers must decide what strategies are most effective and practical. Using containment barriers is effective for preventing establishment of new NICS populations, but lack of documented knowledge and concerns about the impacts of barriers on other aquatic species can prevent managers from using barriers to prevent the spread of NICS.

PROJECT GOALS

- Evaluate the success of past efforts to control NICS in Switzerland to form a basis for future NICS management strategies
- Compile knowledge on barrier construction and impacts of barriers by conducting a literature review
- Conduct experiments to determine necessary factors for barrier design and construction

eDNA Detection

The KFKS developed assays to monitor the distribution of seven crayfish species in Switzerland using environmental DNA (eDNA) in water samples.



Sampling of eDNA for the Detection of Crayfish and Crayfish Plague

PROJECT HIGHLIGHTS

Control Measure Evaluation: The KFKS evaluated data from previous control campaigns to determine their effectiveness. Eradication efforts succeeded approximately 83% of the time, suppression efforts succeeded approximately 17% of the time, and containment efforts succeeded 100% of the time during the evaluation period.

Literature Review: The KFKS reviewed 133 scientific papers to synthesize knowledge on the use of barriers for crayfish management. Findings affirmed the utility of barriers for NICS management.

Barrier Construction and Passability: The KFKS constructed eight barriers to test their effectiveness. The KFKS used the barriers to determine important features that maximally inhibit the spread of NICS while minimally disrupting fish migration. To test barriers, the KFKS introduced marked crayfish and fish downstream of the barrier and monitored their migration.

Lab Testing: To determine if crayfish could use algae to grip and climb barriers, the KFKS conducted lab tests using various materials. Crayfish used algal filaments to resist currents while standing on all materials but copper, steel, and black glass-reinforced plastic. Brass and copper showed the least algal growth.

Collaborators

- Swiss Coordination Office for Crayfish/
Koordinationsstelle Flussschnecken Schweiz

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Visit CART:



LESSONS LEARNED

Containment using barriers is the most effective and economical method of crayfish management. While suppressive and eradication measures can reduce or eliminate NICS populations, barriers are the most effective strategy for preventing establishment of new NICS populations. However, barriers can limit the migration of bottom-dwelling (benthic) and weak-swimming fish.

The KFKS recommends using both eDNA sampling and traditional survey methods to ensure barriers are built upstream of NICS populations. To reduce costs and increase functionality, barriers may be built directly upstream of, or as modifications to, existing structures. To ensure functional water velocity, build fish-passable and flow-dependent barriers only in sites with constant water flow, rather than in waters with fluctuating flow. Stainless steel and GRP are recommended as barrier materials. Monitor barriers for at least one year to account for seasonal changes in crayfish behavior and migration. Barriers should be regularly cleaned and maintained.

NEXT STEPS

- Implement approximately 30 additional barriers across Switzerland
- Establish breeding centers to increase indigenous crayfish numbers
- Continue monitoring the distribution and population densities of ICS and NICS
- Monitor fish-passability of barriers using internal PIT-tags
- Maintain existing barriers and monitor long-term barrier functionality

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Monitoring Crayfish at Night