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Red swamp crayfish

(*Procambarus clarkii*)

Classification	
Order	Decapoda
Family	*Cambaridae*
Genus	*Procambarus*
Species	*P. clarkii* (Girard, 1852)

Originated in Northern Mexico and southern sections of the United States. Introduced in France in 1976 for human consumption.

Description

- The maximum size is approximately 150 millimetres
- Generally red in colour, but can also range from grey to blue
- Cephalothorax with a rough surface (part 1 in Figure 1)
- Incurved rostrum with converging edges (part 2 in Figure 1)
- Inward-facing points (parts 1 and 2 in Figure 1), spurs on the proximal segment above the claws (part 3 in Figure 3)
- Red tubercles on the large claws (part 4 in Figure 3)

Ecology and reproduction

- Common habitats are rivers, lakes, ponds, marshes and canals
- The species prefers calm, turbid waters, with grass beds
- It digs tunnels into banks
- It is active primarily during the daytime
- It is an opportunistic omnivore, however it consumes primarily plants
- Sexual maturity is achieved at 6 months
- Reproduction can occur several times per year (50 to 600 eggs)

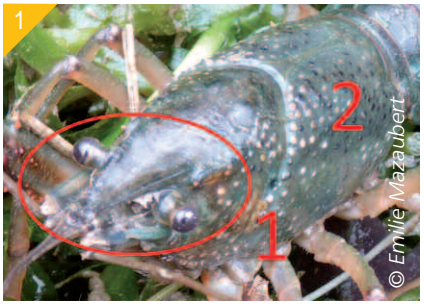
Documentation

- GISD worldwide database on invasive species. Invasive species specialist group, IUCN:

http://www.issg.org/database/species/ecology.asp?si=608

- Lorraine fishing federations. 2012. Crayfish identification guide for continental France. 28 pp.
- Nepveu C. 2002. Les espèces animales et végétales susceptibles de proliférer dans les milieux aquatiques et subaquatiques - Fiches espèces animales (Les espèces exotiques). Agence de l'eau Artois-Picardie. 98 pp.

Author: Emilie Mazaubert, Irstea



Red swamp crayfish

(*Procambarus clarkii*)

Experiments on controlling red swamp crayfish stocks using traps and natural predators in the Brière regional nature park

The Brière regional nature park

■ The regional nature park was approved by the Ecology ministry and is run by a board, with representatives from the departmental council, the Pays-de-la-Loire regional council, neighbouring towns and stakeholders, that manages the marshes and works with towns, the marsh boards and private individuals.

■ One of the main objectives of the park is to preserve biodiversity and restore the wetlands (marshes, wet meadows, reed ponds, canals, etc.).

■ Contact: Jean-Patrice Damien - jp.damien@parc-naturel-briere.fr

Programme to preserve biodiversity from the invasion by red swamp crayfish

■ The programme included applied research from 2010 to 2012, managed by INRA and funded primarily by Onema.

■ The general objective was to identify the mechanisms involved in the successful invasion by red swamp crayfish (*Procambarus clarkii*) via a five-point approach:

- development of a monitoring method for crayfish populations and testing of new molecular techniques to detect crayfish in large aquatic environments;
- study on the population response of red swamp crayfish as a function of various environmental conditions (hydroperiod, salinity, etc.);
- study on trophic determinism in the invasive success of red swamp crayfish and the position of the species in the upper links of the food chain (with respect to fish);
- study on biodiversity patterns as a function of colonisation (or lack of colonisation) of pool networks by the invasive species;
- experiments on controlling red swamp crayfish stocks using traps and a natural predator, the European eel (*Anguilla anguilla*).

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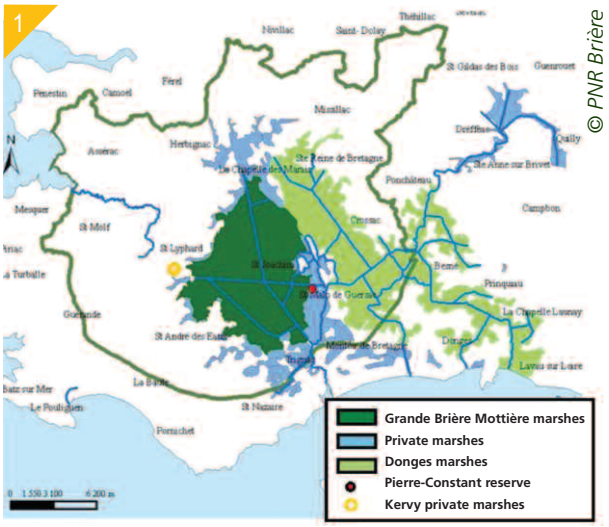


1. The Brière regional nature park and the different sectors.

Intervention site

■ Since 2009, attempts to draw down the stock of red swamp crayfish through continuous trapping have been undertaken in small ponds and lakes (isolated using a small-mesh barrier) in the Pierre-Constant reserve.

■ The reserve, owned by the park, is located to the east of the Grande Brière Mottière marsh among the Rozé private marshes in the town of Saint-Malo-de-Guersac (Loire-Atlantique department).

■ It covers a surface area of 25 hectares, of which 40% are ponds and lakes (some are watered year round, others are dry in the summer).

■ In 2009, the initial trials to regulate crayfish stocks were conducted exclusively in pond A. These initial experiments will not be discussed here.

■ In 2010 and 2011, trapping trials were carried out on two ponds (A and B, with respective surface areas of 225 and 715 square metres). In 2012, new trials to regulate the stocks were conducted on three ponds, including A and B:

- pond A, continuous trapping combined with the introduction of a natural predator, the European eel;
- pond B, continuous trapping with different types of traps to test their effectiveness (the results concerning trap effectiveness are not presented here);
- pond C, a new pond covering 680 square metres, served as a control environment.

■ These three ponds colonised by red swamp crayfish are good examples of the ponds in the Brière marshes. They are shallow (approximately 60 centimetres deep in April), generally dry from August to October, have slightly sloping banks and a peaty substrate.

2. A pond in the Pierre-Constant reserve with a barrier installed around it.

Disturbances and issues involved

■ The presence of red swamp crayfish in the Brière marshes is thought to be due to the accidental dispersal of the species from a crayfish farm located near the marshes in the 1980s. Since that time, red swamp crayfish have colonised the entire wetland area (20 000 hectares), a situation that has had numerous impacts on the ecosystem:

- a significant reduction in aquatic plant beds to the point that some species have disappeared, e.g. water lilies, resulting in a proliferation of cyanobacteria;
- modification and simplification of the food chain. Crayfish are a highly consumed source of food for a wide range of predators (birds, fish, mammals, etc.);
- tunnels dug into banks degrade the water quality (increased turbidity) and damage the banks;
- given the lack of a baseline, it is difficult to assess the impact on fish populations. However, it is important to note a reduction in the carrying capacity of the environment for phytophilic fish species.

Interventions

■ Trapping experiments in 2010 and 2011

■ The objective of the tests to draw down the stock of red swamp crayfish is to determine the feasibility of controlling populations in small ecosystems and to assess the response of plant and animal communities to the expected drop in the pressures exerted by crayfish. In 2010 and 2011, the initial experiments consisted solely of trapping in the Pierre-Constant reserve.

■ Experiments in 2012 combining trapping and the introduction of a natural predator

■ Given the limited results of the experiments in 2010 and 2011, it was decided to attempt to regulate the stock of red swamp crayfish in 2012 by pursuing trapping, but also by introducing European eels.

■ Eels are a common, native species in the Brière marshes and a known predator of crayfish.

■ The objective of the experiments is to compare the impact on crayfish stocks of a method combining trapping and natural predation to the method tested in 2010 and 2011 involving only trapping.

■ The experiments were conducted on the three ponds from 2 April to 25 August 2012 and were organised as follows:

- pond A, continuous trapping and introduction of eels. 15 wire hoop nets were used, i.e. one for every 15 square metres of pond, and checked every 24 to 72 hours. On 11 April 2012, 31 eels (average length 550 millimetres and average weight 330.5 grams) were released, each with a PIT-tag;
- pond B, continuous trapping. A total of 70 traps of different types (traditional and wire hoop nets, large cage traps, experimental traps) were used, i.e. one for every 10 square metres of pond, and were checked every 24 to 72 hours;

- pond C, a control pond where no trapping took place prior to 2012. Trapping was used to assess the crayfish population (density over time). It took place in two 24-hour sessions per week using 10 wire hoop nets installed at the start of the session (hour 0) and removed at the end (hour 24).

■ At the end of each session:

- the crayfish captured in each trap over the 24-hour session were counted and weighed;
- the crayfish from each trap were frozen.

■ The study took place in 3 phases, namely a phase prior to the introduction of the eels (sessions 1 to 3), a 3-month phase during which the eels were present (sessions 4 to 23) and a phase during which some of the eels were removed (sessions 24 to 28).

*3- Red swamp crayfish (*Procambarus clarkii*).*

Results of the interventions.

Year	2010	2011
Trapping period	14 April to 19 July	11 April to 22 July
Trapping organisation	• Pond A. 15 wire hoop nets in the water approximately 1 metre from the bank, 1 trap for every 15 square metres. • Pond B. 70 traps of different Types (traditional and wire hoop nets, large cage traps, experimental traps) in the water approximately 1.5 metres from the bank, 1 trap for every 10 square metres. • Bait (dog kibble) was placed in the traps each time they were checked.	• Pond A. Same as in 2010 + 7 additional traps starting on 4 July. • Pond B. Same as in 2010. • Bait (dog kibble) was placed from 24 June to 1 July in the traps in pond B and from 4 July onward in the traps in pond A, each time the traps were checked.
	• The traps were totally submerged (optimal capture conditions). • The traps were checked twice per week in both ponds.	
Handling after capture	• The crayfish in each trap were counted (except in 2010 in pond B). • The biomass in each trap was weighed. • The captured crayfish were frozen.	
Assessment	• A reduction in the numbers and total biomass captured from 2010 to 2011, but no significant reduction in spite of the relatively limited surface areas. • Trapping of red swamp crayfish requires significant human resources even for small ponds. It would be difficult to implement this technique in larger ecosystems.	

Results and assessment

■ Results

■ Total biomass captured:

- 2010. Pond A: 30 100 g (6 417 crayfish captured), i.e. 134 g per square metre. Pond B: 70 800 g, i.e. 99 g/m^2
- 2011. Pond A: 24 960 g (1 973 crayfish captured), i.e. 111 g/m^2. Pond B: 41 445 g, i.e. 58 g/m^2.

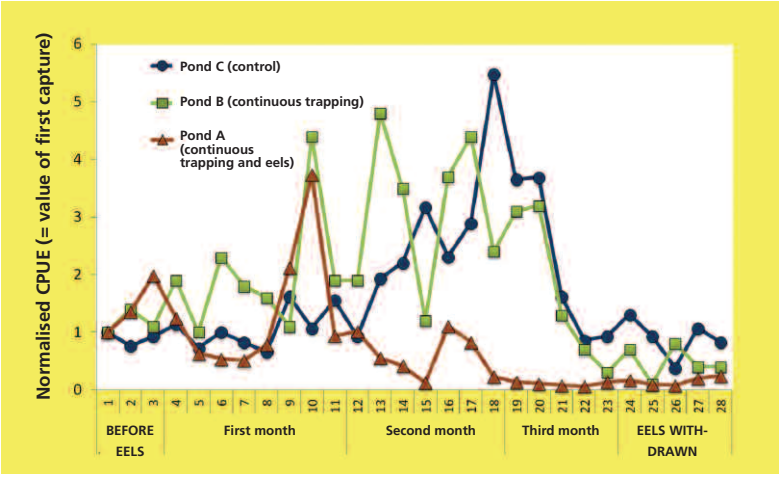
■ Experiments in 2012

■ The initial stock, measured in average captures per unit of effort (CPUE = average number of crayfish per trap per 24 hours), was higher in pond A (6.27 ± 1.18) than in ponds B and C (respectively 1.16 ± 0.46 and 2.60 ± 0.63).

■ Trapping had little effect on the crayfish stock in pond B. The drop at the end of the period was due to the drop in crayfish activity at that time of year.

■ The combined action of continuous trapping and the introduction of the predator produced a significant reduction in pond A (3 070 crayfish were removed from the pond, i.e. a density of 13.6 per square metre).
■ The major reduction in the numbers of crayfish in pond A was due to the high level of predation by the eels, probably in conjunction with a change in behaviour on the part of the crayfish (drop in activity) due to the presence of the eels.
■ This hypothesis is supported by the CPUE results in pond C.

Normalised captures per unit of effort (CPUE) in the three ponds. (The CPUE values were normalised to the initial CPUE value in each pond in order to take into account the differences in the initial stocks in the ponds.)

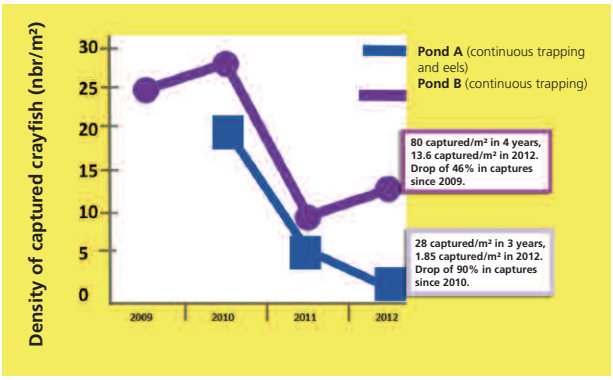


■ Assessment

■ Experiments in 2010 and 2011:
- a reduction in the numbers and total biomass captured from 2010 to 2011, but no significant reduction in spite of the relatively limited surface areas;
- trapping of red swamp crayfish requires significant human resources even for small ponds. It would be difficult to implement this technique in larger ecosystems.

■ Trapping in 2012 in the Pierre-Constant reserve produced limited results:
- densities dropped significantly from 2009 onward, but remained at high levels;
- the variations in biomass between 2011 and 2012 may indicate changes in the population structure (the studies on the population structure are not discussed here). Strong increases in the numbers of juveniles may be observed the year following large reductions in the crayfish stock.

■ The presence of the predators has a significant effect that is however difficult to interpret (direct predation and/or effect on the activity of the crayfish).
■ A significant reduction in the population of red swamp crayfish becomes difficult once it has reached high density levels.
■ Total results since 2009: 10 371 traps checked, 138 “sessions”, 580 man-hours in the field, 3 408 hours to lay the traps, 38 000 crayfish captured, i.e. 40.4 per square metre and approximately 120 kilograms of biomass captured, i.e. 128 grams per square metre.
■ The effort made for continuous trapping would be difficult to extend to a large, open environment.



Density of captured crayfish in ponds A and B.

Overall captures in ponds A and B.

	2010	2011	2012
Density (nbr/m²)	28.5	10.2	13.6 (↗)
Biomass (g/m²	133.8	128.1	60.6 (↘)

Outlook

■ Efforts will be made to perfect the combination of captures and predation over the long term:

- selective trapping will be implemented if a major trapping effort is made and/or if emblematic species are present. Tests on selective trapping were run during the experiments and proved the effectiveness of the technique. An assessment of the technique in terms of the applicable regulations is in progress;
- the stock of predatory fish will be optimised to enhance their impact on the population of red swamp crayfish;
- particular efforts will be made for sites in the early stages of colonisation.

Information on the project

■ The first national meeting on invasive alien crayfish, held from 18 to 20 June 2013 in Saint-Lyphard (Loire-Atlantique department), was organised by INRA Rennes, the Brière regional nature park, the Forum of Atlantic marshes, the CNRS Rennes and Onema:

- a paper was presented on the trials to draw down the stock of red swamp crayfish *Procambarus clarkii* using trapping and biocontrols;
- the project results were published in an *Onema Meetings* document and in the *Aestuaria* collection of documents.

Author: Sandra Fernandez, Irstea

For more information

■ Basilico L., Damien J.P., Roussel J.M., Poulet N. et Paillisson J.M. 2013. Les invasions d'écrevisses exotiques. Impacts écologiques et pistes pour la gestion. Onema, 76 pp.

■ Ginon A. 2009. État de colonisation, interactions et gestion de deux espèces invasives : la jussie et l'Écrevisse de Louisiane. Mémoire de fin d'étude, Agrocampus Rennes, 43 pp.

■ Lecoq N. 2012. Expérimentation d'une modalité de gestion biologique complémentaire du piégeage pour contrôler les populations de l'Écrevisse de Louisiane, *Procambarus clarkii* : l'Anguille. Rapport stage master 1 GHBV, Rennes, 22 pp.

■ Paillisson J.M., Roussel J.M., Tréguier A., Surzur G. et Damien J.P. 2012. Préservation de la biodiversité face aux invasions de l'écrevisse de Louisiane (*Procambarus clarkii*), rapport final, accord cadre Onema/Inra, 32 pp.

■ Soudieux A. 2010. Restauration de la biodiversité par épuisement de stock de *Procambarus clarkii*. Mémoire de fin d'étude d'école d'ingénieurs. ESITPA, Rouen, 58 pp.

■ Thabot S. 2011. Évaluation de pièges pour la capture de *Procambarus clarkii*, espèce invasive : efficacité-sélectivité-périodicité. Master mention Biotechnologies, Gestion et Valorisation des ressources biologiques, Université de Bretagne Sud, 36 pp.

Parc naturel régional de Brière

Red swamp crayfish

(*Procambarus clarkii*)

Experiments on managing red swamp crayfish in ponds in the Vosges department

Onema, the French national agency for water and aquatic environments, NE regional office

■ Onema is a public agency under the supervision of the Ecology ministry and was created by the Law on water and aquatic environments (30 December 2006) in response to the requirements of the Water framework directive (23 October 2000) which set quality objectives for water and aquatic environments with a deadline in 2015.

Onema is the principle technical organisation in France in charge of developing knowledge on the ecology of aquatic environments and managing aquatic ecosystems. Its mission is to contribute to comprehensive and sustainable management of water resources and aquatic environments.

■ Five main missions:

- provide technical support for water polices (local governments, Water agencies, State services, etc.);
- stimulate research on the major challenges facing water and aquatic environments (climate change, new forms of pollution, etc.);
- improve knowledge on the status and uses of water and aquatic environments and make the information available to the public;
- play an essential role in the police for water and aquatic environments, in support of State services;
- fund specific water policies, such as solidarity funding between river basins and the Ecophyto plan.

Three organisational levels:

- the general management develops science-advice capabilities in support of public water policies, manages the agency and coordinates the Water information system (WIS-FR);
- the nine regional offices corresponding to one or more administrative regions in France. They represent the agency in its dealings with local authorities and they manage the local offices in their region;
- the local offices are the basic building blocks of Onema. Their mission is to inspect and monitor water uses and to provide technical support to the water police. They also collect data on the status and uses of water and aquatic environments, as well as on species.

■ Contact: Marc Collas - marc.collas@onema.fr

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1. Intervention site.

Intervention site

■ The site is located in the town of Bellefontaine, in the southern section of the Vosges department in the Semouse river basin (Rhône-Méditerranée-Corse basin).

■ The site consists of two ponds/reservoirs on a tributary to the Semouse River. They are also supplied by springs and rainfall. The two ponds are equipped with a draining system and can be drained. The upstream pond has a surface area of 2 500 square metres and the downstream a surface area of approximately 8 000 m^2.

■ They are privately owned and are intended for recreational fishing. Legally speaking, the ponds were authorised for a period of 30 years. At the time of the intervention, the 30-year period had expired and the owner was obliged to correct the situation by submitting an application to the departmental territorial agency.

Disturbances and issues involved

■ The announcement concerning the presence of *Procambarus clarkii* was only the second in the Lorraine region. It entails a number of consequences for the local environment, including:

- a risk that certain native species (native crayfish, molluscs, invertebrates, fish, amphibians) may regress or simply disappear;
- the crayfish may be healthy carriers of “crayfish plague” (aphanomycosis), a disease that kills native crayfish;

- the crayfish may be carriers of chytridiomycosis, a pathology affecting amphibians;
- destruction of cyprinid spawning grounds due to the reduction in aquatic plant beds where many fish species spawn;
- the crayfish can damage structures and hydraulic installations by digging into banks (tunnels up to 1 metre deep, even 2 metres in Spain) and completely destabilising them at great economic cost.

* Disturbances on the local level:
- risks of colonising new sites;
- competition with native species.

*2. Red swamp crayfish (*Procambarus clarkii*).*

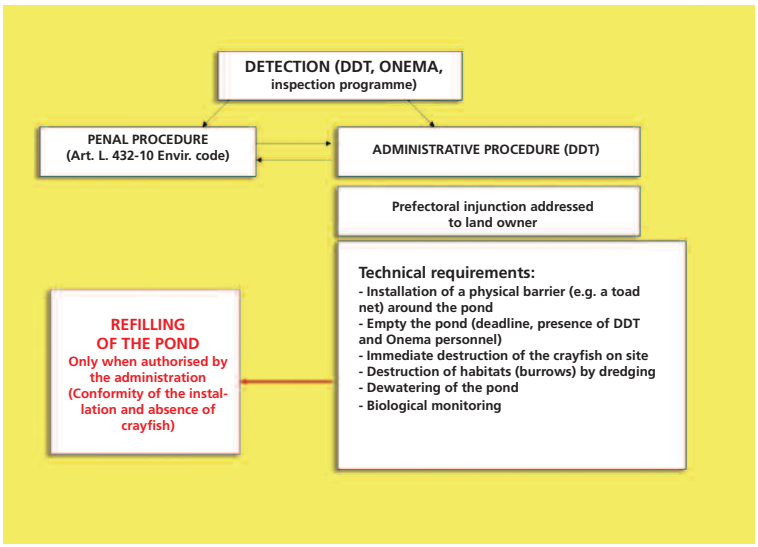
Interventions

■ September 2009, an exuvia discovered during a check on pond conformity signalled the presence of red swamp crayfish.

■ October 2009, the presence of the species was confirmed by trapping using hoop nets with bait. Gravid females were captured and numerous juveniles were observed. All size classes were noted.

■ The crayfish had not colonised the tributary, i.e. they were present exclusively in the two ponds.

Diagram of the administrative and penal system in the Vosges department.



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■ Intervention period and method

■ Fall 2009:

- November 2009, slow emptying of the ponds by the owner in the presence of the State services, DDT and Onema, following the prefectoral injunction;
- installation of a physical barrier (plastic tarp) with pails as traps around the perimeter to avoid any escape of the crayfish;
- netting to collect a maximum number of crayfish, plus manual collection of any visible crayfish and searches in the various habitats;
- use of quicklime in pools remaining in the pond;
- total dewatering with filtration systems in the pond fish trap to avoid the escape of any remaining crayfish to the stream.

■ 2010:
- the pond was dewatered in the winter and summer, with monitoring of the filtering system and collection of the crayfish in pond fish trap;
- regular monitoring of the site to check for the presence of crayfish.
■ 2011:
- the pond was dewatered in the winter and summer, with monitoring of the filtering system;
- regular monitoring of the site to check for the presence of crayfish.
■ 2012:
- the pond was dewatered in the winter and summer, with monitoring of the filtering system;
- regular monitoring of the site to check for the presence of crayfish.
■ 2013, the owner received permission to refill the pond.

Results and assessment

■ Results

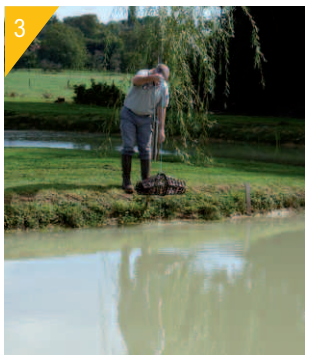
■ Following the three years of successive dewaterings and the end of the experiment, the combined techniques resulted in the complete eradication of red swamp crayfish in the two ponds where the species had naturalised (reproduction, growth).
■ This result is the product of several factors:
- early detection;
- rapid intervention on the site in the framework of regulatory constraints weighing on the pond owner;
- and all the measures implemented following the emptying of the ponds.
■ The work must be followed by biological monitoring on the site and the surrounding area. The monitoring showed that in this particular case, the red swamp crayfish had not colonised the downstream environment and the surrounding ponds.

■ Costs

■ In this case, the costs were not calculated and fell entirely on the pond owner who had introduced the crayfish.
■ However, the costs incurred by the fishing operations, the quicklime operation and purchase of equipment (physical barrier) may be estimated at around 5 000 euros.
■ Monitoring consisted of two annual visits following the emptying of the ponds.
■ A further element is the loss of use of the ponds for three years and the destruction of the fish in order to avoid transporting crayfish larvae to other ponds.

Outlook

■ Total emptying of the colonised ponds and control over the water levels were indispensable elements in the success of the management work against the invasive crayfish.
■ This case showed that in efforts against an invasive species, the work must be adapted to each situation and each site. It also showed that an intervention may last a fairly long time (three years in this case).
■ Finally, during the intervention, ample information must be provided in the local press as well as to elected officials and the owners of ponds and lakes.



3. Detection of the species.
4. The physical barrier around a pond.
5. Use of quicklime in pools remaining in the pond.
6. Draining the pond in the winter.
7. Filtering systems in the pond fish trap.

Information on the project

■ The first national meeting on invasive alien crayfish, held from 18 to 20 June 2013 in Saint-Lyphard (Loire-Atlantique department), was organised by INRA Rennes, the Brière regional nature park, the Forum of Atlantic marshes, the CNRS Rennes and Onema. The project results were published in an *Onema Meetings* document and in the *Aestuaria* collection of documents.

Note on applicable regulations

■ The introduction of a "species likely to provoke biological imbalances", as per articles R432-5 and L432-10 in the Environmental code, is subject to a fine of 9 000 euros.

Author: Marc Collas, Onema

8. Dead red swamp crayfish following emptying of the pond.

For more information

■ http://www.onema.fr/Les-rencontresde-l-Onema
■ http://www.onema.fr/collection-les-rencontres-syntheses
■ http://www.set-revue.fr/la-gestion-des-ecrevisses-exotiques-envahissantes-dans-le-departement-des-vosges/texte
■ Collas M., Julien C. et Monnier D. 2007. Note technique : La situation des écrevisses en France. Résultats des enquêtes nationales réalisées entre 1977 et 2006 par le Conseil Supérieur de la Pêche. Bulletin Français de la Pêche et de la Pisciculture (386) : 1-39. http://www.kmae-journal.org
■ Collas M. 2014. La gestion des écrevisses en plan d'eau dans le département des Vosges. *In* Premières rencontres françaises sur les écrevisses exotiques invasives. Damien J-P., Gallicé A. Miossec G. et Paillisson J.M. (eds) Aesturia - Paroles des Marais Atlantiques.
■ Holdich D.M., Reynolds J.D., Souty-Grosset C., Sibley P.J. 2010. A review of the ever increasing threat to European crayfish from non-indigenous crayfish species - Knowledge and Management of Aquatic Ecosystems (2009) 394-395, 11. http://www.kmae-journal.org
■ Souty-Grosset C., Holdich D.M., Noël P.Y., Reynolds J.D.et Haffner P. (eds) 2006. *Atlas of Crayfish in Europe.* Muséum national d'Histoire naturelle, Paris, Patrimoines naturels, (64), 187 pp.

ONEMA
Office national de l'eau et des milieux aquatiques

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Signal crayfish

(*Pacifastacus leniusculus*)

Classification	
Order	Decapoda
Family	*Astacidae*
Genus	*Pacifastacus*
Species	*P. leniusculus* (Dana, 1852)

Originated in the Northwest of the United States. Introduced in France in the 1970s for commercial farming tests.

Description

- The maximum size is approximately 180 millimetres
- The animals tend to be light brown in colour
- Cephalothorax with a smooth surface (part 1 in Figure 1)
- Rostrum with parallel edges (part 2 in Figure 1)
- Large, smooth claws:

- with a whitish or bluish spot at the joint of the claws (part 3 in Figure 2)
- with a red underside

Ecology and reproduction

- Habitats vary significantly, ranging from small streams and large rivers to ponds and lakes
- It digs tunnels into banks
- It is active primarily during the night
- Omnivorous:

- adults consume primarily plants
- juveniles consume primarily other animals

- Sexual maturity is reached between 12 and 24 months
- Reproduction occurs once per year (150 to 400 eggs)

Documentation

- Species fact sheet drafted by the University of Metz:

http://www.invabio.univ-metz.fr/z_pacifastacus_leniusculus.htm

- Lorraine fishing federations. 2012. Crayfish identification guide for continental France. 28 pp.
- Nepveu C. 2002. Les espèces animales et végétales susceptibles de proliférer dans les milieux aquatiques et subaquatiques - Fiches espèces animales (Les espèces exotiques). Agence de l'eau Artois-Picardie. 98 pp.

Author: Emilie Mazaubert, Irstea

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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.

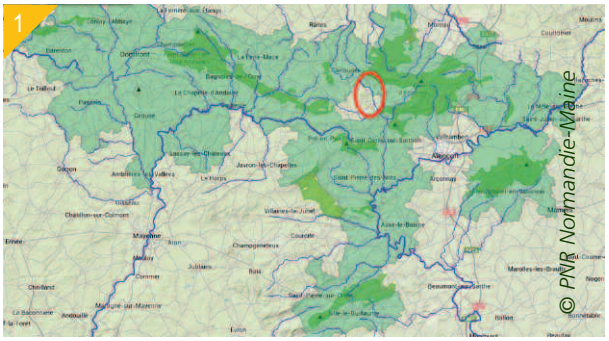
■ Fields of expertise:

- 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.

■ Contact: Théo Duperray - theo.duperray@sauleseteaux.fr



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

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;
- the pond (500 m^2) 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 Rouperroux.
- 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).

*3. Signal crayfish (*Pacifastacus leniunculus*).*

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.

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

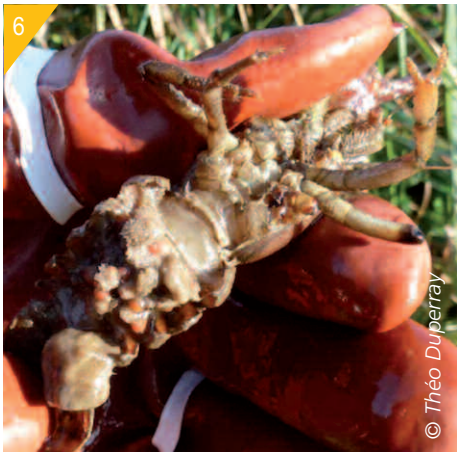
■ Onema carried out three types of monitoring after the sterilisation phase:
- the purpose of the first was to monitor the distribution and survival rate of the sterilised males;
- the two other types of monitoring attempted to assess the rate of successful reproduction following the sterilisations. 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.



5. Viable eggs (brown colour).
6. Non-viable eggs (orange colour).

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).

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 were 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.

Author: Sandra Fernandez, Irstea

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 *Pacisfastacus leniusculus* par stérilisation des mâles. Compte rendu des opérations réalisées sur le Sarthon et le Rouperroux en 2011.

Signal crayfish

(*Pacifastacus leniusculus*)

Experiments on managing signal crayfish in ponds in the Vosges department

Onema, the French national agency for water and aquatic environments, NE regional office

■ Onema is a public agency under the supervision of the Ecology ministry and was created by the Law on water and aquatic environments (30 December 2006) in response to the requirements of the Water framework directive (23 October 2000) which set quality objectives for water and aquatic environments with a deadline in 2015.

Onema is the principle technical organisation in France in charge of developing knowledge on the ecology of aquatic environments and managing aquatic ecosystems. Its mission is to contribute to comprehensive and sustainable management of water resources and aquatic environments.

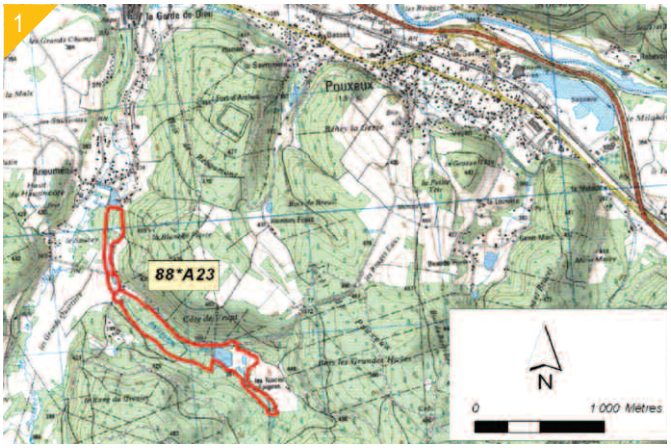
■ Five main missions:

- provide technical support for water polices (local governments, Water agencies, State services, etc.);
- stimulate research on the major challenges facing water and aquatic environments (climate change, new forms of pollution, etc.);
- improve knowledge on the status and uses of water and aquatic environments and make the information available to the public;
- play an essential role in the police for water and aquatic environments, in support of State services;
- fund specific water policies, such as solidarity funding between river basins and the Ecophyto plan.

■ The agency is organised around three hierarchical and geographical organisational levels:

- the general management develops science-advice capabilities in support of public water policies, manages the agency and coordinates the Water information system (WIS-FR);
- the nine regional offices corresponding to one or more administrative regions in France. They represent the agency in its dealings with local authorities and they manage the local offices in their region;
- the local offices are the basic building blocks of Onema. Their mission is to inspect and monitor water uses and to provide technical support to the water police. They also collect data on the status and uses of water and aquatic environments, as well as on species.

■ Contact: Marc Collas - marc.collas@onema.fr



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1. Map showing the intervention site.

Intervention site

■ The site is listed among the sensitive natural areas in the Vosges department and covers a total of 30 hectares. This report deals essentially with the management of the ponds and of the signal crayfish (*Pacifastacus leniusculus*).

■ The two ponds lie on private land. Following the discovery of signal crayfish during an inspection carried out by Onema in September 2009 and given the illegal nature of the ponds, legal proceedings were initiated at the end of 2009 by the departmental territorial agency against the owners, in order to regularise the situation.

■ The injunction (signed in March 2010) stipulated that:

- the ponds be drained to eradicate the population of signal crayfish;
- a wetland and ecological continuity be restored by setting up a bypass. The towns of Arches and Pouxeux volunteered to provide the technical oversight. The policy of the Vosges departmental council concerning sensitive natural areas applied and was implemented by the Lorraine nature conservatory.

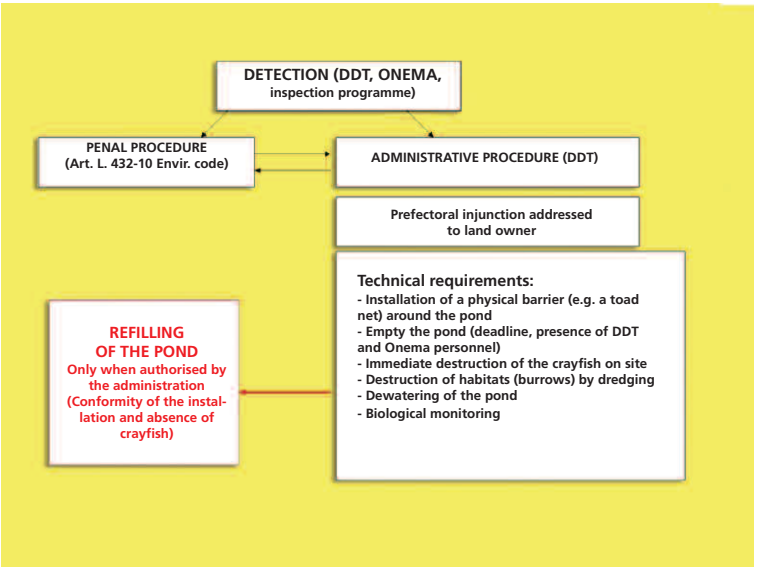
■ The site consists of two ponds/reservoirs on a tributary to the Noires Feignes stream (Rhin-Meuse basin).

The ponds, with a respective surface area of 21 ares and 1.5 hectares are also supplied by springs.

■ The two ponds are each equipped with a draining system and can be drained.

■ The inspections on site noted, however, that the signal crayfish had already colonised the Noires Feignes stream downstream of the ponds.

Diagram of the administrative and penal system in the Vosges department.



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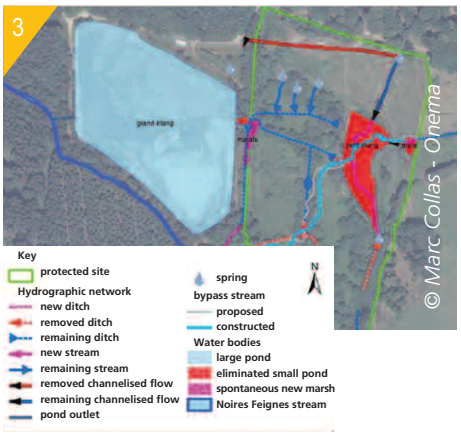


2. Pacifastacus leniusculus *(signal crayfish).*
3. Map showing the hydrographic network and the restoration work.

Disturbances and issues involved

■ The presence of the signal crayfish entails a number of consequences for the local environment, including:

- a risk that certain native species (native crayfish, molluscs, invertebrates, fish, amphibians) may regress or simply disappear;
- the crayfish may be healthy carriers of “crayfish plague” (aphanomycosis), a disease that kills native crayfish. The infection rate for crayfish plague of the observed population was high.

■ On the local level, the objective of the intervention was to eliminate the “source population”, introduced to the ponds by the owners via living animals transported from Lake Geneva, and to limit the spread of the population both upstream and downstream in the stream.

Interventions

■ The two ponds were drained and the signal crayfish were eliminated.

■ The smaller pond was purchased by the public authorities and eliminated:

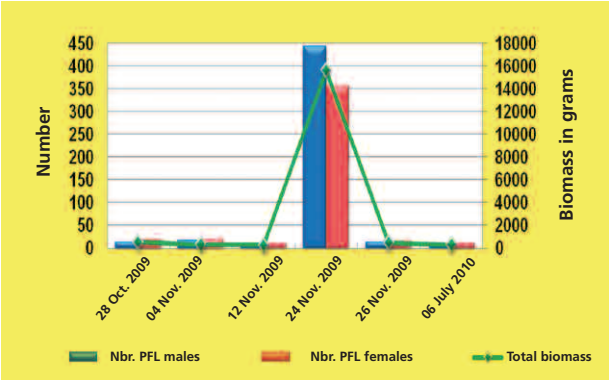
- ecological continuity was restored by destroying the draining systems and reinstating the normal flow toward the Noires Feignes stream;
- functioning of the wetland was restored by recreating the riverbed in the tributary. Previously, the small pond drained directly into the larger pond. Restoration of ecological continuity required that the water from the small pond flow directly to the Noires Feignes stream. The selected technical solution consisted of recreating a riverbed to enable the movement of fish;
- the landscape was restored by partially lowering the dike and reprofiling the former banks.

■ Small and large pond

■ Fall 2009:

- November 2009, slow emptying of the ponds by the owner in the presence of the State services, DDT and Onema, following the prefectoral injunction;
- netting to collect a maximum number of crayfish, plus manual collection of any visible crayfish and searches in the various habitats. Over 800 crayfish were captured during the draining of the ponds;
- use of quicklime in pools remaining in the pond;
- total dewatering with filtration systems in the pond fish trap to avoid the escape of any remaining crayfish to the stream.

Numbers and total biomass of crayfish removed during the interventions in 2009 and 2010.



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■ Large pond

■ 2010, the pond was dewatered in the winter and summer, with monitoring of the filtering system and collection of the crayfish in the pond fish trap.

■ 2011:

- mechanical means were used to dredge and restructure the bed. The burrows in the banks and other habitats of the signal crayfish were destroyed;
- biological monitoring was organised on the site.

■ 2012, the pond was refilled.

■ Small pond

■ 2010, the small pond was eliminated and restoration work was undertaken for the wetland and stream.

Results and costs

■ Results

■ The measures implemented in this particular case succeeded in eliminating the population of signal crayfish found in the two ponds. Concerning the colonised stream, no work was undertaken against the crayfish population in the absence of effective techniques.

■ Costs

■ For the large pond, the costs were not calculated and fell entirely on the pond owner who had introduced the crayfish.

4. Work to eliminate the small pond.
5. Dredging in the large pond.
6. Captured signal crayfish.
7. View of the large pond following the work.
8. Restoration of the stream on the site of the small pond.

■ The elimination of the small pond and the accompanying measures cost 25 761,84 euros including VAT and were carried out in November 2011. The work required the use of a 20-ton excavator on special “marsh tracks” and equipped with a support system to improve stability and reduce the impact on the soil.

Outlook

■ Total emptying of the colonised ponds and control over the water levels were indispensable elements in the success of the management work on the invasive crayfish.

■ This case showed that in efforts against an invasive species of crayfish, the work must be adapted to each situation and each site. It also showed that an intervention may last a fairly long time (two years in this case).

Information on the project

■ The Lorraine nature conservatory conducted a number of informational sessions on site for the owners prior to the work.

■ Several articles were published in the local press on the method and work.

Note on applicable regulations

■ The introduction of a “species likely to provoke biological imbalances”, as per articles R432-5 and L432-10 in the Environmental code, is subject to a fine of 9 000 euros.

Author: Marc Collas, Onema

For more information

■ http://www.onema.fr/Les-rencontresde-l-Onema

■ http://www.onema.fr/collection-lesrencontres-syntheses

■ http://www.set-revue.fr/la-gestion-des-ecrevisses-exotiques-envahissantes-dans-le-departement-des-vosges/texte

■ Collas M., Julien C. et Monnier D. 2007. Note technique : La situation des écrevisses en France. Résultats des enquêtes nationales réalisées entre 1977 et 2006 par le Conseil Supérieur de la Pêche. Bulletin Français de la Pêche et de la Pisciculture (386) :1-39. http://www.kmae-journal.org

■ Collas M. 2014. La gestion des écrevisses en plan d’eau dans le département des Vosges. *In* Premières rencontres françaises sur les écrevisses exotiques invasives. Damien J-P., Gallicé A. Miossec G. et Paillisson J.M. (eds) Aesturia - Paroles des Marais Atlantiques.

■ Holdich D.M., Reynolds J.D., Souty-Grosset C., Sibley P.J. 2010. A review of the ever increasing threat to European crayfish from non-indigenous crayfish species - Knowledge and Management of Aquatic Ecosystems (2009) 394-395, 11. http://www.kmae-journal.org

■ Souty-Grosset C., Holdich D.M., Noël P.Y., Reynolds J.D. et Haffner P. (eds) 2006. *Atlas of Crayfish in Europe*. Muséum national d’Histoire naturelle, Paris, Patrimoines naturels, (64), 187 pp.

ONEMA
Office national de l’eau et des milieux aquatiques

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Pumpkinseed

(*Lepomis gibbosus*)

Classification	
Order	Perciformes
Family	*Centrarchidae*
Genus	*Lepomis*
Species	*L. gibbosus* (Linnaeus, 1758)

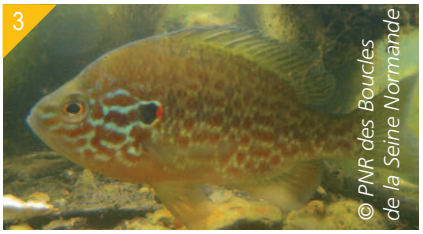
Originated in the Northeastern section of North America. Introduced in France in 1877 for recreational fishing and for its ornamental value in aquariums. The population is currently growing.

Description

- Adults vary in size between 8 and 15 cm
- Tall, narrow body shape
- Terminal mouth, small and slightly oblique
- Fins:

- the tail fin is only slightly forked
- the two dorsal fins are joined
- the pectoral fins are long and pointed
- the anal fin has three sharp spines

- Brilliant colours with touches of green and blue on the back and reddish spots on the sides
- Bright blue lines on the cheeks, particularly of males
- The operculum is wide with a black spot and an adjacent bright red spot in males, that is absent or less pronounced in females
- Males are larger and more brightly coloured than females



Ecology and reproduction

- Habitats include shallow waters in ponds, lakes and rivers with slow currents, fairly warm waters with abundant submergent vegetation
- Sedentary and gregarious species, active during the day, defensive of its territory
- Juveniles consume plankton, adults are carnivorous (insect larvae, crustaceans, worms and small molluscs, fish roe and larvae)
- Sexual maturity is attained at the age of 3 to 4 years (but 1 year is possible):

- spawning from May to August in shallow waters
- 1 500 to 3 000 eggs are laid in a nest guarded by the male up to a few days after hatching

Documentation

- Pascal M., Lorvelec O., Vigne J.D. 2006. Invasions biologiques et extinctions : 11 000 ans d'histoire des vertébrés en France. Quae, Versailles. 350 pp.
- Observational data to identify subaquatic fauna and flora (DORIS). For the fact sheet on *Lepomis gibbosus*, see: http://doris.ffessm.fr/fiche2.asp?fiche_numero=287)
- Nepveu C. 2002. Les espèces animales et végétales susceptibles de proliférer dans les milieux aquatiques et subaquatiques - Fiches espèces animales (Les espèces exotiques). Agence de l'eau Artois-Picardie. 98 pp.

Author: Emilie Mazaubert, Irstea

Pumpkinseed

(*Lepomis gibbosus*)

Proposed protocol for pumpkinseed management in the Trait marshes

The Boucles de la Seine Normande regional nature park

■ The park was created in 1974 in the Seine-Maritime and Eure departments as the Brotonne regional nature park. The name was changed to the Boucles de la Seine Normande regional nature park in April 2001.

■ The main missions are to conserve natural environments, biodiversity and the landscape by:

- setting up programmes to preserve biodiversity;
- achieving good ecological status of water bodies in compliance with the Water framework directive (WFD) and the 2006 Law on water and aquatic environments;
- generating knowledge through scientific research and monitoring;
- managing and restoring environments (and notably wetlands) through direct project management or by accompanying project promoters. A management plan for the period 2011 to 2014 was set up for the marshes in the town of Trait for the Rouen-Elbeuf-Austreberthe urban area (CREA).

■ In the framework of a policy to control the invasive alien species on the site, a management protocol for pumpkinseed (*Lepomis gibbosus*) was proposed.

■ Contact:

Florian Rozanska (Boucles de la Seine Normande regional nature park) - florian.rozanska@pnr-seine-normande.com
Vincent Targosz (CREA) - vincent.targosz@la-crea.fr

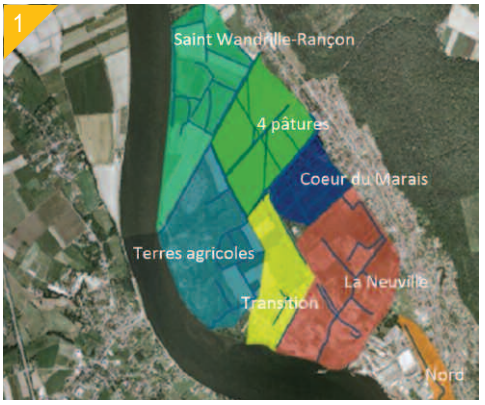
Intervention site

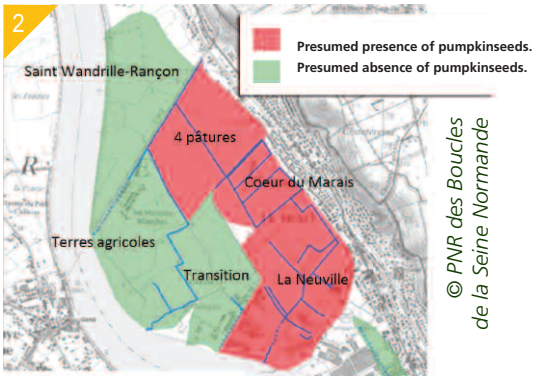
■ The protocol was proposed for the management of the pumpkinseed populations in the marshes in the town of Trait (Seine-Maritime department). Trait lies on the right bank of the Seine, approximately 25 kilometres downstream of Rouen and over 70 kilometres upstream of Le Havre.

■ The Trait marshes are located in the Trait-Yainville loop of the Seine, within the floodplain of the river. The Trait marshes are a Natura 2000 site that is part of the Boucles de la Seine Aval Natura 2000 zone (FR2300123).

■ The marshes cover a surface area of 114 hectares. The fish in the marshes travel via a dense network of interconnected ditches (representing a total distance of 14 325 metres).

■ The hydraulic network is divided into eight sectors:
"Saint Wandrille-Rançon", "Terres agricoles", "zone de transition", "La Neuville", "Nord", "Cœur du marais",





1. Sectors of the hydraulic network in the Trait marshes.
2. Sectors of the marshes with pumpkinseed populations.

"Les quatre pâtures" and "Yainville" (the latter lies to the south and is not shown on the map).

■ The protocol will be implemented in the sectors "Cœur du marais", "La Neuville" and "Les quatre pâtures".

Disturbances and issues involved

■ In 2008, the park conducted an assessment on the status of the marshes in view of the future management plan. The surveys on the fish populations revealed a large pumpkinseed population.

■ The species is seen as a "species likely to provoke biological imbalances" (articles L432.10 and R432-5 in the Environmental code).

■ Given its reproductive capabilities, it is considered invasive and its presence can produce a number of impacts, including:

- competition with native fish species with as a result a possible reduction in cyprinid communities;
- possible impacts on different insect larvae, crustaceans, worms and small molluscs, but also the eggs and alevins of amphibians.

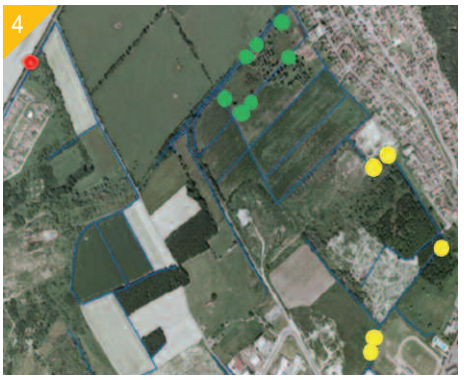
Interventions

■ Surveys of fish populations

■ A survey was conducted in 2008 to determine the status of the Trait marshes prior to setting up the management plan. It was an occasion to draw up an inventory of the ditches and other hydraulic networks in the Trait-Yainville loop.
Survey protocol:
- a trapping campaign was conducted from 9 to 12 June;
- fyke nets were set in all the ditches (three sectors) still containing water during the campaign. Seven were set in the "Cœur du marais" sector (green dots in Figure 4), five in a ditch in the "La Neuville" sector (yellow dots) and one in a ditch near the "Maisons blanches" site, between the "Terres agricoles" and "Saint Wandrille Rançon" sectors (red dot);
- the traps were checked once daily.

■ A survey was conducted in 2010 in the framework of a study specifically on eels (*Anguilla anguilla*) in certain river loops in the park, including the Trait marshes. One objective of the study was to compare the methods (fyke nets and electrofishing) employed for fish surveys. To that end, electrofishing was carried out in two sectors surveyed using fyke nets in 2008.
Survey protocol:
- electrofishing was used for point abundance sampling (PAS) on 29 June 2010;
- the sectors surveyed were "Cœur du marais" and "Nord".

■ A survey was conducted in 2011 in the framework of an inventory of fish populations in the hydraulic networks of all the Seine loops.
Survey protocol:
- the survey on the Trait loop was carried out from 4 to 7 July 2011;
- eight fyke nets were set up for three days at three points in the "Coeur du marais" sector;
- the traps were checked once daily.



*3. Pumpkinseed (*Lepomis gibbosus*).*
4. Positions of the fish traps in the Trait marshes.

Results and assessment

■ Main results of the 2008 survey

Sector	"Cœur du marais"	"La Neuville"	"Terres agricoles"
Average number of fish caught per day and per trap (CPUE)	11	6	7
Percentage of pumpkinseed caught	77 %	3 %	0 %

■ Main results of the 2010 survey

■ "Cœur du marais" sector: 22.4% of the fish caught were pumpkinseeds.
■ "Nord" sector: no pumpkinseeds were caught.

■ Assessment

■ The data produced by the fish surveys indicate:
- the proven presence of pumpkinseed populations in the "Coeur du marais" and "La Neuville" sectors;
- the absence of pumpkinseed populations in the "Nord" and "Saint Wandrille-Rançon" sectors.

■ The connections between the ditches in the various sectors mean that the "Les quatre pâtures" sector must be presumed to be colonised by pumpkinseeds.

■ As a result, the total length of the ditches presumed to be colonised by pumpkinseeds is thought to be 8 046 metres out of a total of 14 325 metres. It should be noted that not all of the colonised ditches are filled with water year round

■ Proposal for a pumpkinseed management protocol

■ In view of controlling the pumpkinseed population in the Trait marshes, the Boucles de la Seine Normande regional nature park devised a management protocol in 2011 for CREA. The protocol presents methods to experiment different types of traps with estimates on the human and financial resources required.

■ The experimentation phase was intended to select the best possible trap, providing sufficient catch per unit effort, based on a number of parameters:

- the type of trap (hoop net or fyke net);
- the netting mesh, between 10 and 20 mm to capture fish of all sizes;
- the size of the trap, large enough to catch several fish, but small enough that the entry is completely submerged in the water of the ditch;
- the material used for the traps, taking into account the probability of damage by mammals (coypus, muskrats) present at the site and the perception (attraction/repulsion) of the trap by fish;
- the effectiveness of the trap (bait).

■ The protocol was proposed for use on the 8 046 metres of ditches colonised by pumpkinseed:

- the ideal period for trapping is in April and May, i.e. when the marshes are not flooded and before the reproductive period in order to catch adult fish before they reproduce. If it is decided not to intervene during the spring period (e.g. low temperatures limit the activity of the fish), then the summer period (July to October) should be selected to ensure effective catches;
- the traps are laid for 24-hour periods to limit the risks of mortality and cannibalism in the traps;
- the protocol foresees approximately 20 traps laid every 4 metres (a compromise between the “inventoried” surface area and the “attractiveness” of the trap), thus covering 80 metres of ditch;
- three replicates.

■ In that the protocol is experimental, the parameters will be adjusted to meet the conditions encountered in the field and in step with the effectiveness of the traps.

■ Cost estimate:

- estimates are difficult as long as the protocol has not been finalised;
- one indication is that a trap costs between 60 and 200 euros (before VAT) depending on the size and the mesh of the netting..

Assumptions on the time required to manage pumpkinseed populations in the Trait marshes as a function of different conditions.

Length of ditch (metres)	Number of replicates	Hours required to lay and check the traps
80	1	2
80	3	6
8 046	1	201
8 046	**3**	**603**

Outlook

■ CREA will purchase four double-entry hoop nets with 10 mm netting.

■ Experiments on the equipment and the method will be run to test their effectiveness as soon as the authorisation for the management work has been received. The request has been made to the State services.

Author: Sandra Fernandez, Irstea

For more information

■ Internet site of the Boucles de la Seine Normande regional nature park: http://www.pnr-seine-normande.com/

■ Rozanska, F. (PNR des Boucles de la Seine-Normande). 2011. Proposition d’un protocole pour la régulation de la Perche soleil (*Lepomis gibbosus*), Marais du Trait.

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American bullfrog

(*Lithobates catesbeianus*)

Classification	
Order	Anura
Family	*Ranidae*
Genus	*Lithobates*
Species	*Lithobates catesbeianus* (Shaw, 1802)

Originated in North America. Introduced in the Gironde department in 1968 and later in the Sologne area.

Description

- Skin colour varies from olive green to dark brown
- Creamy white underside with yellow throat in adult males
- Length 15 to 20 centimetres from nose to cloaca, 40 cm from nose to end of fully extended hind legs
- Adults vary in weight between 500 and 800 grams
- Large-diameter tympanum:
- equal in size to the eye in females
- two times the size of the eye in males
- A fold in the skin runs from the eye, above the tympanum, to the base of the hind legs (no folds across the back)
- The hind feet are palmed
- The characteristic call of the American bullfrog resembles the lowing of a cow.

Ecology and reproduction

- Habitats in all types of lentic aquatic environments
- They can travel via rivers with slow currents
- Bullfrogs are active during both the night and the day
- Adults hibernate starting in the middle of the fall, tadpoles spend the winter in water
- Bullfrogs are opportunistic predators, feeding on amphibians, fish, small mammals, reptiles, insects, etc.
- Reproduction occurs between May and August, generally in the form of a single spawn comprising up to 25 000 round, transparent eggs in a gelatinous mass
- The eggs hatch after 4 or 5 days
- In France, the larvae metamorphose after 2 to 3 years and the frogs become sexually mature 2 to 4 years later

Documentation

- Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) : connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.
- Nepveu C. 2002. Les espèces animales et végétales susceptibles de proliférer dans les milieux aquatiques et subaquatiques - Fiches espèces animales (les espèces exotiques). Agence de l'eau Artois-Picardie. 98 pp

1. Male American bullfrog.
2. Rear foot.
3. Spawn.
4. Tadpole.

Author: Emilie Mazaubert, Irstea

American bullfrog

(*Lithobates catesbeianus*)

2003-2007 multi-year programme for the management of American bullfrogs in the Aquitaine region

Gironde federation for fishing and the protection of aquatic environments

■ The federation was recognised as a "public service" organisation by the Water law (30 December 2006) and operates under the stipulations of the 1901 law on non-profit associations.

■ It groups 58 certified associations for fishing and protection of aquatic environments (AAPPMA) and a certified departmental association of recreational fishermen using nets and traps (ADAPAEF).

■ It oversaw the 2003-2007 multi-year programme for the eradication of American bullfrogs.

Cistude Nature Association

■ The association provided technical and scientific management of the 2003-2007 multi-year programme to eradicate American bullfrogs.

■ The main missions included:

- managing all work in the field, including surveys, tests on traps, population monitoring (distribution, ecological characteristics, etc.);
- training and assistance for the initial interventions in the field and for the checks on the presence of American bullfrogs;
- work to raise awareness, consisting of distributing brochures in the mailboxes of owners of colonised sites and the drafting of announcements in the letters sent by the towns confronted with the problem.

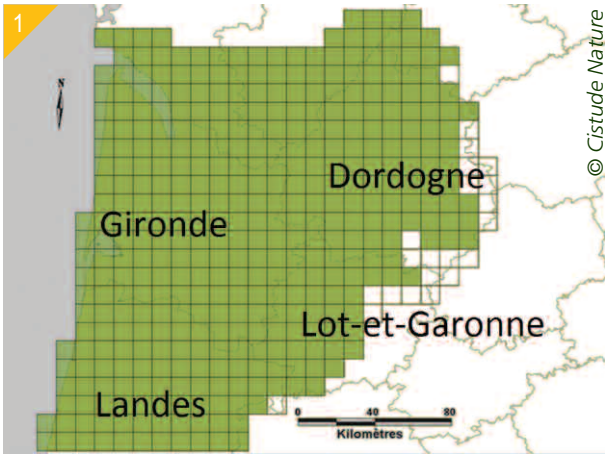
■ Contact: Matthieu Berroneau - matthieu.berroneau@cistude.org

Intervention site

■ In the Aquitaine region, American bullfrogs were introduced in 1968 in the town of Arveyres. The main management issue concerning the species is the preservation of native amphibians impacted by its presence:

- large quantities of other amphibians have been found in the stomachs of bullfrogs;
- high densities of American bullfrogs result in inter-species competition because the animals fill an important ecological niche that is very similar to that of native species, particularly green frogs (*Pelophylax* spp.);
- they can be a health carrier of the fungus responsible for chytridiomycosis (Batrachochytrium dendrobatidis), a disease that kills native species.

1



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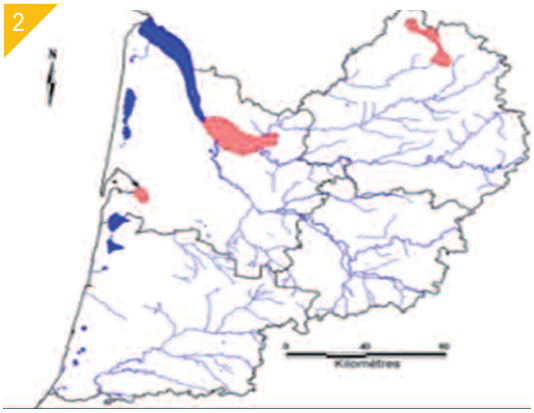

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1. Area studied for the eradication programme.
2. The red zones indicate the presence of American bullfrogs in the Aquitaine region.

Disturbances and issues involved

■ In the Aquitaine region, American bullfrogs were introduced in 1968 in the town of Arveyres. The main management issue concerning the species is the preservation of native amphibians impacted by its presence:

- large quantities of other amphibians have been found in the stomachs of bullfrogs;
- high densities of American bullfrogs result in inter-species competition because the animals fill an important ecological niche that is very similar to that of native species, particularly green frogs (*Pelophylax* spp.);
- they can be a health carrier of the fungus responsible for chytridiomycosis (*Batrachochytrium dendrobatidis*), a disease that kills native species.

Interventions

■ The multi-year programme to eradicate American bullfrogs

■ Objectives of the programme:

- determine the distribution of American bullfrogs in the Aquitaine region;
- understand the dispersal and colonisation mechanisms of the species;
- determine the most effective capture and eradication techniques;
- raise awareness concerning invasive alien species.

■ Numerous regional stakeholders participated, including ONCFS 40, ONCFS 33, the Landes de Gascogne regional nature park, the Périgord Limousin regional nature park, the Onema local office in Dordogne and Cistude Nature.

■ Study on the American bullfrog population in the Aquitaine region

■ The distribution of the species was determined by listening for the calls of males in two phases. During the first, seven water bodies were randomly selected in each grid sector (10 x 10 km each) and 386 sectors were surveyed. During the second phase, the sectors where the species was previously detected were divided into 5 x 5 km sectors and all water bodies were surveyed.

■ Species dispersal and colonisation mechanisms:

- radio-monitoring of 25 bullfrogs captured randomly to learn more on their vital habitats, habitat use, mortality rates and migratory movements;
- monitoring of the dispersal of juveniles by setting up nets with capture buckets (trap barriers);
- study of bullfrog diets by analysing stomach contents.

■ The results of the study were used to propose recommendations for the trapping and eradication tests:

- concentrate eradication efforts during the summer when bullfrogs gather near permanent water bodies;
- shoot the adults rather than draining and drying the ponds because almost 30% of bullfrogs hibernate outside of the water, under leaves or in burrows;
- limit development during the juvenile stage when the species disperses over short distances.

■ Trapping tests

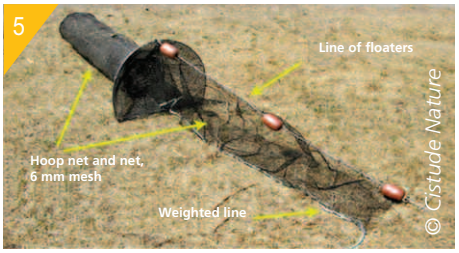
■ In order to formulate the most effective possible protocol for the elimination of American bullfrogs, Cistude Nature conducted trapping tests on sites in the towns of Ambarès-et-Lagrave and Izon in the Gironde department.

■ 2003 and 2004, tests were run on different types of traps taking into account the biological stages of the bullfrogs.

3. Trap barrier used to monitor juveniles.
4. Equipment used to collect spawns.

Trapping tests carried out in 2003 and 2004.

Year	2003	2004
Types of traps	■ Hoop net for minnows ■ Hoop net for catfish ■ Fyke net made of white nylon ■ Large shelter trap ■ Small shelter trap ■ Floating shelter trap	■ Hoop net for catfish; fyke net with finer mesh, large shelter trap ■ New system with fyke nets (a net positioned near the banks in the water)
Conclusions	■ The most effective traps for American bullfrogs are: ■ hoop nets for catfish to trap tadpoles and to a lesser degree juveniles, fyke nets for tadpoles, adults and subadults ■ Large and floating shelter traps for adults and subadults	■ Shelter traps are effective for adults and subadults ■ Juveniles are difficult to capture ■ Shooting is advised for adults and juveniles ■ Fyke nets were abandoned because they were too fragile and less effective than hoop nets for catfish



5. Single-entry hoop net with net.
6. American bullfrog.

■ 2005 and 2006, tests were run on the best trap layout and densities for catching bullfrog tadpoles:

- single and double-entry hoop nets with attached netting, developed in conjunction with a specialised firm;
- prior to each trapping campaign, capture-mark-recapture (CMR) was carried out to determine the tadpole population and measure the effectiveness of the method.

Summary of the work done in 2005 and 2006.

Year	2005	2006
Study protocol	■ Intervention on the Saint-Denis site (town of Ambarès-et-Lagrave) ■ CMR from 12 to 18 May ■ Intervention from 01 July to 10 August, 40 days of effective trapping ■ 30 traps laid in water, along the banks, every 8 metres	■ IIntervention in the town of Ambarès-et-Lagrave ■ CMR in April ■ Intervention from 28 April to 08 June, 19 days of effective trapping ■ Two sessions to test the positioning of traps were run in the water body

■ Shooting trials

■ Cistude Nature also participated in setting up shooting trials to determine the effectiveness of the technique in eliminating American bullfrog juveniles and adults.

■ The trials were conducted in conjunction with the National agency for hunting and wildlife (ONCFS in the Gironde department), following authorisation by the Prefect, in the concerned towns from 2004 to 2006.

■ The main site was located in the town of Izon.

■ The method involved:

- interventions in the pools on the Gabauds site (1 200 square metres) and in the nearby ponds (La Naude and the wastewater-treatment plant) in the town of Izon;
- a total of six sessions from 2004 to 2006;
- night-time hunting by a two-man team where the first person must identify the animals with a flashlight and the second shoots the identified frogs with an air rifle or a .22 long rifle;
- retrieval of the animals immediately or during the following shooting trial.

Results

■ Study of animal populations

■ Study of isolated groups spread over two departments.

Distribution of isolated populations of American bullfrogs.

Department	Gironde		Dordogne		
Sector	Libourne / St André-de-Cubzac	Arcachon bay	St-Saud-Lacoussière	Piégut-Pluviers	Thiviers
Surface area	250 km²	12 km²	9 km²	6 km²	7,5 km²
Number of colonised water bodies	300	18	29	25	24

■ American bullfrogs are a versatile species, capable of adapting to very different environments. Individuals differ widely in terms of their home range and their use of the habitat.

■ Ideal sites for colonisation are those with abundant aquatic and riparian vegetation.

■ Their diet varies, but consists essentially of aquatic prey:

37% amphibians (American bullfrog, green frogs (*Pelophylax* spp.) and the Mediterranean tree frog (*Hyla meridionalis*)), 32% insects and 13% crustaceans (Cistude Nature, 2007 annual report).

■ Trapping tests

■ 2005:

- 5 772 tadpoles captured out of an estimated 8 400 (± 2 200);
- the tests were halted after 40 days because the number of catches dropped after the 30th day.

■ 2006:

- a total of 9 380 tadpoles were caught (it was not possible to compare this data with the CMR results);
- trapping results were better when the traps were laid in areas with ample vegetation and when single-entry hoop nets were used with the nets running toward the bank.

■ Shooting trials

Results of the shooting trials.

Dates	01 Sept. 2004	07 Sept. 2004	03 May 2004	18 July 2004	19 July 2005	20 July 2005
Length of trial (one team)	160 minutes	190 minutes	360 minutes	220 minutes	110 minutes	105 minutes
Shots fired	26	29	38	16	8	5
Animals retrieved	16	19	20	12	4	3
Animals hit, but not retrieved	4	5	12	1	1	1

■ Observations on the site following the trials:
- no American bullfrogs were observed in September 2005;
- one American bullfrog and large numbers of green-frog tadpoles were observed in May 2006. A shooting campaign was organised during which 12 frogs were killed and retrieved. The recommended air rifle was used because higher firing rates are possible targeting both adults and juveniles (the ammunition is inexpensive), even though it is much less powerful than a .22 long rifle.

■ Assessment

■ Protocols were drafted for shooting adults, trapping tadpoles and collecting spawn.
■ A plan to eradicate American bullfrogs from the Périgord Limousin regional nature park is under way using the proposed protocols.
■ The project to set up an eradication plan for the Arcachon basin and the area around the town of Libourne was not launched due to a lack of funding.

Information on the project

■ A total of 24 000 brochures and 350 posters were produced and distributed to raise awareness concerning the invasion of American bullfrogs and present the management programme.
■ An internet site on the topic existed from 2004 to 2010.
■ Information on the project was supplied via press articles as well as radio and television programmes.

Author: Sandra Fernandez, Irstea

7. Documents to raise awareness.

For more information

■ Cistude Nature: http://www.cistude.org/
■ Cistude Nature. 2007. Rapport annuel d'activité. Programme pluriannuel de mise en place d'une éradication de la Grenouille taureau : répartition, colonisation, tests d'éradication, sensibilisation. 38 pp.
■ Information on American bullfrogs on the Cistude Nature site: http://www.cistude.org/index.php/conservation/especes-exogenes/grenouille-taureau

CISTUDE NATURE

American bullfrog

(Lithobates catesbeianus)

Managing the American bullfrog in Sologne (Loir-et-Cher department)

Beuvron basin management board (SEBB)

- SEBB is the project supervisor.
- SEBB is a local government created in 1996.
- Its main missions are to manage the rivers in the Beuvron basin, including restoration and maintenance of the rivers, conducting the necessary studies on river management and projects against invasive alien species (both plant and animal).
- Workforce and territory. One policy officer for the basin contract, a river technician, four operators for river maintenance and a part-time secretary make up the SEBB personnel. The board represents 70 towns in the river basin, covering a total of 2 191 square kilometres.
- Contact: Dominique Béguin - beguin.sebb@orange.fr

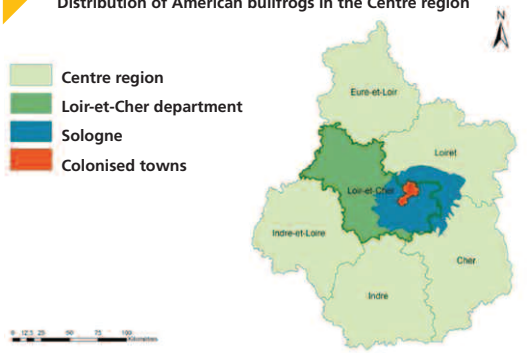
Loir-et-Cher departmental committee for the protection of nature and the environment (CDPNE)

- CDPNE is the project manager.
- It is a non-profit association.
- The main missions include managing nature reserves (Grand Pierre et Vitain national nature reserve, Pontlevoy regional geological nature reserve, Vallées aux Fleurs - Fossé archeological reserve, Grouais de Chicheray - Pezou archeological and geological reserve), providing environmental training to school children and adults, consulting and environmental studies (fauna, flora, habitats, waste, water, carbon footprint).
- Workforce of 13 in the Loir-et-Cher department.
- Contact: Gabriel Michelin - gabrielmichelin.cdpne@orange.fr

Intervention site

- Sologne is a “territory”, covering approximately 5 000 square kilometres spread over three departments (Cher, Loir-et-Cher and Loiret). * It is divided into two main parts:
- Grande Sologne, including the ponds (between the Sauldre and Beuvron Rivers), the section near the city of Orléans (between the Beuvron and Cosson Rivers) and the section along the Cher River;

1 Distribution of American bullfrogs in the Centre region



1. Distribution of American bullfrogs in the Centre region.

- the wine-growing section in the western part of the river basin.
- This area is home to a very large number of wetland species and is an important ecological site in Europe.
- The 10 000 hectares of stagnant waters constitute a good habitat for amphibians and the two large rivers, the Beuvron and the Tharonne, flowing through the area are open channels for movement.
- The dense network of ditches between ponds, supplying pools and along roads also facilitate the movement of aquatic species.
- American bullfrogs were first observed in Sologne in 2002.
- Since then, three towns in the middle of the ponds section of Sologne have been colonised.

Disturbances and issues involved

Impacts on native species

- There is a significant loss of biodiversity on colonised sites due to competition and predation. In Sologne, analysis of stomach contents revealed that the bullfrogs consume amphibians, invertebrates, reptiles, fish and even small mammals and birds. American bullfrogs represent a direct threat to 13 protected species of amphibians.
- The species is also a healthy carrier of chytriodiomycosis, a pathology transmitted to native amphibians. In Sologne, the Chytridiomycota phylum was analysed and found to be non-lethal.

■ Impacts on land use

■ Competition with and predation on fish communities, i.e. impact on fishing. It is necessary to check any caught fish to avoid transporting American bullfrog tadpoles outside the colonised areas.

■ Direct predation of alevins.

Interventions

In Sologne, a management programme was established for the period 2003 to 2008. During that time, a number of elimination methods were tested. On the basis of the results obtained over the five-year period, an eradication programme was established for the period from 2009 to 2013 using the most effective techniques.

■ Environmental monitoring

■ Monitoring was conducted prior to the eradication operations on colonised and nearby sites to pinpoint the range of the species and the invasion front.

■ The work was initiated at the end of the month of May when American bullfrogs exit hibernation.

■ A large-scale survey was run in 2009 on 9 areas, each comprising 10 sectors (2 x 2 km) in the colonised territory, covering a total of 36 000 hectares (219 ponds in 11 towns).

■ A team of 2 people inspected each area twice.

■ Night-time listening:

- the team went to 2 sites in each sector and listened for 15 minutes. If calls were heard in a sector, all sites in the sector were then inspected during the day;
- in addition to listening, searchlights and binoculars were used, as were dip nets to find tadpoles.

■ Daytime inspections:

- observations using binoculars for adults, juveniles and spawn, dip nets for tadpoles and spawn;
- using binoculars, between 1 and 10 observations were made on each site (10 minutes per observation, every 100 metres);
- using a dip net, 3 samples were taken on each site in vegetation-rich areas in order to catch tadpoles;
- since 2010, standard monitoring techniques have been used during the daytime on small sites and environmental-DNA monitoring has been used on larger sites.

■ Environmental DNA:

- this technique has been used since 2011. It consists of detecting in water samples DNA fragments left by organisms in the environment (see Figure 4);
- the technique enhances species detectability when small numbers of the species inhabit the site, provides information on the invasion front and can be used to check that a species has been effectively eradicated from certain ponds;
- it takes much less time in that more precise detection can be achieved in 2.5 times less time than a standard survey at night using searchlights;
- in 2013, water samples (one every 20 metres along the banks on each site) were taken on two different days during the last half of July and sent to a lab (Spygen in the Savoie department) for analysis.

2. Adult female frog, 550 grams, with a 77 cm grass snake in its stomach.
3. Sorting American-bullfrog tadpoles following their capture in a pond.
4. Drawing water samples for analysis using environmental DNA to detect the presence of American bullfrogs.

■ Work to control the population of American bullfrogs

■ A number of methods are used in parallel.

■ Search and remove spawn:

- spawn is destroyed as soon as it is discovered to prohibit the reproduction of the population;
- this work has been carried out since 2006 on priority sites;
- every 4 days, a team inspects the sites.
- Shooting campaigns:
- the work is done at night (22.00 to 05.00) in teams of two people, two nights per week;
- following authorisation by the Prefect;
- males are located by their calls, females and juveniles are located using a searchlight;
- the targets are first checked prior to shooting to avoid confusion with green frogs;
- assistance has been provided by ONCFS since 2002 and by volunteers since 2010.

■ Trap barriers, fishing and draining of ponds:

- barriers are a means to catch all the amphibians entering or leaving a site;
- the traps are checked daily to free the native species;
- seine fishing is used to catch the fish prior to draining ponds.

■ Screens are placed in outlets to block the passage of tadpoles:

- once the water level has dropped, the tadpoles can be removed.

Results and assessment for the period 2003 to 2013

■ Environmental monitoring

Since 2002, American bullfrogs have been detected on a total of 90 sites. In 2013, 37 sites were colonised in the beginning of the year and 22 were still colonised after the management work.

The species had been completely eradicated from 20 sites by 2013.

■ Work to control the population of American bullfrogs

■ Removal of 11 spawns from 7 sites, compared to 57 on 20 sites in 2012. Tadpoles were found on 10 sites in 2012, but on only 3 sites in 2013.

■ Shooting, organised in 68 sessions on 32 sites, eliminated 96 bullfrogs weighing over 100 grams and 891 weighing less than 100 grams. Since the start of the shooting campaigns, the average weight of adult bullfrogs has dropped from 461 to 200 grams, i.e. a drop of over half the average weight of the eliminated bullfrogs compared to the initial measures launched in 2003.

■ The species continues to reproduce on only 10 sites and the number of reproducers per site has dropped from 9 to 3.

■ Only one site was fished and drained in 2013 and no bullfrogs were caught

■ Human resources in 2013

■ 52 man-nights by volunteers.

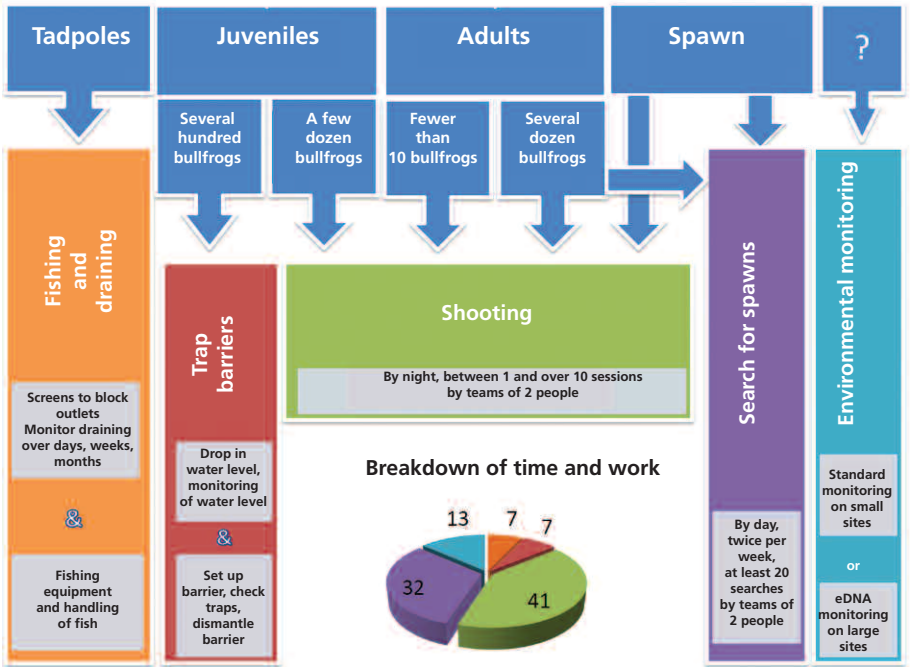
■ 69 man-nights with funding.

■ 32 volunteers.

■ Coût du programme 2009-2012 : 342 645 €

■ Of which, 15 850 euros (85 kits) for environmental-DNA analysis.

5. A team for night-time shooting.
6. Barrier and traps set up for American bullfrogs around a pond.
7. Document to raise awareness.



Source: Departmental committee for the protection of nature and the environment 2014

Decision aid for the work required on sites depending on the biological stage of the species.

■ Funding
- Pays-de-Grande-Sologne (LEADER programme) (32%);
- Centre region (25%);
- Centre regional environmental directorate (14%);
- SEBB (17%);
- Beauval Nature association (12%).

Information on the project

■ Annual reports were produced on the preliminary and operational phases.
■ Efforts were made to raise the awareness of the general public (brochure, public meetings).
■ A documentary film was made by Philippe Henri, titled “La Grenouille taureau, une intruse en Sologne”.
■ Articles appeared in the press.
■ Scientific articles were published in “Science Eaux et Territoires” and in a collective document on the Loire Grandeur Nature plan.
■ Presentations of the work have been made in symposia and in professional training courses.

Outlook

■ The results of the management plan are positive, but the work must be pursued on approximately 30 sites.
■ The 2009-2013 programme ended and the search has begun for funding partners in 2014. Plans are being made for a national programme on invasive amphibians.
■ Future work:
- continued monitoring using the environmental-DNA technique;
- inspections for spawns and shooting campaigns primarily on sites where reproduction of juveniles has been observed (36 priority sites).

Author: Emmanuelle Sarat, Comité français de l'UICN

For more information

■ www.bassin-du-beuvron.com
www.cdpne.org
■ The initial version of this document was first published in:
Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.
■ CDPNE et SEBB. 2012. Grenouille taureau *Rana catesbeiana* (Shaw,1802) : Bilan des prospections et de la phase opérationnelle 2013. CDPNE et SEBB. 52 pp.
■ Michelin G. 2012. La Grenouille taureau en Sologne, de la lutte à l'éradication. Sciences Eaux et Territoires, 6: 50-56.
■ Michelin G. et Béguin D. 2013. Grenouille taureau : menaces et mise en place d'un programme d'éradication en Sologne du Loir-et-Cher. Journées d'échange sur les espèces exotiques envahissantes du bassin de la Loire, Tours, 29-30 octobre 2013. 43 pp.

CDPNE
Comité Départemental de la Protection de la Nature et de l'Environnement

Syndicat d'Entretien du Bassin du Beuvron

American bullfrog

(Lithobates catesbeianus)

Managing the American bullfrog on Vancouver Island, BC, Canada

Context and issues involved

■ Vancouver Island is the largest island on the western coast of North America (32 134 square kilometres). The species was introduced to the island after the Second World War, in the framework of a project for war veterans in view of breeding the animals for human consumption. The commercial endeavour was a failure and the American bullfrogs were released to the natural environment.

■ The species dispersed via small populations along the entire south-eastern coast of the island and to a number of nearby, smaller islands. It has also spread to the city of Vancouver and the nearby coastline.

■ American bullfrogs compete with several species of native frogs, including the northern red-legged frog (*Rana aurora*), the foothill yellow-legged frog (*Rana boylii*) and the Pacific tree frog (*Pseudacris regilla*). They are also a healthy carrier of *chytridiomycosis*, a disease causing death in native amphibian species.

■ In 2006, a programme was launched by the Water department (Vancouver regional authorities) to design, field test and improve new equipment and techniques to capture the American bullfrogs.

Interventions

■ Modified electrofishing equipment was used. A prototype of an electrofrogger shock wand was developed and subsequently patented in 2012. The wand is supplied with power from a 24 V battery.

■ The manual capture technique targeting adult and juvenile American bullfrogs was tested three years, from 2007 to 2009, on two sites colonised by the species since 2006, namely Amy Pond and Glen Lake.

■ Capture operations:

- adults and juveniles are caught at night, from April to October, using a boat;
- the team consists of 2 people;
- each operation lasts 4 hours;
- operations are conducted 3 to 5 nights per week, depending on the weather conditions;
- bullfrogs are located using a searchlight and listening for calls;
- one person manoeuvres the boat, the second locates and catches the adults and juveniles;
- blinded by the searchlight, the bullfrogs tend to freeze;

1

1. Study site and distribution of American bullfrog populations on Vancouver Island.

- the electrofrogger shock wand generates an electric field on the water surface approximately 50 centimetres in diameter around the targeted bullfrog. The electric field temporarily paralyses the bullfrogs for 30 seconds, enough time to catch them;
- the captured bullfrogs are placed in a modified freezer that reduces their body temperature to 2°C. After 12 hours, the bullfrogs are transferred to a standard freezer where they die.

Results and assessment

■ Results from 2007 to 2011

At the end of the season in 2009, the two age groups (adults and juveniles) of American bullfrogs had been eliminated from the two sites:

■ Amy Pond, spawning was blocked starting in 2007 by eliminating the adults prior to the reproductive period. In 2009, there were no longer any tadpoles on the site, however a few juveniles arrived from nearby ponds.

■ Glen Lake:

- in 2007, a single spawn was observed in the lake, as well as a few tadpoles first observed in 2006;
- during the summer of 2007, management operations focussed on areas with high densities of juveniles. The presence of many thickets and willows made the work difficult;

- in 2009, a few adults and juveniles from nearby ponds were observed.

Financial aspects

- The average cost of a night of work was 400 Canadian dollars (276 euros). A total of 3 361 bullfrogs were caught, for an overall cost of 25 600 CAD (17 100 €) over 3 years on the two sites.
- From 2006 to 2014, over 30 000 American bullfrogs were caught in approximately 20 colonised lakes on the Saanich peninsula.

2. Capturing American bullfrogs.

Table showing the operational results and costs (2007 to 2011).

Site	Perimeter	Nights			Bullfrogs captured			Annual cost (€)			Bullfrogs captured over 3 years	Total cost (€)
		2007	2008	2009	2007	2008	2009	2007	2008	2009		
AMY POND	0.4 km	8	10	5	871	661	55	2 200	2 700	1 400	1587	6 300
GLEN LAKE	2 km	16	16	9	1376	366	32	4 400	4 400	2 000	1774	10 800
TOTAL		24	26	14	2247	1027	87	6 600	7 100	3 400	3361	17 100

Information on the project

- The electrofrogger shock wand was patented and the equipment will be marketed in conjunction with the Smith-Root company.
- An article was published in the IUCN document titled *Island Invasives, eradication and management*.
- The bullfrog control group works with CABI on invasive alien species (*Invasive species compendium*).
- An article was published in *Neobiota* on the stomach contents of American bullfrogs.

Outlook

- In the two study areas, where a single case of successful reproduction was observed, eradication should be possible after three more years of work.
- Sites that have been colonised for longer periods will require operations spanning more time. Early detection is of the utmost importance.
- The electrofrogger shock wand has no effect on tadpoles. Additional management measures (draining, seine netting) are required to control this development stage.
- The degree of effort required varies from one site to another, depending on the local situation (accessibility, layout, proximity to a colonised site and migratory habits of American bullfrogs).
- The management work has been done since 2006 in the Victoria basin on Vancouver Island.
- From 2007 to 2011, the work was conducted on 16 sites and 445 passage ways. A total of 15 508 bullfrogs were removed. However, the species continues to progress.
- Local authorities are considering additional measures (habitat restoration, informing and raising the awareness of the public).
- The management work will be pursued and reinforced with the creation of a second team in 2014. The work will be carried out on over 20 lakes along a corridor on the isthme of the largest peninsula and focussing on areas recently colonised by American bullfrogs.

For more information

- www.smith-root.com
- www.bullfrogcontrol.com
- www.crd.bc.ca
- Shock wand for aquatic creatures. U.S. patent number 8 091 269. United States Patent and Trademark Office.
- Orchard, S. A. 2011. Removal of the American bullfrog, Rana (Lithobates) catesbeiana, from a pond and a lake on Vancouver Island, British Columbia, Canada. Island invasives: eradication and management. IUCN (Gland, Switzerland) 1–542.
- Jancowski, K. et Orchard, S. 2013. Stomach contents from invasive American bullfrogs *Rana catesbeiana* (*Lithobates catesbeianus*) on southern Vancouver Island, British Columbia, Canada. NeoBiota 16, 17–37.
- City of Langford. 2012. Park, recreation, culture and beautification committee. Bullfrog eradication program results, 2011. 5 pp.
- Errico C. 2013. American bullfrog management on Vancouver Island. 20 pp.

Authors: Emmanuelle Sarat, Comité français de l'UICN et Stan Orchard, BullfrogControl

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African clawed frog

(*Xenopus laevis*)

Classification	
Order	Anura
Family	*Pipidae*
Genus	*Xenopus*
Species	*Xenopus laevis* (Daudin, 1802)

Originated in South Africa. Introduced in France in the 1950s for biological research. Unintentional introduction (escape from a breeding centre) in the Deux-Sèvres department in the 1980s.

Description

- The eyes are located on the upper part of the head
- Colours vary depending on the environment, from yellowish to brown with spots
- Sexual dimorphism in adults with females 11 to 14 centimetres in size and males 6 cm
- The rear feet are palmed with three dark claws
- The front feet are short and characteristic in shape
- The frogs have whitish “ribs” along the side
- Tadpoles have two barbels and move in groups with their head facing downward
- The frogs are thought to live for over 15 years

Ecology and reproduction

- Habitats span a wide range, including human-impacted and highly modified environments, notably stagnant aquatic environments (pools, ponds and lakes), rivers, canals, etc.
- The highest population densities are found in eutrophic waters
- The animals can migrate in large numbers if reproduction ponds begin to dry up and the weather is fairly wet
- The diet consists essentially of invertebrates, but direct predation of fish and amphibians is also possible
- The reproductive potential is high with 2 to 3 spawns per year (several thousand eggs each) and with females arriving at sexual maturity at the age of 6 to 8 months

Documentation

- Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) : connaissances et expériences de gestion. ONCFS, Plan Loire Grandeur Nature, 128 pp.
- Manche C. 2007. Les espèces exotiques envahissantes susceptibles de proliférer dans les milieux aquatiques et les zones humides sur le territoire du SAGE Authion - Guide technique - Fiches descriptives par espèces. Univ. François Rabelais, CLE du SAGE Authion. 74 pp.
- Tinsley R., Minter L., Measey J., Howell K., Veloso A., Núñez H. et Romano A. 2009. *Xenopus laevis*. In: IUCN 2013. IUCN *Red List of Threatened Species*. Version 2013.1. www.iucnredlist.org.

Author: Emilie Mazaubert, Irstea

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1. Rear foot.
2. Front foot.
3. The “ribs” along the side.
4. Different stages of tadpole development.

African clawed frog

(Xenopus laevis)

Managing the African clawed frog in the Argentonnay area

Bressuire urban area (Agglo2b)

■ This management project was carried out from 2011 to 2013 by the Argentonnay intermunicipal association (CCA). Following the local-government reform, the CCA was folded into the Bressuire urban area (Agglo2b) on 1 January 2014.

■ One of the responsibilities assumed by Agglo2b concerns the protection and development of the environment and of living conditions:

- restoration, maintenance and preservation of rivers, management of the Argenton valley Natura 2000 site;
- management of invasive species with an action plan against the African clawed frog initiated in 2011.

■ Contact:

Centre for the environment and sustainable development: Guillaume Koch, environmental policy officer - guillaume.koch@agglo2b.fr and Benjamin Audebaud, environmental technician - benjamin.audebaud@agglo2b.fr

Intervention site

■ The Argentonnay area

■ This area is crossed by the Argenton River which flows through several types of territory, ranging from bocage landscapes to plains. Fauna and flora are particularly rich and diversified, including the European otter.

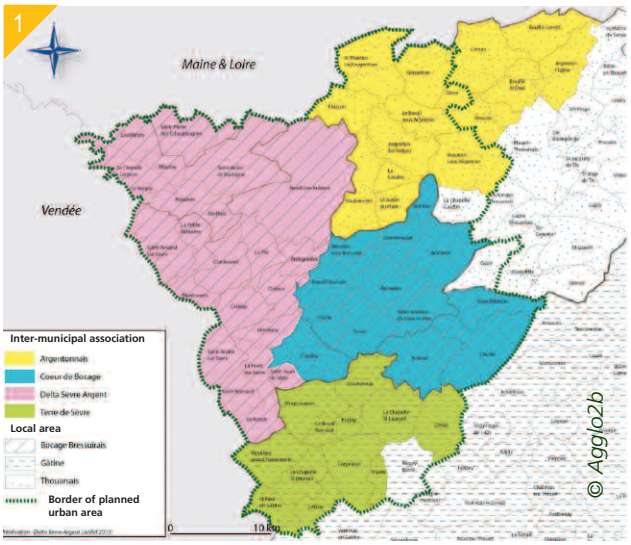
■ The main economic activity is farming. The crops in the plains give way to meadows in the bocage areas where hedgerows still exist and there are pools in virtually each plot of land, for the greater benefit of amphibians.

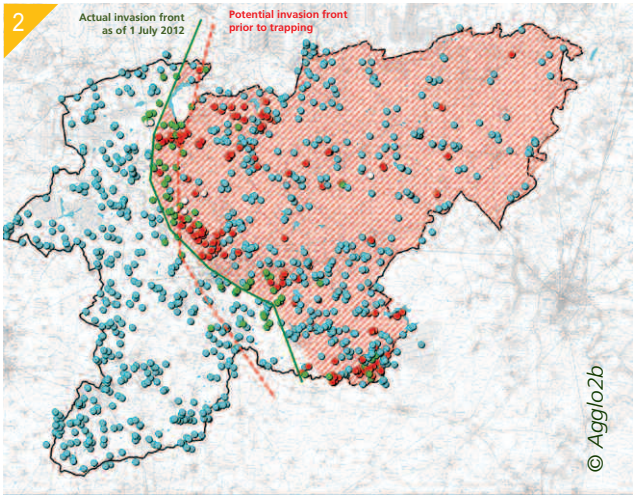
■ The area colonised by the African clawed frog covers a surface area of between 102 and 139 square kilometres in 26 towns, including 11 in the Maine-et-Loire department and 15 in the Deux-Sèvres department (2012 estimates).

■ Distribution of the African clawed frog

■ First reports of African clawed frogs were made following the discovery of a few colonies in the Argentonnay area in 1998. The unintentional introduction occurred in the 1980s when the animals escaped from a breeding centre run by the National scientific research centre (CNRS) in the town of Bouillé-Saint-Paul.

■ In 2012, traps were set in 201 water bodies and African clawed frogs were caught in 113.





1. The Bressuire urban area.
2. Invasion front of the African clawed frog in 2012

Disturbances and issues involved

■ Impacts on native species

■ Predation on amphibian eggs, notably those of the marbled newt (56% of plant stalks had at least one newt egg in water bodies without African clawed frogs compared to only 9% in water bodies where the African clawed frog was present).

■ On the basis of stomach contents, the frogs consume the larvae and adults of amphibians, as well as fish, insects and molluscs.

■ Species richness has dropped in colonised areas over the past few years from 3.2 species in areas without African clawed frogs to 1.8 in those with.

■ Impacts on ecosystems

■ The frogs interfere in food webs and in species successions.

■ Impacts on animal health

■ The species is suspected of transmitting diseases to native amphibians (salmonellosis, sparganosis and especially chytridiomycosis for which the species is a healthy carrier)

3. African clawed frog.

Interventions

■ Two studies, conducted from 2003 to 2008 by environmental-protection associations with support from the Deux-Sèvres departmental council and the Loire-Bretagne water agency, determined the distribution and rate of advance of African clawed frogs in the Argentonnay area and their impact on the native species. A number of management methods were tested.

■ Following the studies, the species was listed as invasive first on the regional level (2009), then on the national level (ministerial decree dated 30 July 2010).

■ Tests on different management methods

Chemical method

■ The resistance of African clawed frog adults and larvae to different concentrations of Rotenone, an organic substance naturally produced by certain tropical plants, was tested. The substance is toxic for many species of poikotherm (cold blooded) animals. The use of Rotenone in aquatic environments was subsequently prohibited in France in 2009.

■ Ten frogs were placed in 100-litre containers with different concentrations of Rotenone (300 ppm, 600 ppm and 1 200 ppm):

- 83% of the frogs died from the 300 ppm concentration after 7 to 9 hours of exposure;
- 50% of the frogs died from the 1 200 ppm concentration after 90 minutes of exposure;
- 50% of the larvae died from the 300 ppm concentration after 90 minutes of exposure.

■ The use of Rotenone produced useful results, but could lead to the death of other species if it is used in the natural environment.

■ The same protocol was used to test the resistance of African clawed frog adults and larvae to quicklime (0.4 grams per litre):

- no deaths were observed;
- burns and non-lethal alterations to limbs were nonetheless observed.

Mechanised method

■ A standardised trapping technique was employed using hoop nets baited with kibble or liver:

- at least one trap was installed for every 100 square metres of water body;
- the traps were checked every morning for five days;
- the captured African clawed frogs were counted.

■ Seine nets were used on occasion in the water bodies where reproduction was observed (presence of large groups of tadpoles).

■ If the tipping point (a reduction in the number of African clawed frogs caught) was not reached after one week, trapping continued to achieve effective results.

■ Local action plan in the Argentonnay area

■ In 2011, the Argentonnay intermunicipal association (CCA) launched an action plan over its entire territory and hired a policy officer to ensure its implementation. The tasks of the policy officer included the points below.

■ Trapping of adults and tadpoles from April to November:

- traps were set in 15 to 20 water bodies per week, starting from the invasion front and heading toward the source;
- the hoop nets were not fully submerged in order to avoid killing non-targeted species;
- the traps were laid on Monday and checked every day until Friday. If frogs were still being trapped toward the end of the week, trapping was continued the next week;
- tadpoles were caught using a seine net (fine mesh, 0.5 x 0.5 cm) and dip nets;
- on private property, direct access was possible thanks to the previous information efforts addressing the owners, who also participated in the trapping work (an agreement was signed with CCA for the provision of the equipment and recommendations);
- captured frogs were put to death by freezing and then transferred to the rendering service.

■ Monitoring of native amphibians in parallel with trapping:

- night-time visits to count amphibians using searchlights;
- counting of amphibians accidentally caught in the traps;
- a monitoring sheet (environment, species) for each water body was used in conjunction with a geographic information system.

■ Provision of information year round to the population:

- on different topics, e.g. African clawed frogs and other invasive species, native amphibians, aquatic environments, food chains, etc.;
- to different groups, e.g. school classes, elected officials, owners of water bodies.

■ Monitoring the impacts of the action plan:

- visits to previously trapped water bodies, one week, month and year later;
- monitoring over several years of other amphibian species before and after trapping;
- assessment of captures to determine any changes in the distribution of African clawed frogs.

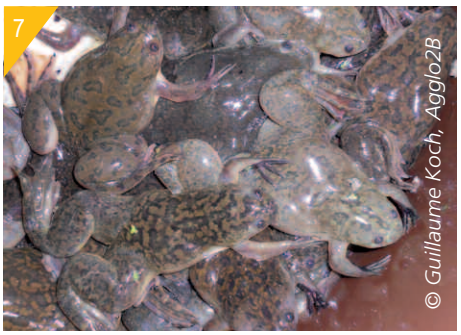
4. 5. 6. Preparation and installation of hoop nets for African clawed frogs.

Results and costs

■ Results

Table of the main results.

Water bodies trapped	295
Water bodies with proven presence of the species	174
Water bodies seine netted	24
Frogs captured **Adults** **Juveniles (< 4 cm nose to cloaca)** **Tadpoles**	 15 792 1 948 62 174
Number of owners met	≈ 100
Owners participating in trapping	23
Informational meetings held	42
Total number of people informed	> 1 000



7. Captured African clawed frogs.
8. A presentation to a school class.

■ Costs

■ Total cost of management operations from June 2011 to June 2013 = 64 300 euros, including:
- 49 250 euros for payroll costs (policy officer);
- 8 300 euros for personnel costs (vehicle, clothes, etc.);
- 4 000 euros for equipment (hoop nets, seine nets, dip nets, etc.);
- 2 000 euros for informational material;
- 360 euros for storage material;
- 390 euros for mapping of data.

Sources of funding for the management plan.

Source of funding	%
Poitou-Charentes regional council	20
Deux-Sèvres departmental council	40
CCA (internal funding)	40

Outlook

■ Expand the action plan to neighbouring areas (Thouarsais, Saint-Varentais, southern section of the Maine-et-Loire department) to ensure the effectiveness of trapping over the long term.
■ Inform a maximum number of persons (land owners, farmers, the public, etc.) to create an area-wide surveillance network for early detection of sites colonised by the African clawed frog.
■ Use the environmental-DNA technique to detect the presence of the species (in conjunction with the standard method in the field).
■ Study the long-term impacts, the foreseeable final distribution, the most heavily used dispersal channels, behavioural traits of assistance in capturing the species, the most critical developmental stages, etc.

Information on the project

- A brochure presenting the African clawed frog and the action plan was published.
- A sequence on the issue was aired on 7 June 2011 on a regional television news show.
- Information has been provided on local and national radio shows.
- Articles have been published in the press.
- A poster presents the species, its origin, distribution and impacts.
- Half-day field sessions were organised by ONCFS on the African clawed frog in 2012 and 2013, during a continuing-education course on invasive alien vertebrates in the Loire basin.
- The results of the action plan were presented during symposia and workshops, and notably the Meetings on invasive alien species in the Loire basin, held on 29 and 30 October 2013 in Tours.

Author: Guillaume Koch and Benjamin Audebaud, Agglo2b, Emmanuelle Sarat, IUCN French committee and Emilie Mazaubert, Irstea

9. A brochure on African clawed frogs

For more information

- The initial version of this document was first published in:
Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) : connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.

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Red-eared slider turtle

(*Trachemys scripta elegans*)

Classification	
Order	Testudines
Family	Emydidae
Genus	Trachemys
Species	*Trachemys scripta elegans* (Wied, 1839)

Originated in North and Central America. Imported in France up to 1997 as a pet.

Description

- Yellowish stripes along the head and neck
- Characteristic red “ears” posterior to the eyes
- Shell up to 24 cm (males) and 29 cm (females) long in adults:
- black carapace (yellow and light-green stripes in juveniles)
- yellow plastron with dark-green spots
- Average adult weight is 3.2 kilograms
- Sexual dimorphism in adults with, for males:
- a longer and thicker tail
- larger claws on the front feet
- Maximum life span approximately 30 years

Ecology and reproduction

- Habitats in many types of aquatic environments, primarily in stagnant water
- Carnivorous diet for juveniles and omnivorous for adults
- Reproductive activity starting at an age between 3 and 8 years
- Mating in the spring and/or fall
- Females lay eggs once or twice per year, approximately a dozen eggs in nests dug into banks
- Incubation for 70 to 90 days
- Newborn vary in size between 23 and 35 mm

Documentation

- Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) : connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.
- Nepveu C. 2002. Les espèces animales et végétales susceptibles de proliférer dans les milieux aquatiques et subaquatiques - Fiches espèces animales (Les espèces exotiques). Agence de l'eau Artois-Picardie. 98 pp.
- Pascal M., Lorvelec O. et Vigne J.-D. 2006. Invasions biologiques et extinctions: 11 000 ans d’histoire des vertébrés en France. Quae éditions. 350 pp.

Author: Emilie Mazaubert, Irstea

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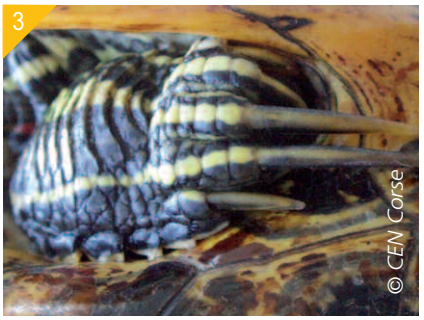

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Red-eared slider turtle

(*Trachemys scripta elegans*)

Management programme for red-eared slider turtles on Corsica (Corse)

Corse nature conservatory

■ The Friends of the Corse regional nature park association (non profit), created in 1972 and a member of the Federation of conservatories for natural areas since 1992, became the Corse nature conservatory (CENC) in 2011.

■ The main missions include:

- sustainably managing and preserving the ecologically important natural sites through land purchases and controlled use;
- improving knowledge on the habitats and species present on natural sites, whether managed or not by CENC;
- promoting sustainable development of the island by reconciling the preservation of natural areas with human activities;
- enhance the value of the natural environment in the eyes of the general public through events, on-site developments and naturalist excursions.

■ Contacts: Julie Peinado - julie.peinado@espaces-naturels.fr, Richard Destandau - richard.destandau@espaces-naturels.fr, Valérie Bosc - valerie.bosc@espaces-naturels.fr

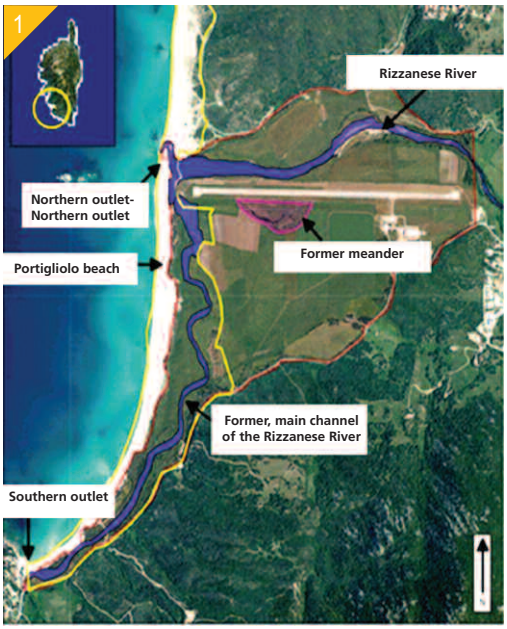
Management programme for red-eared slider turtles 2009-2011

■ The programme was funded by the Corse regional environmental directorate and the Rhône-Méditerranée-Corse water agency.

■ A scientific committee for the project included members from the National scientific research centre (CNRS) in Montpellier and from INRA in Rennes.

■ The project consisted of two main parts:

- "preparation of a method to manage and limit the populations of *Trachemys scripta elegans*" by acquiring knowledge on the biology and ecology of the subspecies in the area where it was introduced, acquiring experience in trapping and by testing the devised method;
- "raising awareness and informing on the issues concerning the subspecies and new pets in general".



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1. The sectors where trapping took place.

Intervention site

■ The programme study and work site (outlined in red on the map) is located at the mouth of the Rizzanese River, at the southern end of the Gulf of Valinco in the town of Propriano.

■ On arriving near the coast, the Rizzanese River forms a vast wetland of 180 hectares. The mouth of the river was divided into two outlets by the construction of the Tavaria airport in 1974:

- the channelised, northern outlet that became the main outlet;
- the southern outlet located at the end of the former, main channel of the river that is now a string of small water holes that are periodically interconnected. The old channel and the Portigliolo beach are listed as a type-1 ZNIEFF (natural zone with high ecological value) and are part of the Rizzanese outlet and Olmeto beaches Natura 2000 zone (outlined in yellow on the map) that is managed jointly by CENC, the Seaside and Lake Conservation Trust and the Corse-du-Sud departmental council.

■ In 2009 and 2011, studies were conducted on several sectors of the site whereas in 2010, the studies dealt exclusively with a former meander now cut off from the river (outlined in pink on the map).

Disturbances and issues involved

■ Red-eared slider turtles (*Trachemys scripta elegans*) were first observed and captured on the study site during a study on European pond turtles (*Emys orbicularis*) conducted from 2002 to 2008.

■ Management of the invasive subspecies is an important ecological issue in that it can impact native turtle species and European pond turtles in particular, the sole freshwater turtle in Corsica listed in Annexes II and IV of the Habitats directive and listed as “near threatened” in the Red list of threatened species in France (reptiles and amphibians) drawn up by IUCN France.

■ To date, the impacts have not been extensively studied and not a great deal is known, however a number of studies, including those by Cadi and Joly (2003, 2004) and Verneau *et al.* (2007 and 2009 not published; 2011) indicate that:

- competition exists and is being won by red-eared slider turtles, particularly for access to sunning spots, which leads to loss of weight and higher mortality rate for European pond turtles;
- exogenous parasites carried by the red-eared slider turtle are transferred to native turtles, including the European pond turtle.

■ In 1998, the EU prohibited the import of red-eared slider turtles into Europe (EC No 2473/98). In France, possession of the *Trachemys* species is subject to authorisation (ministerial decree dated 10 August 2004) and since the decree dated 30 July 2010, it has been prohibited to release red-eared slider turtles to the natural environment.

*2. Red-eared slider turtle (*Trachemys scripta elegans*).*
3. Work sectors (Phase 1). Free-flowing river circled in blue and stagnant areas in green.
4. Hoop net.

Interventions

■ Study of animal populations

■ To improve the available knowledge on red-eared slider turtles and set up an effective management technique, CENC launched a study on the population on the Rizzanese site in the framework of the 2009-2011 programme.

■ The objectives of the study were to:

- determine the population size and structure, and its success in reproducing;
- learn more on the phenology of the subspecies;
- monitor site occupation and the movements of individual turtles;
- inspect upstream sites to detect any isolated population groups.

■ The methods employed included:

- capture-marking-recapture (CMR);
- radio-monitoring;
- observations using binoculars to assess the relative abundance in each type of environment.

■ Trapping campaign

■ In order to offer managers with an effective management technique for red-eared slider turtles, CENC conducted tests in different phases.

■ **Phase 1 in 2009.** Trapping test to compare four different types of traps (fyke nets, sundeck turtle traps, cage traps, hoop nets) in two different types of environment.

Study protocol:

- CMR technique;
- traps of one type were laid in each of the four sectors for one week;
- four trapping sessions were conducted during the month of July;
- the captured turtles were measured, weighed and marked. Their sex and age were estimated..

■ **Phase 2 in 2010.** Attempt to eradicate the turtles in the former meander and assessment of the attempt. The meander was selected because it is isolated and because of the large number, on the basis of the population study, of red-eared slider turtles living there.

Protocol:

- traps were set along the banks, one trap every 15 metres, including 38 hoop nets from 8 June to 31 August, 5 fyke nets and 15 sundeck traps from 1 to 16 September;
- traps were removed two weeks after the last capture;
- they were checked once daily, toward the end of the day;
- the captured turtles were euthanised (frozen).

■ **Phase 3 in 2011.** Trapping campaign in three sectors in the northern part of the site.

■ The protocol was the same as for Phase 2, but only hoop nets (approximately 40) were used.

Results and costs

■ Study of animal populations

■ Main results of the three-year study period:

- 84 turtles were identified (including one dead) on the site, with 35 juveniles and 48 adults, of which 70% were female;
- in the former meander, the estimated population consisted of 46 red-eared slider turtles and 120 European pond turtles;
- the preferred habitats are stagnant waters surrounded by reed beds, located in the northern part of the study zone (with maximum densities in the former meander);
- three red-eared slider turtles were observed upstream of the study zone.

■ Trapping campaign

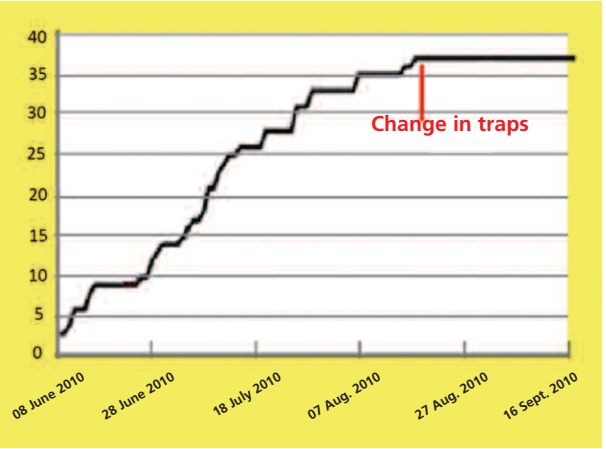
■ Phase-1 results:

- hoop nets were the most effective in the two types of environment;
- turtles were caught in the hoop nets on a regular basis throughout the trapping campaign;
- a larger number were captured in the area around the former meander.

■ Phase-2 results:

- a total of 37 turtles were captured over the 101 days (out of the estimated 46 turtles present), including 12 juveniles and 25 adults;
- more captures were made in narrow, sunny sectors out of the wind, with natural sunning areas.

Cumulative number of captured turtles (Phase 2).



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5. Work sectors (Phase 3).
6. Distribution of observed turtles according to the type of habitat (green = reed bed, blue = running water, pink = stands of salt cedar/irises).
7. Informational poster.

■ Phase-3 results:
- a total of 34 turtles were captured;
- the results confirmed and provided further information on the data from 2010. A large number of turtles were captured in areas around reed beds, in narrow (side) channels with steep banks, deep water (at least 1.5 to 2 metres), out of the wind, but well exposed to the sun.

■ Results of the "management" section of the programme

■ In the lower Rizzanese valley, the red-eared slider turtle population is capable of reproducing and dispersing, and has been observed upstream.
■ The trapping technique is effective in confined and isolated areas, but did not eradicate the species. During the project, only 72 of the 84 identified turtles were captured.
■ Management costs over the 3-year period amounted to 79 500 euros (34 500 in 2009, 25 000 in 2010 and 20 000 in 2011).

Outlook

■ The distribution map for the subspecies in Corsica will be updated.
■ A network of managers will be created to feed a joint database and share results and information.
■ The stakeholders in the network will be trained on monitoring and capturing red-eared slider turtles.
■ A technical guide will be drafted for the managers.
■ Trapping will be conducted in Corsica.e.

Information on the project

■ Informational documents were prepared and distributed from 2010 to 2012:
- a three-part document (5 000 copies), comprising a description of the subspecies, a presentation of the work done and an observation sheet, was distributed to organisations involved in protecting and/or managing natural areas, stores and veterinarians;
- an exhibition with a total of six panels;
- an informational poster (1 000 copies) with a sticker;
- teaching material (booklet and kit) for the "Turtles and more" campaign intended for school children and the general public;
- pages on the CENC site on the red-eared slider turtle programme, providing access to the informational documents and an occasion for the public to comment on the programme.
■ The "Turtles and more" presentation, lasting 45 minutes and including three workshops, is intended for school children and the general public.
■ Information for the managers of natural areas:
- an information sheet was sent by mail to the partners (nature reserves, ONCFS, the Seaside and Lake Conservation Trust, etc.);
- information on the protocols drafted and the results obtained during the population study and the tests to trap and eradicate the animals is available on the internet site;
- assessment information on the management programme is also available on the internet site.

Author: Sandra Fernandez, Irstea

For more information

■ CENC internet site: http://www.cen-corse.org/
■ Cadi A., Joly P., 2004. Impact of the introduction of the red-eared slider (*Trachemys scripta elegans*) on survival rates of the European pond turtle (*Emys orbicularis*). Biodiversity and Conservation, 13 : 2511-2518 (1,31).
■ Cadi A., Joly P. 2003. Competition for basking places between the endangered European pond turtle and the introduced red-eared slider. Canadian Journal of Zoology 81, 1392-1398.
■ CEN Corse. 2011. Mise en place d'une méthode de gestion de la sous-espèce *Trachemys scripta elegans* sur le site pilote de l'embouchure du Rizzanese: Résultats de deux années d'étude.
■ CEN Corse. 2013. Programme « Tortues de Floride en Corse » : retour d'expériences, perspectives.
■ Peinado J., Bosc V., Destandau R. et Fleuriau R. 2011. Programme de gestion d'une tortue exotique *Trachemys scripta elegans* en région Corse « Tentative d'éradication et de sensibilisation du public aux problématiques liées aux espèces exotiques » - Synthèse de trois années : 2009/2011. CEN Corse. 15 pp.
■ Verneau O. 2007 et 2009. Rapports scientifiques n°1 et n°2 rédigés pour l a DIREN Languedoc-Roussillon. Taxonomie et systématique des parasites d'amphibiens et de tortues d'eau douce en Languedoc-Roussillon.
■ Verneau O., Palacios C., Platt T., *et al.* 2011. Invasive species threat: Parasite phylogenetics reveals patterns and processes of host-switching between non-native and native captive freshwater turtles. Parasitology, 138, 1778-1792.

Conservatoire d'espaces naturels Corse

Red-eared slider turtle

(*Trachemys scripta elegans*)

Managing alien turtles on the Étang de Mauguio Natura 2000 site in the framework of the European LIFE + LAG'Nature programme

LIFE + LAG'Nature programme 2009-2013

■ The programme was coordinated by the Languedoc-Roussillon conservatory for natural areas (CENLR) and implemented in a partnership with five managers of Natura 2000 pilot sites, namely the board for the Camargue in the Gard department (SMCG), the inter-municipal board for littoral ponds (SIEL), the inter-municipal board for the enhancement, development and management of the Salses-Leucate Pond (RIVAGE), the board for the lower valley of the Aude River (SMBVA) and the Or Pond board (SYMBO).

■ The main objective was to create a network of demonstration sites in lagoon and dune environments in order to improve the conservation status of the habitats.

■ "Pilot" projects were launched, focussing on three aspects on the five Natura 2000 sites:

- restoration of lagoon, peri-lagoon and dune habitats;
- managing visits to the sites;
- managing invasive alien species, namely littoral flora (lily of the valley vine, pampa grass, Hottentot figs) and alien turtles.

■ The programme was funded by the Languedoc-Roussillon region, the LR regional environmental directorate, the Rhône-Méditerranée-Corse water agency and the departmental councils of the Aude, Hérault, Gard and Pyrénées-Orientales departments.

■ Contact: Thomas Gendre - thomas.gendre@cenlr.org

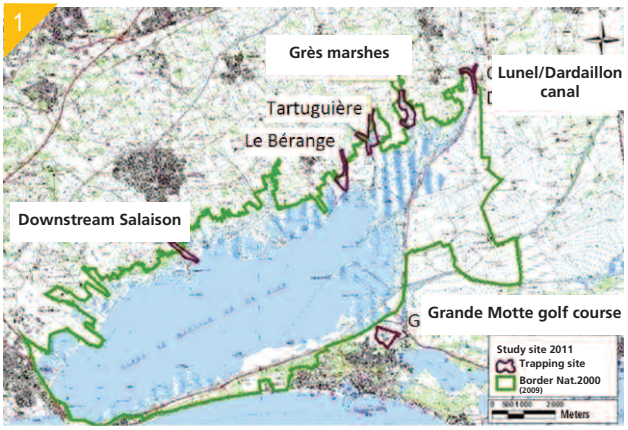
Or Pond board (SYMBO)

■ The board for inter-municipal cooperation was founded in 1991 and groups 34 towns around the Or Pond.

■ It manages the document listing objectives for the Étang de Mauguio Natura 2000 site.

■ It is also the project supervisor for the management of alien turtles in the Or Pond in the framework of the LIFE + LAG'Nature programme.

■ Contact: Ludovic Cases - lcases@symbo.fr



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1. The sectors where trapping took place.

Intervention site

■ The LIFE + LAG'Nature programme deals with five lagoon and dune Natura 2000 pilot sites in the Languedoc-Roussillon region, namely "Basse plaine de l'Aude", "Camargue gardoise", "Étang de Mauguio", "Étangs Palavasiens" and "Salses-Leucate".

■ SYMBO is in charge of managing alien turtles on the "Étang de Mauguio" Natura 2000 site, a 2 960 hectare lagoon surrounded by 2 000 hectares of wetlands.

■ The lagoon, located for the most part in the town of Mauguio, belongs to the French State (maritime public domain).

■ In 2011, management work (trapping) was carried out on five sites:

- sector 1: Grès marshes (town of Saint Nazaire de Pézan);
- sector 2: Bérange (town of Candillargues);
- sector 3: Tartuguières (town of Lansargues);
- sector 4: Lunel/Dardaillon canal (towns of Lunel and Saint Nazaire de Pézan);
- sector 5: Downstream Salaison (town of Mauguio).

■ In 2012, sectors 1, 2, 3 and 5 were trapped, in 2013, sectors 1 to 4 and a new sector, the Grande Motte golf course (sector 6).

Disturbances and issues involved

■ Alien turtles (*Trachemys scripta elegans* and *Trachemys scripta troosti*) outgrew their welcome and were released by pet owners to the natural environment.

■ Today, large population groups of primarily *Trachemys scripta elegans* (red-eared slider turtles) have been observed to reproduce in the Mauguio Pond.

■ Management of the species is an important ecological issue in that it can impact native turtle species, namely European pond turtles (*Emys orbicularis*) and Spanish pond turtles (*Mauremys leprosa)*. The two species are listed in Annexes II and IV of the Habitats directive and are covered by national action plans.

■ To date, the impacts have not been extensively studied and not a great deal is known, however a number of studies, including those by Cadi and Joly (2003, 2004) indicate that:

- competition exists and is being won by red-eared slider turtles, particularly for access to sunning spots, which leads to loss of weight and higher mortality rate for European pond turtles;
- exogenous parasites carried by the red-eared slider turtle are transferred to native turtles, including the European pond turtle.

2. Red-eared slider turtle (Trachemys scripta elegans*).*

Interventions

■ Since 2009, SYMBO has managed invasive alien turtles via the EU LIFE+ LAG'Nature programme in order to check the spread of the species and to assist the native species.

■ To that end, it conducted trapping campaigns in two phases. Phase 1 in 2009 served to test different types of traps in order to select the most effective. This phase will not be discussed here.

■ Phase 2, under way since 2010, includes large-scale trapping on the Étang de Mauguio Natura 2000 site (the first year of Phase 2 will not be discussed here).

■ The traps used were:

- double-entry hoop nets, fyke nets and/or cage traps (Fresquet cages measuring 1 x 2 metres or 0.5 x 1 metre with one entry, made by a volunteer using a roll of wire fencing);
- the traps were laid near the sunning spots;
- they were not totally submerged;
- bait consisted of frozen sardines and anchovy cream placed in little bags attached inside the hoop nets or to the nets.

■ Each site was trapped four nights per week:

- traps were laid on Monday;
- they were checked each morning;
- traps were removed on Friday;
- trapping occurred on an irregular basis.

■ Trapping occupied a SYMBO technician and two interns (students from a technical school).

■ The captured turtles were measured and their sex determined.

■ They were then sent to the "Tortue passion" centre in the Gard department.

Table listing trapping periods.

Year	2011	2012	2013
Period	February to July	End of May to July	Mid-April to September
Duration	20 weeks	8 weeks	20 weeks

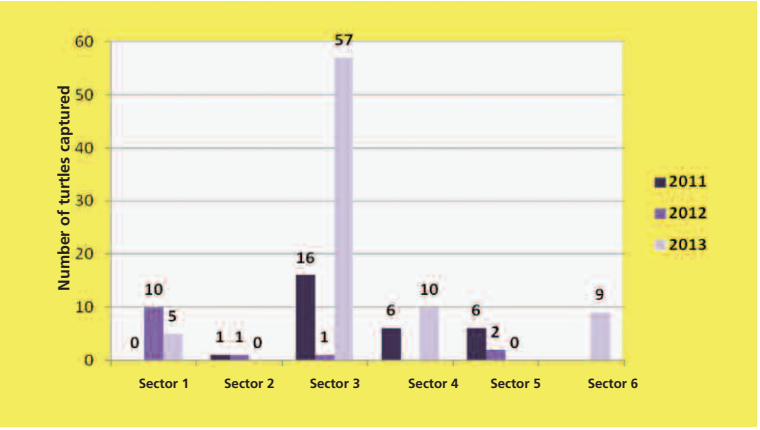
Results and assessment

■ Results

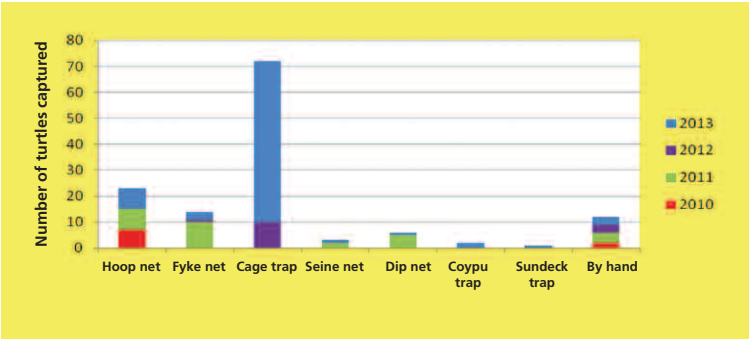
■ Differences in capture data between sectors from one year to the next are difficult to explain. Trapping pressure, annual variability in densities per sector, the layout of sectors, the types of traps used, etc. may have influenced the results.

■ The Fresquet cage traps were used starting in 2012 and turned out to be very effective.

Numbers of turtles captured per sector (2011-2013).



Captures per type of trap (2010-2013).



■ Assessment

■ From 2010 to 2013, 133 alien turtles were captured (*Trachemys scripta elegans, Trachemys scripta troosti*).

■ The estimated average cost per captured turtle was a total of 184 euros, including all equipment (traps, bait, etc.), travel costs and the payroll costs of the technician.

3. Checking a Fresquet cage trap.
4. Checking a Fyke net.

Results of trapping from 2011 to 2013.

	Sector 1			Sector 2			Sector 3			Sector 4		Sector 5		Sector 6
Year	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2013	2011	2012	2013
Weeks trapped	1	9	6	3	2	1	6	6	5	6	5	4	2	4
Hoop nets	23	-	5 to 10	14 to 24	6 to 15	12	24 à 25	0 à 25	0 to 14	18 to 27	12 to 15	21 to 27	16	14 to 16
Fyke nets	-	-	-	-	-	-	0 à 2	2	-	0 to 2	0 to 2	0 to 2	2	1
Cage traps	-	2	0 to 2	-	-	-	-	0 to 1	0 to 7	-	1 to 2	-	-	-

Table listing captures of European pond turtles.

European pond turtles captured	2011	2012	2013
New turtles	20 (+ 1 Spanish pond turtle)	63	51
Marked (recaptured) turtles	26	151	34

Outlook

- The work will be pursued with the interns from the technical school and the SYMBO technician.
- The Fresquet cage traps should be used wherever possible in all the trapping sectors.

Information on the project

- A number of articles were published in various media:
- the regional press (Midi Libre newspaper);
- the Lagunes bulletin;
- the ONCFS book titled *Invasive alien vertebrates in the Loire basin (not including fish), Knowledge gained and management feedback* (Sarat, 2012);
- the "Tortues d'Oc" internet site on the results of the trapping campaign in 2013 and the use of the Fesquet cage trap.
- A sequence on the work was aired in 2010 on a regional television news show.
- Participation in a sequence aired on the ARTE channel during a show on invasive alien species.
- Reports on the work during meetings with elected officials, land owners (private, the Seaside and Lake Conservation Trust, etc.) and managers of the sites in question.
- Informational meetings with professional fishermen and certified trappers on species identification and on how to increase trapping pressure.
- Workshops on aquatic turtles for school classes during projects on bullfighting traditions in the Camargue.
- For the past five or six years, an annual role game and project on European pond turtles has been under way with a high school in Montpellier.

Author: Sandra Fernandez, Irstea

For more information

- SYMBO internet site: http://www.etang-de-l-or.com/
- LIFE+ LAG'Nature internet site: http://www.lifelagnature.fr/
- Cadi A., Joly P. 2004. Impact of the introduction of the red-eared slider (*Trachemys scripta elegans*) on survival rates of the European pond turtle (*Emys orbicularis*). Biodiversity and Conservation, 13 : 2511-2518 (1,31).
- Cadi A., Joly P. 2003. Competition for basking places between the endangered European pond turtle and the introduced red-eared slider. Canadian Journal of Zoology 81, 1392-1398.
- Carbone H. 2011. Campagne de lutte à grande échelle contre les tortues de Floride *Trachemys scripta elegans* et autres tortues exotiques sur le site Natura 2000 « étang de Mauguio » dans le cadre d'un programme européen : LIFE + LAG'Nature, 46p. Rapport de stage.
- Sarat E. (coord.). 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors Poissons) : connaissances et expériences de gestion. Plan Loire Grandeur Nature - Office national de la chasse et de la faune sauvage. p.97.
- SYMBO. 2011. Bilan synthétique 2011 de la campagne de lutte contre les tortues exotiques, 2pp.
- SYMBO. 2011. Rapport annuel de la campagne de piégeage des tortues indigènes et exotiques – année 2011, 21pp.
- SYMBO. 2012. Rapport annuel de la campagne de piégeage des tortues indigènes et exotiques – année 2012, 10 pp.

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LIFE+LAG' Nature

Red-eared slider turtle

(*Trachemys scripta elegans*)

Managing red-eared slider turtles in an urban setting (Navarra, Spain)

Herpetology department of the Aranzadi scientific society

■ The department strives to conserve amphibian and reptile populations and their habitats. It produces and disseminates scientific knowledge on the topic.
The objectives are to:
- establish specialised research teams;
- conserve amphibian and reptile populations;
- provide professional training in the field;
- inform the general public.

■ The study on the distribution and management of red-eared slider turtle populations in Navarra was conducted in a partnership with the city of Pamplona and the Navarra regional government.

Context and issues involved

■ Red-eared slider turtles were first observed in Spain in 1983 in a pond near Madrid, after having been released by people who no longer wished to keep their pet.

■ In 1997, the species was present in 45 towns, essentially in Catalonia and in Andalusia. In 2010, the species was observed in 32 provinces and 17 regions, an increase of 78% with respect to the previous survey.

■ Population groups are now found in all types of freshwater aquatic environments, both natural and artificial, including estuaries, rivers, ponds, irrigation reservoirs, etc. There are urban populations, the result of the turtles regularly released by people, and feral populations in natural environments located far from towns.

■ Red-eared slider turtles are seen as one of the most troublesome invasive species in Spain, due to their significant reproductive capabilities (between two and three spawns per year with 12 to 17 eggs per spawn in Catalonia) and their long life expectancy (up to 30 years in natural environments).

■ The species competes for food and habitats with native turtles such as Spanish pond turtles (*Mauremys leprosa*) and European pond turtles (*Emys orbicularis*).

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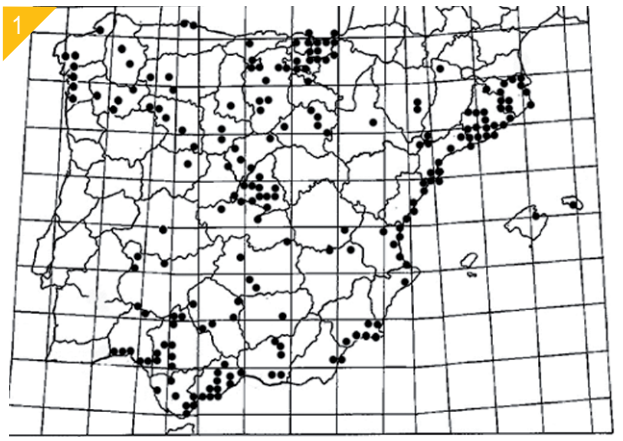

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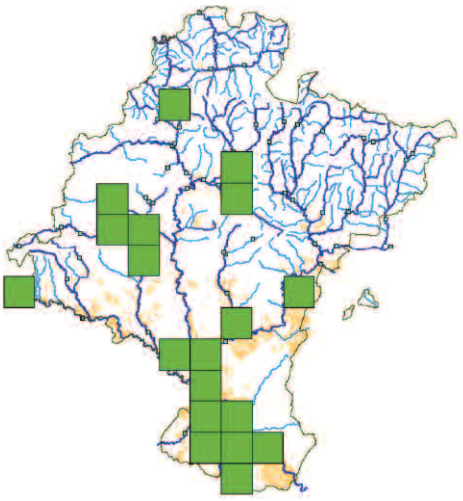

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1. Distribution of red-eared slider turtles in Spain in 2010.
2. Observations of red-eared slider turtles in the Navarra region.

Interventions

■ Test of trapping techniques

■ Several techniques have been developed to eliminate alien turtles, ranging from capture by hand to shooting and an array of trapping techniques. In certain regions of Spain, including Navarra, red-eared slider turtle populations are located in areas frequently visited by the public and close to urban centres, which makes management more difficult in terms of:
- access to private water bodies;
- finding sunning spots used by the turtles;
- people vandalising traps and releasing trapped turtles;
- limited possibilities for shooting.

■ In Navarra, the main objectives of the study conducted by the Herpetology department of the Aranzadi scientific society and the Navarra regional government were to:
- update the information on the distribution of red-eared slider turtles in Navarra;
- develop and test an effective trap for use in urban areas.

■ The sunning spots for the turtles were detected and characterised. They were located in areas where water depths exceeded 2 metres and where the turtles used emerged tree trunks to sun.

■ Several types of traps were laid and tested on the Arga River in the city of Pamplona.

■ A modified "Bolue" trap

■ The "Bolue" trap is a sundeck trap comprising a round, floating platform. The turtles climb up on the platform which tips over and the turtles find themselves caught in a net. The platform was originally made of wood, but subsequently cork was used. The netting under the platform was attached using fishing line to the bank so that the captured turtles could be easily retrieved.

■ "Aranzadi" turtle trap

■ This trap is an adaptation of the sundeck turtle trap that comprises a floating cage with a slippery inside frame that turtles cannot climb. The frame is made of PVC tubes on top of which cork is fixed. The traps are attached to the banks using fishing line. Some of the traps were baited.

■ The trapping campaigns took place from June to August 2008 in two sections of the Arga River in Pamplona. The two types of traps (modified Bolue and Aranzadi) were installed in sites where red-eared slider turtles had been frequently observed.

■ The baited traps were checked daily and the other traps were checked once weekly.

■ The captured turtles were weighed, had their sex determined, the shell measured, and were then euthanised (frozen).

■ Study of animal populations

■ In addition, population monitoring was conducted on all the rivers, dams and ponds of Navarra.

Results and assessment

■ Test of trapping techniques

■ A total of ten slider turtles were captured in the two test zones, including the subspecies *T. scripta elegans* and *T. scripta scripta*, as well as a hybrid of the two species.

■ In the areas where the traps were laid, the Aranzadi were the most effective with over 70% of the captures made.

■ One Aranzadi trap was vandalised during the trapping campaign and a Bolue trap was stolen.

■ The Aranzadi traps were effective in the sunning spots already used by the turtles, including in river reaches where the water was less than 2 metres deep.

■ The baited traps and the Bolue traps were not as effective due to the slow tripping mechanism which provided the turtles with enough time to escape and due to the wariness of the turtles concerning the most commonly used baited traps (notably hoop nets).

© BOLUE Estudiaos ambiantales ingurumen ilerketak

3. Red-eared slider turtle.
4. Bolue trap.
5. 6. Aranzadi turtle trap.

■ The Aranzadi traps are cumbersome and difficult to move, which made them more difficult to steal in an urban setting.
■ The cork on the top of the traps attracted the turtles in the sunning spots.

■ Study of animal populations

■ The species was observed in areas used for sport fishing (ponds and reservoirs) and near dense urban areas (the cities of Pamplona, Tuedla, Estalla and Logrono). A single specimen was observed in a rural area, near a village with approximately 100 residents (Gallipienzo). Turtles of both sexes were observed in the Pamplona area. The species is therefore likely to reproduce in the area and monitoring is required.

Information on the projects

■ The results of the project were presented during a symposium on freshwater alien species introduced in the Iberian peninsula, held in Pamplona on 12-13 November 2009.

Outlook

■ A much larger project is currently under way in the framework of the LIFE + Trachemys (*Strategy and proven techniques for the eradication of freshwater invaders*) (LIFE09 NAT/ES/000529) programme. The project will deal with 13 sites around Valencia and 4 sites in Portugal, from 2011 to 2015.
■ Approximately 100 sundeck traps and hoop nets are used to trap the turtles. The objective is to capture 1 000 turtles per year.
■ The management techniques will be presented during seminars and training sessions in the other regions of Spain and in other countries confronted with invasive alien turtles.
■ A manual on management and capture techniques will be published. It will present the applicable legislation, how to set up an operational monitoring network, trapping protocols and techniques, and communication strategies for dealing with the general public.
■ The project will also work on improving available knowledge on the biology and reproduction of *Trachemys scripta elegans*. Finally, the LIFE + programme includes a project to reintroduce European pond turtles.

Author: Emmanuelle Sarat, Comité français de l'UICN

For more information

■ LIFE Trachemys programme: http://www.cma.gva.es/web/indice.aspx?nodo=72096&idioma=I
■ Aranzadi scientific society: http://www.aranzadi-zientziak.org/
■ Verterbrados ibéricos: http://www.vertebradosibericos.org/reptiles/habitat/trascrha.html
■ Valdeón A., Crespo-Diaz A., Egana-Callejo A., et Gosá A. 2010. Update of the pond slider Trachemys scripta (Schoepff, 1792) records in Navarre (Northern Spain), and presentation of the Aranzadi Turtle Trap for its population control. Aquatic Invasions, 5(3) : 297–302.
■ Santigosa N. P., Paniagua C. D., Vila J. H., Robles F., Ayala J. M. P. de, Remedios M., Bañuls S. 2006. Trampas y plataformas de asoleamiento: la mejor combinación para erradicar galápagos exóticos. Boletín de la Asociación Herpetológica Española, 17(2), 115 120.
■ Zugadi I., Buenetxea X. 2004. "Trampa Bolue": Presentación de un nuevo modelo de trampa para la captura y observación de galápagos acuáticos en balsas de agua. Pp. 129-130. Dans : Libro de resúmenes del VIII Congreso Luso-Español, XII Congreso Español de Herpetología, Málaga, España.

Ruddy duck

(*Oxyura jamaicensis*)

Classification	
Order	Anseriformes
Family	*Anatidae*
Genus	*Oxyura*
Species	*O. jamaicensis* (Gmelin, 1789)

Introduced in Great Britain in 1949 for ornamental purposes. The birds escaped from captivity and reproduced for the first time in 1960. They arrived in France in 1974.

Descriptif

- A small, diving duck 35 to 45 cm long, with a wingspan of 53 to 62 cm
- The ducks have a large tail, short wings and a large bill
- Clear sexual dimorphism:

- the average weight of females is 510 grams, of males 610 grams
- breeding males are ruddy brown in colour with white cheeks and black top of head, a sky blue bill and white under the tail. Their eclipse plumage is greyish brown, but the head is identical
- females and immature males are a drab brown with a brown bill and yellowish cheeks with a brown stripe

Ecology and reproduction

- Habitats include:

- water bodies with dense riparian vegetation
- fresh or brackish water, however in France, they are found exclusively in fresh waters

- The animals may be aggressive with congeners and other species during the breeding season, but are peaceable otherwise
- Their diet consists of aquatic plants, molluscs, crustaceans, worms and insects
- Reproduction occurs from June to the end of August:

- during the period, the animals are highly dispersed with their nests hidden in the riparian vegetation
- broods count 6 to 14 eggs that incubate for 25 days
- the young take off on their own after 50 to 55 days
- first reproduction at age of 2 years

1. Male ruddy duck with breeding plumage.
2. Female ruddy duck.
3. Aggressive males during the breeding season.

Documentation

- Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) : connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.
- Madge S., Burn H. 1995. Guide des canards, des oies et des cygnes. Delachaux et Niestlé, Lausanne. 304 pp.
- Caizergues A., Fouque C. 2008. Zoom sur l'Érismature rousse, une espèce à éradiquer en France. Faune Sauvage, 280 : 64-66.

Author: Emmanuelle Sarat, IUCN French committee

Ruddy duck

(*Oxyura jamaicensis*)

Managing ruddy ducks in France

National agency for hunting and wildlife (ONCFS)

■ Research department - Bretagne-Pays-de-la-Loire regional office

■ ONCFS is a public agency placed under the supervision of the Ecology and Agriculture ministries.

■ Five of its main missions correspond to the guidelines contained in the Grenelle environmental agreement:

- policing activities for the environment and hunting;
- research and studies on wildlife and its habitats;
- technical support and advice;
- develop environmentally friendly hunting practices and management techniques for rural areas;
- organise and run examinations for hunting permits.

■ The Bretagne-Pays-de-la-Loire regional office covers 9 departments with a work force of 130.

■ Contact: Research department

- jean-baptiste.mouronval@oncfs.gouv.fr,

Bretagne-Pays-de-la-Loire regional office

- jean-francois.maillard@oncfs.gouv.fr

Intervention site

■ The presence in Western Europe of the ruddy duck, a small, diving duck from the Americas, is due to ducks that in 1953 escaped from breeding centres, notably from the Wildfowl and Wetlands Trust in Slimbridge (U.K.).

■ The presence of ruddy ducks in France was documented in 1974 and initial proof of its breeding was obtained in 1988 (Perennou, 1997). The regular presence of potential breeders was observed in the Pays-de-la-Loire region, in particular in the Mayenne and Loire-Atlantique departments (Grand-Lieu Lake).

■ Since the creation of a monitoring system and the start of eradication operations in 1997 by ONCFS and its partners, ruddy ducks have been observed on 75 sites in 30 departments. The Loire-Atlantique, Mayenne, Vendée and Ille-et-Vilaine departments represent the strongholds of the species.

■ During the winter period (November to February), virtually the entire population gathers in the Grand-Lieu Lake in the Loire-Atlantique department, where the numbers reach a peak in December (Reeber, 2012). The numbers of ducks gathering in the winter rose sharply from 1997 to 2007, then fell rapidly. The drop in numbers coincided with a fall in the population in the U.K., where an intense eradication effort had been undertaken.

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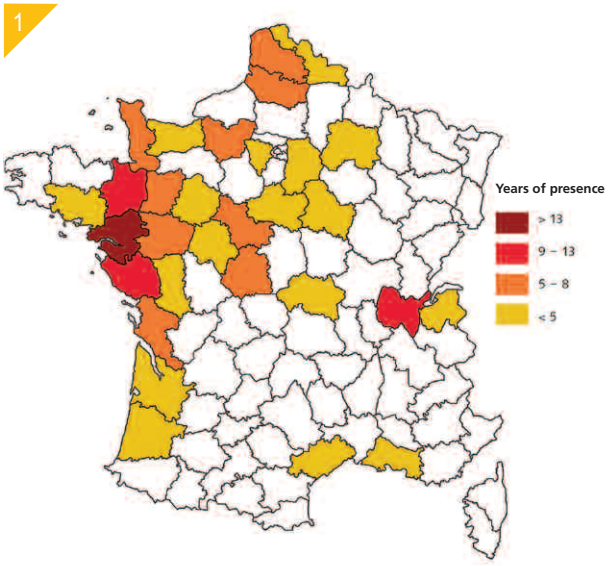


1. Sites where ruddy ducks have been observed in France since 1997.

Disturbances and issues involved

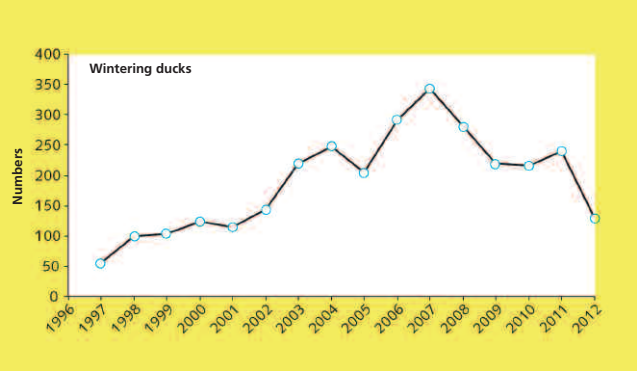
■ The invasive potential of ruddy ducks is high in that, in the U.K., its numbers were estimated at 350 ten years after its introduction and at almost 6 000 by the time eradication measures were launched shortly after 2000.

■ In addition to its invasive potential, the presence of ruddy ducks is a problem because it can create a hybrid with white-headed ducks and thus compromise the long-term survival of the latter (Muños-Fuentes *et al.* 2007).

■ The total population of white-headed ducks probably numbers less than 15 000, spread over three main areas (Eastern Mediterranean, Western and South-western Asia, Spain/Morocco and Northern Africa). They are considered threatened and a European action plan exists for their survival.

■ Hybridisation with ruddy ducks is seen as the main threat to the survival of white-headed ducks, particularly for the population in South-western Europe (Hughes *et al.*, 2004).

Numbers of ruddy ducks wintering in France (1996-2012).



2. Male white-headed duck.

Interventions

■ In 1992, when the threat had become clear, a monitoring and management strategy was set up and included a study on the feasibility of eradication.

■ The eradication trials in the U.K. and Spain produced rapid results and it was decided to generalise the successful approach to all European countries, including France. France committed to eradicating the species by 2015. The country is thus in compliance with its international obligations, notably the recommendation of the Berne convention concerning the eradication of the ruddy duck in the Western Palaearctic, but also more generally with the recommendations of numerous international agreements on the management of invasive alien species.

■ Since 1997, almost 1 200 birds have been eliminated, of which almost half on Grand-Lieu Lake by the personnel of the nature reserve.

■ Population monitoring and reports

■ The objectives of the monitoring programme for ruddy ducks set up in 1996 were to:

- estimate the size of the breeding population via counting operations during the summer;
- estimate the size of the wintering population;
- assess the effectiveness of the eradication work.

To that end, special surveys were conducted with the assistance of observer networks in the framework of more general surveys on water birds, carried out in a partnership with hunting federations, naturalist surveys and those conducted by the managers of protected zones.

■ The observations made during these surveys as well as those made regularly throughout the year enabled the elimination of the birds by authorised ONCFS personnel and by personnel of the Grand-Lieu Lake national nature reserve.

■ Processing of the protocol data and organisation on the national scale was done by the ONCFS research department. The data was then transmitted to the Ecology ministry for inclusion in the report to the EU commission.

■ Elimination of the ducks

■ The ministerial decree dated 12 November 1996 authorises shooting of ruddy ducks anywhere and any time by authorised personnel of the ONCFS and the nature reserves.

■ The work is subject to prior agreement with pond and lake owners.

■ Two main techniques are used, depending on the layout of the site and the period of the year.

■ Shooting from a hide at mid to long distance:

- one person alone or in a group of two;
- when the birds are nesting during the breeding season;
- using a 22 long rifle equipped with a moderator to limit disturbances and a magnifying scope;
- the shooters are hidden in the vegetation;
- precise safety measures are implemented.

■ Driving and shooting from a short distance:

- this technique requires a group of people;
- the ducks are driven by a boat or canoe toward to shooters in boats or on land;
- this technique is used essentially during the moulting and/or wintering season (the birds are grouped together);
- 12-gauge shotguns are used with steel shot;
- good coordination is indispensable to ensure safety.

Results and assessment

■ Results

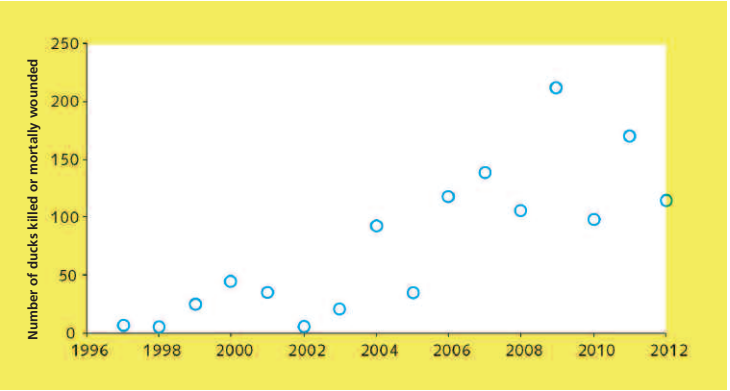
■ The wintering population of ruddy ducks would appear to be declining in France.

■ This result is without doubt due to the joint eradication efforts in France and particularly in the U.K. where the population numbers dropped from 6 000 just after the year 2000 to 130 today.

■ In spite of the eradication efforts, the number of breeding ducks has not dropped as significantly (the number is currently estimated at 40 couples), but the increase in numerical and geographic terms would seem to have been halted.

■ The current range is limited to 6 or 7 departments, particularly in the Pays-de-la-Loire region.

Numbers of ruddy ducks shot in France (1997-2012). Source: Caizergues and Maillard, 2013.



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3. Shooting across water.
4. Driving the ducks to the shooters.
5. Monitoring and management work for ruddy ducks by ONCFS personnel on the Grand-Lieu Lake.
6. Brochure to raise awareness concerning ruddy ducks.

Outlook

■ A national action plan requested by the Ecology ministry is in the process of being finalised by ONCFS in view of reaching the international objectives.

■ The management work undertaken over the past 15 years provides a number of ideas on how to improve the strategy:

- improve detection of the breeding population, notably on secondary sites;
- increase the human and financial resources available for projects;
- develop additional control methods (call ducks, float tubes, etc.);
- target the females that are more discreet when the couples have nested;
- work on improving regulations, raising awareness and informing the legal owners of ruddy ducks.

Information on the project

■ Monitoring and management work was presented during a number of international workshops (U.K. 2007, France 2008, Spain 2010).

■ ONCFS and the Ecology ministry published a brochure on ruddy ducks in 2012.

■ Articles were published in the ONCFS bulletin.

■ Management techniques and results are presented during training courses and national events.

Authors: Alain Caizergues, Jean-François Maillard, Jean-Baptiste Mouronval, ONCFS

For more information

■ ONCFS internet site: www.oncfs.gouv.fr

■ Caizergues A., Maillard J.-Fr. 2013. Invasions biologiques et biodiversité : l'éradication de l'Érismature rousse en Europe. Faune sauvage, 300 : 14-18.

■ Maillard J-Fr. et Fontaine V. 2013. L' Érismature rousse *Oxyura jamaicensis* ou quand la survie d'une espèce autochtone est menacée par l'introduction d'une proche cousine... Journées d'échange sur les espèces exotiques envahissantes du bassin de la Loire, Tours 29-30 octobre 2013. 23 pp.

■ Caizergues A., Fontaine V. et Simon L. 2012. La gestion de l'Érismature rousse dans l'Ouest de la France. *In* Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) : connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.

■ Hughes B., Henderson I. S., Robertson A. W. 2006. *Conservation of the globally threatened white-headed duck*, Oxyura leucocephala, *in the face of hybridization with the North American ruddy duck*, Oxyura jamaicensis: *results of a control trial.* Acta zoologica Sinica, 52: 576-578.

■ Pérennou C., Dubois P.J., Hughes B. 1997. L'Érismature rousse (*Oxyura jamaicensis)* : une introduction problématique d'oiseau dans les milieux aquatiques. Bulletin Français de la Pêche et de la Pisciculture, 344-345: 143–151.

■ Reeber S. 2012. Rapport d'activité du Lac de Grand-Lieu. Société nationale de protection de la nature, 33 pp.

■ Munos-Fuentes, V., C. Vila, A. J green, J. J Negro, et M. D Sorenson. 2007. *Hybridization between White headed Ducks and Introduced Ruddy Ducks in Spain*. Molecular Ecology 16 (3): 629 638.

Office National de la Chasse et de la Faune Sauvage

Ruddy duck

(*Oxyura jamaicensis*)

Programme to eradicate ruddy ducks in the U.K.

Food and Environment Research Agency (FERA)

■ The agency operates under the supervision of the U.K. department for the environment, food and rural affairs (DEFRA). FERA is active in developing sustainable agriculture, in managing and conserving the environment and in ensuring food safety.

Context and issues involved

■ Ruddy ducks were introduced to the U.K. in 1949 and the first reproduction in the natural environment was observed in 1960, following the escape of ducks from captivity. In the 1970s and 1980s, the species increased its range in the U.K. and colonised neighbouring countries, notably Spain, where it menaced the white-headed duck through hybridisation.

■ In 2000, the population of breeding ruddy ducks in the U.K. had reached 6 000 and attempts to reproduce had been observed in 7 European countries.

■ The threats weighing on the white-headed duck led to the creation of an action plan requiring the cooperation of all European countries confronted with the ruddy duck in view of its eradication.

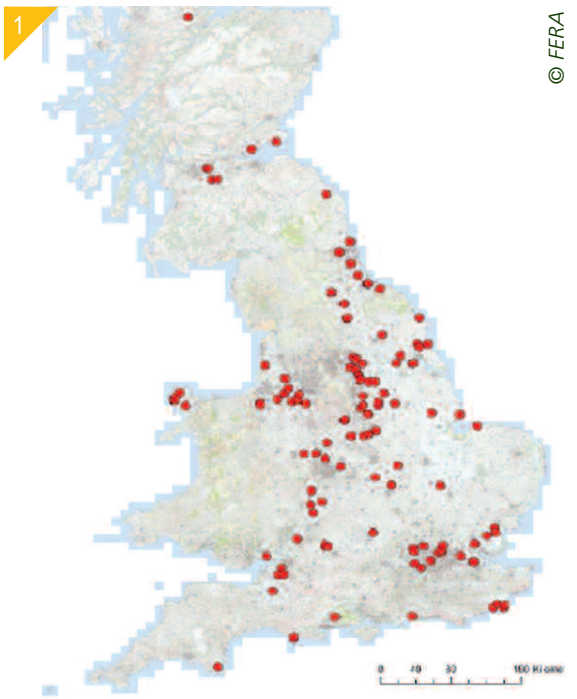
Interventions

■ In the beginning of the 1990s, when 95% of the ruddy-duck population were concentrated in the U.K., the Wildfowl et Wetlands Trust (which originally introduced the species in 1949) tested from 1993 to 1996 various methods to control the species (different capture methods, shooting techniques, sterilisation of eggs).

■ Fewer than 100 ducks were eliminated and the efforts had no effect on the population.

■ That being said, these preliminary studies determined the best management techniques and the seasons most conducive to their implementation, namely shooting during the breeding and wintering seasons.

■ Eradication was deemed possible on the condition that measures be undertaken on a larger scale.



1. Shooting sites.

■ The Food and Environment Research Agency (FERA) assumed responsibility for the work in 1999-2005 and launched two programmes, the first on a regional scale from 1999 to 2002 and the second on the national scale from 2003 to 2005).

■ These programmes served to improve shooting techniques during the wintering season. Each year, between 700 and 900 ruddy ducks were eliminated, leading to a slight decline in the national population.

■ European LIFE programme

■ In 2005, FERA obtained a total of 3.3 million pounds (50% LIFE, 50% FERA and a contribution from the Spanish government) for the eradication programme.

The main objectives were to:

- protect the European populations of white-headed ducks by eradicating ruddy ducks from the U.K.;
- share and disseminate information on the control methods and the results of the work to the other European nations in order to enhance the effectiveness of management measures on the European scale.

■ The shooting campaigns launched in the framework of the new programme led to a significant drop in population numbers (6 000 ducks in January 2000, 3 000 in January 2003), however the rate of decline was deemed insufficient. FERA conducted an econometric study and an analysis of project feedback to devise a new strategy optimising the effectiveness to cost ratio. A team of ten people was assigned the full-time job of eradicating the species within five years, from 2007 to 2011.

■ Techniques employed

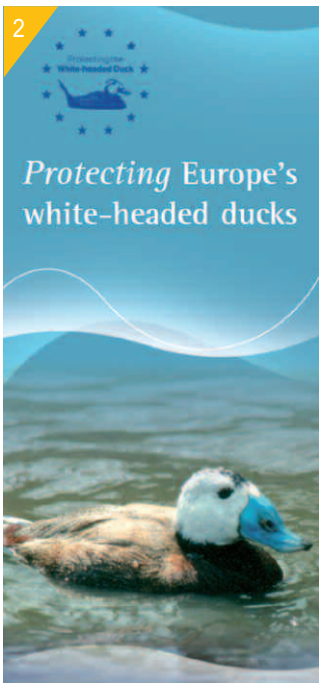
■ Wintering ducks were designated as the priority target in that 80% of the ruddy-duck population gathered on 25 sites during the winter. Management work also concentrated on the sites with high breeding rates.

■ Management techniques during the wintering season:

- shooting from boats or from the shore near the vegetation;
- the ducks are driven close to the shore;
- shooting sessions every 10 to 14 days to avoid having the ducks leave the site definitively;
- pauses were organised during shooting sessions to enable the ducks to regather.

■ Management techniques during the breeding season:

- moderators were used more frequently;
- visits were more frequent, but shorter;
- shooting sessions took place from April to June, prior to the hatching of eggs;
- female ducks were the priority target;
- decoys were used to attract ducks of both sexes.



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2. Informational brochure.

Results

■ Shooting took place on a total of 132 sites throughout the U.K., with the agreement of all land owners. In 2013, 45 ruddy ducks remained in the U.K. The remaining ducks continued to go to the known wintering sites in spite of the shooting. The population is spread over a few regional sites with 5 to 10 ducks each.

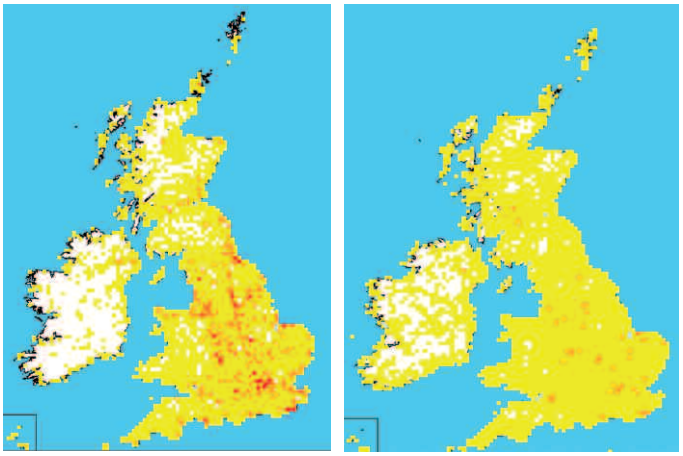
Results of the shooting trials.

Programme (time)	Ducks eliminated	Breeding population
First programme 1993-1995	134	6 000
Second programme 1999-2005	5 065	2 000
LIFE programme 2005-2011	7 100	114
2011-2013	124	45
TOTAL	12 557	

■ In addition to the management work, the population of ruddy ducks is counted annually by the Wildfowl and Wetlands trust. In January 2013, 110 sites throughout the U.K. were counted. Counts were also conducted in Ireland.

Numbers of ruddy ducks in the U.K. from 1967 to 2011. Source: FERA/WWT.

Distribution of ruddy ducks (red and orange dots) before and after (2013) the management work. Source: FERA.



Outlook

- The programme will be pursued to achieve full eradication of ruddy ducks in the U.K. by the year 2015, in compliance with the recommendations of the Berne convention.
- Eradication of the species, the objective of projects in other countries (Netherlands, France, Spain), should be achieved if the operations in the U.K. are successful.
- The project for ruddy ducks is an example of European cooperation in managing invasive alien species, an indispensable feature if the efforts in other European countries are to succeed.

Information on the project

- Efforts to inform and raise the awareness of land owners was required to access and work on key sites.
- The results of the eradication programme were presented during the Fifth Meeting of the parties to the African-Eurasian Waterbird Agreement (AEWA) in La Rochelle, 2012.
- Information is available at the GB Native secretariat (www.nonnativespecies.org).
- An informational brochure titled *Protecting Europe's whiteheaded ducks* was published to explain the LIFE programme.

Author: Emmanuelle Sarat, IUCN French committee

For more information

- FERA : http://www.fera.defra.gov.uk/
- *GB Non-native species secretariat :* http://www.nonnativespecies.org/index.cfm?pageid=244
- Wildfowl et Wetlands Trust. 2012. *The status of the Ruddy Duck (*Oxyura jamaicensis*) in the western Palearctic and an action plan for eradication, 2010-2012. Wildfowl et Wetlands Trust,* Slimbridge. 21 pp.
- Conseil de l'Europe. 2013. *Follow-up of recommendation* No.149 (2010) *on the eradication of the Ruddy duck (*Oxyura jamaicensis*) in the western Palaeartic.* National reports. 13 pp.
- Henderson, I. 2010. « *The Eradication of Ruddy Ducks in the United Kingdom* ». Aliens: *The Invasive Species Bulletin,* no 29: 17-24.
- Henderson, I. 2011. UK *Ruddy duck eradication programme : September 2005 to March 2011.* FERA. 33 pp.
- FERA. 2012. *UK Ruddy duck eradication programme project bulletin*. April 2012. 3 pp.

fera
The Food and Environment Research Agency

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Sacred ibis

(Threskiornis aethiopicus)

Classification	
Order	Pelecaniformes
Family	*Threskiornithidae*
Genus	*Threskiornis*
Species	*T. aethiopicus* (Latham, 1790)

Originated in Sub-Saharan Africa. Introduced as an ornamental species in France.

Description

- White birds with a featherless black head and neck (the skin is black) and wing feathers tipped in black
- The birds stand 65 to 75 centimetres tall with a wingspan of 110 to 120 cm
- Weight approximately 1.5 kilograms
- The long, thick bill is black and curves down
- The average life span is approximately 20 years
- Young birds have feathers on the head and neck, but progressively lose them at the age of 2 to 3 years

Ecology and reproduction

- Preferred habitats are large, open spaces near wetlands:
- agricultural areas, tilled land, bird farms in open fields
- dumps containing food waste
- more or less wet meadows, marsh fields and flooded reed beds, coastal habitats, etc.
- The birds gather at night in groups of up to several hundred
- The species is an opportunistic carnivore consuming a wide range of prey, including invertebrates, amphibians, fish, bird eggs and chicks, etc.
- The birds often feed in groups and with other species
- Breeding takes place in large groups with nests positioned very close to one another
- Eggs are laid between April and July:
- 2 to 3 eggs on average per season
- incubation for approximately 28 days
- the chicks leave the nest after 14 to 21 days and can fly after 40 days
- The species is gregarious and highly tolerant of human contact

Documentation

- Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) : connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.
- Clergeau P., Yésou P., Chadenas C. 2005. Ibis sacré *Threskiornis aethiopicus*, état actuel et impacts potentiels des populations introduites en France métropolitaine. Rapport Inra-ONCFS, Rennes et Nantes. 53 pp.

Author: Emilie Mazaubert, Irstea

Sacred ibis

(Threskiornis aethiopicus)

Eradicating the sacred ibis around the Mediterranean basin

National agency for hunting and wildlife

■ The public agency was created in 1972.

■ The main missions include:

- enforcing hunting and environmental regulations, assisting the Prefects in maintaining law and order and carrying out administrative procedures in the hunting and environmental fields;
- conducting studies, research and experiments on conserving, restoring and managing wildlife and its habitats;
- contributing, as part of the technical and scientific missions set by the 2012-2014 Statement of objectives, to controlling invasive alien animal species (essentially mammals and birds) and species disrupting ecosystems or harming human activities;
- participating in monitoring, studies and management of alien species found to be invasive;
- assisting the Prefects concerning interventions on invasive species.

■ Contact: Jean-Baptiste Mouronval - jean-baptiste.mouronval@oncfs.gouv.fr

Intervention site

■ The intervention was initiated in the spring of 2007, at a time when the populations of sacred ibis had already reached a large number and had spread widely over the lagoons in the Languedoc and Camargue regions.

■ It took place in the five departments (Aude, Hérault, Gard, Bouches-du-Rhône and Alpes-Maritimes) where the species had clearly established habitats.

■ The inventories and monitoring of sacred ibises along the Mediterranean coast in France involved counting operations on 55 sites. Management work (elimination and capture) was conducted on four overnight roosting sites, on four nesting sites and on approximately 25 daytime feeding sites.

■ The work took place in agricultural areas (rice paddies and meadows), private marshes, nature reserves, sensitive natural areas and parks open to the public (zoological and ornithological parks).

■ The installation of the sacred ibis along the French Mediterranean coast took place in several steps:

- the birds present in the natural environment along the Mediterranean coast come from the zoological park in the town of Sigean (Aude department) where eight of the birds were imported from the U.K. in the 1980s to see whether they could adapt to the climate;
- the birds were allowed to fly freely and started to reproduce in the natural environment around the year 2000. The numbers increased regularly and reached a maximum of 105 breeding couples on the nearby Bages Pond in 2005. Starting in 2000, a few birds from Sigean were observed in Camargue, 130 kilometres to the east of their introduction site;
- during the summer of 2007, a net in an aviary was torn and 38 sacred ibises escaped from the zoological park in the town of Saint-Jean-Cap-Ferrat (Alpes-Maritimes department). The same year, a private breeder of ornamental birds in the Hérault department released the two sacred ibises that he owned;
- the minimum number of sacred ibises living in the wild in the five Mediterranean departments was estimated in 2007 to represent a total of 360 birds.

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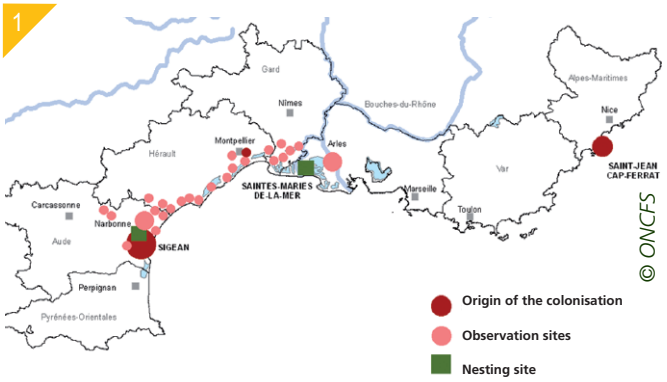

2

1. Distribution of the sacred ibis around the Mediterranean basin.
2. Sites on which sacred ibises were observed in the Camargue.

Disturbances and issues involved

■ The main concern along the Mediterranean coast is the long-term conservation of the breeding colonies of certain species of water birds, including herons, glossy ibises, gulls and terns.

■ Sacred ibises have a number of proven and some supposed impacts on nesting birds.

■ They are known to be predators for the eggs and chicks of Ardeidae (heron) species, e.g.:

- cattle egrets (*Bulbulcus ibis*) (observations at the Bages Pond in the Aude department in 2004 and in the town of Saintes-Maries-de-la-Mer in the Bouches-du-Rhône department in 2013) and squacco heron (*Ardeola ralloides*) (in the town of Aigues-Mortes in the Gard department in 2003).

■ The reduction in the number of Ardeidae (heron) couples nesting in the Bages Pond (from 680 in 1998 to fewer than 100 in 2007) coincided with the installation of the sacred ibis on Planasse Island. The assumed cause of the reduction is the possible competition for space and/or food.

*3. 4. Sacred ibis (*Threskiornis aethiopicus*).*

Interventions

■ Regulatory aspects

■ In 2005, the Ecology ministry requested that ONCFS and INRA assess the situation. Their report concluded that it was necessary to limit or to eradicate the populations of sacred ibis in France in compliance with the precautionary principle.

■ In March 2006, the Ecology ministry requested that the Prefects of the concerned departments proceed with the elimination of the birds. In 2008, this decision was reinforced by the agreement on the conservation of African-Eurasian migratory waterbirds (AEWA, resolution 4.5).

■ Prefectoral orders to eliminate the birds were issued starting in 2007 in four departments (Aude, Hérault, Gard and Bouches-du-Rhône) in the framework of policies for pests and/or invasive alien animals (articles L427-6 and L411-3 in the Environmental code, ministerial decree dated 30 July 2010 prohibiting the introduction of the species into the natural environment in continental France).

■ The ministerial order dated 25 March 2004 concerning the operation of zoological parks enabled interventions in the parks where sacred ibises were not constrained.

■ Inventory of populations

■ Starting in 2007, ONCFS personnel initiated a number of operations:

- contacts (telephone or email) with the main organisations involved in studying and managing wildlife or in managing natural areas (environmental-protection associations, the managers of protected zones, etc.), with the park in Sigean, and with hunters, land owners and marsh managers to collect information on the habitats of the sacred ibis and to request their participation in the inventory;
- the contacts were a means to inform the managers and land owners concerning the presence of the sacred ibis and its potential impacts in order to obtain permission to access the sites as needed.

■ Inventories were carried out regularly to identify the main sites and to monitor changes in population numbers.

■ The main ornithological sites were monitored and databases accessible on-line were regularly consulted (particularly Obsmedit).

■ A total of approximately 20 organisations participated in locating and counting the sacred ibises

■ Elimination of populations

■ A number of methods were used to remove the sacred ibises from the natural environment with the assistance of approximately 20 people. The initial interventions took place in 2007, in the Aude department.

■ Shooting of adult birds:

- the sessions were organised taking into account the constraints imposed by human activities (sites open to the public, hunting, etc.);
- the shooting occurred on feeding sites, roosting sites and along the itineraries used by the birds;
- different weapons were used, including shotguns, .22 long rifles and .222 Remingtons equipped with scopes and moderators;
- wooden decoys were installed at times to attract the birds;
- where possible, the shot birds were retrieved;
- they were frozen in order to study the stomach contents.

■ In the nesting colonies, nests, eggs, chicks and occasionally adults (shooting) were captured and eliminated from April to October.

■ The birds in the zoological parks in Sigean and Saint-Jean-Cap-Ferrat were captured:

- using bait made of fish treated with chloralose, a sedative;
- in compliance with the requests of the authorised personnel of the parks, the birds were reanimated (warmed) and returned to the aviary or buried if they had died.

■ The participants included:

- ONCFS personnel, the main group of people authorised to eliminate the birds in the natural environment using any means and at any time;
- the authorised personnel of the zoological parks;
- a number of other participants, on the condition for some that they follow a short training course, including wolf-hunting officers, ONF (National forestry agency) and Onema personnel, authorised personnel of protected zones and of land belonging to the Seaside and Lake Conservation Trust, and game wardens in their specific areas.

5. A chick caught in the nest.

Results and costs

■ Results of elimination work

■ A total of 395 adult sacred ibises and 90 chicks were removed from the natural environment between 2007 and 2013:

- in 2007, 234 adult birds and 30 chicks were removed from the natural environment, i.e. two-thirds of the total counted that year along the Mediterranean coast, of which 90 were sent to aviaries and the rest were eliminated;
- the 38 birds that had escaped from the zoological park in Saint-Jean-Cap-Ferrat were captured in 2007 and 2008;
- all the sacred ibises present in the Aude and Hérault departments were removed from the natural environment from 2007 to 2009;
- in 2013, only three sacred ibises remained in Camargue.

■ Costs

■ To date, it has not been possible to precisely cost the eradication programme.

■ The average cost of elimination per bird by ONCFS personnel was calculated by analysing the activity reports of the local offices. This figure varies significantly depending on the situation:

- it is lower for groups of birds (-) very close to the introduction site and very high for birds (+++) spread in small groups and located far from the source;
- in addition, the average cost increases when the number of birds to be eliminated decreases.

Summary table of the intervention results and costs.

Site	Interventions	Sacred Ibises captured/eliminated	Dispersion	Unit cost
Saint-Jean-Cap-Ferrat	First intervention over 2 days	36	-	39 €
Aude	Intervention on first site over 2 days	87	+	38 €
Camargue	2007-2013	Approx. 40	+++	711 €
	Last 8 months of intervention	< 10	+++	1 303 €

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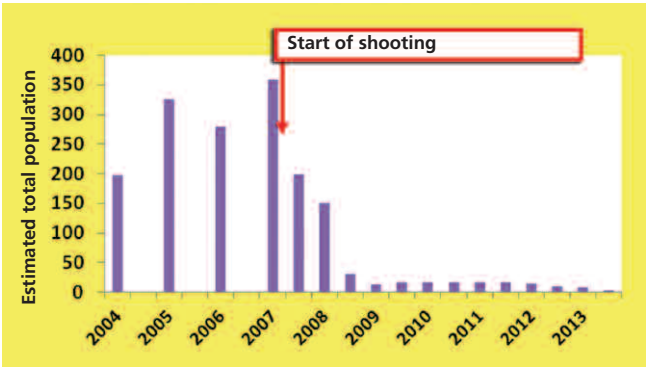
■ Assessment

■ The management work was deemed effective in that only three birds were observed in the natural environment in 2013.

■ A number of difficulties were encountered (in terms of logistics and the eco-ethology of the birds):

- there were no specific regulations suited to exogenous species until 2010 and it was necessary to obtain yearly authorisations with long publication lead times;
- certain naturalists were hesitant to indicate the locations of the birds;
- there were restrictions concerning the persons authorised to eliminate the birds and a lack of human resources;
- certain land owners refused entry to their property;
- there were safety considerations inherent to work on sites open to the public;
- reactions to announcements concerning observations were occasionally slow;
- the time required to organise often exceeded the residence time of the birds on a site;
- work was complicated by multi-species colonies, roosting and feeding sites given the risk of impacting non-targeted, emblematic species;
- it was often difficult or impossible to approach the birds within shooting range given that they prefer very open spaces;
- the great mobility of the birds made it difficult to precisely locate them within their home range;
- participants were less motivated when the potential numbers of sacred ibis were so low that the probability of a capture fell almost to zero.

Estimated population numbers from 2004 to 2013 (per half year).



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Outlook

- The remaining birds should be eliminated as soon as possible.
- Regular monitoring along the Mediterranean coast, through contacts with the managers of natural areas, will be required to avoid recolonisation by the population from the Atlantic coast in France or by the small groups of birds that may remain in Italy or Spain.

Information on the project

- Efforts are made to inform and raise the awareness of stakeholders concerning the sacred ibis, including the managers of natural areas, the owners of wetlands, naturalist associations, hunters. A memo is distributed explaining the objectives and the resources invested in the management of the sacred ibis along the Mediterranean coast and encouraging the transmission of information on the species.
- A report on the management work for sacred ibises was aired by French public television in March 2013.

Author: Sandra Fernandez, Irstea

For more information

- Clergeau P., Reeber S., Bastian S. et Yésou P. 2010. Le profil alimentaire de l'Ibis sacré *Threskiornis aethiopicus* introduit en France métropolitaine : espèce généraliste ou spécialiste ? Rev. Écol. (Terre Vie), vol. 65 : 331-342.
- Clergeau P., Yésou P. et Chadenas C. 2005. L'Ibis sacré (*Threskiornis aethiopicus*). État actuel et impacts potentiels des populations introduites en France métropolitaine. Ministère de l'Écologie et du Développement. 52 pp.
- Kayser Y., Clément D. et Gauthier-Clerc M. 2005. L'Ibis sacré *Threskiornis aethiopicus* sur le littoral méditerranéen français : impact sur l'avifaune. Ornithos 12 : 84-86.
- Marion L. 2013, *Is the Sacred ibis a real threat to biodiversity ? Long-term study of its diet in non-native areas compared to native areas.* C. R. Biologies.
- Yésou, P. et Clergeau, P. 2005. *Sacred Ibis: a new invasive species in Europe. Birding World,* 18 : 517-526.

Office National de la Chasse et de la Faune Sauvage

Sacred ibis

(*Threskiornis aethiopicus*)

Managing the sacred ibis in Western France

National agency for hunting and wildlife

■ Bretagne-Pays-de-la-Loire regional office

■ ONCFS is a public agency placed under the supervision of the Ecology and Agriculture ministries.

■ Its missions correspond to the guidelines contained in the Grenelle environmental agreement, including research on wildlife and its habitats and participation in the management of invasive alien species.

■ The Bretagne-Pays-de-la-Loire regional office covers 9 departments with a work force of 130.

■ Contact: ONCFS Bretagne-Pays-de-la-Loire regional office - dr.bretagne-paysdeloire@oncfs.gouv.fr

Intervention site

■ History of species colonisation and management

■ 1974-1987. A zoological park imported 30 sacred ibises. The birds born in captivity were allowed to fly freely and dispersed along the Atlantic coast.

■ 1991. The first attempt at nesting was observed at Grand-Lieu Lake (Loire-Atlantique department).

■ 1994. Scientists and farming representatives drew the attention of the local government to the presence of the sacred ibises and to the risks involved.

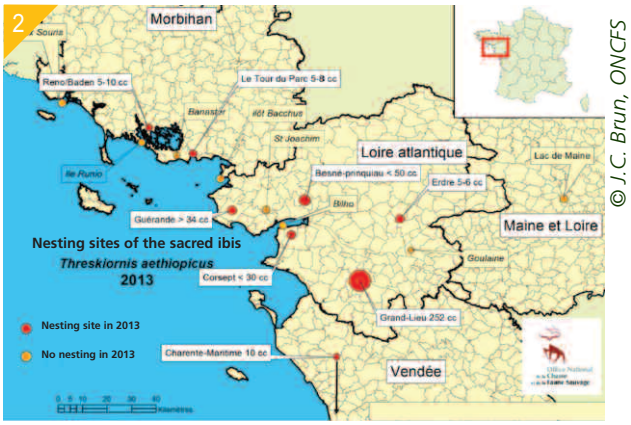
■ 1997. The young birds were no longer allowed to escape from the zoological park.

■ 2004. The managers of natural areas in the Loire-Atlantique, Vendée and Morbihan departments requested that the sacred ibis be included in conservation policies.

■ 2005. The Ecology ministry requested that ONCFS and INRA assess the situation and propose management solutions. Their report acknowledged the risks created by the increased numbers and wider geographic area covered by the sacred ibis and proposed scenarios with progressive management solutions. Following a referral by the Ecology ministry, the National council for the protection of nature advised eradicating the species.

■ 2006. A total of 1 700 couples and 5 000 birds were inventoried in Western France.

■ 2007. Prefectoral orders were signed enabling the start of operations to reduce the numbers of sacred ibises.



1. Site of the Grand-Lieu nature reserve.
2. Nesting sites of the sacred ibis in the Bretagne and Pays-de-la-Loire regions in 2013.

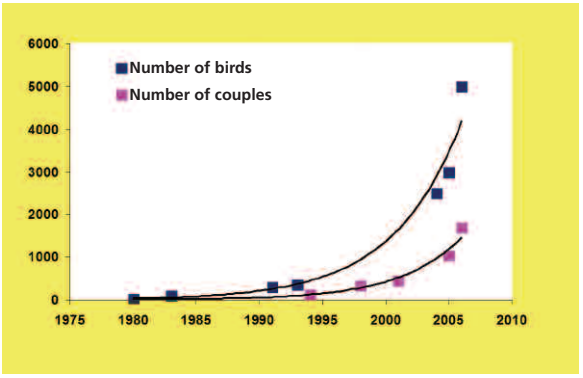
■ 2013. Only 280 to 300 breeding couples were inventoried, a significant drop since 2006 that may be attributed to the management work.

Disturbances and issues involved

■ Impacts on native species

■ The birds are predators for a wide range of prey that are already confronted with habitat degradation. The overall impact has not been quantified, however predation has been observed on the nests and chicks of sensitive species (marsh terns, herons, terns and waders).

Numbers of sacred ibises in Western France prior to the management work.



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■ Health risks

■ The alternate food sources on pathogen-rich sites (dumps, bird farms, etc.) represent a health risk for the fauna in wetlands.

Interventions

■ Monitoring the breeding of the sacred ibis

■ In parallel with the prefectoral orders to eliminate the sacred ibises in the Loire-Atlantique, Morbihan and Vendée departments, the Bretagne and Pays-de-la-Loire regional environmental directorates requested that ONCFS monitor population numbers in Western France.

■ The ornithological community, the managers of natural areas and ONCFS in the concerned departments all participated in the annual counting of colonies.

■ An annual, regional report was drafted with a map of the colonies, the numbers of couples and of fledglings per colony, the change in the overall population from year to year and the impact of the measures to limit the population.

■ Management work

■ An attempt to remove the eggs from the main colony was undertaken in 2006. This operation resulted in the birds moving to another site and laying new eggs, consequently this method was not implemented twice.

■ In 2007, a first prefectoral order in the Loire-Atlantique department was signed to test shooting over a limited period as a management method. Following the experiment and starting in 2008, annual prefectoral orders were issued in the Loire-Atlantique, Morbihan and Vendée departments, and in 2009 in the Maine-et-Loire and l'Ille-et-Vilaine departments.

■ Since 2009, another prefectoral order has filled out the approach. The National association for the protection of nature (SNPN), in its role as the manager of the Grand-Lieu national nature reserve, the site of the largest colony, was charged with sterilising sacred-ibis eggs.

■ The combined implementation of egg sterilisation in the main colony and shooting of flight-capable birds around the edges of colonies and on feeding sites is a means to limit:

- the number of reproducers the following season (this is due to shooting flight-capable birds that are primarily adults);
- the number of juveniles replacing the eliminated adults (due to the drop in the number of fledglings caused by the sterilisation operations).

3. 4. Sacred ibises in the Massereau Pond.

■ Elimination by shooting:
- the shooting is done by ONCFS personnel, occasionally assisted by other authorised persons acting, for this work, under the responsibility of ONCFS;
- the operations take place on feeding sites or near the colonies;
- safety measures and efforts to avoid impacts of the shooting campaign on other species are important factors during the work to limit the populations of sacred ibis;
- during this work, the personnel also drew biological samples used for studies on the parasites carried by the birds, on the viruses (detection of the avian influenza virus strain H5N1) and on the diet of sacred ibises.
■ Sterilisation of eggs:
- the objective is to limit as severely as possible the number of young sacred ibises capable of leaving the colonies established at Grand-Lieu Lake;
- the process consists of simply running a spike through the eggs;
- this work was carried out by authorised personnel of the nature reserve who were extremely knowledgeable concerning the local conditions, which made it possible to limit the disturbances and the impact on sensitive species nesting nearby.

5. Chicks in a nest.
6. Threskiornis aethiopicus.

Results and assessment

■ Nesting of the sacred ibis in Western France in 2013

■ In 2013, approximately 280 to 300 couples nested, including 10 couples in the Charente-Maritime department (outside the area currently covered by the prefectoral orders to eliminate the species), which represents a decrease of 17 to 27% compared to the 350 to 410 couples in 2012.
■ The distribution of the colonies is similar to that in the previous four years, i.e. approximately 90% of the regional nesting population is located at Grand-Lieu Lake.

■ Results of management work from 2006 to 2013

■ Sterilisation of eggs:
- SNPN put great effort into complying with the prefectoral order concerning the sterilisation of eggs at the Grand-Lieu Lake;
- in 2013, 422 nests and a total of 1 270 eggs were treated;
- the operation took place during two periods (April and May) in order to sterilise the replacement eggs laid following the first passage;
- the operation was successful in that very few juveniles were born at Grand-Lieu Lake and only a few dozen became fledglings.
■ Shooting campaigns:
- a total of 274 sacred ibises were eliminated in 2013;
- the results indicate that the number of young birds born is significantly lower than the number of birds eliminated;
- consequently, the drop in the regional population should continue in 2014. However, the shooting and sterilisation work must be pursued with vigour to avoid any regrowth of the population;
- the means to halt the development of a colony of breeders in the Charente-Maritime department must be found.

Results of management work on the sacred ibis in Western France.

Year	Birds shot	Nests sterilised	Couples observed
2006			1 700
2007	226		1 430-1 860
2008	2 939		1 400
2009	1 252	157	850
2010	887	1013	670
2011	413	880	560-600
2012	635	248	350-410
2013	274	422	280-300
TOTAL	6 626	2720	- 82%

Information on the project

■ An annual report on monitoring results for the breeding population is submitted to the government and made available via the internet.

■ Scientific research has been put into learning more on the biology of the sacred ibis and its impacts (a partnership between INRA, MNHN, SNPN, Oniris and ONCFS). This work resulted in a number of reports and publications on the following topics:

- the primary aspects of its reproduction (Alauda, 2006);
- a status report on the current situation (*Biological Invasions,* 2006);
- the absence of a positive relationship between the sacred ibis and the Eurasian spoonbill (Oryx, 2010);
- an assessment of the health risks (presentation to the European Wildlife Disease Association, 2010);
- feeding habits and impact on sensitive species (*Revue d'Écologie – Terre et Vie*, 2010).

■ Informational articles have been published for amateur ornithologists in the journals *Ornithos* and *Birding World* (2005).

Authors: Pierre Yésou, Jean-François Maillard and Luc Simon, ONCFS

For more information

■ Bretagne-Pays-de-la-Loire regional office: www.oncfs.gouv.fr

■ Publications are available via the link below:
http://www.oncfs.gouv.fr/La-lutte-contre-les-especes-exotiques-envahissantes-ru152/LIbis-sacre-ar282

■ Yésou P. et Maillard J.F. 2013. Bilan de la reproduction des opérations de destruction de l'Ibis sacré en Bretagne Pays de la Loire pour l'année 2013. Office national de la chasse et de la faune sauvage. Nantes. 7 pp.

■ Clergeau P., Yésou P., Chadenas C. 2005. Ibis sacré *Threskiornis aethiopicus*, état actuel et impacts potentiels des populations introduites en France métropolitaine. Rapport Inra-ONCFS, Rennes et Nantes. 53 pp.

Office National de la Chasse et de la Faune Sauvage

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Canada goose

(*Branta canadensis*)

Classification	
Order	Anseriformes
Family	*Anatidae*
Genus	*Branta*
Species	*B. canadensis* (Linnaeus, 1758)

Originated in North America. Introduced in Europe in the 1700s for ornamental purposes. The species started to colonise France in the 1960s and 1970s.

Description

- Large goose with a black head and neck that contrast sharply with the white cheeks and breast
- Brown body with a white underside
- The plumage is identical for the two sexes
- Adults stand 1 metre tall with a wing span of between 160 and 175 cm
- The average weight is approximately 5.2 kilograms
- The average life span is approximately 24 years

Ecology and reproduction

- The birds adapt to highly diverse habitats:
- natural or artificial wetlands near agricultural areas
- ponds, quarries, lakes, rivers, golf courses, parks, reed ponds, etc.
- In France, the species is sedentary with the birds grouped together in wintering zones and dispersed in the summer
- The species is herbivorous and feeds on reeds, grain, stalks, leaves, roots and tubers
- In Europe, the birds can nest in colonies.
- Adults and young can group in maternity colonies:
- 3 or 4 chicks constitute an average brood
- incubation lasts for 28 to 32 days
- juveniles begin to fly at 10 weeks
- first reproduction at age of 3 to 4 years
- The species is gregarious and highly tolerant of human contact

Documentation

- Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) : connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.
- Cramp S., Simmons K.E. 1977. *Handbook of the birds of Europe, the Middle Eastand North Africa. The birds of the Western Palearctic* (1) *Ostrich to Duck. Oxford, UK ; Oxford University Press. 913* pp.
- Fouque C., Schricke V., David Y., Serre D. 2011. La Bernache du Canada : une espèce exotique devenue envahissante. Diagnostic, plan de lutte et régulation. Faune Sauvage, 290 : 18-31.

Author: Emmanuelle Sarat, IUCN French committee


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Canada goose

(*Branta canadensis*)

Managing Canada geese in the Centre and Île-de-France regions

National agency for hunting and wildlife (ONCFS), Centre and Île-de-France regional office

- ONCFS is a public agency placed under the supervision of the Ecology and Agriculture ministries.
- Its missions correspond to the guidelines contained in the Grenelle environmental agreement, including general surveillance of rural areas and policing activities for the environment and hunting, and research on wildlife and its habitats.
- The Centre and Île-de-France regional office comprises a workforce of 119 based in six departmental offices in the Centre region, two in the Île-de-France region and in the regional office itself.
- Contact: Centre and Île-de-France regional office - dr.centre-iledefrance@oncfs.gouv.fr

Intervention site

- In the Centre and Île-de-France regions, Canada geese were first observed in the natural environment in 1976 and 1985. They had escaped from recreational parks or from private owners.
- The species colonised natural and artificial wetlands in the two regions, notably the park and national nature reserve in the town of Saint-Quentin-en-Yvelines, as well as the recreational park in Cergy-Pontoise where efforts to limit the species were undertaken due to the pollution of the bathing water caused in part by the population of Canada geese.
- The Centre region is home to over 5% of all wetlands in continental France, primarily in the Brenne area (1 300 ponds) and in the Sologne area (3 000 ponds). Colonisation of these areas by Canada geese can cause problems in terms of degraded environments and competition with the native species.

Disturbances and issues involved

Impacts on native species

- There is a risk of hybridisation with the barnacle goose, a protected species, and the greylag goose (ten cases were observed in 2012 in the Centre and Île-de-France regions).

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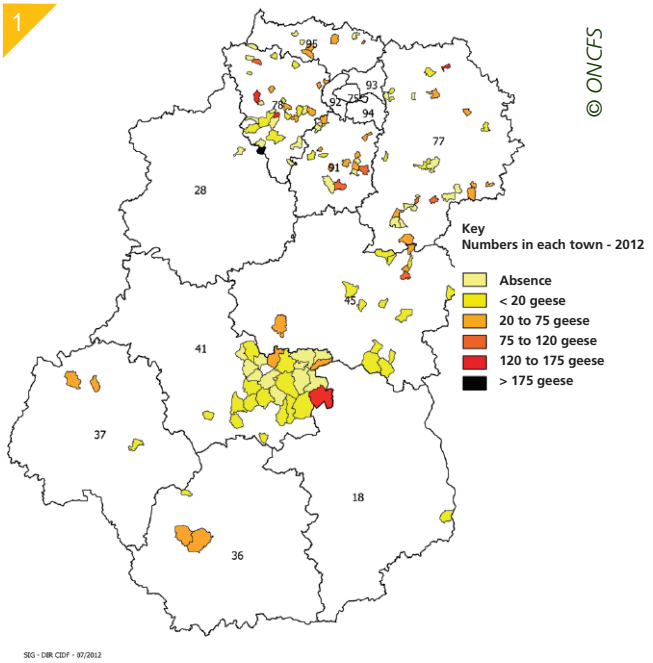


1. Winter counting of Canada geese in the Centre and Île-de-France regions.

Impacts on the environment

- The animals can damage the environment (banks and reed beds) through excessive trampling.
- They can also cause eutrophication of water due to the high input of nutrients (droppings).

Impacts on human activities and health risks

- The birds can pollute bathing waters, overgraze meadows and leave their droppings in public areas.
- These disturbances required the rapid intervention of ONCFS at the request of prefectoral authorities, in the form of efforts to limit the numbers and to count the populations during the winter.

Interventions

Monitoring populations by counting in the winter

- Annual counting operations have been carried out on wintering sites since 2006. The work is done during the period prior to dispersal of the birds in search of their breeding sites.

■ The populations of Canada geese were counted in ten departments of the two regions, starting with the towns where ONCFS personnel were aware of their presence and then expanding the search to new towns where the species had been observed.

■ In 2013, Canada geese were noted in 140 towns and a total of 3 397 birds were counted. The Île-de-France region was home to 70% of the total.

■ The annual monitoring revealed a strong increase in the numbers starting in 2010 in the Île-de-France region and apparent stability in population numbers in the Centre region.

■ Management work

■ In addition to the counting, operations to limit the populations were launched by ONCFS starting in 2007. Since 2011, in response to a ministerial circular, the control work by the ONCFS has targeted primarily protected natural areas.

A number of management methods may be used. They complement each other and must be adapted to the specific situation.

■ Sterilisation of eggs:

- spray the eggs with glycerol or with formaldehyde;
- shake the eggs to destroy the internal membrane;
- pierce the eggs with a spike.

■ The first two techniques avoid rotting of the eggs and consequently any renewed attempt to lay eggs. To be effective, sites must be systematically searched and at least 80% of the eggs must be destroyed over a period of several years.

■ Shooting using a shotgun or a rifle:

- during operations organised year round by ONCFS with prefectoral authorisation, adult and subadult geese are eliminated using firearms (shotguns and .222 Remington rifles);
- this method is highly effective and results in a long-term reduction in populations, however qualified personnel are required and attention must be paid to the safety measures and to the impact of the shooting on other species.

■ Netting:

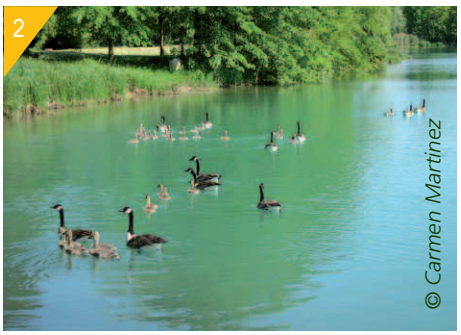
- the birds are captured during their post-nuptial moulting (when they cannot fly) on the feeding sites, using nets (5 x 5 cm mesh);
- great skill is required and only a part of the population can be targeted, however a large number of birds can be captured in a limited amount of time.

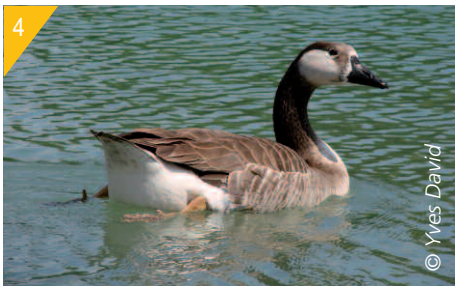
Results and assessment

■ Results

■ This initial control operation made clear that to have any real impact on the Canada goose population, it is necessary to have a comprehensive, strategic approach capable of limiting the dispersal of the population and eliminating the breeding centres.

■ Shooting was highly effective on sites where there were few possibilities to disperse. On other sites, e.g. a string of wetlands, a combination of the three techniques is indispensable to limit the spread of the species. To obtain any significant results, the management work must be pursued over the long term.





2. Canada geese.
3. Geese grouped in a field.
4. A hybrid of a Canada goose and a swan goose.
5. Sterilisation of Canada goose eggs by spiking them.
6. 7. Shooting operations.

■ Assessment

■ The table below is an example of the results from 2011.

Results of control work and human resources required (man-days) in 2011.

2011	Adults	Juveniles	Eggs	Total	Man-days
Loiret	189	22	317	528	10
Cher	25			25	0 (special authorisations)
Indre-et-Loire	No operations in 2011				0
Loir-et-Cher	121	36	112	269	25
Indre	No operations in 2011				0
Eure-et-Loir	50	0	0	50	6
Yvelines	47	3	262	312	25
Essonne	97	6	119	222	38
Val d'Oise	0	0	132	132	2
Seine-et-Marne	179	0	82	261	18
TOTAL	683	67	1 024	1 799	124

8. Raising awareness concerning the Canada goose during a public event.

Information on the project

■ Two articles on the work to control Canada geese in the Centre and Île-de-France regions were published in the *Faune sauvage* journal that devoted a report to the species in the beginning of 2011. A report and a map presenting the situation for the species are published each year by the ONCFS regional office.

■ The issues surrounding the Canada goose were also presented to the general public during various events (agricultural fair, etc.).

Outlook

■ This work requires a large number of man-days in the field, which represents a considerable cost for ONCFS.

■ Classification of the Canada goose as a huntable pest should result in a reduction in numbers at less cost, however other control measures must also be taken, notably in areas where hunting is not possible (parks, recreational areas, protected natural areas).

■ It is also necessary to take into account the risk of the birds dispersing during the operations, particularly in wetlands such as Sologne, Brenne and the Loing valley.

Rote on applicable regulations

■ The species may not be introduced into the natural environment (ministerial decree dated 30 July 2010).

■ The species may be hunted until February 2015 (ministerial decree dated 23 December 2011).

■ The species is considered a pest throughout continental France.

Author: Emmanuelle Sarat, IUCN French committee

For more information

■ Centre and Île-de-France regional office: www.oncfs.gouv.fr

■ The initial version of this document was first published in:

Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.

■ Fouque C., Schricke V., David Y., Serre D. 2011. La Bernache du Canada : une espèce exotique devenue envahissante. Diagnostic, plan de lutte et régulation. Faune Sauvage, 290 : 18-31.

■ ONCFS, délégation interrégionale Centre-Ile de France. 2012. La Bernache du Canada en régions Centre et Ile-deFrance : expérience de suivi et de gestion des populations 2011-2012. Office national de la chasse et de la faune sauvage. 15 pp.

Office National de la Chasse et de la Faune Sauvage

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Egyptian goose

(*Alopochen aegyptiaca*)

Classification	
Order	Anseriformes
Family	*Anatidae*
Genus	*Alopochen*
Species	*A. aegyptiaca* (Linnaeus, 1766)

Originated in Sub-Saharan Africa. Introduced into the U.K. at the end of the 1600s, then into Germany during the 1700s. It escaped from captivity and colonised the Netherlands, Belgium, Spain and France where the first reproduction was observed in 1985.

Description

- The bird looks like a goose, but with a special plumage:
- light-coloured head, darker neck
- chocolate-brown spot around the eye
- greyish-brown back with a brown spot
- green underwing, black tail
- Pink legs
- Adults stand 70 cm tall with a wing span of 140 cm
- The average weight ranges from 1.5 to 2.25 kg
- The average life span is between 15 and 20 years

Ecology and reproduction

- Habitats include urban water bodies, quarries and rivers
- Herbivorous diet (grass, leaves, seeds and grain). The birds can fill out their diet with insects, frogs and worms
- Reproduction can occur year round. In France, laying of eggs is observed from March to May
- The birds are gregarious during the pre-nuptial period, but aggressive during the breeding season
- Couples defend a territory of approximately one hectare
- Broods count 8 to 9 eggs that incubate for 28 to 30 days
- The young can fly after 70 to 75 days
- First reproduction at age of 2 years

Documentation

- Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.
- Fouque C., Benmergui M., Bullifon F., Schricke V. 2012. L'Ouette d'Égypte : une espèce exotique en plein essor en France, Faune Sauvage N°296 : 15-25.
- Benmergui M., Bullifon F., Fouque C. 2011. L'Ouette d'Égypte *Alopochen aegyptiaca*. Synthèse bibliographique et perspectives de gestion pour la France. Office national de la chasse et de la faune sauvage, Station de la Dombes, Birieux. 42 pp.
- Cramp S., Simmons K.E. 1977. Handbook of the birds of Europe, the Middle Eastand North Africa. The birds of the Western Palearctic (1) Ostrich to Duck. *Oxford University Press*, Oxford, UK. 913 pp.

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Author: Emmanuelle Sarat, IUCN French committee

Egyptian goose

(*Alopochen aegyptiaca*)

Managing Egyptian geese in Eastern France

National agency for hunting and wildlife (ONCFS), Northeast regional office

- ONCFS is a public agency placed under the supervision of the Ecology and Agriculture ministries.
- Its missions correspond to the guidelines contained in the Grenelle environmental agreement, including general surveillance of rural areas and policing activities for the environment and hunting, and research on wildlife and its habitats.
- The Northeast regional office covers ten departments and three administrative regions (Alsace, Lorraine and Champagne-Ardenne) with a workforce of over 100 in the local offices and 16 for administrative and technical tasks.
- Contact: ONCFS - Northeast regional office - dr.nord-est@oncfs.gouv.fr

Situation in the Northeast of France

- Most of the Egyptian geese observed in the Northeast of France come from neighbouring countries. Large populations exist in Germany, Luxembourg and Belgium. The three countries are in direct contact with the three regions that make up the Northeast regional office, namely Alsace, Lorraine and Champagne-Ardenne. An increase in the home range and in the numbers of the population in Northeast France are due to the influx from the neighbouring countries.
- The initial observations were undertaken by ONCFS in 1988 in the Moselle department and the first brood was discovered in 1996 in the town of Bousse (Moselle department).
- Today, colonisation of the territory continues with increasingly large populations along the Moselle and Rhine Rivers which act as incoming corridors for the species from the neighbouring countries. It follows that the departments bordering the rivers, namely Moselle, Meurthe-et-Moselle, Bas-Rhin and Haut-Rhin, are the most affected. However, increasing numbers of breeding couples have been observed in the neighbouring departments, namely Meuse, Vosges, Aube and Ardennes. The species is clearly in an expansion phase and the entire territory of the Northeast regional office is likely to be affected by the spread of the Egyptian goose.

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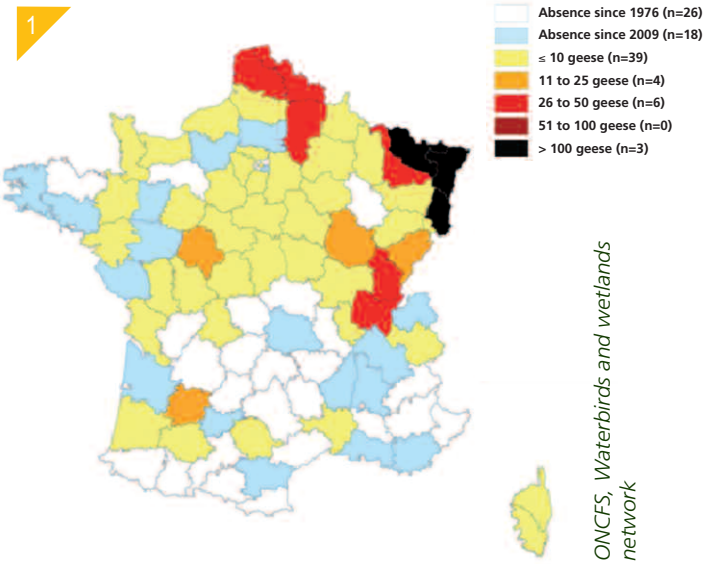

ONCFS, Waterbirds and wetlands network

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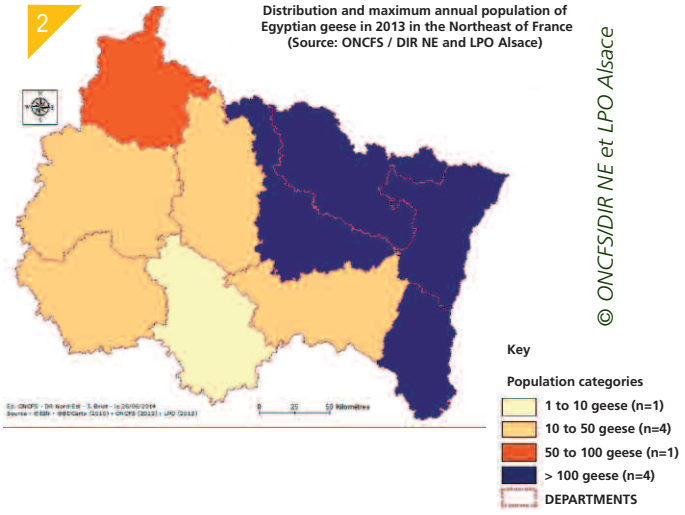

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1. Distribution and maximum annual population of Egyptian geese in France during the period 2009 to 2011.
2. Distribution and maximum annual population of Egyptian geese in the Northeast of France.

Disturbances and issues involved

Impacts on native species

- The observations carried out in the field by ONCFS personnel or by naturalists revealed aggressive behaviour of the species during the reproductive season toward protected, native species such as the great crested grebe (*Podiceps cristatus*).

Monitoring the populations

■ Following numerous observations of the species, a regional survey was launched in 2008 via the departmental offices to determine the status of the species. The survey consisted of collecting information on nesting, on the numbers of nesting couples and on their location.

■ In 2009, the national survey managed by the *Oiseaux d'eau et zones humides* network replaced the regional survey.

■ Then in 2010, the regional survey was reactivated and a map was drawn up indicating the towns where the species nested.

■ This monitoring work made it possible to precisely locate the nesting couples and to determine the departments where populations were growing rapidly. In compliance with the precautionary principle, it was decided to launch an operation to control the species and to limit its expansion.

Shooting

■ Obtaining the prefectoral orders

■ Starting in 2009 with a request by the Moselle departmental office, prefectoral orders authorising the shooting of Egyptian geese were progressively issued in several departments covered by the NE regional office on the basis of regulations concerning pests. The orders stipulated the conditions under which the Egyptian geese were to be controlled. Generally speaking, they authorised the holders of hunting rights, their beneficiaries and official personnel in charge of enforcing hunting regulations to shoot the species.

■ In order to monitor implementation of the measure and assess its effectiveness, each bird shot must be reported at the end of the month or the end of the hunting season to the departmental territorial agency, to the ONCFS departmental office or to the local hunting federation. Certain orders include models of shooting reports indicating the place and date, the number of birds eliminated and their estimated age (juvenile or adult).

■ Two periods would appear to be particularly suitable for control operations, namely March-April when the couples have formed on the nesting sites and July-August when the young birds are present. The results of operations are better when the participants have in-depth knowledge of the habits and needs of the species, and of the area where the operation takes place.

■ Example of shooting techniques used in the Bas-Rhin department

■ The use of both shotguns and rifles was found to be advantageous in eliminating the birds.

■ Number 2 steel shot was used successfully in shooting Egyptian geese.

■ In terms of rifles, the .17 HMR (1-gram projectiles) and .22 Hornet calibres produced good results.

■ In step with the repetition of operations, the geese became increasingly wary to the point that the approaches in open terrain became impossible. Surprise is of the essence.

■ Approaches using a vehicle often produced better results than on foot. However, the use of a vehicle must be explicitly mentioned among the equipment listed in the prefectoral order.

■ The partnership with the river police made it possible to use a patrol boat for one operation and to eliminate a few birds that were too far from the banks.

3. Egyptian geese.
4. 5. 6. Shooting operations.

■ Dogs were used to retrieve the dead birds and avoid them being seen by the public.
■ Given public sensitivities, birds inhabiting certain sectors cannot be eliminated. These sectors effectively become refuge zones for the species.

Results and assessment

■ Results

■ The tables below list the prefectoral orders issued in the three regions and present the results of the control operations over the years.

Results of control operations for the Egyptian goose in the Lorraine region.

Lorraine	Prefectoral order	Period	Authorised persons	Conditions	Birds eliminated
Moselle (57)	Annual order since 2009	23 August to 1 February	Holders of hunting rights and their beneficiaries Hunting police	Shooting as per hunting rules On or near water bodies Report at end of season to federation 77	2009-2010 = 29 (DO) 2010-2011 = 11 (DO) 2011-2012 = 34 (DO) / 100 (hunters) 2012-2013 = NI 2013-2014 = 137 (hunters)
Meurthe-et-Moselle (54)	Order dated 5 July 2012	Same dates as geese listed as game (21 August to 10 February)	Holders of hunting rights and their beneficiaries ONCFS personnel	Shooting under same conditions as goose hunting throughout the department Report at end of February to DO 54 by ONCFS personnel	2011-2012 = 27 (hunters) 2012-2013 = NI 2013-2014 = 12 (hunters)
Vosges (88)	Annual order since 2011	21 August to 10 February	Holders of hunting rights and their beneficiaries Hunting police	Shooting as per hunting rules On or near water bodies Report by end of February to DO 88	2011-2012 = 2 (hunters) 2012-2013 = NI 2013-2014 = 1 (hunters)
Meuse (55)	Order dated 18 July 2012	21 August to 10 February All year for authorised personnel and game wardens	Holders of hunting rights and their beneficiaries Hunting police Authorised game wardens	Shooting as per hunting rules Authorised sites for hunters Entire department for the hunting police Report by 15 March to DDT 55	2012-2013 = NI 2013-2014 = 3 (DO) / 3 (hunters)

DO = departmental office, NI = no information

Results of control operations for the Egyptian goose in the Alsace region.

Alsace	Prefectoral order	Period	Authorised persons	Conditions	Birds eliminated
Haut-Rhin (68)	Permanent order since 2010	1 October to 1 February	Holders of hunting rights and their beneficiaries Hunting police	Shooting as per hunting rules On open waters and restricted waters for hunters Entire department for the hunting police Report by 10 February to DDT 68	2010-2011 = 7 (DO) / 10 (hunters) 2011-2012 = 21 (DO) 2012-2013 = NI 2013-2014 = 34 (DO) / 5 (hunters)
Bas-Rhin (67)	Permanent order since 2011	15 April to last day of February All year for authorised personnel and game wardens	Holders of hunting rights and their beneficiaries Hunting police Authorised game wardens	Shooting as per hunting rules On open waters and restricted waters for hunters All areas where game wardens are authorised Entire department for the hunting police Report by 15 March to DDT 67	2011-2012 = 18 (DO) / 7 (wolf-hunting officers) / 36 (hunters) 2012-2013 = NI 2013-2014 = 57 (DO in 2013) / 161 (hunters)

Results of control operations for the Egyptian goose in the Champagne-Ardenne region.

Champagne-Ardennes	Prefectoral order	Period	Authorised persons	Conditions	Birds eliminated
Aube (10)	Order dated 17 June 2012	Same dates as geese listed as game (21 August to 10 February) All year for authorised personnel and game wardens	Holders of hunting rights and their beneficiaries Hunting police Authorised game wardens	Shooting as per hunting rules Entire department for the hunting police Report within 48 hours to ONCFS which produces final report at end of April	2012-2013 = NI 2013-2014= 0
Ardennes (08)	Order dated 26 December 2012	Same dates as geese listed as game (21 August to 10 February) All year for authorised personnel and game wardens	Holders of hunting rights and their beneficiaries Hunting police Authorised game wardens	Shooting as per hunting rules On open waters and restricted waters for hunters Entire department for the hunting police Report within 1 week and final report by end of February to DDT 08	2012-2013 = NI 2013-2014 = 3 (hunters)

■ Total :
- 2009-2010: 29 (department 57);
- 2010-2011: 28 (departments 57 and 68);
- 2011-2012: 245 (departments 54, 57, 67, 68, 88);
- 2012-2013: no information;
- 2013-2014: 416 (departments 57, 68, 67, 54, 55, 88, 08, 10);
- Total for the four seasons: 718

Information on the project

■ Articles were published in the *Faune Sauvage* journal.
■ Annual reports and maps.

Outlook

■ When a biological invasion occurs, it is imperative to act quickly. Prevention is the name of the game. In spite of early observations of Egyptian geese, it was not clear that the species was invasive and control measures were not implemented immediately, thus enabling the species to establish in the region. Today, the species is clearly an invasive alien species. Eradication is no longer a realistic option and the objective of the current measures is to contain the species in the north-eastern section of France and avoid colonisation of the rest of the country.
■ In addition to the efforts to limit the populations in the northeastern section of France, it is indispensable that the neighbouring countries take similar measures because the largest feral populations of Egyptian geese are located in those countries. Uniform action by the French regions and the neighbouring countries confronted with the invasion is essential to produce effective results.
■ Under the current conditions, prefectoral orders authorising the shooting of Egyptian geese are the most rapid means of limiting the spread of the species. The species is also highly recognisable which limits the risks of shooting errors. However, this control measure must not be interpreted by hunters as the addition of a new type of game, but as a special effort against an invasive alien species in order to limit the negative impacts.

■ Given the results since 2009 (over 700 geese eliminated), efforts to control the species by shooting would appear to be insufficient in light of the overall population and the growth rates of the species.

■ This situation suggests that the measure should be expanded to include all of the Moselle and Rhine basins in order to unify management techniques and exert real pressure on the species.

■ It is important to continue informing hunters, particularly the waterfowl hunting associations, on the negative aspects of biological invasions and on current regulations in order to expand their role in controlling the species.

■ Other measures, such as the creation of an observation network or interventions during the nesting period, should be studied in order to make the management of the IAS more effective.

■ Finally, it would be useful to add this species to the "invasive species" category (group 1) in the new regulations concerning animal species listed as pests. The management work could then be conducted on the national scale.

Authors: Emmanuelle Sarat, IUCN French committee, Marie-Laure Schwoerer, Paul Hurel and Blandine Guillemot, ONCFS NE regional office

7. Egyptian goose.

For more information

■ www.oncfs.gouv.fr

■ The initial version of this document was first published in:
Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.

■ Fouque C., Benmergui M., Bullifon F., Schricke V. 2012. L'Ouette d'Égypte : une espèce exotique en plein essor en France, Faune Sauvage N°296 ; pp 15-25.

■ Benmergui M., Bullifon F., Fouque C. 2011. L'Ouette d'Égypte *Alopochen aegyptiaca*. Synthèse bibliographique et perspectives de gestion pour la France. Office national de la chasse et de la faune sauvage, Station de la Dombes, Birieux. 42 pp.

■ Hurel P. 2011. Les espèces exotiques envahissantes animales du Nord-Est de la France. Inventaire, évaluation, hiérarchisation et plan d'action. Application du plan d'action sur le Castor canadien et l'Ouette d'Égypte. Rapport de stage Master Environnement et aménagement. Université Paul Verlaine, Metz, 53 pp + Annexes.

Office National de la Chasse et de la Faune Sauvage

Coypu

(*Myocastor coypus*)

Classification	
Order	Rodents
Family	*Myocastoridae*
Genus	*Myocastor*
Species	*M. coypus* (Molina, 1792)

Originated in South America. The species was introduced in France in the 1800s initially for research purposes, later for the fur industry.

Description

- A semi-aquatic rodent that can weigh up to 10 kilograms adult weight (6 kg on average)
- The fur is brown with guard hairs and a waterproof undercoat
- A massive body approximately 50 to 60 centimetres long
- The tail is cylindrical, approximately 40 cm long, with little hair
- The front paws have strong claws
- The rear feet are palmed
- Nostrils have valves to seal out water
- Orange-coloured incisors are always visible
- Females have 8 to 10 teats (two dorsolateral rows)
- Life expectancy is approximately 4 years in the natural environment

Ecology and reproduction

- The species can adapt to diverse habitats, including marshes, rivers, drainage ditches, ponds and lakes, dikes, reed ponds
- The animals dig burrows for protection against the weather and to bear young
- They are active primarily at dusk and during the night
- Gregarious tendencies, but also territorial
- Almost exclusively herbivorous, the species feeds on all types of aquatic and terrestrial plants depending on availability, which means the animals can adapt to a wide range of environments
- Prolific species with up to three litters per year and up to six young per litter

Documentation

- Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) : connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.
- Léger F. 2009. Les mammifères aquatiques exotiques envahissants – Formation Onema sur les espèces exotiques envahissantes en milieu aquatique, 25/05/2009 – 29/05/2009, Fouencamps, FRA, 209 pp. (Communication orale).
- Nepveu C. 2002. Les espèces animales et végétales susceptibles de proliférer dans les milieux aquatiques et subaquatiques - Fiches espèces animales (Les espèces exotiques). Agence de l'eau Artois-Picardie. 98 pp.

Author: Emilie Mazaubert, Irstea

Coypu

(Myocastor coypus)

Controlling populations of harmful aquatic rodents (coypu and muskrats) in the Loire-Atlantique department

Loire-Atlantique departmental federation of pest-control groups (FDGDON 44)

- FDGDON 44 is a professional farming group that is supervised by the Regional food service (SRAL).
- The executive board comprises 13 members elected by the 60 intermunicipal and municipal groups during the annual meeting.
- The federation has a permanent workforce of 11.
- The objectives are contained in the Rural code, with more precise goals stipulated in ministerial decrees and, where applicable, prefectoral and/or municipal orders. They include the organisation of collective projects against pests attacking crops, plants and plant products in the department.
- Contact:Marc Pondaven, Director
- marcpondaven-fdgdon44@wanadoo.fr

Intervention site

- The Loire-Atlantique department covers a total surface area of 6 815 square kilometres.
- The hydrographic network is very dense.
- There are two main river basins:
- the Loire, comprising the Loire itself, its tributaries and the many wetlands and littoral areas in contact with its estuary;
- the Vilaine, comprising the basins of the Chère, Don, Aron and Isac Rivers, as well as a part of the canal from Nantes to Brest.
- There are a number of coastal rivers.
- The department is made up of highly diverse environments, including large and small rivers, streams and canals, estuarine salt meadows, marshes (fresh, brackish and salt waters), ponds and lakes, littoral areas.
- Certain areas are emblematic, due to both their hydrographic functioning and their outstanding heritage value, namely the Loire estuary, the Brière area, Grand-Lieu Lake, the Mazerolles marsh and the Marais Breton marsh.

Disturbances and issues involved

Impacts on the environment

- Coypus dig burrows that can lead to the collapse of river banks and to sedimentation modifying the morphology of the environment.
- They can also reduce plant cover.

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© Wikipedia

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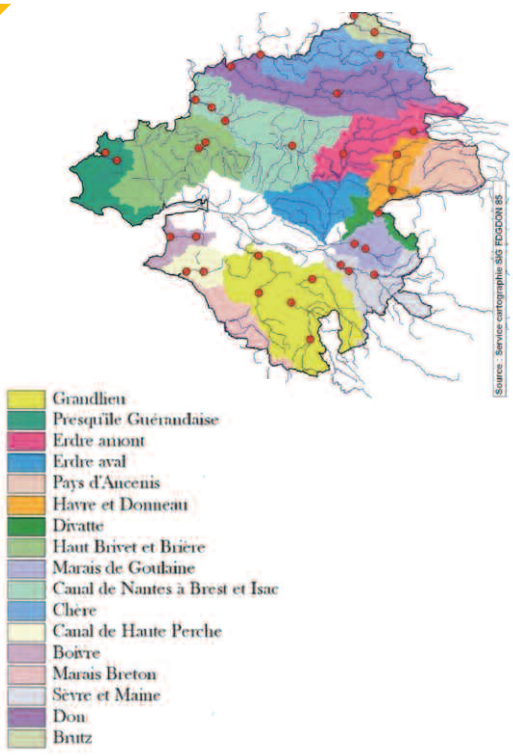

© FDGDON 44

1. Map of the Loire-Atlantique department.
2. Sites of population-density monitoring in the river basins.

■ Impacts on agriculture

■ The animals eat crops.

■ The damage to river banks creates risks for farm vehicles.

■ Impacts on hydraulic structures

■ The damage to river banks can weaken structures (dikes, bridges).

■ Impacts sanitaires

■ Contamination des eaux douces par l'urine et les excréments.

■ Possible transmission de maladies au bétail et à l'homme (leptospirose, grande douve du foie).

3. Damage to a maize field caused by coypus.

Interventions

■ Monitoring the populations

■ Prior to control work and in compliance with the ministerial order dated 8 July 2003, FDGDON conducts checks, twice per year in the spring and fall, on the densities of rodent populations in the river basins.

■ This monitoring is carried out in different parts of the department according to a strict protocol (cage traps every 50 metres).

■ The animals captured in the traps are counted, weighed and their sex determined.

■ The resulting data can be plotted graphically and indicates whether the populations in a given river basin are increasing or decreasing. This information is used to organise the control work.

■ Monitoring is a necessary and mandatory component, according to the prefectoral order organising the management efforts against coypus and muskrats.

■ A collective effort

■ FDGDON intervenes on the primary hydrographic network and volunteers on the secondary and tertiary networks.

■ FDGDON uses a number of control techniques, primarily trapping, but also shooting during collective operations and protection systems for river banks (occasionally, during maintenance work). Poison has not been used since 2003.

■ Trapping campaigns are organised by zone and an operation in a zone lasts three weeks.

■ Cages are set up every 50 metres and remain in place for the duration of the operation. They are checked daily.

■ No particular type of cage or certification is required:

- cages may be of different lengths;
- treadles may be made of sheet metal, horizontal bars or wire mesh, and installed more or less deeply in the cage;
- the cages are attached to a raft made of resin-coated cellular polycarbonate and anchored to trees or vegetation on the banks.

■ FDGDON 44 owns between 250 and 300 traps with a service life of approximately ten years:

- if vandalism and losses due to flooding are excluded, frequent causes of damage to cages are their transport and shooting the animals;
- renewal rates therefore vary significantly.

■ The type of cage used and their installation on the rafts makes them highly selective. Very few non-targeted species are captured. Any animals accidentally captured can be released without harm.
■ The captured animals are killed immediately, in the cage, using a .22 long rifle:
- technically speaking, this is the best solution because the regulations require that the animals be killed rapidly and without suffering;
- this technique is not advised for volunteers for safety reasons and due to regulations (difficulties in applying both the trapping and firearms regulations);
- alternate methods are drowning (authorised in the Loire-Atlantique department) and clubbing.
■ Technical personnel may not take action against animals on the river banks:
- different regulations apply and a hunting license is required;
- the person must have hunting rights and/or be a certified game warden for the area in question;
- in addition, .22 long rifles are not authorised for hunting.
■ The work takes place primarily during the fall and winter and in two-man teams (driver and shooter) when access to the traps requires a boat.
■ The dead animals are placed in containers in the boat and then transported to the federation.
■ The rendering service picks them up free of cost if the total weight exceeds 40 kilograms (approximately a dozen coypus). It follows that the rendering service comes fairly often.

4. A baited cage trap with a trapped coypu.

Results and costs

■ Results

■ In terms of the density monitoring, the unit of comparison is the average number of animals per kilometre of river.
■ A drop in the average number of animals captured per kilometre is an indication of the effectiveness of the management work.
■ A drop in the average weight of the captured animals highlights the value of maintaining the trapping pressure in that the animals do not have the time to age.
■ Collective shooting operations organised in certain areas (Brière and Grand-Lieu Lake) produced divergent results:
- due to variable environmental factors (water levels, temperature);
- due to the high cost of ammunition, a demotivating factor for volunteers.
■ The work nonetheless reduced the population of rodents and limited the level of infestation that would have increased if not measures had been taken.

Number of animals eliminated during the collective operations against harmful aquatic rodents from 2004 to 2010.

	2004	2005	2006	2007	2008	2009	2010
Shooting	6 931	4 818	4 282	3 493	2 395	4 426	3 791
Volunteer trapping: elimination	35 624	43 073	33 584	41 160	43 160	46 174	41 418
Volunteer trapping: surveys	962	1 946	1 250	1 354	2 031	1 333	980
FDGDON 44 technicians	2 492	2 612	2 175	2 125	2 851	2 322	2 192
TOTAL	46 009	52 449	41 291	48 132	50 437	54 255	48 381

FDGDON 44: Table drawn from the general meeting held on 1 April 2011

Intervention costs

- Costs varied depending on tariffs and environmental conditions:
- in areas accessible by boat, costs were approximately 900 euros per kilometre;
- in areas not accessible by boat, costs were higher due to the time required to access difficult spots and the more expensive equipment required;
- costs for density monitoring were lower because FDGDON 44 paid for some expenses.
- Management costs were lower than the potential restoration costs of the avoided impacts.
- The participation of volunteers reduced the costs while producing good results.

Information on the project

- Of the 220 towns in the Loire-Atlantique department, over 190 are members of FDGDON for the management work against coypus and muskrats. The other towns have hydrographic networks that do not require work against these species (e.g. no ponds or rivers).
- FDGDON prepares the volunteer networks in conjunction with the towns and manages them:
- organisation, training;
- dissemination of information (regulations, etc.);
- organisation of an annual meeting to discuss results, new regulations, map sites and trapped areas;
- meet all the trappers in the field to monitor captures and collect the tails for the bounty.
- FDGDON regularly informs the managers of natural areas and newly formed river boards about the obligations concerning species that must be controlled.

Note on applicable regulations

- According to the interministerial decree dated 6 April 2007, coypus and muskrats are pests that must be controlled in the framework of plant-protection regulations.

Author: Emilie Mazaubert, Irstea

For more information

- http://www.fdgdon44.fr

FDGDON44
LOIRE-ATLANTIQUE

Coypu

(*Myocastor coypus*)

Coypu management by the Association of certified trappers for the Gironde department

Association of certified trappers for the Gironde department (ADPAG)

- The non-profit organisation was founded in 1997 and is certified for environmental protection.
- The main missions include:

- representing the certified trappers in the Gironde department in their dealings with the administrative, professional and hunting authorities;
- managing and informing the certified trappers concerning regulations and safety;
- organising the capture of pests.

- Contact: Gérard Delas - gerard.delas@club-internet.fr

Intervention site

- ADPAG represents the certified trappers (both professional and volunteer) that operate in the towns of the Gironde department.
- The association coordinates trapping by signing agreements with various entities (towns, intermunicipal associations, river boards, farmers, the Bordeaux urban area, the departmental council, etc.).
- Coypus have been trapped in the Gironde department since 1997. During the 2011-2012 season, certified trappers were active in 263 out of the 542 towns in the department.
- The traps are generally positioned near aquatic environments (rivers, wetlands), on the banks, in compliance with the applicable regulations (annual prefectoral order).

Disturbances and issues involved

Impacts on the ecosystem

- The animals consume aquatic macrophytes and the roots and bark of shrubs on banks in the winter.
- They undermine banks by digging burrows and eating the shrubs on the banks.

Impacts on health

- Coypus may transmit leptospirosis to humans and livestock.

Impacts on agriculture

- The animals eat crops (wheat, maize, etc.).

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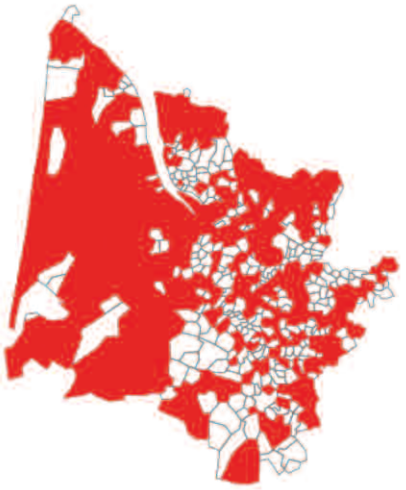


1. Towns in the Gironde department where coypus are captured by certified trappers.

Interventions

- ADPAG coordinates trapping by the certified trappers in the Gironde department and draws up an annual report on coypu trapping on the basis of the data supplied by the trappers. Trapping activities are reported to the administrative authorities in each town.
- Trapping:

- operations are conducted throughout the year and the results are assessed at the end of June;
- cage traps with a single entry are used;
- bait consists of apples, carrots or maize;
- the traps have escape holes (5 x 5 cm) for European mink that must be open from April to the end of July when the traps are laid less than 200 metres from water bodies and wetlands in compliance with the prefectoral order;
- the traps are supplied by ADPAG;
- traps are checked daily in compliance with the applicable regulations.

- Capture data:

- data is compiled on the basis of the “capture-data sheets” sent to trappers at the end of June;
- the sheets list the captures of pests such as coypus, indicating the number per town, species by species (pests and released other species).

■ The trapping effort is assessed on the basis of “trapping-pressure sheets” indicating the number of trapping days and the number of traps laid in each town.

Results and costs

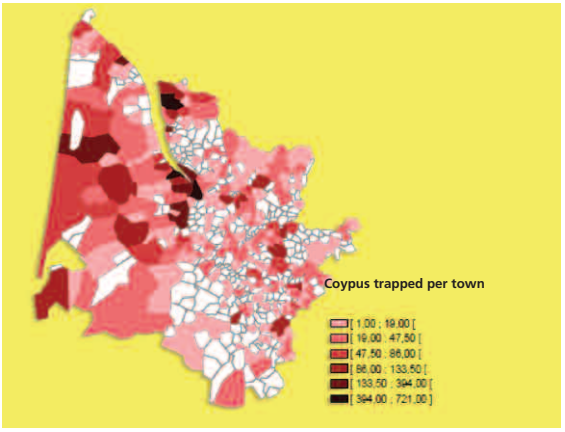
■ Results of the 2012-2013 season

■ 1 118 capture-data sheets were submitted by trappers.
■ 9 813 coypus were captured in 261 towns throughout the department (706 925 hectares).
■ 357 certified trappers took part in the campaign.
■ 28 coypus were caught on average by each trapper.
■ 235 769 trap-days for the department as a whole.

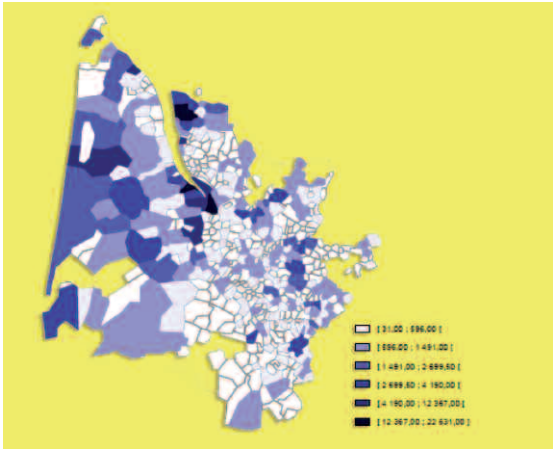
■ Costs

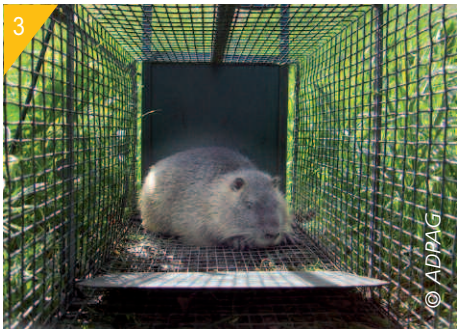
■ The overall increase in trapped coypus was probably due to the greater number of trappers.
■ Starting in 2009, there was a decrease in the total number of animals captured and in the number of coypus trapped per square kilometre.
■ ADPAG decided to calculate the density of coypus per square kilometre because that would appear to correspond to the home range of the species.
■ The operations since 2006 cost 50 000 euros for the equipment and 30 000 euros in bounties for the trappers (3 euros per animal) and operating costs.
■ The main difficulty encountered concerned the theft of or damage to the traps.

Average number of coypus captured per square kilometre per town during the 2011-2012 season.



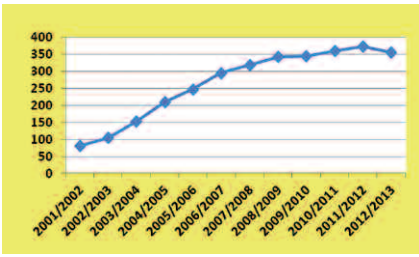
Total number of trap-days per town during the 2012-2013 season.



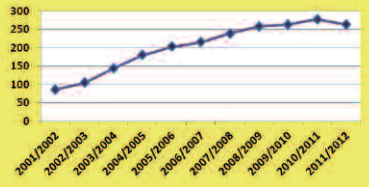


2. A coypu on a bank.
3. A coypu captured in a cage trap.
4. A cage trap for coypus with an opening for European mink.

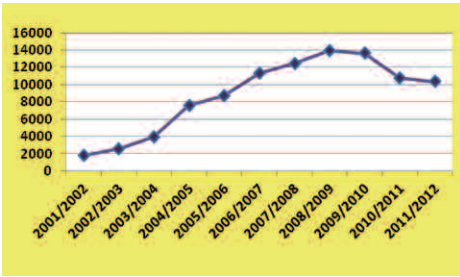
Total number of trappers from 2001 to 2013.



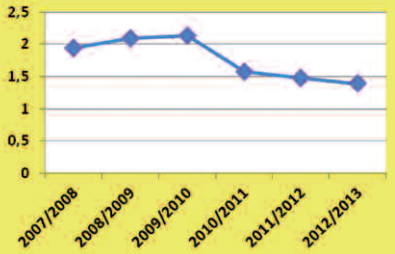
Number of towns in which at least one coypu was trapped from 2001 to 2013.



Annual number of coypus trapped from 2001 to 2013.



Average number of coypus trapped per square kilometre from 2007 to 2013.



Information on the project

■ Mandatory upgrade courses on techniques, regulations and awareness raising are provided for certified trappers every five years in agricultural training schools.
■ The annual trapping report is published on the ADPAG internet site with information on initial and upgrade training courses for trappers.

Outlook

■ An effort is under way to determine the cause of the reduction in the coypu population (trapping pressure, weather conditions, etc.).
■ A policy officer will be hired to encourage the pursuit of the trapping operations and to coordinate the volunteer trappers.

Note on applicable regulations

■ The species is considered a pest throughout continental France (ministerial decree dated 24 March 2014).
■ The species is harmful to plants and must be controlled (ministerial decree dated 31 July 2000, modified by ministerial decree dated 25 August 2011).
■ The conditions for the control of coypu and muskrat populations were set by decree dated 6 April 2007.
■ Trapping conditions for animals declared as pests were set by decree dated 27 June 2009, modified by the decree dated 13 December 2011.

Author: Sandra Fernandez, Irstea

For more information

■ ADPAG internet site: http://www.adpag.fr/
■ ADPAG, avril 2012. Le ragondin en Gironde – Saison 2010/2011.
■ ADPAG, avril 2013. Le ragondin en Gironde – Saison 2011/2012.
■ ADPAG, mai 2013. Synthèse du piégeage en Gironde – Saison 2011/2012.
■ ADPAG, novembre 2013. Synthèse du piégeage en Gironde – Saison 2012/2013.

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Muskrat

(*Ondatra zibethicus*)

Classification	
Order	Rodents
Family	*Muridae*
Genus	*Ondatra*
Species	*O. zibethicus* (Linnaeus, 1766)

Originated in North America. Introduced in France in 1920 for the fur industry

Description

- Semi-aquatic rodent weighing between 0.6 and 2 kilograms
- Dark brown, thick, waterproof fur, grey fur on the stomach
- A stocky body approximately 30 centimetres long
- A thin tail flattened vertically, approximately 20 cm long, with scaly skin
- Short snout, small eyes and short ears hidden under the fur
- The rear feet are not palmed, but the toes are covered with tufts of hairs
- Chisel-shaped incisors, yellow-orange in adults
- Two musk glands are located under the skin near the rectum
- Life expectancy is approximately 4 years in the natural environment

Ecology and reproduction

- Habitats range from running to stagnant waters with high levels of aquatic vegetation
- The animals dig burrows into banks and build huts
- They are active primarily at dusk and during the night
- The species is essentially herbivorous, though it occasionally eats molluscs and crustaceans
- The females bear young 3 to 4 times per year with 3 to 7 young per litter

Documentation

- Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) : connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.
- Nepveu C. 2002. Les espèces animales et végétales susceptibles de proliférer dans les milieux aquatiques et subaquatiques - Fiches espèces animales (Les espèces exotiques). Agence de l'eau Artois-Picardie. 98 pp.

Author: Emilie Mazaubert, Irstea

Muskrat

(*Ondatra zibethicus*)

Managing muskrats in the Somme department

Departmental river and maritime agency

■ The agency became part of the operational and infrastructure-maintenance directorate of the departmental council as of 1 January 2008.

■ The agency works on the public river and maritime domain of the Somme department, i.e. 720 hectares comprising 120 kilometres of waterways and tow-paths as well as 30 km of natural rivers and discharge channels.

■ The main missions include:

- management of visits to and activities in the river domain (river tourism and traffic, fishing, boating, hiking, etc.);
- maintenance and work on the banks;
- maintenance and upgrading of structures;
- IAS management by an "IAS unit" that traps rock doves and European rabbits, manages invasive alien plant species along the Somme canal (Japanese knotweed, water primrose, summer lilac, giant hogweed, garden balsam and goldenrod) and controls muskrats.

■ Contacts: David Dhennin - d.dhennin@somme.fr, head of the Canal operating and infrastructure service, Somme departmental council;
Jean-Louis Derosière - jlderosiere@somme.fr, head of the IAS unit.

Intervention site

■ The Somme department comprises over 1 000 kilometres of river, 6 000 hectares of water bodies and a wide array of highly diverse wetlands. The basin of the Somme River spans the entire department. The river begins in the Aisne department and flows to the Somme Bay.

■ The IAS unit operates in part in the public river and maritime domain, which is simply the river basin from Sourmont to the estuary.

■ For muskrats, the unit also works in sectors outside the domain on tributaries to the Somme, on the Bresle and Authie Rivers (two coastal rivers just outside departmental limits) and on the Marquenterre area (low-lying fields, ditches, etc.).

■ On the other hand, the unit is not responsible for other types of water bodies (public and private marshes, ponds).

1

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1. The basin of the Somme River and the hydrographic network of the Somme department.

Disturbances and issues involved

■ Muskrats have very few predators in France, with the exception of humans, foxes and skunk, which explains their very wide dispersion

■ Impacts on the environment

■ The animals dig burrows, leading to the collapse of river banks.

■ They can also reduce plant cover.

■ Muskrats compete with native species such as the European water vole.

■ They are also predators of native species (amphibians and anodonta (freshwater mussels)).

■ Impacts on agriculture and vegetable farming

■ The animals occasionally eat crops.

■ Impacts on structures

■ The damage to river banks can weaken structures (dikes, bridges).

■ Muskrats eat the bark of willow trees planted on the banks.

■ Impacts on health

■ The animals can pollute fresh waters with their urine and feces, creating a risk of transmission of diseases (leptospirosis and echinococcosis) to humans and livestock.

■ These disturbances resulted in the signing of a prefectoral order on 28 June 2007, listing muskrats among "pests" in the Somme department.

Interventions

■ In managing muskrats in the Somme department, the IAS unit decided in favour of a highly regulated technique, trapping. Trapping activities must be declared annually in each town hall.

■ Human resources and equipment:

- four professional trappers including one general purpose (maintenance of river equipment, operations);
- the trappers each work a separate geographic sector except along the Somme canal where they work together;
- three 4-wheel drive vehicles are used;
- a motorised boat is available.

■ Two types of trap are used:

- category-1 traps (declaration in town hall required, but no certification), e.g. cage traps with plant bait;
- category-2 traps (require certification), e.g. conibear traps, steel-jaw traps.

■ Trapping is carried out throughout the year. Sites are selected depending on the number of animals present.

■ The abundance of muskrats is determined according to the damage done to banks.

■ Traps are checked daily before noon in compliance with the applicable regulations.

2. Burrows dug into a bank.

Results and assessment

■ Results for 2012

■ Traps were laid approximately 10 000 times.

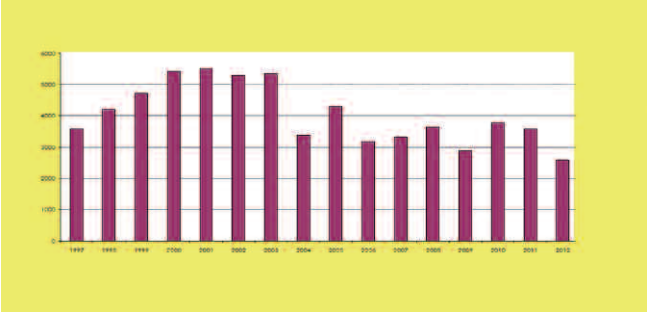
■ A total of 2 594 muskrats were captured.

■ Quantitative capture data has been collected since 1997. The number of captures varies from one year to the next, depending on several factors, including the reproductive success of the species, weather conditions, hydrological (water-level) conditions and possible access to areas by trappers. It should be noted that the number of trappers can also vary from one year to the next.

Muskrat captures in 2012. Source ADFM.

Mois	Muskrats trapped in the public river and maritime domain	Muskrats trapped outside of the public river and maritime domain	Total per month
January		457	457
February		345	345
March		314	314
April	53	34	87
May	30		30
June	80	26	106
July	32		32
August			0
September		9	9
October	25	287	312
November	67	512	579
December		323	323
Annual total	**287**	**2 307**	**2 594**

Muskrats trapped per unit of effort from 1997 to 2012.



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3. A muskrat captured in a cage trap.

■ Assessment of Jean Louis Derosière, trapper and head of the IAS unit

■ On the whole, the number of trapped muskrats has decreased.

■ The decrease in the number of muskrats in the Somme department is linked to the increase in the red fox (*Vulpes vulpes*) population.

■ Captures have increased from September to March and particularly from November to March, the reproductive season.

■ Difficulties encountered

■ The safety distances for category-2 traps (more than 200 metres from homes and 50 metres from public roads) were a major constraint, particularly along the Somme canal.

■ Volunteer trappers rarely worked on private properties and on ponds and lakes, most likely given the insufficient financial incentives.

■ It was difficult to access the banks of certain rivers and ditches not maintained by local residents.

Information on the project

■ An annual report on muskrat management is drafted and distributed to partners (departmental territorial and maritime agency, Somme hunting federation and the National agency for hunting and wildlife).

■ Information on the trapping campaigns is included in the declarations to each town hall.

■ Training is provided to volunteers on the equipment used to trap muskrats, e.g. for the game wardens of the Somme fishing federation.

Outlook

■ The presence of new invasive alien species in the hydrographic network is monitored:

- information is relayed to the managers of the hydrographic network;
- personnel are trained to recognise the species by the Bailleul national botanical conservatory.

Note on applicable regulations

- The species may not be introduced into the natural environment (ministerial decree dated 30 July 2010).
- Possession of the species is subject to an authorisation (ministerial decrees dated 10 August 2004).
- The species is listed among those that may be hunted (ministerial decree dated 26 June 1987).
- The species is considered a pest throughout continental France (ministerial decree dated 24 March 2014).
- The species is harmful to plants and must be controlled (ministerial decree dated 31 July 2000, modified by ministerial decree dated 25 August 2011).
- The conditions for the control of coypu and muskrat populations were set by decree dated 6 April 2007.
- Trapping conditions for animals declared as pests were set by decree dated 27 June 2009, modified by the decree dated 13 December 2011.

Author: Sandra Fernandez, Irstea

For more information

- Internet site of the Somme hunting federation: http://www.fdc80.com/20-la-fdc80/45-le-piegeage.html
- Internet site of the National union of certified trappers: http://www.unapaf.com/pieges.php
- Meresse G. 2008. La lutte contre le Rat musqué dans la Somme. État des lieux, proposition. Rapport de stage, 48 pp.
- ADFM, 2013. Évolution des captures de rat musqué par l'unité "gestion des espèces invasives" du Conseil général.
- ADFM, 2013. Indicateurs de lutte contre les espèces invasives 2012.
- Boidin R. 2012. L'agence départementale fluviale et maritime. La lutte contre les espèces invasives et la maintenance des équipements de loisir, 29 pp.
- Présentation « Régulation du Rat musqué *Ondatra zibethicus* par le Conseil général de la Somme », séminaire Onema-Cemagref « Gestion des espèces invasives en milieu aquatique », oct. 2010.
- Document de France nature environnement : « Ragondin, Rat musqué, stop au poison. Les alternatives à l'utilisation des anticoagulants en milieu naturel ».
- Presentation of the Somme river basin on the site of the Somme basin management board: http://www.ameva.org/?q=content/lebas-sin-versant/

somme

Muskrat

(*Ondatra zibethicus*)

Managing muskrats in the Audomarois marshes

Ondatra pest-control group

- Non-profit organisation founded in 1955, transformed into a pest-control group in 2003 (ministerial decree).
- The main missions include:

- coordinating volunteer trapping of muskrats in the Saint-Omer urban area (CASO), e.g. collecting the muskrat tails, paying the trappers, providing the traps;
- raising awareness and organising training courses for trappers.

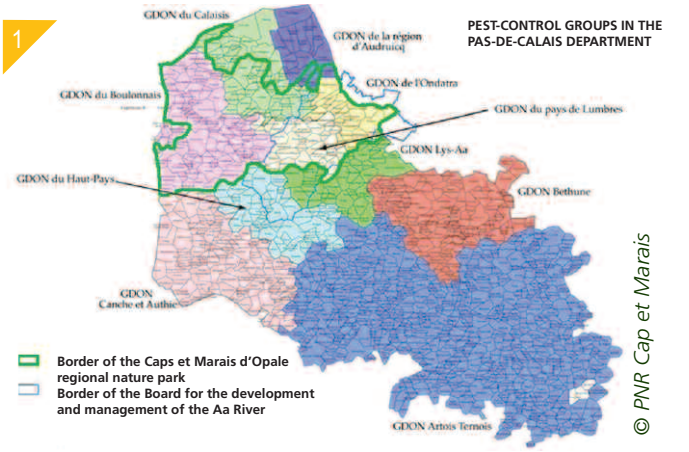
- Contact: Marie Lefebvre, President
- mairie-de-serques@wanadoo.fr

The Caps et Marais d'Opale regional nature park

- The park was created in March 2000 by merging the Boulonnais and Audomarois parks. It is managed by a board comprising 152 towns, 6 intermunicipal associations, 5 consular bodies, the Pas-de-Calais departmental council and the Nord-Pas-de-Calais regional council.
- The park provides technical and administrative assistance to the Ondatra pest-control group (organisation of tail collections, informational activities, assessments and board meetings, etc.).
- Contacts: Luc Barbier - lbarbier@parc-opale.fr, Clémentine Coulon - ccoulon@parc-opale.fr

Intervention site

- The Caps et Marais d'Opale regional nature park is located in the northern part of the Pas-de-Calais department. The landforms are highly diverse and include littoral environments (dunes, cliffs and estuaries), marshes and wetlands, forests, bocage landscapes, limestone swards and heathlands.
- The Ondatra pest-control group works in the Saint-Omer urban area (CASO), which is made up of 19 towns belonging to the regional nature park.



1. Map of the Caps et Marais d'Opale regional nature park, March 2005. DDAF 82, Nord-Pas-de-Calais regional council, Smage Aa, Cap et Marais d'Opale regional nature park.

Disturbances and issues involved

Ecological impacts

- Muskrats compete with native species such as the European water vole.
- They are also predators of freshwater mussels that are required for the reproduction of the Amur bitterling (*Rhodeus sericeus*), a freshwater fish species.
- They dig burrows that destabilise banks and canals.
- Muskrats are a vector of disease and parasites (*fasciolosis, leptospirosis, tularemia, alveolar echinococcosis*).

Impacts on human activities

- Damage to crops (cereals, beets, vegetables) and to meadows.
- Damage to banks and dikes.
- Damage to roads (undermining).
- Problems for fishing and fish farming (loss of water from ponds, damage to nets, destruction of spawning grounds).

Interventions

- The Ondatra pest-control group manages trapping of muskrats by volunteer and professional trappers in the Saint-Omer urban area (CASO) in a partnership with the Caps et Marais d'Opale regional nature park.

■ Trapping

■ Trapping is carried out year round.

■ Conibear and cage traps are supplied by the pest-control group to the volunteers.

■ The group collects the muskrat tails from the volunteer trappers and pays a bounty of 1.50 euros per tail.

■ An annual trapping report compiles the data from:

- the volunteer trappers (approximately 40);
- the professional trappers, including two from CASO, one from the town of Saint-Omer and one from Eden 62, the Board for the management of sensitive natural areas in the Pas-de-Calais department.

■ Results

■ Muskrat populations have been in decline since 2011. The pest-control group has the unconditional financial support of its local partners in balancing its budget, which means it can pursue its work over the long term.

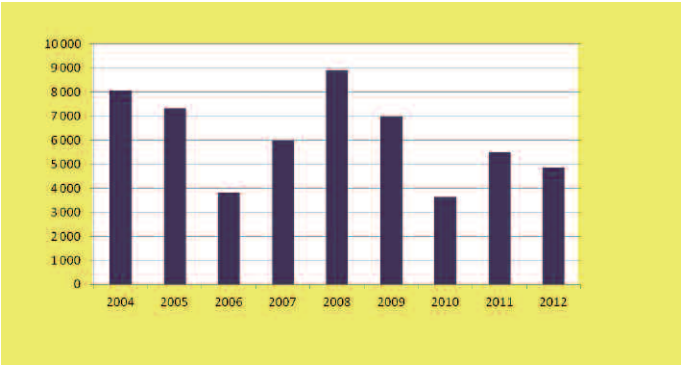
■ The number of volunteer trappers has stabilised at around 40, with a majority of retired persons. It is difficult to convince new trappers because the work takes a great deal of time.

■ It is probable that chemical means, though prohibited, continue to be used to a certain degree.

■ It is necessary to continue efforts to recruit new trappers, to reward them and maintain their enthusiasm, notably by organising meetings.

2. 3. Ondathra zibethicus.

Annual captures.



*Annual captures by type of trapper. (NI: no information, * up to October 2013, ** up to 18 November 2013).*

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CASO trappers	1 949	2 644	1 432	1 541	1 863	1 473	1 382	2 058	1 776	1 012 *
Departmental brigade	NR	245	NR	NR	0	0	0	0	-	-
Tail bounty	5 929	4 440	2 393	4 439	6 890	5 417	2 144	3 334	3 182	2 893
(incl. high-impact operation)	-	-	-	-	-	-	-	-	[1 145]	[549]
Saint-Omer trapper	-	-	-	-	154	73	110	126	227	114 *
Romelaere protocol	78	45	31	24	50	23	16	-	-	-
Eden 62	-	-	-	-	-	-	-	58	106	51 **
TOTAL	7 956	7 374	3 856	6 004	8 957	6 986	3 652	5 576	5 291	4 070

Funding of traps and tail bounties for the year 2013.

Source of funds	Amount
CASO	10 000 €
7th section Wateringues	1 500 €
AAPPMA la Concorde	400 €
Fees	91 €
Total	**11 991 €**

Information on the project

- Every two years, a training programme for trapping certification is organised in a partnership with the Pas-de-Calais departmental hunting federation.
- In March, a meeting is organised with the volunteer and professional trappers to check traps in the field, talk shop, review regulations and sit down for a good meal.
- During February and March, over a three-week period, a "high-impact operation" is organised in a favourable trapping period. The objective is to lay as many traps as possible over a short period, involving a maximum number of volunteer and professional trappers.
- A brochure, prepared in conjunction with a doctor on the health risks involved in trapping, was distributed to the trappers.
- Articles on the work (meetings, tail collections, high-impact operations) are regularly published in the local press (*Indépendant* newspaper, *Voix du Nord* newspaper).

Outlook

- The yearly meetings in March will be continued to bring together and motivate the trappers.
- An exhibition on muskrats and trapping will be prepared to inform the public and elected officials, and to recruit new trappers.
- Information on the pest-control group will be supplied to the press.

Note on applicable regulations

- The species may not be introduced into the natural environment (ministerial decree dated 30 July 2010).
- Possession of the species is subject to an authorisation (ministerial decrees dated 10 August 2004).
- The species is listed among those that may be hunted (ministerial decree dated 26 June 1987).
- The species is considered a pest throughout continental France (ministerial decree dated 24 March 2014).
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- Trapping conditions for animals declared as pests were set by decree dated 27 June 2009, modified by the decree dated 13 December 2011.

Author: Sandra Fernandez, Irstea

4. Cage trap.

For more information

- Internet site of the Saint-Omer urban area (CASO): http://www.ca-stomer.fr/
- Ondatra pest-control group, 2013. Note on operating conditions.

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American mink

(*Neovison vison*)

Classification	
Order	Carnivores
Family	*Mustelidae*
Genus	*Neovison*
Species	*Neovison vison* (Schreber, 1777)

Originated in North America. Imported in France for the fur industry (first seen in breeding centres in the Savoie and Haute-Savoie departments in 1926).

Description

- A thin, fusiform body, 41 to 62 centimetres long for adults
- Adults vary in weight between 0.6 and 1.8 kilograms
- Sexual dimorphism with males larger than females
- Flattened snout
- Short legs
- Small, round ears
- Dark brown fur over the entire body
- The animals may have a white spot on the chin and/or the throat, in rare cases on the upper lip

Ecology and reproduction

- A semi-aquatic species, living exclusively in wetlands:
- small to mid-sized rivers, forest rivers
- floodable wooded areas
- marshes, wet meadows and streams through farm land
- in maritime environments along inlets, on islands, etc.
- The animals live in burrows dug into river banks and between tree roots, but they can also sleep in the open or in hollow trees
- The species is a generalist carnivore that consumes amphibians, crustaceans, semi-aquatic mammals, birds and eggs, fish, etc.
- The animals can hunt both in water and on land
- Sexual maturity is reached quickly, after just one year:
- mating season from the end of February to the beginning of April
- birth of young from March to June, 2 to 7 young per litter
- Life expectancy is 3 to 6 years in the natural environment

Documentation

- Sarat E. (coord.) 2012. Vertébrés exotiques envahissants du bassin de la Loire (hors poissons) : connaissances et expériences de gestion. Office national de la chasse et de la faune sauvage, Plan Loire Grandeur Nature, 128 pp.
- A page on the American mink on the *Les petits carnivores de Bourgogne et Franche-Comté* internet site: http://droitnature.free.fr/NouveauSite/visonamerique.htm.

Author: Emilie Mazaubert, Irstea

American mink

(*Neovison vison*)

Control programme for American mink in the Midi-Pyrénées region

Midi-Pyrénées regional hunting federation

- The federation is a non-profit organisation, certified for environmental protection, with articles drafted in compliance with the applicable ministerial decree. It represents the departmental federations in the region and is in charge of coordinating regional and inter-departmental projects.
- It is a member of the technical committee in charge of reducing the pressure exerted by the American mink, in the framework of the 2007-2011 national plan to restore the European mink (*Mustela lutreola*).
- Manager of the control programme for American mink (*Neovion vison*) in the Midi-Pyrénées region, in a partnership with the hunting federations of the Hautes-Pyrénées and the Gers departments.
- Contact: Karine Saint-Hilaire - frcmp@chasseurde-france.com

2010-2013 control programme for American mink

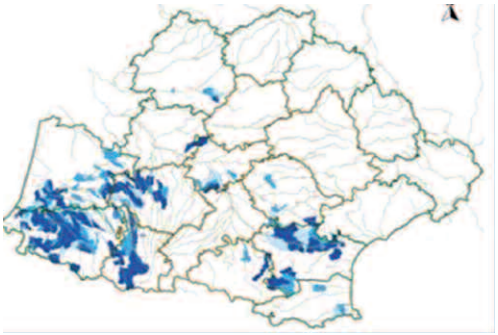
- The programme was set up in response to the objectives of the second national plan to restore the European mink (2007-2011), namely to “reduce the competition with the American mink”.
- The control programme included five aspects:

- project management;
- purchase of equipment and development of skills;
- organisation of trapping and verification of captures;
- consolidation of knowledge on the American mink in the Midi-Pyrénées region;
- information on the project.

- The objectives were to:

- determine the distribution of the American mink in the Midi-Pyrénées region;
- pursue and expand control work (reduce population numbers, limit the spread) on the American mink along the edges of the range of the European mink;
- provide additional information for the report and the outlook of the national restoration plan for European mink.

- The project was run by the regional and departmental hunting federations, in a partnership with the trapper association of the Hautes-Pyrénées and Gers departments and the ONCFS regional office, with support from the EU and the Midi-Pyrénées regional environmental directorate.



1. Distribution of European mink in the Midi-Pyrénées region and the adjacent departments from 2007 to 2012. Map: FRC MP Anaïs Borrell, August 2012.

Intervention site

- In 1999, three feral populations of American mink had been observed in France, including one located in several hydrographic sectors of the Adour River in Southwest France (Aquitaine and Midi-Pyrénées regions).
- In 2012, as part of the control programme for American mink, a study was conducted in the Midi-Pyrénées region and neighbouring departments to determine the distribution of the American mink population in Southwest France.
- The campaigns to capture American minks took place only in the Hautes-Pyrénées and Gers departments (the only ones taking part in the plan for European minks).

Disturbances and issues involved

- The presence of American mink in the natural environment in France is the consequence of the animals regularly escaping from farms set up for the fur industry starting in 1926.
- The population in Southwestern France appeared in the 1980s, in the Pyrénées-Atlantiques and Hautes-Pyrénées departments. In the 1990s, this population spread to the Gers and Landes departments.
- In the Midi-Pyrénées region, the primary objective of the work to control American-mink populations is to preserve native species.
- In the competition with the European mink, the American mink has the upper hand:

- the European mink is a protected species in Europe (Bern convention and listing in the Annexes II and IV of the

Habitats directive) and on the national level (interministerial decree dated 23 April 2007), and a species for which two national restoration plans have been set up (2000 to 2004 and 2007 to 2011);
- the native species occupies the same ecological niche as the American mink and its populations have regressed severely. However, the Hautes-Pyrénées and Gers departments are acknowledged as areas in which the European mink could stage a comeback.
■ The invasive species is a generalist and opportunistic predator of a wide range of prey, including:
- birds in contact with aquatic environments, amphibians, poultry, fish (impacts on fish farms), etc.;
- occasionally the Pyrenean desman (*Galemys pyrenaicus*), an insectivorous mammal endemic to the Pyrenees and for which a national action plan exists.
■ The species can transmit diseases to the native fauna and to humans (canine distemper, parvovirus, leptospirosis, etc.).

Interventions

■ Study on the distribution of the American mink in the Midi-Pyrénées region

■ The national survey launched in 1999 by ONCFS and the data-collection work carried out in 2011 for the Atlas of mammals in the Midi-Pyrénées region noted the presence of an American-mink population in Southwestern France (Hautes-Pyrénées, Pyrénées-Atlantiques, Landes and Gers departments), but also mentioned a dozen observations of individual animals in the *Montagne Noire* area (Aude and Tarn departments).
■ In the framework of the control programme for American mink in the Midi-Pyrénées region, a regional survey was conducted in 2012 to update the available knowledge on colonisation by the species in Southwestern France and anticipate any possible spreading of the population.
■ The survey was conducted under the following conditions:
- collection of data spanning the period from July 2007 to June 2012;
- in the Midi-Pyrénées region and the adjacent departments;
- the recipients of the survey results included the 19 departmental hunting federations, the 8 departmental associations of certified trappers in the Midi-Pyrénées region (following information provided to the National union of certified trappers and to the existing regional unions), ONCFS local offices, naturalist groups (Nature Midi-Pyrénées, nature conservatories, etc.), the regional environmental directorate, the departmental territorial agencies, Onema, the regional nature parks, etc.;
- participants filled out two Excel tables sent via email. The first served to identify the respondent and the second contained the data on each observation (date, geographic coordinates, observation conditions and circumstances), any information on the possible presence of a litter, on the possible origins of the animal(s) and any information confirming the observation (photos, cadaver, etc.);
- where possible, on-site meetings with local stakeholders, essentially in the Hautes-Pyrénées and Gers departments.

■ Trapping campaigns

■ The campaigns to capture American minks took place in the Hautes-Pyrénées and Gers departments (the departments participating in the national restoration plan for European minks).

2. American mink.
3. 4. American minks captured in a cage trap.

■ The work was done by a network of volunteer trappers who received:
- cage traps (category-1 traps) free of cost from the departmental hunting federations. Use of this type of trap requires certification and a declaration in the town hall of each town where traps are set;
- assistance from a federation technician who confirmed the type of species captured. Confirmation was mandatory for the 2011-2012 campaign in the Gers department, but not in the Hautes-Pyrénées department (according to the prefectoral orders);
- compensation for costs incurred for protocol compliance in the form of 20 euros for each American mink captured alive and confirmed by a technician.
* Each trapper filled out a sheet listing the captures.
* The captured minks were euthanised (shot).

Results and assessment

■ Survey results

■ The range of American mink in Southwestern France increased after the 1999 survey.

■ The survey confirmed the existence of a fourth population in the eastern section of the Midi-Pyrénées region, in the *Montagne Noire* area.

■ In the future, there is a risk that the various populations will merge in the Haute-Garonne department, coming together via the *Canal du Midi* and its tributaries.

■ Results of the trapping campaigns in 2011-2012 and 2012-2013

Trapper activity during the 2011-2012 season.
Source: Departmental hunting federations.

Department	65	32
Total number of trappers in the department	350	282
Trappers that contacted the technician for confirmation	10	10
Trappers that captured at least one American mink	9	7

Captures during the 2011-2012 season.

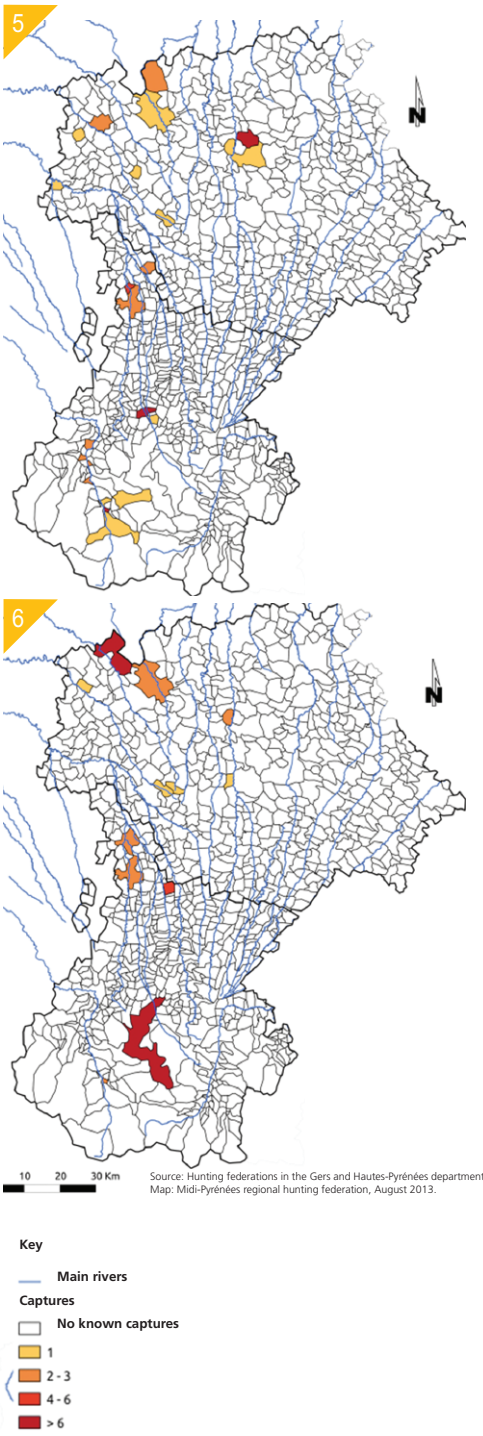
Department	65	32
Towns with confirmed captures	≈ 10	11
Checked captures	57	27
Confirmed American minks	54	19
Other species	3 skunks	8 skunks

■ Costs

■ The results were achieved by a dozen trappers actively targeting the American mink (regular trapping in areas with confirmed presence of the species).

■ The captures are not particularly representative of the actual presence of the species in the departments because trapping was often carried out in the same places throughout the year.

■ The objectives in terms of the numbers of captures (based on the trapping declarations of the previous years) were not met:
- Hautes-Pyrénées department: 150;
- Gers department: 100.



5. Captures of American minks in the Gers and Hautes-Pyrénées departments. Season 2011-2012.
6. Season 2012-2013.

■ It was difficult to motivate the trappers in the Gers department due to the modifications and uncertainties in trapping conditions between 2012 and 2013.
■ According to experienced trappers, there are areas ("sinks") with heavy concentrations of American minks and others without any animals. No explanation has been provided for the moment.
The total budget for the two campaigns (2011 to 2013) amounted to 44 849 euros.

Information on the project

■ The results of the trapping campaigns in the two departments were presented to the steering committee.
■ A poster presenting the survey results was displayed during the naturalist symposium for the Midi-Pyrénées region, organised in February 2013 by the Nature Midi-Pyrénées association.
■ The results of the trapping campaigns were presented during the Agricultural Fair in Tarbes in 2013.
■ An article was published in the *Dépêche du Midi* newspaper (28 June 2013) on the trapping campaigns for American minks.
■ The internet site of the Midi-Pyrénées regional hunting federation includes:
- pages on the control programme for the American mink;
- an article on the results of the survey conducted by the Midi-Pyrénées regional hunting federation in 2012 on "The situation with the American mink in the Midi-Pyrénées region";
- a fact sheet describing the species.

Outlook

■ The programme as currently organised may be abandoned given the spread of the species and the uncertainty surrounding the intentions of the national authorities concerning the future of the national restoration plan for the European mink and the control of the invasive American mink. The programme may simply provide information via the trapping training courses.
■ An effort will be made to remobilise the network in the framework of the project to exchange traps in the Midi-Pyrénées region.

Author: Sandra Fernandez, Irstea

For more information

■ The internet site of the Midi-Pyrénées regional hunting federation: http://www.frc-midipyrenees.fr/.
■ Borrell, A. 2012. Statut et lutte contre une espèce exotique envahissante : le Vison d'Amérique (*Neovison vison*) en Midi-Pyrénées. Rapport de fin d'études pour l'obtention du diplôme d'Ingénieur de l'Institut Supérieur des Sciences Agronomiques, Agroalimentaires, Horticoles et du Paysage, Angers. 103 pp.

American mink

(Neovison vison)

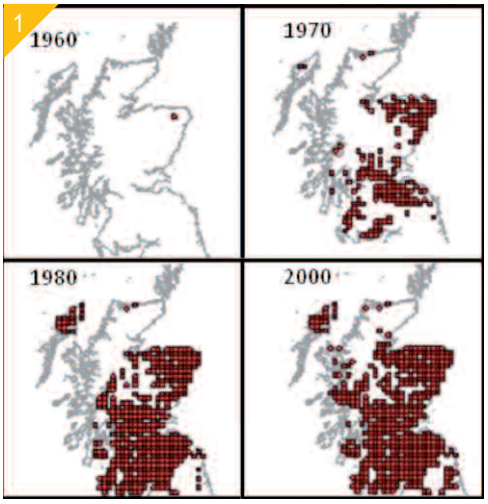
Collective management of the American mink in Scotland

Scottish Mink Initiative

- The Scottish mink initiative (SMI) for the American mink is a joint project between the Rivers and Fisheries Trust of Scotland, the Scottish Wildlife Trust, the Scottish Natural Heritage, the university of Aberdeen and the Cairngorms national park.
- The SMI is managed by the Rivers and Fisheries Trust of Scotland and is part of a larger project, the Biosecurity and invasive non-native species programme.
- The initial phase of the project lasted 24 months from August 2011 to August 2013.
- The main objective of the SMI is to eliminate the American mink from several river basins in order to protect the native species such as voles, salmonids, birds nesting on the ground and birds prized for hunting, by:

- eliminating all reproduction of the American mink in the project zone;
- ensuring the long-term sustainability of the American-mink control programme by transferring the know-how, knowledge and the responsibility for the continued management of the species to local organisations;
- sharing the methods and data with researchers in order to spread the benefits of joint management adapted to invasive alien species.

- The estimated annual cost of the SMI is 156 000 euros, of which 73% is funded by the Rivers and Fisheries Trust of Scotland.



1. Spread of the American mink in Scotland from 1960 to 2000.
2. Intervention area.

Context and issues involved

- The American mink settled in the U.K. starting in the 1950 following releases and escapes from farms for the fur industry. The species has now spread throughout the country, except in the extreme northern section. The species is firmly established in continental Scotland, as well as in the Western and Hebrides Islands.
- The American mink is commonly found in aquatic environments, notably along the coast where the species is particularly abundant.
- The mink is an opportunistic predator that feeds on a wide range of small mammals, birds and fish.
- In Scotland, the species has had a clear impact on voles, Atlantic salmon, black-throated loons, common scoters, northern lapwings, curlews and oystercatchers.
- Above and beyond the local biodiversity, the species creates indirect economic difficulties for fish farming and recreational activities such as hunting and fishing.
- The objective of the Scottish mink initiative was to set up, test and maintain collective management of the American-mink populations on over 20 000 square kilometres of the Scottish mainland.
- To facilitate project implementation, the project was divided into four large areas, namely Rural Aberdeenshire, Cairngorns-Moray, Highlands and North Tayside.

Interventions

- Control of American-mink populations consists of setting up a network of traps in the intervention area.
- The first step was to detect where the species was located in order to facilitate its capture.
- The strategy was to expand the trapping zone while maintaining detection efforts along the invasion front.
- A team was employed full-time in each sector of the intervention area to train, support and coordinate a network of volunteers, fisheries' employees and managers of natural areas.

3. An American mink and it prey.

Equipment used

- The type of trap used is the mink raft, developed in 2002 by the Game and Wildlife Conservation Trust (GWCT).
- The mink raft is made up of:

- a floating platform (a slab of polystyrene between two pieces of plywood);
- a metal grid along the edges of the platform to facilitate access by the animals;
- a basket filled with clay and sand for footprints;
- a wooden tunnel positioned above the basket.

- This type of device can be used both to detect and to trap minks:

- for detection, the footprints left in the mix of sand and clay in the basket serve to identify the species that visited the device;
- for trapping when minks have been detected, a cage trap can be placed inside the tunnel to capture the animals alive and release any species captured accidentally (European otter, voles, European pine marten).

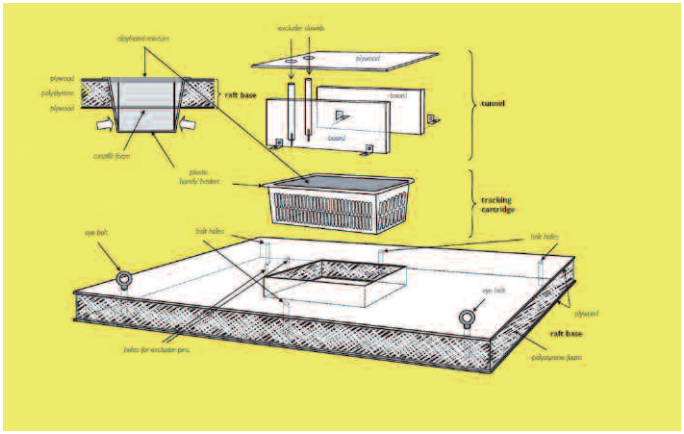
- The rafts can be purchased commercially or made by volunteers. Construction costs have been estimated at approximately 75 euros per raft. Detailed plans and a list of the necessary materials are provided by the Game and Wildlife Conservation Trust.

A network of traps

- In each project area, trap densities varied according to the conditions in the area and were regularly adjusted to take into account detections and captures.
- On average, one trap per kilometre of river was set up.
- The density of traps was increased in reproductive and nursing areas, and reduced in areas above an altitude of 300 metres where the species was rarely observed in Scotland.
- Each trap was numbered and its location precisely registered by GPS.
- A map of the habitats preferred by American minks was drawn up by the University of Aberdeen to select the priority trapping areas.
- The rafts were placed in water, with vegetation to mask them, near the bank and attached to the bank by a string long enough to handle variations in the water level.
- The rafts (without a cage trap) were checked every two weeks. A system to exclude the European otter was installed, given that the two species live in the same environments.
- If the footprints of an American mink were detected, a cage trap was installed in the tunnel.

Captures

- The traps were checked daily. Other species of animals were released on site.
- The traps remain operational until a mink is caught. If no minks were caught after five nights, the rafts were moved and set up for detection.
- Any minks caught were killed directly in the cage using a compressed-air pistol (Webley Typhoon).
- Each capture was recorded (GPS location, date, sex of the animal). An application for on-line entry of the data was developed (Mink App).
- The cadavers were either incinerated or buried. During the SMI, the cadavers were frozen for research on population genetics to determine the dispersion of the species in the project area and any exchanges between the mainland and the island populations.
- Most of the work (setting the traps, capture and killing) was done by volunteers. In areas where there was a lack of volunteers, the work was done by personnel employed specifically for the project by the Rivers and Fisheries Trust of Scotland.



Building diagram for the GWCT mink raft.

4. A GWCT mink raft.
5. A raft installed on a river.

Results and assessment

Extension of the intervention area

- Following observations of the species in 2011 in Northwestern Scotland, the intervention area was extended to 30 000 square kilometres, spanning 24 river basins and including over 20 000 kilometres of river.

A network of traps

- In June 2013, a total of 1 019 traps were deployed in the intervention area.
- Of the total, 980 were monitored by volunteers and 39 by personnel employed by the Rivers and Fisheries Trust of Scotland.

Implication of volunteers

- The degree of implication varied over time with 200 volunteers in the beginning of the project and up to 600 in 2012. The number then dropped to 500 in 2013, due to several volunteers who failed to mention that they had halted their trapping activity and other who lost interest in the project.
- Over 40% of the volunteers were permanent residents in the intervention area.

Breakdown of volunteers (in %).

Year	2011
Forestry workers, game wardens	24
Fisheries employees	15
Public institutions and agencies	5
Environmental-protection groups	7
Tourism sector	2
Farmers	2
Other	6

■ Captures

■ At least 472 American minks were captured throughout the area from 2011 onward.

■ After three years of trapping work, the level of mink presence and of trapping activity was assessed in each river basin:

- absence of mink if no females were trapped for two consecutive quarters;
- probable presence if an animal of either sex was captured over the last six months, in which case trapping activity was reduced;
- active trapping with a campaign under way.

■ The results indicated that American minks were absent from 10 of the 24 river basins. The basins with no minks were located primarily in Northern Scotland. The presence of American minks was considered possible in five river basins.

■ Of the nine basins where American minks are still present, four are in direct contact with areas where no control work has been undertaken. These areas constitute a potential source of minks for recolonisation.

Information on the project

■ A communication strategy was established comprising:

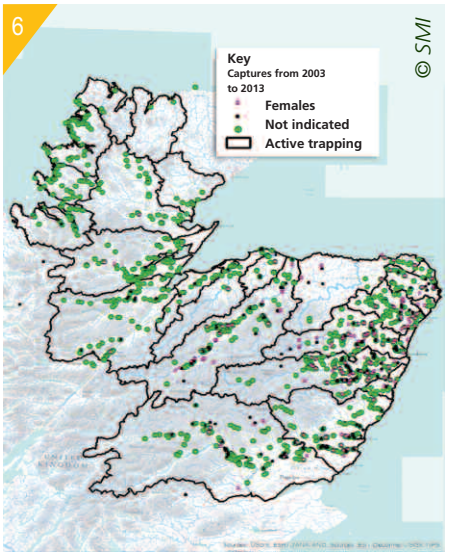
- the creation and management of a dedicated internet site, www.scottishmink.org.uk;
- information on the project on the local and national levels with over 150 articles;
- a twice yearly information bulletin presenting SMI news in each geographic sector;
- teaching material for schools (addressing four different class levels);
- presentations of the SMI during public events, symposia, to local groups;
- training courses for trapping volunteers with over 300 people trained.

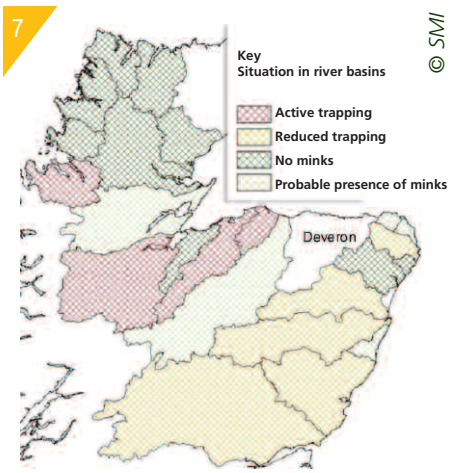
Outlook

■ The project will be pursued in the coming years.

■ Improvements are required, notably concerning:

- identification of American minks and checks on observation reports in order to reduce mistakes concerning the European polecat, erroneous reports and unnecessary laying of traps;
- the long-term implication of volunteers by providing them regularly with information and inviting them to meetings on project results;





6. Map showing the trapping network.
7. Presence of American minks and trapping activity in the river basins.

- the geographic distribution of volunteers, who are unevenly spread or even absent in certain regions (Highlands), due to the very low population densities, difficulties in accessing rivers and the very discreet presence of American minks;
- strengthening links with research programmes to ensure that results are of use for management work (population genetics, ethology, etc.);
- transfer of management responsibilities and the implication of local communities to ensure the pursuit of the project in an increasingly large area.

Author: Emmanuelle Sarat, IUCN French committee

8. Raising awareness during events intended for the general public.

For more information

- Internet site of the Scottish Mink Initiative: www.scottishmink.org.uk
- *Scottish Mink Initiative*. 2013. Final report. 14 pp.
- Bryce R., Oliver M., Davies L., Gray H., Urquhart J., et Lambin X. 2011. T*urning back the tide of American mink invasion at an unprecedented scale through community participation and adaptive management. Biological Conservation,* 144(1), 575 583.
- *Game and Wildlife Conservation Trust.* 2013. *Guidelines for the GWCT Mink raft.* 11 pp.
- *Game and Wildlife Conservation Trust.* 2009. *Building a GWCT Mink Raft. A 0step-by-step guide.* 8 pp.

Scottish Mink Initiative
Working with Communities to Protect Native Wildlife