

PASCAL FAVEROT  
WITH BENOÎT CASTANIER, LAURENT GIGOUT, PIERRE  
JOLY AND CLAUDE MIAUD

# Management of reproduction zones for amphibians



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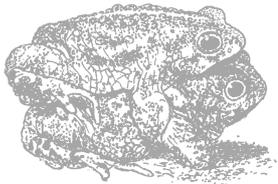
## TECHNIQUES TO MAINTAIN AND RESTORE ENDANGERED HABITATS



Technical  
Manual nr 7

The conservation of remarkable nature sites requires different forms of action, including some that occasionally necessitate the use of heavy machinery. Calling on the experience gained through the many existing programs in the Rhône-Alpes region, this article presents the basic information required to correctly restore a site.

Note  
The purpose here is not to discuss the problems facing amphibians in mires and marshes alone. This document covers the subject in a more general manner, in light of the many projects where the goals include the diversification of habitats through the creation or deepening of waterholes.



*The role played by amphibians in the ecosystem and notably that of tadpoles in the recycling and export of organic materials in continental waters has now been clearly identified. What is more, their organisation, often in small populations, and their usefulness in gaining knowledge on the evolution of species contribute to their environmental value. The destruction of wetlands required for their reproduction has resulted in the decline of many amphibian species, in spite of their protected status. In light of all the above, conservation and management efforts are now required.*

### THE GENERAL CYCLE, EXAMPLE OF BUFO BUFO.



Land habitat:  
forest, almost  
the entire year.

### DEFINE GOALS ACCORDING TO THE SPECIES ENCOUNTERED

During the formulation of a management plan, certain criteria are decisive in determining the environmental value of the site and the species to be included in the management goals.

There are two main criteria:

- the presence of rare or endangered species, or those at the edge of their known geographical zones;
- sites where numbers have dropped sharply.

In the above situations, the overriding goal is to assist the existing populations. The development of species not already on the site is highly uncertain. It depends on the capacity of those species to move to new sites and the

proximity of one or more groups. Do not forget that natural silting makes these shallow environments very temporary in nature (they tend to fill in over a few decades) and consequently, restoration work is required.

**The biological cycle.** There are two distinct phases in the biological cycle of most amphibians:

- an aquatic phase (egg and tadpole);
- a land phase (young and adult animals) following the metamorphosis of the tadpoles.

This cycle means that there are migrations between land and water.

In addition to the spawning zones, site management must make sure that the areas between the reproduction zones and the land habitats do not constitute barriers to migration.

Reproduction zone:  
the males are present for one month at the beginning of the spring, the females just a few days.



Migration zone:  
depending on the weather conditions, the migration may last nearly two weeks and cover one to two kilometers.



The *Bombina variegata* (in the defensive position), a small toad of major importance in Europe.

**Occupation of reproduction habitats and coexistence of species.** Certain species may suffer when they must compete with others (*Bufo calamita*, *Pelodytes punctatus*). They tend to avoid competition with other species by settling in temporary sites such as puddles and dips in sandy substrata, etc.

A waterhole measuring a few dozen square meters is the standard element required for the creation of a reproduction zone for amphibians. The three categories opposite may be added to account for the diversity of the habitats occupied by the various species.

**THE STATUS OF THE SPECIES FOUND IN THE RHÔNE-ALPES REGION**

name	protection	Habitat directive	Red list
<i>Alyte oobstetricans</i>	National	Appendix IV	Uncertain
<i>Bombina variegata</i>	National	Appendix II	Vulnerable
<i>Bufo bufo</i>	National	/	Monitor
<i>Bufo calamita</i>	National	Appendix IV	Monitor
<i>Hyla arborea</i>	National	Appendix IV	Vulnerable
<i>Hyla meridionalis</i>	National	Appendix IV	Monitor
<i>Pelodytes punctatus</i>	National	/	Vulnerable
<i>Pelobate cultripes</i>	National	/	Vulnerable
<i>Rana dalmatina</i>	National	Appendix IV	Monitor
<i>Rana temporaria</i> and <i>kl. esculenta</i>	Partial	/	/
<i>Rana lessonae</i>	Partial	Appendix IV	Monitor
<i>Rana perezi</i>	Partial	/	Monitor
<i>Rana ridibunda</i>	Partial	/	Monitor
<i>Salamandra salamandra</i>	National	/	Monitor
<i>Salamandra lanzai</i>	National	Appendix IV	Uncertain
<i>Triturus alpestris</i>	National	/	Vulnerable
<i>Triturus cristatus</i>	National	Appendix II	Vulnerable
<i>Triturus helveticus</i>	National	/	Monitor
<i>Triturus vulgaris</i>	National	/	Monitor



Sites on gravel or sandy substrata

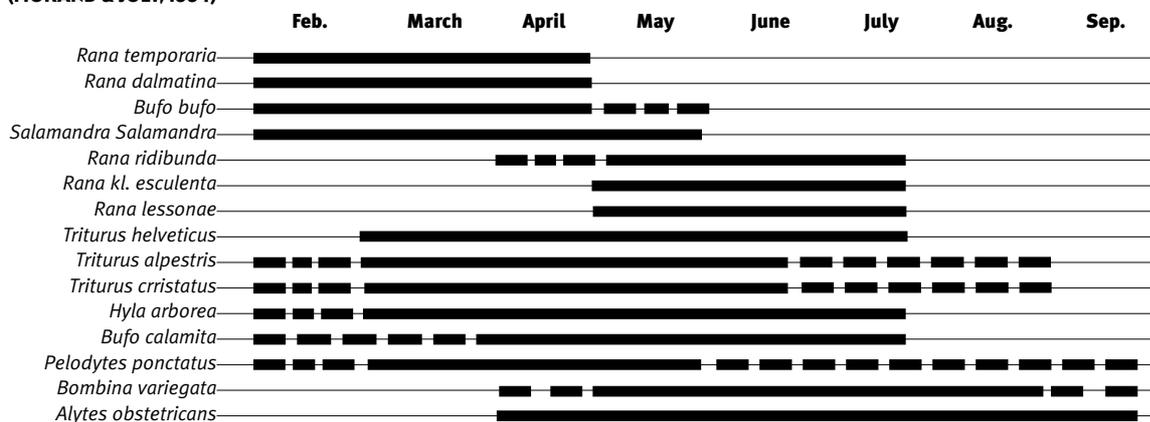


Temporary sites in forests



Stagnant sites in open land

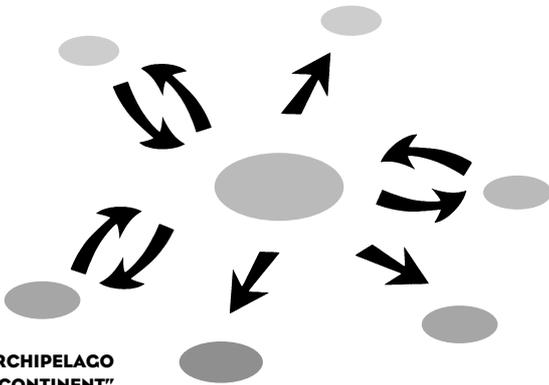
**REPRODUCTION DATES OF VARIOUS AMPHIBIANS ON THE UPPER RHÔNE RIVER (MORAND & JOLY, 1994)**



## CONFIGURATION OF THE HABITATS REQUIRED FOR THE REPRODUCTION

For habitat-diversification projects (creation of pools in swamp areas, etc.), the success of the venture does not depend on the presence of a reproduction site alone. A complete configuration of habitats suited to the vital movements of the animals (migrations, search for reproduction sites, etc.) is required.

**A fragmented habitat.** For a given total number of square meters of open water, a series of small sites offers more resources for amphibians than one large site. The total length of banks is greater and there are consequently more sites for tadpoles. The risks of predators and of a site drying up is spread over a number of water-



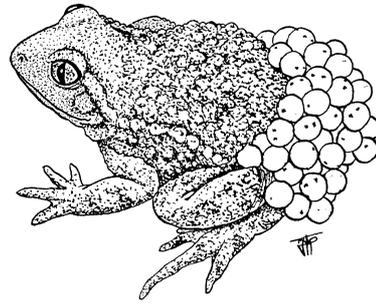
### "ARCHIPELAGO CONTINENT" SYSTEM

This system is required to ensure the presence of the *Triturus cristatus* in the Dombes area. The archipelago of five pools created on the site of the Pierre-Vérôts foundation would seem to be indispensable.

holes. What is more, the diversity of the created sites is a further parameter likely to increase the number of species living in the area.

**A network of sites.** The stability of populations depends on the links that are created with a number of nearby sites (compensation of local drops in numbers through migration). The capacity of a population to rapidly re-establish a positive trend is therefore improved when:

- there is a network of potential reproduction sites not far from each other (from a few dozen to a few hundred meters);



Alyte obstetricans  
(design J.P. Thomas)

- the habitat is structured with a central site (the "continent", for example a pond) ringed by a number of satellite waterholes (an "archipelago" of small pools).

#### Major factors in structuring the habitat :

- An "archipelago" of small pools is better than a single large waterhole.
- Make every effort to limit the arrival of fish likely to eat tadpoles and eggs by avoiding areas submerged during flooding and any links to waterfilled ditches.
- Select sites depending on their suitability for migrations (type of substratum, existing obstacles, etc.) and the capacity of nearby land to serve as a habitat (woods, rocky areas, depending on the species).

**Concerning migration zones.** The capacity of a population to travel from one reproduction site to another and between reproduction and land sites should be managed. A well selected habitat must avoid all obstacles between sites and notably:

- physical obstacles (walls, stone fences);
- roads which cause very high mortality rates (90% of a population is killed when it attempts to cross a road where there is one car per minute, according to Swiss data);
- rivers;
- ploughed fields.

**Migration is facilitated in sheltered environments** (hedges, woods) or on grassy substrata (see the figure below).

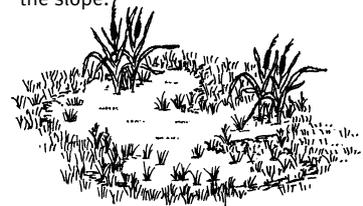
**The incorrect "corridor" idea.** Amphibians use their sense of smell for orientation and travel in straight lines. Consequently, they do not travel around ploughed land by following the hedges. All potential obstacles in their path must be taken into account.

**Take into account "natural" migrations.** In alluvial zones, flooding contributes to the "management" of reproduction sites and settlement in new sectors, and are a positive factor for mobile species, suited to unstable environments (*Rana ridibunda*).

## CONFIGURATION OF THE REPRODUCTION SITES

Among the possible reproduction sites for amphibians, the pool is probably that used by the largest number of species and is the easiest to create, if the ground can bear the weight of excavation equipment. It may be used in all environments with captive water (silting marshes, mires, etc.), as well as in meadow environments.

**Shape and slope.** There must be at least one gently sloping bank to enable the young animals to easily exit the water and to encourage the growth of the bank vegetation that is required for the growth of the tadpoles. A steep bank can however be favourable for certain types of insects. Note that over time, a number of factors (erosion, trampling by hoofed animals) will contribute to reducing the slope.



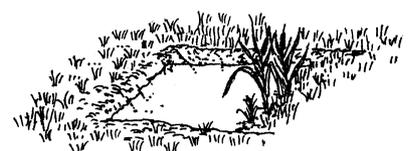
#### CASE 1.

- high percentage of gradual slopes (nearly 100%).

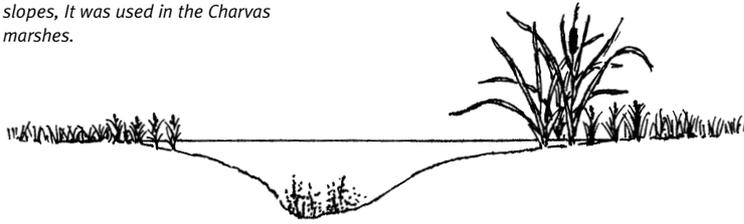
- large area required.
- easier coexistence of species.
- \* numerous spawning sites.
- high risk of water drying up or high cost.

#### CASE 2.

- 20 to 35% of gradual slopes.
- small area required.
- \* coexistence between species not easy.
- small number of spawning sites but cost probably lower.



This profile makes it possible to increase the depth while maintaining gradual slopes, It was used in the Charvas marshes.



**Depth.** The depth must be sufficient to maintain water during the entire time the tadpoles are developing. Depending on the local conditions, a minimum of three months with water is required. A waterhole that dries up at the end of the month of August has no particular impact on the cycle of the amphibians and is a means to limit the presence of dangerous fish.

A depth of 1.2 meters was created in the Dombes and the Charvas marshes.

**Encouraging vegetation on the banks.** Nearby trees contribute to eutrophication of the pool (particularly alder trees) and reduce the penetration of sunlight which is an important factor in oxygenating the water. It is preferable to clear the surrounding area.

**Aquatic vegetation.** The eggs of many species are laid on or among the leaves of the aquatic plants which are also a source of food for the tadpoles. *Glyceria*, *Potamogeton* and *Carex* are particularly suitable and may be planted in reasonable quantities to avoid the arrival of undesirable floating plants that cover the water. Periodic maintenance is required.

**Water quality.** Water quality is apparently not a decisive factor unless the pH is under 4.

**Spreading the earth.** A mound along the edge of the pool may cause difficulties (mowing), but reduces the cost of transporting the removed earth.

**The costs.** A major part of the cost is incurred when heavy excavation equipment is required. When the earth must be moved any distance, the costs rise sharply and there are legal problems (see Technical Manual number- nine;

- by the cubic meter of earth dug and spread.

Average price for regional projects: 3.00 to 4.50 euros (before VAT) per cubic meter of earth removed and spread.

- 50.00 euros (before VAT) per hour.

For a pool 100 square meters in size with a maximum depth of 1.5 meters and if the earth does not need to be transported, the cost is approximately 380 euros (before VAT).

This cost increases significantly if the soil is peaty and cannot bear heavy equipment because access is more difficult and the work takes more time.

**Possible funding through compensation measures.** Many "substitution" pools have been created in the framework of infrastructure projects (e.g. roads) that disrupt the migration of certain amphibians. These measures may also apply to temporary waterholes and endangered species.

#### ADJACENT HABITATS SUITABLE FOR HIGH-VALUE

**Temporary sites such as ruts and ditches in forests.** A management plan specifically for these micro-biotopes would be difficult to implement. Their temporary nature and uncertain use by the animals would require numerous interventions.

However, a part of the management plan may attempt to preserve these nearby forest micro-environments that are often found near marshes and fens. For example, they may comprise a network of ditches and temporary waterholes found among copses of alder or birch trees. It may be necessary to maintain or to create sufficiently deep ruts in unused roads or ditches along them.

The purpose is to maintain sufficient water for the development of the tadpoles and their design must take into account the configuration of the landscape mentioned above.

**Sites on sandy or gravel substrata.** Abandoned stone and gravel quarries as well as other sites with sandy or gravel substrata are ideal for the *Alytes obstetricans*, *Bufo calamita* and *Pelobate cultripipes* or even *Bombina variegata* or *Pelodytes punctatus*.



Two version of pools created near [FB1]the Saint-Louis pond (Tricastin). The size of the open-water area had significantly decreased in just a few decades. The first year, the shape and profile were designed simply to evaluate the technical difficulties. The following year, a more elaborate design was implemented.

These sites with temporary pools are a low-cost habitat for species with high environmental value. In certain cases, these sites are indispensable additions to the network of sites occupied by a metapopulation.

The negotiations with the site owner or operator (for quarries) must target:

- maintaining sandy banks with vegetation over 20 to 30% of the surface, next to the spawning zone and preferably exposed to the south and west. This area will serve as the hunting ground, the daytime quarters and the winter habitat;
- maintaining a low area to receive run-off water, with little vegetation, intended as the reproduction zone (plants are however useful for the spawn of the *Bombinus variegata* or *Pelodytes punctatus*).

The end of commercial operations on the site remains the greatest problem because the areas with heavy vegetation must be regularly cleared. Caution is required for limestone substrata because the temperature of the water rises faster and greater depths may be necessary.

Pelobate  
cultripes.  
(design  
J.P. Thomas)



### MONITORING AMPHIBIAN SITES AND POPULATIONS

Once a waterhole has been created or restored, the project gradually shifts to regular monitoring and maintenance. The goal of these two activities is to maintain the favourable situation newly re-established and to assess whether the management policies are effective. These are important aspects and must obviously take into account a range of factors, not only the amphibians.

**Periodicity of interventions.** Waterholes often require very little



Excavation of the central zone and grading along the edges to create gradual slopes for the pools in the Boîtray marsh extended the wet period and increased the presence of vegetation. Most of the maintenance work is automatic, due to the major fluctuations in the water levels, notably the high levels in the winter.

maintenance. Except in special cases, dredging of mud is required once every 20 to 30 years, on average. The most favourable period for the batrachians is from August to February, the best month being September.

Work is required on the aquatic vegetation if it is particularly dense. The vegetation must be scythed, selected and any undesirable plants must be removed.

Trimming or even cutting of trees may be necessary, depending on the local environment of the pool. However, this work is also relatively infrequent.

#### Site maintenance by grazing?

Extensive grazing may be a useful means to maintain the aquatic vegetation in spite of the resulting trampling and the increase in organic material. It

replaces a major part of the manual intervention required to clear the area.

The most palatable plants (*Glyceria*, *Typha*, etc.) are consumed. However, caution is advised concerning implementation of an extensive grazing plan. A number of watering points are required for the herd or water pumps must be installed to provide the necessary volumes.

Generally speaking, the livestock should have access to only a part of the pool.

**Monitoring of amphibian populations.** Preparation of reproduction sites for amphibians contributes to maintaining biological diversity. The effectiveness of the recommended management techniques depends on a high level of knowledge concerning both the population and the organisation of the created sites. To that end, an initial assessment prior to any work and scientific monitoring afterwards are indispensable. There are two types of evaluation.

- Qualitative evaluation is fairly easy to carry out. Concerning toads and frogs, it is necessary simply to listen. A net with fine mesh may be used for the *Triturus*. This form of evaluation is used primarily for high-value species and provides a rough idea on the population (number of croakers).

- Quantitative evaluation is more complex and requires precise monitoring instructions, regular visits according to an itinerary that does not change from one year to another (the transects or paths must be planned) and prior determination of the periods of greatest presence.

Quantitative monitoring is generally indispensable to ensure correct assessment of the impact of the management system on the existing populations.

### TO LEARN MORE ABOUT AMPHIBIAN ECOLOGY

**Reviews and guides.** "Les amphibiens de France" by R. Guyétant, Revue française d'aquariologie, first and second quarters of 1986. The various amphibian identification guides edited by Solar et Delachaux.

**Video.** *La grenouille et le crapaud et La salamandre et le triton*, directed by J.-P. Macchioni, coproduced by Aster Les films du silence, available

from Aster, 155 cours Bérriat, 38028 Grenoble Cedex 1.

**Background material :** The management plans and activity reports for the project sites in the Rhône-Alpes region.

### PROJECTS IN THE RHÔNE-ALPES REGION

The point here is not to list all the waterholes created, but rather to highlight a series of projects with major amphibian importance, each implemented on a scale going beyond the individual pools and impacting on entire populations.



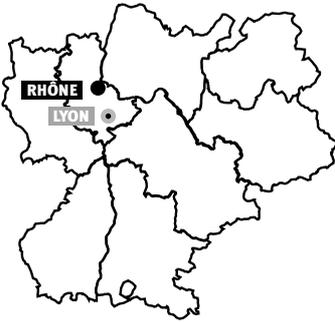
**Twelve pools created.** The double goal is to maintain species (*Rana dalmatina* and three *Triturus* species) and gain knowledge through experiments, in collaboration with the University of Lyons (Claude Bernard). Manager:

**Fondation P. Vérots, Praillebard,  
F-011390 St-Jean-de-Thurigneux**



\* **The "botasses" in Sandrans.** A conservation experiment in which pools in the Dombes region were restored (FGER funding). Managed by the Sandrans CUMA and the Chamber of agriculture (Ain department). Information campaign in 1995 for farmers and restoration work in 1996. Manager:

**Chambre d'agriculture de l'Ain,  
antenne Dombes  
F-01330 Villars-les-Dombes**



**The Montfort marshes (Crolles).** Management of the “chantournes” (scything, etc.) for amphibian and floristic goals.

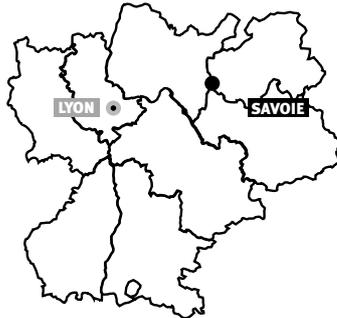
**The Herretang mire (St-Laurent-du-Pont, St-Joseph-de-Rivière).** Grading and management of former peat-extraction sites. The shallowest of the sites are the most used by the amphibians.

Manager:

**AVENIR, 10 rue Raspail  
F-38000 Grenoble**

\* **The Boîtray marshes (St-Georges-de-Reneins).** In 1997, grading work and excavation of four pools and 1000 meters of canal between the Saône river and the marsh. This work is part of a larger project for water management in the marshes. Manager:

**CREN**

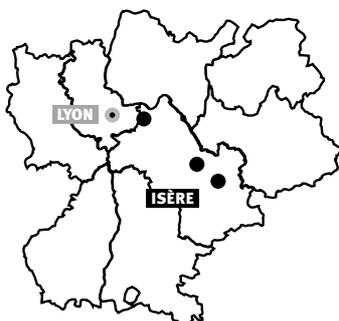


\* **The St-Louis Pond (Suze-la-Rousse)** Creation of open-water areas in a pond choked with vegetation. Manager:

**CREN, General Council of the Drôme Department and et Sci Saint-Louis Pond.**

**The Lavours marshes (Chindrieux...)** On a silt substratum, excavation of a former branch of the Séran river and creation of three satellite pools to extend the habitat and a pond with very shallow and muddy edges. On a peat substratum, excavation of three pools to restore the semi-aquatic environment. Manager:

**Eid, chemin de la Tour,  
F-73310 Chindrieux**



**The Charvas marsh (Villette d'Anton).** Nine “substitution” pools created as compensation measures in the framework of the TGV high-speed train and A432 highway projects. The goal was to avoid obliging the batrachians to cross the highway. The results were positive for all species except the *Bufo bufo*.



**The Maurienne valley.** Creation of pools in Saint-Rémy-de-Maurienne and on the Hurtières plain, as compensation measures in the framework of the A43 highway project. The major concerns were the amphibians, primarily the large population of *Bufo bufo calamita*

**The Bassin Mollard marshes (Aiton.)** Grading of tarns using heavy excavation equipment.

**The Aiguebelette lake.** Creation of numerous pools in Nances, Saint-Alban-de-Monbel and Lépin-le-Lac. Manager:

**CPNS, Le Prieuré  
F-73372 Bourget-du-Lac**

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CREN

La Maison Forte  
2, rue des Vallières,  
F-69390 Vourles, France  
E-mail: cren.rhonealpes@wanadoo.fr