



Red swamp crayfish

(Procambarus clarkii)

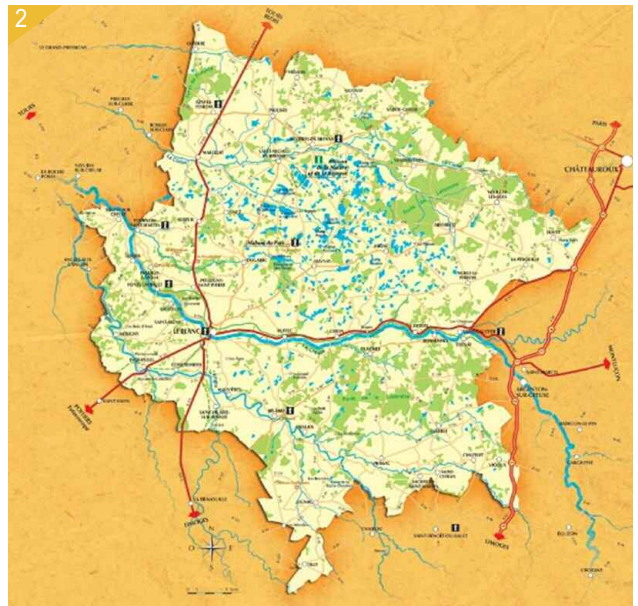
Managing red swamp crayfish in the Brenne regional nature park

Brenne regional nature park

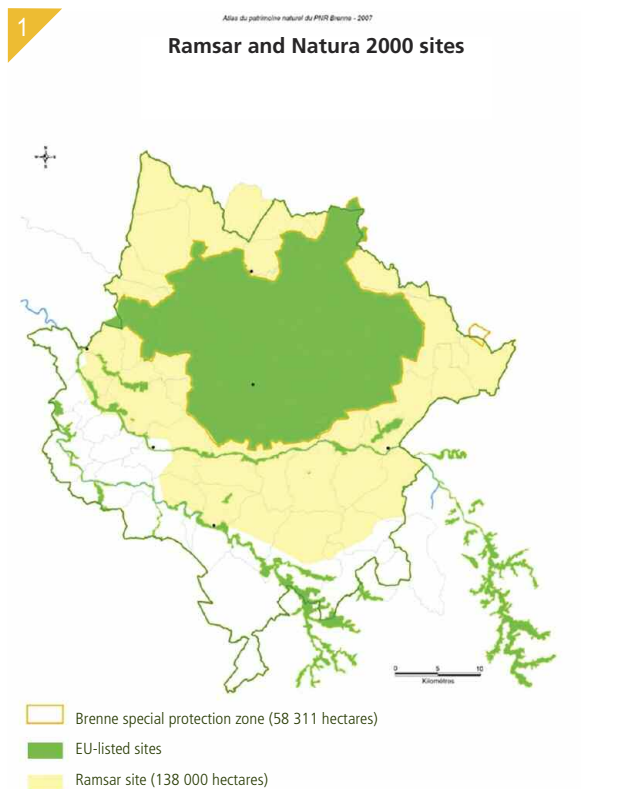
- The Brenne regional nature park, created on 22 December 1989, is located in the Indre department and comprises a total of 51 towns covering a surface area of 182 700 hectares.
- The park is managed by a board in which are represented all the local governments (towns, Indre department, the region) that have approved the park charter and the French State in view of establishing a collaborative and coherent form of management for the area.
- The objective of the park is to protect and enhance the natural, cultural and human qualities of the area by implementing an innovative policy for economic, social and cultural development that respects the environment.
- Contact: Aurore Coignet, policy officer for invasive alien species - a.coignet@parc-naturel-brenne.fr

Intervention site

- The Brenne is a true patchwork of landscapes (meadows, ponds, heathlands, forests, valleys and caves) that provide it with a wealth of ecological riches and wonderful views.
- It was listed by France as a Ramsar site (1991 Ramsar convention for the preservation of wetlands). The area is also recognised on the European level with four Natura 2000 sites. The first three are special conservation zones as defined by the Habitats directive, in the Creuse, Anglin and Grande Brenne valleys. The fourth is a special protection zone as defined by the Birds directive, which is larger than and comprises the Grande Brenne special conservation zone (see Figures 1 and 2).
- The entire park is located in the Loire River basin and is crossed by four rivers, the Indre, Claise, Creuse and Anglin.
- The man-made ponds (over 3 000) are fished each year and drained once every seven to ten years for a ten-month period over the fall and winter.
- Over 300 land owners in the Brenne are involved in fish farming and produce over 1 350 tonnes of fish (60% carp) per year. One-half of the 8 000 hectares of ponds are used for fish farming (Territorial assessment, 2009).



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1. Map of the Brenne regional nature park.
2. Map of the Ramsar and Natura 2000 sites in the Brenne regional nature park.

Disturbances and issues involved

- Red swamp crayfish were first observed in the centre of the Brenne regional nature park in July 2007.
- The species is a healthy carrier of crayfish plague (*Aphanomycosis*), which has been identified as one of the main causes in the disappearance of native crayfish. In the Brenne, a test was conducted in 2012 and revealed the presence of the disease on certain sites. A few populations of white-clawed crayfish still exist in the Indre department, but none within the borders of the park.
- The presence of red swamp crayfish produces a number of ecological impacts, e.g. a reduction in aquatic grass beds, predation on molluscs and tadpoles (this aspect was confirmed by an analysis of stomach contents conducted by the regional nature park in 2011 and 2015).
- Fish farming is also affected economically due to the consumption of alevins. The reduction in the vegetation caused by red swamp crayfish in turn encourages predation of fish by birds, a non-negligible loss for fish farmers.
- Another visible impact in the Brenne is the digging of burrows resulting in severe damage to pond banks and adjacent roads. These burrows, in addition to those caused by coypus, have obliged land owners to repair the roads.

Interventions

■ Objective of the interventions

- In order to coordinate the work against colonisation by red swamp crayfish and to limit the damage caused in the park, a management brigade for invasive alien species was created in October 2009.
- The team, made up of four people, carries out trapping with the towns and owners of ponds, responds to requests made by land owners and contributes to enhancing knowledge on the distribution of the species.
- The work in this field consists of three main activities, namely species management, communication and awareness-raising, and research. The research is intended to improve knowledge on the biology and ecology of the species and its dynamics in order to adjust and refine the management work.
- A database containing the updated inventory results is used to monitor crayfish populations throughout the area.
- Vast numbers of burrows enable red swamp crayfish to take cover when ponds are drained and fished. The links between ponds and the high mobility of the crayfish are factors contributing to the colonisation by the species and making it impossible to completely eradicate the species from the Brenne. That is why trapping was selected as the means to manage the species.

■ Discussions with other stakeholders and partners

- Immediately following the initial observations of red swamp crayfish in July 2007, a number of discussions were initiated.
- A steering committee, presided by the vice-Prefect, was created to launch coordinated and active management of the species. The committee brought together numerous local stakeholders, environmental-protection groups, Onema, the Chérine national nature reserve, the Indre fishing federation, the



3. A red swamp crayfish.
4. A berried (gravid) female.

Intermunicipal board for sanitation and enhancement of the Brenne, researchers and scientists, the Union of fisheries' owners and operators, etc.

■ In 2008, a trip was made to the Brière regional nature park (Loire-Atlantique department), also confronted with the red swamp crayfish, to meet the elected officials and discuss the problems encountered.

■ Research

■ A partnership was established in 2010 with the University of Poitiers (Ecology, evolution, symbiosis lab) to learn more on the biology and ecology of the species and to improve management techniques. A study is conducted each year, e.g. on stomach contents, the typology of burrows, estimates of crayfish numbers using the capture-mark-recapture (CMR) technique, tests on different prototypes of traps and baits, etc.

■ Management method

■ Inventories were carried out on a total of 442 ponds. Among that total, red swamp crayfish were observed in 147 ponds.

■ Trapping was conducted in 120 ponds (owners refused access to some sites).

■ When sufficient trapping pressure is maintained year round, it is possible to capture all cohorts of crayfish, notably the berried (gravid) females and those with larvae present primarily in the fall and winter.

■ The "hoop net" used was made of rigid plastic with two entries and a central section for bait.

■ Carp offal was used to attract the crayfish. It was supplied free of cost by the Fish Brenne company (a company selling freshwater-fish products).

■ Work is also done when the ponds are fished (fall and winter). Assessments can be carried out simply by walking around the pond with the owner and looking under stones, locating burrows, etc. When red swamp crayfish are present, large numbers can generally be collected in the mud and in the fish trap.

■ A study was launched in 2013 (the Fish-crayfish interaction project) to find a means to enhance the trapping results by stocking ponds with particular species of fish. Biological control using carnivorous fish turned out to be very effective in conjunction with trapping. The results are, for the time being, positive and will serve to advise pond owners and fisheries on the best combinations of fish species to limit the populations of red swamp crayfish.

Results and assessment

■ Overall trapping results

■ Since 2007, over 522 000 crayfish have been captured and eliminated by the various stakeholders in the regional nature park (pond managers, park personnel, employees of the Chérine national nature reserve).



5. Checking the traps.

6. A plastic "hoop net" used for trapping.

Number of red swamp crayfish trapped and eliminated since October 2009.

Stakeholders	2009	2010	2011	2012	2013	2014	2015	Total
Brenne brigade	11 218	43 119	8 269 *	28 257	28 728	101 627**	76 690**	297 908
Pond owners and managers	3 637	40 296	45 913	25 924	28 267	35 019	20 908	199 964
Chérine nature reserve	11 506	2 871	3 552	4 960	2 035	(trapping halted)	-	24 924
Total	26 361	86 286	57 734	59 141	59 030	136 646	97 598	522 796

* Reduced number due to draining of two highly infested ponds.

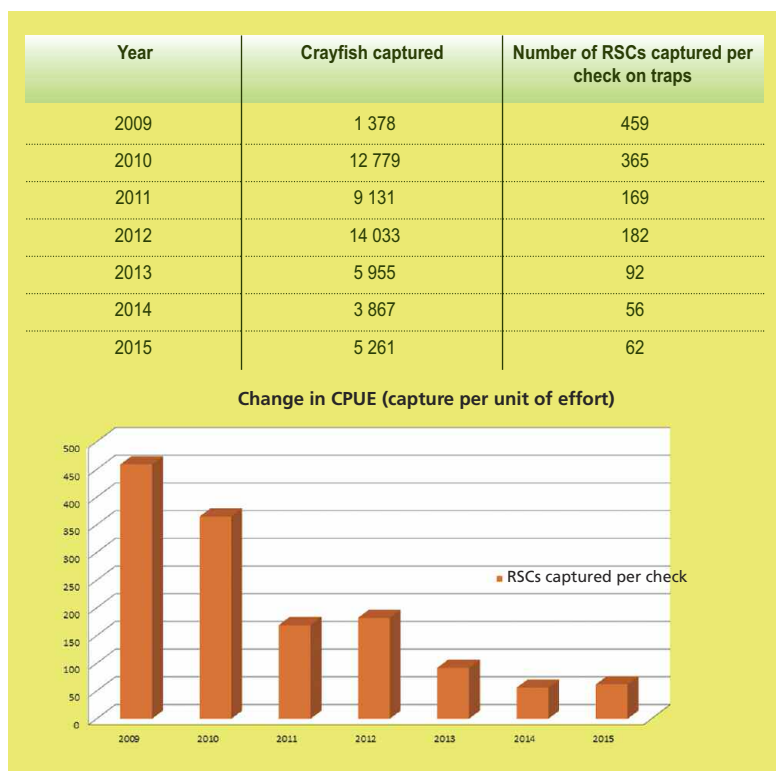
** Fish-crayfish interaction project.

Inventory data.

Inventory data

Year	Colonised ponds	Surveyed ponds
2009	28	40
2010	55	149
2011	92	242
2012	113	242
2013	119	378
2014	130	423
2015	147	442

■ Example of the results in a pond in the southern section of the park



Trapping results in a pond in the southern section of the park.

■ Management work in the pond presented above started in 2009 and a major trapping effort was made from 2010 to 2012.

■ The pond covers a surface area of 13 hectares and 15 to 20 traps were in place throughout the year. Trapping also took place in the neighbouring ponds, which made it possible to limit the number of red swamp crayfish in the series of five ponds.



- The traps were laid twice per week, a level of pressure deemed sufficient. The neighbouring ponds were also trapped because an entire area must be trapped to be effective.

- Since 2012, both the number and size of the crayfish caught has dropped.

■ Results of trapping combined with stocking of carnivorous fish

- The carnivorous fish tested in this study have traditionally been used by fish farmers in the Brenne (no alien fish species were introduced). The definitive results of this project are not yet available. The Fish-crayfish interaction project (see the year-end report of the Brenne regional nature park) will end at the end of the year and should be pursued.

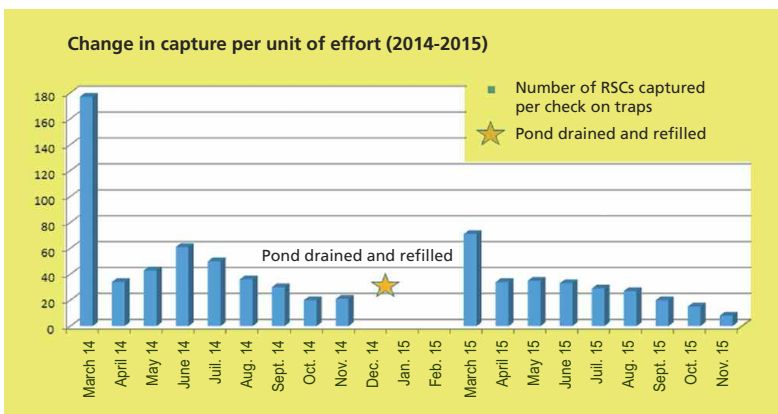
- A reduction in the numbers of crayfish captured was observed during the first year of the project.

- The combination of mechanical (trapping) and biological (carnivorous fish) management would seem to be an effective technique in reducing the population of red swamp crayfish. Control of the populations of red swamp crayfish can in effect be optimised by combining several management methods (in this case, trapping and stocking of carnivorous fish).



7. Teaching school children about invasive alien species.

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Results of trapping combined with stocking of carnivorous fish in a study pond.

■ Cost of the management work

- As an example of costs, over the three-year period (2013-2015) for the Fish-crayfish project, the amount spent in managing red swamp crayfish was 245 000 euros, including salaries, travel, equipment costs, communication, presentations, meetings, etc.

- This work was funded by the EU (ERDF), the Centre regional environmental directorate and the Centre region.

■ Negative factors

- Red swamp crayfish continue to propagate due to their natural mobility (particularly during strong rains) and due to human causes (some travel still occurs for human consumption).

- The park alone cannot take action in all the ponds in the entire area because the human resources are not available. That is why the involvement of land owners is indispensable.

- Access is not possible to certain private properties.

- Trapping alone is not sufficient in large ponds.

Information on the project

- A film titled “La Peste rouge” (The red plague) was made to inform the public. A travelling exhibition is also available for the towns and schools in the park.
- Presentations are made to school children, notably one titled “Meeting invasive alien species” that has been presented in primary schools every year since 2010.
- Efforts are made to raise the awareness of the general public:
 - a presentation on “Threatening species” is offered once each year during the nature excursions in the park;
 - since 2012, the park has held a stand presenting the red swamp crayfish and other invasive alien species during the Fishing Show in the Indre department. In 2015, 300 people visited the stand and received information;
 - over a dozen press articles have been published since the start of the management work.
- Dissemination of scientific information:
 - participation in conferences, symposia and training sessions on invasive alien species (IAS) and on the ponds;
 - publication of scientific articles in scientific journals, the proceedings of symposia.

Outlook

- Assessments will continue to be carried out in the park to detect the presence of red swamp crayfish, using trapping and the environmental DNA technique (now being developed).
- Trapping pressure will be maintained on colonised ponds and monitoring will be continued on the ponds near the source populations.
- Land owners and park guards will be assisted in managing the species by combining trapping with stocking of fish that consume red swamp crayfish.
- Pond owners will receive advice and assistance in managing red swamp crayfish as well as other invasive alien species, notably invasive plants.
- Training sessions on IASs will be organised for land owners.

Regulations

- *Procambarus clarkii* is an invasive alien species listed among the species likely to provoke biological imbalances (article L432-10 in the Environmental code). For that reason, its introduction into French waters is subject to a fine of 9 000 euros (article R432-5 in the Environmental code). Its transport and sale (living animals) are subject to authorisation (decree dated 21 July 1983).

Author: Aurore Coignet, Brenne regional nature park. January 2016.

For more information

- Internet site of the Brenne regional nature park:
<http://www.parc-naturel-brenne.fr/fr/accueil/un-territoire-d-exception/nature/especes-exotiques-envahissantes/97-un-territoire-d-exception/especes-exotiques-envahissantes/413-lecrevisse-rouge-de-louisiane>
- Aesturia « Premières rencontres françaises sur les écrevisses exotiques invasives », Actes du colloque sciences et gestion, 19 et 20 juin 2013, Saint-Lyphard. Collection Paroles des Marais Atlantiques. Pages 137-142.
- Report on management of red swamp crayfish and the Fish-crayfish interaction project (2013-2015). Brenne regional nature park.
- Coignet, A., F. Pinet, et C. Souty-Grosset, (2012). « Estimating population size of the red swamp crayfish (*Procambarus clarkii*) in fish-ponds (Brenne, Central France) ». Knowledge and Management of Aquatic Ecosystems, no 406: 02.
- Diagnostic de Territoire. Agenda 21 territorial. PNRB (2009) 179 pp.
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- Souty-Grosset, C., J. Reynolds, F. Gherardi, L. Aquiloni, A. Coignet, F. Pinet, M. Del Mar Mancha Cisneros., (2014). « Burrowing Activity of the Invasive Red Swamp Crayfish, *Procambarus clarkii*, in Fishponds of La Brenne (France) ». Ethology Ecology & Evolution 26, 23 (3 juillet 2014): 263-276.