



Signal crayfish

(*Pacifastacus leniusculus*)

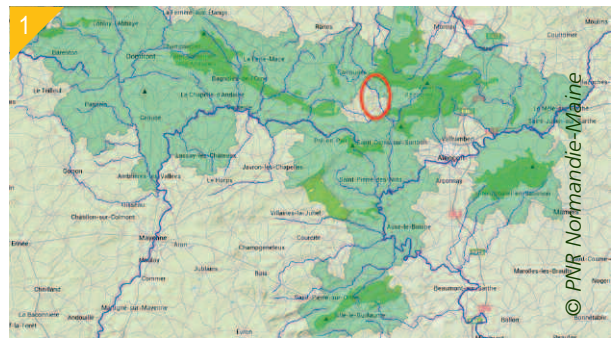
Managing signal crayfish by sterilising males in the Sarthon basin

Saules et eaux consulting firm

- The consulting firm was founded in 2009 and is specialised in work in rivers and the restoration of aquatic environments.
- Fields of expertise:
 - protection of river banks using plant-based technologies;
 - preservation of biodiversity by studying crayfish, notably study of invasive alien crayfish and white-clawed crayfish (*Austropotamobius pallipes*) in the framework of experiments in artificial environments to study their behaviour, diet and interspecific predation, as well as in the framework of impact studies and Natura 2000 inventories in the natural environment;
 - breeding of native crayfish species in basins to save the gene pool and/or to grow reproducers for restocking operations;
 - training and awareness raising concerning native and invasive alien crayfish, advice on management options to encourage the development of native crayfish populations;
 - advice on and participation in managing invasive alien crayfish, with the development of an experimental protocol to sterilise the males, tested first in basins, then in the natural environment. This technique blocks reproduction and produces imbalances in the sex ratio and in the relative sizes, with as a result a major reduction in population numbers. The objective is to achieve total elimination of the species after applying the protocol for a few years.
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Intervention site

- The management work on signal crayfish (*Pacifastacus leniusculus*) by sterilising the males was conducted in the Normandie-Maine regional nature park in the Orne department, along 2 kilometres of the Sarthon River and its tributary, the Rouperroux.
- For the purposes of the work, the rivers were divided into 29 sections, each 100 metres long and numbered from downstream to upstream.
- The work also took place on two water bodies:
 - the old washing area (50 square metres) on the Rouperroux between sections 26 and 27;



1. Map showing the regional nature park.
2. Intervention site.

- the pond (500 m²) located approximately 7 metres from the Rouperroux in section 27.
- The sterilisation technique was implemented on the two rivers starting in 2010, except in sections 1 to 5 located downstream of the colonised area (no signal crayfish) and in the most upstream sections 18 to 29 where sterilisation was started in 2011.
- This report presents the work done in 2011.

Disturbances and issues involved

- In 2006, during inventories of white-clawed crayfish (*Austropotamobius pallipes*) conducted by Onema for the Normandie-Maine park, signal crayfish (*Pacifastacus leniusculus*) carrying “crayfish plague” (aphanomycosis) were discovered in the Roupperroux.

- Their presence represented a threat for the 6 remaining populations of white-clawed crayfish in the Sarthon basin.

- The white-clawed crayfish is a protected species whereas the introduction of signal crayfish is prohibited in all environments (article L432-10.1 in the Environmental code).

■ Impacts of signal crayfish on the native fauna

- Signal crayfish compete with white-clawed crayfish in that their habitats and diet are similar.

- They are predators of white-clawed crayfish and of many other aquatic species (fish, invertebrates).

- Signal crayfish are potential carriers of the water mould responsible for aphanomycosis (*Aphanomyces astaci*), a deadly disease for white-clawed crayfish transmitted by direct contact or via equipment used for human activities such as fishing.

Interventions

■ Capture and sterilisation

- The sterilisation protocol for males, previously experimented by Théo Duperray from the Saules et eaux consulting firm, was set up starting in 2010.

- This technique is based on observations concerning the dominance of large males during mating and on the retreat of the females to their burrows following mating.

- There are four steps, namely 1) capture of a maximum number of crayfish, 2) sterilisation of the large males, 3) euthanasia of the females and small males, and 4) release of the sterilised larger males prior to the reproduction period (mid-September).

- Signal crayfish were caught at night, section by section:

- the work was done over two weeks, from 29 August to 1 September and from 11 to 15 September 2011;

- two runs were carried out each night (between 21.30 and 04.00) on a dozen sections from downstream to upstream;

- the crayfish were captured either by hand or using an aluminium gripper, then placed in pails carried by the personnel;

- a periscope, designed by T. Duperray, was used in deep and turbid areas;

- at the end of each run through a section, the captured crayfish were placed in pails located at the head of the section.

- Artificial “lodging” was installed to increase capture rates, particularly for the large males:

- building bricks with 54 x 54 mm holes were placed in the water in sections 12 to 29;

- they were checked during the day.



3. Signal crayfish (*Pacifastacus leniusculus*).

Checks in 2011.

Date	29/08/11	01/09/11	13/09/11	15/09/11
Sections	12 à 21	22 à 29	12 à 21	22 à 29

■ Hoop nets were used to increase the capture rates in high-density areas (old washing area and sections 24, 26 and 29) and in low-density areas (sections 5 to 11):

- 24 traps (olfactory guidance), designed by T. Duperray, were set up from 30 August to 13 September;
- they were installed in the water, aligned with the current and baited with liver or fish;
- checks were run every day just before or after noon.

■ Handling after capture

■ The protocol stipulated the measurement of the captured crayfish and sorting into two groups:

- adult males to be sterilised;
- females and “small” males (small in size and/or not yet adult) to be euthanised. The crayfish were euthanised in groups at the end of each week of capture (2 and 17 September). They were put in a pail that was then filled with very hot water.

■ Prior to sterilisation, the large males were stored in basins with oxygen pumps and “lodging” until the end of the capture operations. The first week, the males were kept in washing-machine drums lowered into a pond. This technique was halted because many crayfish (366 sterilisable males) died.

■ The sterilisation technique was “mechanical”, i.e. did not use chemical products.

■ The sterilised males were marked with a white dot (glue) on the underside of a tail segment and released on 17 September:

- in sections 6 to 10 (low number of males captured), the number of released males was greater than the number of captured males in order to reduce the probability of females mating with non-sterilised males;
- in sections 11 to 29 (high number of males captured), the number of released males was less than the number of captured males in order to release a sufficient number of males in the other sections.

■ Monitoring after sterilisation

■ Onema carried out three types of monitoring after the sterilisation phase:

- the purpose of the first was to monitor the distribution and survival rate of the sterilised males;
- the two other types of monitoring attempted to assess the rate of successful reproduction following the sterilisations. Females and spawns were monitored in November, juveniles were monitored in September (before the new captures).

■ Monitoring of the sterilised males:

- the work was done on 28 September and on 6 and 11 October 2011;
- monitoring was conducted on three groups of “typical” sections, namely sections 6 to 9, the Sarthon invasion front, sections 12 to 14, the most densely populated area, and sections 22 to 28, a very densely populated, upstream area where the sterilisation procedure was implemented for the first time in 2011.

■ The captured crayfish (with the exception of the sterilised males) were euthanised in sections 6 to 9, the invasion front, whereas in the other sections, the crayfish were simply observed.



4. The periscope.

■ Main results:

- few sterilised males were observed in sections 6 to 9 (only one compared to the 32 previously released) and in sections 12 to 14 (two males observed among the 34 released);

- a large number of sterilised males were found dead, up to one-quarter of all the males observed.

■ Winter monitoring to assess the percentage of spawning females and the percentage of non-viable spawns:

- the work was done on 23 November 2011;

- 400 artificial “lodgings” (bricks) were checked and the viability of the eggs in females was examined (on the basis of the colour of the eggs);

- the captured crayfish (with the exception of the sterilised males) were euthanised in sections 6 to 9, the invasion front, whereas in the other sections, the crayfish were simply observed.

■ Summer monitoring by scraping the substrate to estimate the density of juveniles:

- the work was carried out between the end of August and the beginning of September;

- a fine dip net was used to collect the substrate containing debris and juveniles present under stones and pieces of wood (one sample per river section);

- juveniles were captured and counted, and their development stage was noted.

Results and assessment

■ Results

Captures.

Types of crayfish captured	Manual capture	Capture using hoop nets	Capture using bricks	Total
Females	1 209	131	365	1 705
Small males	694	0	16	710
Adult males	468	116	227	811
Non-identified crayfish	105	0	0	105
Total	2 476	247	608	3 331

■ Results of handling after capture

■ Among the 3 331 crayfish captured, 445 males were sterilised and released (out of a total of 811 sterilisable males, the other 366 died during the operation) and 2 504 crayfish were euthanised.

■ Results of the winter monitoring

■ A total of 226 crayfish were captured.

■ Among the 80 spawning females, 46.3% of the spawns were viable, 25% were not viable and 28.7% could not be determined (the colour did not allow for a clear result).



5. Viable eggs (brown colour).

6. Non-viable eggs (orange colour).

Results of the winter monitoring.

Not sterilised			Females captured	
Not sterilised	Sterilisedv	Not adult	Spawning	Not spawning
72	47	4	80	23

■ Results of monitoring by scraping the substrate

- Fewer juveniles born during the year were observed in the sections where sterilisation was carried out prior to 2011.
- An increase in the proportion of adults was observed in the sections 22 to 29 where sterilisation was first carried out in 2011.

■ Assessment

- The capture technique using hoop nets was effective in the downstream sections where there were few crayfish and in the deep-water sections.
- The low percentage of non-viable spawns (25%) would likely not have a significant impact on the growth dynamics of the population.

Outlook

- The management protocol was implemented again in 2012, but not in 2013 because four new populations of signal crayfish were discovered in the meantime and the results of the spawn monitoring were not encouraging (only 20% of the spawns were non-viable).
- The park planned to block off a part of the river to prohibit the signal crayfish from travelling upstream toward the tributaries where there were populations of white-clawed crayfish.

Information on the project

- Students from a nature protection and management course participated in the winter monitoring of the bricks in the framework of a partnership between the Normandie-Maine regional nature park and the Sées agricultural school.
- The project was presented in a number of symposia. An oral report and posters on the work were presented during the first French symposium on invasive alien crayfish, organised by INRA and the Brière regional nature park in June 2013.
- Reports on the work can be downloaded from the site of the consulting firm (<http://sauleseteaux.fr/>).

Remarks

- The white-clawed crayfish is protected by the law dated 10 July 1976 and by the decree dated 21 July 1983, modified by the decree dated 18 January 2000 on the protection of native crayfish, and is mentioned in Annexes II and V of the Habitats directive.

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For more information

- Internet site of the Saules et eaux consulting firm:
<http://sauleseteaux.fr/>
- Duperray T. 2012. Protocole expérimental d'éradication de l'Écrevisse de Californie *Pacifastacus leniusculus* par stérilisation des mâles. Compte rendu des opérations réalisées sur le Sarthon et le Rouperroux en 2011.

