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Action Plan for the Conservation of the Italian Agile Frog (*Rana latastei)* in Europe

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1. Introduction

The Italian agile frog, *Rana latastei*, is confined to the Po Basin of northern Italy and to small adjacent areas of southern Switzerland, western Slovenia and northwestern Croatia. This species has suffered severe declines across its range and is considered by many experts to be one of the most endangered amphibians in Europe. This Species Action Plan has been commissioned by the Standing Committee of the Bern Convention in order to assess the extent of the problems faced by the Italian agile frog *Rana latastei* in Europe, and to make appropriate recommendations for specific actions to address these problems. This section, Part A, summarizes the need for this Species Action Plan and highlights the most urgent priority actions required, as well as the countries to which these are relevant. Further actions and much additional information can be found in Part B, the main body of the Species Action Plan.

2. Rationale

The Italian agile frog has a small range compared to most other European frogs. Its entire global distribution is confined to the Padano Venetian Plain (in northern Italy and southern Switzerland) and to the Triestine and Istrian regions of western Slovenia and northwestern Croatia. The Italian agile frog is primarily a lowland species and, although it has been recorded from above 500 m in Italy, rarely occurs above 300 m throughout most of its range. The main habitat occupied is humid oak-hornbeam forest, which typically grows on flood plains with a high water table and is therefore periodically flooded. Italian agile frogs prefer shaded, constantly humid conditions and dense ground vegetation. Some secondary habitats, such as overgrown ditches and poplar plantations, may also be occupied as long as such conditions are present. This frog appears to have limited dispersal abilities and is therefore much more dependent on habitat continuity than many other amphibian species.

Suitable habitat throughout the range, however, has now been mostly destroyed and the remainder is highly fragmented. Additional threats include habitat degradation (particularly through drainage, water extraction and pollution), introduced species, inappropriate habitat management and a variety of other, localised problems. It is not known what effects climate change will have on Italian agile frogs although it will clearly be difficult for many of the isolated populations to adapt. The total number of surviving populations is currently considered to be around 250. The two largest and most important of these populations occur in the Vipava and Branica valleys in western Slovenia. Most other populations are now small and isolated and many appear to be suffering from loss of genetic diversity. This species is considered to be Vulnerable on the IUCN Red List and is listed in Appendix II of the Bern Convention and on Annexes II and IVa of the Habitats and Species Directive (Italy and Slovenia). Italian agile frogs therefore receive strict legal protection in all of the countries covered by this Action Plan. Furthermore, a significant proportion of the populations in Italy are now included within the Natura 2000 site series and further Natura 2000 proposals have been made for the globally important Slovenian sites. However, further actions are still required to improve the conservation status of the Italian agile frog and to secure the future of this species in Europe.

3. Objectives. The main reasons for producing this Species Action Plan are to ensure that:

i. The decline of the Italian agile frog in Europe is reversed

ii. Viable populations are re-established and enlarged, and isolated populations are re-connected, throughout the European range

iii. All populations are subsequently maintained as a viable and integral part of the habitats and landscapes they occupy

Nine general objectives are proposed to help achieve these overall aims. These cover the protection and management of both species and habitat, additional distribution surveys, population and conservation status monitoring, scientific research, the improved coordination of conservation efforts and raising public awareness.

4. Recommended Actions

Conservation work is already underway in all four range countries but it is important to expand on these successes to ensure the maintenance, and restoration where necessary, of viable Italian agile frog populations in Europe. Consequently, 42 specific actions are proposed in this Species Action Plan, nine of which have been identified as being of the most urgent priority (see Table 1, below). These actions should therefore be implemented as soon as possible. The remaining 31 actions are of a less immediate priority, or, as in the production of national recovery plans, will take time to realise, but are nonetheless still important for the recovery of Italian agile frog populations. Among the most vital elements of future conservation work for the Italian agile frog will be the effective liaison and coordination of these efforts, both within and between range countries, and, of course, adequate funding.

Table 1: Urgent Priority Actions for the Italian Agile Frog *Rana latastei*

Area of Activity	Urgent Priority Actions	Relevant Countries
Habitat Protection	Action 4.1.1. Ensure that ***all*** habitats supporting known *Rana latastei* populations in Switzerland, Italy, Slovenia and Croatia are protected from any threats of further habitat loss by appropriate national and international designations.	Switzerland, Italy, Slovenia and Croatia
Habitat Management	Action 4.2.1. Limit and control coppicing and other tree felling activities in humid forest areas that provide important terrestrial habitats for Italian agile frog populations.	Switzerland, Italy, Slovenia and Croatia
Habitat Management	Action 4.2.2. Limit and control the use of pesticides, fungicides and fertilisers within, or close to, nature reserves or other important aquatic and terrestrial habitats used by this species.	Switzerland, Italy, Slovenia and Croatia
Habitat Management	Action 4.2.3. Eradicate introduced predatory fish, especially *Percottus glenii*, in all water bodies that are known to be *Rana latastei* breeding sites, or are being enhanced to become new breeding sites.	Switzerland, Italy, Slovenia and Croatia
Habitat Management	Action 4.2.4. Ensure that populations of American bullfrog and the two American crayfish species in Italy are eradicated wherever possible.	Italy
Distribution Surveys	Action 4.5.1. Continue distribution surveys and the mapping of further potentially suitable *Rana latastei* habitats in Switzerland, Italy (particularly along the southern tributaries of the Po), Slovenia and Croatia (including the investigation of an old record near Pazin, south east of Motovun).	Switzerland, Italy, Slovenia and Croatia
Population and Conservation Status Monitoring	Action 4.6.1. Determine the historical range of *Rana latastei* in Switzerland, Italy, Slovenia and Croatia, as well as the current range of this species, to assist with the development of specific targets for habitat restoration and re-creation plans, as well as species re-introduction strategies.	Switzerland, Italy, Slovenia and Croatia
Improved Liaison and Coordination	Action 4.8.1. Ensure that the Governments and relevant conservation bodies of Switzerland, Italy, Slovenia and Croatia implement this Action Plan.	Switzerland, Italy, Slovenia and Croatia

PART B. ITALIAN AGILE FROG – SPECIES ACTION PLAN

1. Introduction

The Italian agile frog, *Rana latastei*, is confined to the Po Basin of northern Italy and to small adjacent areas of southern Switzerland, western Slovenia and northwestern Croatia. This species has suffered severe declines across its range and is considered by many experts to be one of the most endangered amphibians in Europe. This Action Plan has been commissioned by the Standing Committee of the Bern Convention to address the problems faced by the Italian agile frog in Europe and to make recommendations for actions in the four range countries. An attempt has been made in this Action Plan to summarise the literature that is most pertinent to the conservation of *Rana latastei* (a more comprehensive bibliography is also available from the authors). The taxonomy and ecology of this species are covered briefly, while its distribution, status and the threats that it is known to face are outlined. A series of general objectives and specific conservation actions are recommended for adoption by the Bern Convention and relevant national governments. It should be noted that this Action Plan is not intended to be a static document. As additional information is obtained, and as conservation work and scientific research progress, subsequent versions should be produced that report on successes and make updated recommendations as necessary. In future years, the successful conservation of the Italian agile frog in Europe should be seen as an important measure of, and contribution towards, international efforts to maintain the biodiversity of Europe.

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Photographs by Paul Edgar

2. Background Information

2.1. Systematics

The Italian agile frog was first described by Boulenger (1879) under the still current name of *Rana latastei*. The type locality was given as the Forest of Redecesio near Milan, Italy, a location where this species is now extinct (Gasc *et al* 1997). No subspecies have ever been described and the taxonomy of *Rana latastei* has remained unchanged since the original description. Attempts to modify the spelling of the specific name from *latastei* to *latastii*, the latter being used in many publications between 1882 and 1910, were rejected under the rules of the International Code of Zoological Nomenclature.

2.2. Description

2.2.1. Morphology.

Rana latastei is a slender brown frog, similar in form to the more widespread agile frog *Rana dalmatina*. There does not appear to be any geographical variation in the morphology of Italian agile frogs and animals from different populations are generally similar. Adult females attain a total snout-vent length of approximately 75 mm, with the males being slightly smaller (Arnold 2002). The snout is usually pointed but may show slight variations in shape among individuals within each population and can even be rounded in some specimens. The eardrum is prominent and well separated from the eye, although it is not particularly large for this genus and, because of the colour pattern, is not always obvious. Well-separated dorsolateral folds occur on the back. *Rana latastei* has long legs and, when these are pressed forwards, the heel reaches well beyond the snout (Arnold 2002), although this is not a particularly reliable method of determining this species (B. Schmidt *pers. com.*).

2.2.2. Colouration.

Rana latastei exhibits the basic colour pattern common to all of the European "brown frog" species (Arnold 2002). There is little geographical variation in colouration, although slight individual differences can be found within each population. The dorsal colouring is a greyish or reddish-brown and is fairly uniform, with little patterning apart from a few dark spots. There is usually a dark bar between the eyes and an inverted V mark between the shoulders. An obvious dark line runs from the tip of the snout to the eyes on each side of the head. A dark triangle is also present behind the eyes and includes the eardrum. *Rana latastei* has a distinctive white line along each hind upper lip that stops under the eye and extends no further forwards. The belly is white but often shows some grey marbling, especially anteriorally. The throat is grey with a light central stripe that is also seen on the chest. Although there is no dramatic sexual dimorphism in colouration, the males develop dark brown nuptial pads on the thumbs of the forelimbs during the breeding season. Sexually active males may also exhibit dark red-brown throat spots and orange or red on the underside of the thighs.

2.3. Life History

2.3.1. Habitat Requirements.

The Italian agile frog is primarily a lowland species and rarely occurs above 300 m in altitude. However, this species has been recorded at 343 m near Cepic in Croatia, at 390 m near Stabio in southern Switzerland and at 490 m at Pedrinate on the Swiss-Italian border. The highest known locality is reported to be near Valganna and Valcuvia, in the province of Varese, Italy, where this species has been found above 500 m (Barbieri and Mazzotti 2006). The main habitat occupied by *Rana latastei* is humid oak-hornbeam forest, classified by botanists as *Querco-Carpinetum boreoitalicum*, which grows on flood plains with a high water table. It also occurs in hygrophilous woods of the *Cladio-Fraxinetum angustifoliae* association (for example at Punte Alberete in the province of Ravenna, Italy) and in riparian woods supporting white poplar, Lombardy poplar, white willow and alder (Barbieri and Mazzotti 2006). Italian agile frogs may sometimes be found in more open areas such as peat bogs, sedge banks and swamps with *Phragmites* reed beds (Mazzotti and Pellizzari 2000). *Rana latastei* has also been recorded from some secondary habitats, such as poplar plantations with a suitably dense understorey, overgrown ditches in agricultural land (if these are close enough to forests for hibernation) and damp meadows.

Its breeding requirements mean that Italian agile frog populations are always found in the vicinity of rivers, lakes, small streams, marshy ground or ditches. The terrestrial microhabitat preferred by *Rana latastei* provides shady, constantly humid conditions and good ground vegetation cover (or at least a deep litter layer) under the canopy. The natural, periodic flooding of its terrestrial habitat is beneficial to this species. In suitable lowland habitat, Italian agile frogs can be found at high densities across the forest floor. Boano and Sindaco (1995) estimated the population of the Bosco del Merlino (Caramagna, province of Cuneo) to be about 90 individuals per hectare; Pozzi (1980) reported the population at Bosco Fontana (province of Mantua) to be 173 individuals per hectare, and that of Cascina Boscaccio, a riparian wood on the banks of the Lambro river (province of Lecco) to be 137 individuals per hectare. However, at higher altitudes Italian agile frogs generally avoid drier high ground and ridges and are more restricted to humid woodland in the immediate vicinity of streambeds.

Figure 2: Italian Agile Frog Terrestrial Habitat, Po Plain, Italy

2.3.2. Dietary Requirements.

Rana latastei mostly consumes insects such as beetles, bugs and earwigs but also eats many other small invertebrates, including worms, snails, centipedes, mites, harvestmen and spiders. The frogs obtain most of their food in the forest litter layer, occasionally also foraging in small mammal burrows and on the banks of waterways, but never in the water itself (Mansi 1992).

2.3.3. Activity and Movements.

Breeding activity takes place in the spring throughout the range of this species, while the rest of the year is spent on land. Since most adults are at the breeding sites, terrestrial activity levels are at their lowest during spring and early summer. In addition, the forest floor is relatively bare at this time of the year and the more open canopy reduces the overall humidity. *Rana latastei* terrestrial activity increases significantly during the summer and into early autumn, when breeding has finished and humidity is at its highest under the dense canopy and lush ground vegetation (Gasc *et al* 1997). Frogs can be observed by both day and night in suitable conditions but are most active in the early morning and around dusk. However, behaviour is heavily influenced by the prevailing weather conditions and in particularly dry periods the adults will remain close to streams and ditches and only become active in the evening. This species usually enters hibernation in October and always hibernates on land, sometimes up to one km from water. Otherwise, *Rana latastei* does not appear to engage in long distance movements and active individuals tend to remain fairly close to the breeding sites.

2.3.4. Reproduction

Like most frog species, the male Italian agile frogs attract females with a species-specific call before pairs join in amplexus and breed. The call is a long thin mew (rather like a cat), which is repeated every 20-60 seconds and is normally made underwater (Arnold 2002). It is likely that only about 35% of adult females lay eggs after a mild winter (Bruno 1977). The spawn is deposited in shallow, slow moving water, often in small pools along streambeds, but ponds and other still water, including shaded ditches, may also be used. This species produces relatively small clumps of spawn in a single, rounded mass, which generally remains compact. Barbieri and Bernini (unpublished data cited in Barbieri and Mazzotti 2006) counted between 676 and 2720 eggs per clump (mean 1278 ± 114, n = 22). *Rana latastei* eggs are distinguished from those of other frog species by a thinner gelatinous envelope, which is only 6-7 mm thick in this species. The spawn clumps are typically anchored to twigs or other supports at a depth of around 20 cm but as egg development proceeds, a process that can take two to four weeks, they may gradually rise to the surface (Arnold 2002).

Italian agile frogs tend to avoid the sunny, open aquatic habitats preferred by the other frog species within their range (Pozzi 1980; Ficetola and de Bernardi 2004) and the breeding sites used by

this species are normally well shaded. Under such conditions, *Rana latastei* tadpoles enjoy a competitive advantage over the larvae of other frogs, especially those of *Rana dalmatina*, that require warmer water bodies. After hatching, Italian agile frog tadpoles take a further two to three months to reach metamorphosis and the baby frogs, measuring 13-15 mm, emerge from the water in late June or July. The young frogs become sexually mature by the end of their first season, when they have reached a length of between 37 and 42 mm, and it is this cohort that will make up most of the next year's breeding population. This species only lives two to three years (Arnold 2002) and larger adults typically become rare in the population by their second year, and are even more so in their third year. In addition, winter mortality appears to be particularly high in this species. Due to the short life span and high mortality rates, population turnover is rapid and *Rana latastei* numbers can fluctuate considerably from year to year. On the other hand, this also means that the size of *Rana latastei* populations can increase dramatically after a single good reproductive season.

2.3.5. Predators and Competitors.

Like most frogs, *Rana latastei* is preyed on by a range of species including grass snakes, dice snakes, herons, egrets and ducks. Pozzi (1980) reported sharp drops in populations in areas with a high density of introduced pheasants. The tadpoles are also eaten by several species of aquatic invertebrate, fish and waterfowl. However, the numbers of predators in the small shaded streams preferred by this species are usually lower than in more open water bodies, perhaps explaining the relatively small numbers of eggs laid compared to other frogs.

Although *Rana latastei* is often sympatric with *Rana dalmatina*, its more specialised breeding and terrestrial habitats tend to limit competition with this species (as well as with other frogs). In addition, hybrids between the two are not known. Where these two species do breed in the same water body, however, the reproductive success of *Rana latastei* is usually reduced as the numbers of *Rana dalmatina* increase (Hettyey and Pearman 2003). However, at some Italian sites occupied by *Rana latastei*, such as at Busatello in the province of Mantua (Salmaso and Osella 1989), Cerea in the province of Verona and Punte Alberete in Ravenna, competition may have led to the exclusion of *Rana dalmatina* (Barbieri and Mazzotti 2006). In some Prealpine sites, *Rana latastei* lives in syntopy with both *Rana temporaria* and *Rana dalmatina*.

2.4. Distribution and Conservation Status

2.4.1. Summary of the Distribution and Conservation Status of the Italian Agile Frog.

This species has a relatively small range (Figure 1) compared to other brown frogs, most of which are widely distributed. The distribution of *Rana latastei* is confined to the Padano Venetian Plain of northern Italy and southern Switzerland, and the Triestine and Istrian regions of western Slovenia and northwestern Croatia (Bruno 1977; Pozzi 1980; Grossenbacher 1982; Burlin and Dolce 1986; Gasc *et al* 1997). Although the extent of the original range has not been diminished, habitats throughout this area have been greatly depleted and fragmented. Many authors now consider *Rana latastei* to be one of the most endangered amphibian species in Europe (Pozzi 1976; Corbett 1989; Gasc *et al* 1997). The number of remaining populations is currently estimated to be approximately 250 (Lippuner 2005), although this figure needs clarification as different criteria have been used to define populations in the past. As further surveys are carried out, additional localities may be discovered or, conversely, it may be determined that supposedly separate sites in some areas are linked and in fact form single populations. In the IUCN red list of threatened species (Andreone, Garner and Schmidt 2004), *Rana latastei* is listed as Vulnerable B2ab (iii). Populations to the west of the range tend to be smaller in size than those from eastern localities and are generally most at risk of extinction.

2.4.2. Distribution and Status in Switzerland.

Rana latastei is only found in Switzerland in Kanton Ticino, in the southernmost area of Ticino on the Italian border, south of the line Rancate-Mendrisio-Balerna. This area is a mere 12 x 8 km at its largest (Garner, Angelone and Pearman 2003) and, within it, Italian agile frogs are only known from 24 localities that cover a total of about 2400 ha of suitable habitat (Lippuner 2005). A number of populations formerly known from further north in Switzerland, near Lugano, are all now extinct (Grossenbacher 1988). Microsatellite studies of DNA polymorphism have shown that the within-population genetic diversity of the Swiss populations is much lower than that of the Italian populations

and of those from further east (Garner, Angelone and Pearman 2003; Garner, Pearman and Angelone 2004). *Rana latastei* is a red list species in Switzerland – it was previously considered Endangered (Duelli 1994; Grossenbacher 1994) but is now listed as Vulnerable (Schmidt and Zumbach 2005).

Figure 1: Distribution of the Italian Agile Frog *Rana latastei* in Europe

2.4.3. Distribution and Status in Italy.

This species is more or less confined to the Padano Venetian Plain of northern Italy in the regions of Piemonte, Lombardia, Veneto and Friuli-Venezia Guilia. There are also unconnected populations at Punte Alberete, in the province of Ravenna, and Malalbergo in the province of Bologna (Barbieri and Mazzotti 2006). This species is more abundant along some of the northern tributaries of the Po River, in the Ticino, Lambro, Olio and Brianza regions, while very few sites are currently known along the southern tributaries. Populations to the east of the Italian range are generally larger than those to the west. However, two tiny, remnant populations of *Rana latastei* have been recently discovered in dry, somewhat atypical karstic habitat near Gorizia, close to the Slovenian border in northeastern Italy (Bressi 2000; 2001). In total, *Rana latastei* has been recorded from less than 200 localities in Italy, although since this species can easily be overlooked or mistaken for *Rana dalmatina* this number may in fact be higher. Nonetheless, almost all surviving sites are now small and isolated and are hence more vulnerable to extinctions caused by human influences or stochastic events. Andreone and Luiselli (2000) studied various factors in order to assess threats to the conservation status of Italian anurans and considered *Rana latastei* to be Vulnerable, mainly because of this fragmented distribution and the high levels of human disturbance in some areas.

2.4.4. Distribution and Status in Slovenia.

In the early years of the 20th Century, *Rana latastei* was recorded from the Panovic Forest near Nova Gorica (Schreiber 1912). This species was subsequently missed for many decades, until its "rediscovery" in 1995. After extensive surveys were conducted in the spring of 1997, a total of 210 *Rana latastei* breeding sites, with 13,200 spawn clumps being recorded, were located in Slovenia, (Poboljsaj 2002). Many of these sites were within 500 m of each other, however, and normal migration between them was therefore thought to be possible. Indeed, as a result of further surveys in 2003 and 2004, most of these populations are now considered to be connected and it is currently believed that only six separate metapopulations of Italian agile frog exist in Slovenia (Poboljsaj and Lesnik 2005). These are the Panovic Forest area (in the western Vipava valley), Rablje and Mlake (also in the Vipava valley), the Branica valley, the Idrija valley and Gorika brda. In Slovenia, *Rana latastei* is typically found along small streams flowing through low hills and in the adjacent humid lowland deciduous forests. The habitat occupied ranges from 50 to 250 m in altitude and probably

does not exceed 30000 ha in total extent for the whole country. The Panovic Forest and the nearby Branica valley still possess fairly intact habitats and large, healthy frog populations – consequently these are the most important *Rana latastei* populations in Europe and, therefore, globally. The remaining four Slovenian populations are threatened to varying degrees by agricultural improvements and drainage (Vogrin 1996; 1997).

2.4.5. Distribution and Status in Croatia.

First discovered in Croatia in 1879 near Pazin (Cei 1944), *Rana latastei* is restricted to the central and northern part of Istria (Schmidtler 1977; Pozzi 1980; Burlin and Dolce 1986; Gasc *et al* 1997). There are few distinct metapopulations in this distribution area. The most significant occurs in the central Mirna valley in the Motovunska šuma forest, the largest remnant of moist deciduous forest in this part of Croatia. Other localities include the tributaries of the Butoniga accumulation lake, the upper reaches of the Mirna river, the River Lipa and three separate populations in the karstic fields north of Motovun along the rivers Malinska (near Čepić), Pregon and Mlaka (near Zrenj).

The Croatian Herpetological Society conducted surveys during the spring of 2006 and located 30 breeding sites, containing a total of 3122 spawn clumps, even though only part of the potential distribution area was searched for this species (M. Gluhacović *pers. com.*). The majority of these breeding localities were in water bodies within moist deciduous forests (and occasionally in nearby fields) up to 200 m in altitude. A few localities are also known from above 300 m in the karstic zone north of the Mirna valley and on the River Lipa. The highest known sites for *Rana latastei* are in karstic fields around the River Pregon (353 m) and the River Mlaka (355 m). Most *Rana latastei* populations in Croatia are threatened by intensive agriculture and drainage. Further surveys and monitoring of this species are planned by the Croatian Herpetological Society.

2.5. Threats

2.5.1. Habitat Destruction.

The main cause of the huge decline of *Rana latastei* populations throughout the range of this species has undoubtedly been direct habitat destruction. The majority of the humid lowland forests of the Po Basin and adjacent areas have now been cleared and drained for intensive agricultural use, poplar plantations and urban development. The somewhat specialised ecology of this species means that such land use changes have almost always been detrimental. Gravel extraction is a threat in some areas, such as along the Tagliamento River in Italy, and the damming of streams has also destroyed much *Rana latastei* breeding habitat. Although a few overgrown ditches and poplar plantations have been colonised by Italian agile frogs, most areas are now unable to support this species in the long term. Today, only small and isolated relicts of suitable habitat survive across the former range.

2.5.2. Habitat Fragmentation.

Apart from the loss of a significant proportion of its former habitat, *Rana latastei* is also threatened by the severe fragmentation of the remaining areas of forest. The Italian agile frog has a relatively poor dispersal ability and is therefore more dependent on habitat continuity than many other amphibians – although Smith and Green (2005) argue that amphibians are more effective dispersers than is commonly supposed. Nonetheless, the physical separation of populations by unsuitable habitat and roads creates barriers to normal movements, and hence to the exchange of genetic material. This may lead to smaller, less genetically diverse populations that consequently face an increased risk of local extinctions (and, of course, roads can also cause direct frog mortality). The problem of habitat fragmentation also appears to exacerbate the natural decrease in *Rana latastei* genetic diversity towards the west of the range (Capula *et al* 1991; Garner, Pearman and Angelone 2004; Garner *et al* 2004). Genetic diversity is estimated to decline by a factor of three from east to west (IUCN Conservation International and Natureserve 2004) and is the result of the post-glacial expansion of this species from a Balkan refugium. Any further decline in genetic diversity caused by habitat fragmentation is therefore a severe threat to many small *Rana latastei* populations. Among other effects, reduced genetic variation is believed to cause greater vulnerability to amphibian pathogens.

Figure 3: Loss of Italian Agile Frog Habitat to Agriculture, Po Plain, Italy

2.5.3. Habitat Degradation.

Drainage activities, aimed at making land more suitable for agriculture and development, have accompanied much of the humid forest destruction throughout the range of *Rana latastei*. Unfortunately, this has also caused a significant lowering of water tables in many of the surviving patches of habitat. Even where deeper ditches still provide some breeding areas, the loss of the lush ground cover, which is dependant on the maintenance of high water tables, reduces the suitability of terrestrial habitats used for feeding and hibernating. In addition, the continued pumping of water for crop irrigation and urban use can dramatically reduce available breeding habitat itself and poses a threat to many populations. This problem has been addressed in some Italian reserves by deliberately pumping water back into the streams and ditches used for breeding by *Rana latastei*. However, this measure has sometimes met with local opposition and has had to be stopped, even when the work has been funded with EU Life grants. A further problem caused by the intensive agricultural use of much of the land now surrounding *Rana latastei* sites is pollution. Various fertilisers and pesticides are thought to be having an adverse impact on many *Rana latastei* populations, both through direct run off and spray drift into the breeding sites and the percolation of pollutants into the water table.

2.5.4. Introduced Species.

A range of introduced species pose a potential, albeit still largely unknown, threat to *Rana latastei* populations. Such species include various predatory fish, the American bullfrog, *Rana catesbiana*, the red-eared slider, *Trachemys scripta elegans* (Soccini and Ferri 2004) and the American species red swamp crayfish and spinycheek crayfish (*Procambarus clarkii* and *Orconectes limosus*). Pheasants may pose a serious threat to *Rana latastei* populations (Honegger 1981; Pozzi 1980) and domestic ducks have also been known to eat both the tadpoles and adults of Italian agile frogs. American bullfrogs have not yet been recorded in the same localities as *Rana latastei* but could become a problem, especially for the smaller western populations of the Po Basin, since they are aggressive predators on other frogs and are known carriers of pathogens such as *Ranavirus* and *Batrachochytrium* (Daszak *et al* 2004; Garner, Pearman and Angelone 2004). In some cases, however, introduced species such as bullfrogs may utilise different, more sunny habitats to those preferred by Italian agile frogs so levels of direct conflict may be lower than those faced by other native amphibians. Perhaps the most serious threat to the survival of *Rana latastei* is the predatory fish, *Percottus glenii*. This species, which originated in the Amur Basin, is often used as bait by fishermen. It has spread widely across Eastern Europe and is able to live in waters of almost any condition. Its preferred food is tadpoles (Shatunovsky *et al* 1988) and its introduction has caused significant declines in a number of amphibian species. *Percottus glenii* has recently been recorded in the Po Basin for the first time (P. Veenvliet *pers. com.*), the implications of which for *Rana latastei* are extremely serious.

2.5.6. Other Threats.

Other threats confronting this species have included the destruction of forest habitats for landfill sites, most seriously at the Valle della Motta in Switzerland (which supports one third of the Swiss *Rana latastei* population). Inappropriate habitat management has also been a problem for some protected sites. In particular, the coppicing of humid forests to harvest timber and promote the growth of fresh tree shoots allows too much sunlight to reach the ground. This greatly reduces humidity levels and renders the terrestrial habitat too hot and dry for *Rana latastei*, at least in the short term. If carried out too extensively in small habitat remnants, as has occurred in some reserves, such management will adversely impact *Rana latastei* populations. The digging of Tartuffi mushrooms by large numbers of people (with dogs) in the Motovun forest, Croatia, may also be a possible threat to *Rana latastei* through the destruction of ground vegetation cover. Fortunately, this species does not appear to be under direct threat from illegal collection, either for the food or pet trades, and deliberate persecution also does not appear to be a problem in any range country. Climate change, however, presents one of the most potentially serious threats to the survival of *Rana latastei*. Although the potential future effects of climate change are hard to predict, the isolated nature of many populations ensure that this species will have extreme difficulty in responding and adapting to them.

2.6. Current Protection

2.6.1. Species Protection.

The Italian agile frog is listed in Appendix II of the Council of Europe's 'Convention on the Conservation of European Wildlife and Natural Habitats' (the Bern Convention), as well as in Annexes II and IVa of the European Community's 'Directive on the Conservation of Natural and Semi-natural Habitats and of Wild Fauna and Flora, Directive 92/43/EEC' (the Habitats and Species Directive). European Union member states have drafted laws that transpose the EU Habitats and Species Directive into national legislation so *Rana latastei* is therefore strictly protected in Italy and Slovenia at all stages of its life cycle. Switzerland and Croatia, as contracting parties to the Bern Convention, have also implemented domestic legislation that protects this species. In reality, however, national legislation is often ineffective at protecting herpetofauna (Scalera 2003; 2004).

2.6.2. Habitat Protection.

The remaining fragments of *Rana latastei* habitat now receive a high degree of protection in the two European Union countries within its range:

- In Italy, 130 sites have been listed as Special Areas of Conservation under the Natura 2000 series. In addition, nine are Corine Biotopes Sites and some are also Ramsar sites (EUNIS 2005). Five *Rana latastei* sites in the region of Lombardia have also been declared as Aree di rilevanza erpetologica nazionale (AREN) by the Societas Herpetologica Italica, although this designation confers no legal protection.
- Four areas have been proposed as Special Areas of Conservation (SAC) for this species in Slovenia and cover 80% of the populations of this species in the country. These sites are the western Vipava Valley (5000 ha), including the Panovic Forest, the Branica valley (3500 ha) and two isolated areas (of 10 and 50 ha) that support the two most easterly populations (Poboljsaj and Lesnik 2005). The Panovic Forest, a mixture of wet forests, damp meadows and drier land close to Nova Gorica, is also listed as a Corine Biotopes Site.
- Outside the European Union, many *Rana latastei* localities in Switzerland, such as the Parco naturale della Valle del Ticino, Torbiere del Bassone di Albate, Lago Alserio and Seseslio, have nature reserve status. Although not created specifically for this species, many were declared to be "amphibian breeding sites of federal importance", based on the number of species, rarity of species and population size. The presence of *Rana latastei* therefore played an important role in the selection process (Borgula *et al* 1994; Ryser 2002; B. Schmidt *pers. com.*).
- *Rana latastei* habitat currently receives little protection in Croatia, where only a small part (281.42 ha) of the Motovunska šuma forest near Buzet is protected as a Special Reserve of Forest Vegetation (E. Kletecki. *pers. com.*).

2.7. Recent Conservation Actions

2.7.1. Habitat Management.

In relatively undisturbed natural forest habitats, little management would be required for this species. However, where human activities are impacting sites, and this is probably a factor for most surviving *Rana latastei* populations, direct intervention is necessary to mitigate for the adverse effects that result. In Italy, for example, water has been pumped into the ditches on some reserves for this species in a deliberate attempt to counteract the lowering of local water tables. Unfortunately, such work has sometimes met with local opposition, as it has been perceived as reducing the water available for agricultural purposes, and has usually been stopped. Only very limited re-creation of aquatic and terrestrial habitats has so far been attempted for this species, although clearly a huge amount of this type of work will be necessary in the future to secure the long-term viability of many populations. An excellent example of the positive benefits of aquatic habitat re-creation was provided near Seseglio, in Switzerland, in an area where some of the original *Rana latastei* breeding sites were destroyed in 1986-1988. A chain of four new ponds, connected by a slow brook, was created and, within seven years, the number of spawn clumps laid annually had increased from 40 to 500 (Grossenbacher 1995). Conservation efforts to improve and maintain the existing and adjacent habitats are ongoing at this site (Grossenbacher 1997)

2.7.2. Species Management.

The translocation of Italian agile frogs has not been widely employed to date, either for the enhancement of existing populations or the re-establishment of former sites. In any event, future translocations will be largely unnecessary if habitat corridors can be re-created between existing sites, thus allowing *Rana latastei* populations to spread naturally. However, the re-introduction of this species to parts of its former range, as well as the continued survival of very isolated, genetically impoverished populations, may both depend upon the increasing use of such species management techniques. As with most anurans, this should not require an expensive captive breeding programme and need only involve the translocation of an adequate number of spawn clumps from healthy, disease-free donor populations to newly re-created habitats, or to ailing, genetically depleted populations. Obviously, any factors known to have caused population declines in the past must have already been addressed before translocations can take place. Only two mentions of this technique being employed for *Rana latastei* appear in the literature. One project, a re-introduction to the Riserva Naturale Bosco "Giuseppe Negri", Pavia, Italy, seems to have been very successful (Bernini and Razzetti 2002). In addition, a recently started three year project, which covers seven protected areas of the Po Plain in Lombardy and seeks to recreate suitable habitats and reproductive sites for *Rana latastei*; has involved the translocation of tadpoles bred in semi-natural conditions immediately prior to metamorphosis (Scali *et al* 2001).

2.7.3. Surveys and Monitoring.

A significant amount of survey work has been done in recent years and a good picture of the distribution of the Italian agile frog is now building up. In Switzerland, Kurt Grossenbacher at the Natural History Museum in Berne has monitored the sites in the Kanton Ticino, along with Mario Lippuner of the Büro für Ökologie und Landschaftsplanung in Zurich. For example, in 2004 the total number of spawn clumps in Mendrisiotto was 1350 (Lippuner 2004). The Societas Herpetologica Italica surveyed most Italian sites in the 1990s, while compiling the national herpetological atlas (Societas Herpetologica Italica 1996), a new, updated version of which has recently been published (Sindaco *et al* 2006). As well as studying sites in the Po Plain, Nicola Bressi at the Trieste Natural History Museum has also made interesting discoveries and observations on *Rana latastei* in the karst country of the extreme northeastern corner of the country (Bressi 2000; 2001).

In Slovenia, the Society of Bird Research and Nature Protection (DPPVN) and the Centre for Cartography of Fauna and Flora (CKFF), with assistance in the field from members of the Slovenian Herpetological Society, carried out extensive surveys in 1997, 2003 and 2004, discovering many new breeding sites in the process. The CKFF has compiled detailed information, such as the density of spawn clumps, which has helped to inform the proposal of Natura 2000 sites (CKFF 2003; Poboljsaj and Lesnik 2005). Preliminary surveys have also been carried out in Croatia in the Mirna valley and

adjacent areas – work that is being continued by the Croatian Herpetological Society. It should be noted that, apart from some work in Switzerland, most studies have involved distribution surveys only. As *Rana latastei* populations undergo such dramatic natural fluctuations, longer-term monitoring (i.e. 10 years or more) will be needed to determine actual population trends, and hence the conservation status of this species.

2.7.4. Scientific Research.

Encouragingly, the endangered status of *Rana latastei* has prompted a number of research projects in recent years. For example, University of Zurich Zoological Institute has investigated genetic diversity (Garner and Pearman 2001; Garner, Angelone and Pearman 2003), reproductive success (Pearman *et al* 2002; Hettyey and Pearman 2003) and the transmission of viruses (Pearman *et al* 2004).

2.7.5. Funding.

All four range states are now funding *Rana latastei* conservation work. The most significant funding, however, has been obtained in Italy as a series of Life project grants:

- 1996 (1996-2000) Fontane Bianche di Lancenigo
- 1996 (1997-2001) Groane regional park (Boschi delle Groane, Pineta di Cesate)
- 1998 (1997-2001) Valle S. Croce e Valle del Curone
- 1999 (2000-2002) Palata Menasciutto
- 2004 (2004-2007) Ganna Lake
- 2005 (2005-2008) Italian Alps (Vicenza and Treviso provinces)

2.7.6. Public Awareness.

Brochures, posters, environmental education programs and information about *Rana latastei* for farmers, foresters and tourists have all been produced as part of the above Life projects in Italy and public awareness campaigns are increasingly being used for this species in every range state.

3. Action Plan Objectives

3.1. Overall Goal

The overall goal of this action plan is to ensure that the decline of the Italian agile frog in Europe is reversed and that viable populations are re-established throughout the range and are subsequently maintained as a viable and integral part of the habitats and landscapes they occupy.

3.2. Objectives

In order to achieve this goal, it is necessary to identify and then remove (or mitigate for) any threats to *Rana latastei* populations and their habitats. The following objectives are integral to this process:

Objective 1. To ensure any significant, unprotected populations of *Rana latastei* in the four range countries listed in Objective 1 are safeguarded by suitable national designations.

Objective 2. To produce international and national recovery plans for *Rana latastei* that clearly set out the work required to ensure the long-term survival of this species in all four range countries.

Objective 3. To produce management plans (or assist with the amendment of existing plans if necessary) for specific protected areas that support significant *Rana latastei* populations in the four range countries, taking into account the particular ecological requirements of this species and thereby ensuring that appropriate management regimes are established.

Objective 4. To continue field surveys in Switzerland, Italy, Slovenia and Croatia to fill all gaps in current knowledge about the distribution and status of *Rana latastei* in Europe

Objective 5. To define and quantify "Favourable Conservation Status" and "Favourable Reference Values" (as defined by the European Commission) for *Rana latastei* in Italy and Slovenia, in order to

plan adequate monitoring programmes and provide an accurate measure of the success of future actions, and to apply similar targets to populations in the non-EU countries of Switzerland and Croatia.

Objective 6. To encourage and support scientific research relevant to the conservation of *Rana latastei.*

Objective 7. To improve international liaison and coordination between all those engaged in surveys, monitoring, habitat management, scientific research, political lobbying and producing and implementing recovery plans (to more effectively achieve Objectives 2-9 below).

Objective 8. To promote a positive public attitude towards the conservation of *Rana latastei* in Europe and secure the support of all relevant governments, policy makers, organisations, institutions, landowners and individuals.

Objective 9. To identify all sources of funding and grants for the activities outlined in Objectives 1-8, ensuring that all relevant organisations, institutions and individuals are made aware of such opportunities.

4. Actions Required

4.1. Habitat Protection

Rana latastei is an idiosyncratic species, with different ecological requirements to many other frogs in its range – the conservation of the richest amphibian communities is largely irrelevant to this species and, conversely, specific measures to protect Italian agile frog habitats benefit few other anurans (Atmar and Patterson 1993; Scali *et al* 2001). Nonetheless, the small size and endangered status of many populations indicates that all habitat occupied by *Rana latastei* in Europe should receive full protection.

A. Urgent Priority Actions

Action 4.1.1. Ensure that *all* habitats supporting known *Rana latastei* populations in Switzerland, Italy, Slovenia and Croatia are protected from any threats of further habitat loss by appropriate national and international designations.

B. Medium Priority Actions

Action 4.1.2. If any new *Rana latastei* populations are discovered through future distribution surveys, ensure that these are brought to the attention of the relevant governments and conservation bodies and that they receive full protection at the earliest opportunity.

Action 4.1.3. Control development on, or the destruction of, areas that include potential *Rana latastei* habitats, particularly where these form important future corridors for the dispersal of key populations.

Action 4.1.4. Establish legal provisions to prevent further degradation of *Rana latastei* habitat through excessive water extraction in areas supporting, or adjacent to, all remaining lowland humid forests.

Action 4.1.5. Examine alternatives to proposed gravel extraction in the flood plain of the Tagliamento River, Italy, to minimise further destruction of *Rana latastei* habitat – any areas where this is carried out should be restored to provide suitable terrestrial and aquatic habitat for *Rana latastei*.

Action 4.1.6. Limit or stop the further destruction of *Rana latastei* habitats by landfill operations in the Valle della Motta in southern Switzerland.

4.2. Habitat Management

In addition to the legal protection of sites, the specific habitats required by *Rana latastei* should be managed appropriately. In particular, potentially damaging management activities (such as coppicing), which may be carried out for entirely unrelated reasons, should be avoided in certain key areas. Although such conflicting management requirements will be inevitable, and sometimes intractable, a balance that ensures the long-term viability of *Rana latastei* populations should be sought wherever possible. Certain problems, such as lowered water tables, chemical use or invasive

alien species, may need to be brought under control. Habitat re-creation will also be essential in many areas to allow dispersal and to prevent the ultimate loss of small *Rana latastei* populations. In many natural forest areas, however, management may simply involve non-intervention and the conservation of Italian agile frogs will not have large cost implications in such cases.

A. Urgent Priority Actions

Action 4.2.1. Limit and control coppicing and other tree felling activities in humid forest areas that provide important terrestrial habitats for Italian agile frog populations.

Action 4.2.2. Limit and control the use of pesticides, fungicides and fertilisers within, or close to, nature reserves or other important aquatic and terrestrial habitats used by this species.

Action 4.2.3. Eradicate introduced predatory fish, especially *Percottus glenii*, in all water bodies that are known to be *Rana latastei* breeding sites, or are being enhanced to become new breeding sites.

Action 4.2.4. Ensure that populations of American bullfrog and the two American crayfish species in Italy are eradicated wherever possible.

B. Medium Priority Actions

Action 4.2.5. Prepare management plans for all known *Rana latastei* sites or ensure that all existing plans are suitably modified. These should map key areas for this species and fully take into account the particular ecological requirements and likely movements of Italian agile frogs on that site.

Action 4.2.6. Maintain current reproduction sites and, particularly where ditches are being used for breeding, ensure that these are cleared out periodically (removing species such as *Typha*) to prevent them from silting up and disappearing.

Action 4.2.7. Prepare habitat re-creation plans where appropriate (including details of corridor widths), particularly where this would reverse the effects of agricultural reclamation, or other past activities, and re-connect presently fragmented *Rana latastei* populations (thus re-establishing a permanent gene flow).

Action 4.2.8. Where appropriate and practicable, re-link as many existing *Rana latastei* sites as possible by re-planting forest corridors along suitable streams, ditches or other potential breeding habitats.

Action 4.2.9. In certain key areas between *Rana latastei* populations, and where it is not possible to replace hybrid poplar monocultures with tree species native to the humid forests of the area, encourage the growth of poplars at a density that provides shade and allows a natural understorey to develop.

Action 4.2.10. Restore natural stream profiles, where these have been artificially canalised, to allow dense natural vegetation to grow on the banks and improve *Rana latastei* breeding success.

Action 4.2.11. Ensure that springs are not artificially blocked with any man made debris, thereby allowing them to flow into stream and river systems at their natural capacity.

Action 4.2.12. Prevent any further lowering of the water table, and raise the levels in areas where it has been reduced by excessive water extraction, to produce the correct conditions for the humid forest and its understorey.

Action 4.2.13. Reduce and control the numbers of introduced non-native species (such as pheasants) where these are known or are thought to be causing problems for any *Rana latastei* populations.

Action 4.2.14. Where applicable on land under military control, negotiate agreements with the relevant authorities to alter or limit any damaging training activities in key *Rana latastei* habitats.

4.3. Species Protection

The Italian agile frog already receives a high degree of protection in Europe, although this has often failed to reduce the past loss or continued degradation of its habitats.

B. Medium Priority Actions

Action 4.3.1. Carry out a review of the effectiveness of current legal protection for *Rana latastei*, and its habitats, and its enforcement throughout the range of this species. Provide recommendations for improving the situation where necessary – for example through appropriate assessments of development impacts, the implementation of suitable mitigation or compensation measures, adequate enforcement and the imposition of higher penalties for infringements.

4.4. Species Management

Opportunities for natural re-colonisation no longer exist in many areas, especially where development or road construction have isolated habitats. In such cases, direct intervention, possibly through captive breeding and release programmes, may be required to re-establish *Rana latastei* in parts of its former range. If a population has been isolated for a long period, and there is evidence of depleted genetic variation, it may be necessary to introduce individuals from a more centrally located population (Garner, Angelone and Pearman 2003).

B. Medium Priority Actions

Action 4.4.1. Assess the requirement for species management initiatives for Italian agile frogs in Switzerland, Italy, Slovenia and Croatia.

Action 4.4.2. Where it is considered necessary and feasible, and where previous known threats have been removed, develop new strategies and plans for the potential re-introduction of *Rana latastei* into parts of the historical range of this species and for translocations to boost genetically impoverished populations.

Action 4.4.3. Investigate pathogens likely to affect Italian agile frogs if or when any translocation programmes are implemented. Ensure that, prior to release, all animals receive adequate health screening for any diseases or parasites that may compromise the survival of both the released frogs and any other wildlife species.

4.5. Distribution Surveys

The extent and status of all *Rana latastei* populations in Europe must be established before the success of conservation efforts can be properly planned and implemented, let alone measured. However, distribution data for Italian agile frogs are still incomplete for some areas. Standardised survey methods and mapping techniques, particularly the use of Geographic Information Systems (GIS), will be useful tools to help fill such gaps in current knowledge.

A. Urgent Priority Actions

Action 4.5.1. Continue distribution surveys and the mapping of further, potentially suitable natural *Rana latastei* habitats in Switzerland, Italy (particularly along the southern tributaries of the Po), Slovenia and Croatia (including the investigation of an old record near Pazin, south east of Motovun).

B. Medium Priority Actions

Action 4.5.2. Conduct additional surveys of artificial habitats that may also be used by this species, such as poplar plantations, overgrown ditches in farmland and meadows close to streams or ponds, especially where such areas lie adjacent to, or between, known existing natural populations.

4.6. Population and Conservation Status Monitoring

It is important to regularly monitor *Rana latastei* populations in order to detect changes in status and to assess the effectiveness of any previous conservation actions taken (this exercise would also enable any effects that may be attributable to climate change to be detected in the future). Monitoring would have to be carried out on an annual basis to detect any overall trends since *Rana latastei* populations naturally fluctuate in size and the timing and amount of rainfall, which affects the humidity of the forest floor, also vary between seasons. Locally based monitoring by a number of surveyors would also be preferable as there is only a narrow window of opportunity for counting spawn clumps each spring. This reduces the effectiveness of national surveys by single individuals,

except where there are only a few populations in a relatively small area, such as in Switzerland or Croatia. Data collection and reporting should be standardised across the range, with at least the following information being obtained for each country:

- Number of breeding sites and number of spawn clumps laid per population or metapopulation.
- Distance of each breeding site from the next nearest breeding site.
- Extent of suitable terrestrial habitat around each breeding site
- Extent and quality of terrestrial habitat between the known breeding sites.
- Total number of populations per country - where a population is described as a group of breeding individuals that are located further than 500 m from any other group of individuals.

Monitoring results can be used to refine and adjust conservation and habitat management techniques and to prioritise the allocation of available resources. The results obtained will differ from year to year due to the short life span of this species and the dependence it has on the climatic conditions especially the humidity each year so several years will have to be examined before any overall changes can be seen.

Defining and quantifying "Favourable Conservation Status" for *Rana latastei* in Italy and Slovenia, with a similar concept being used in Switzerland and Croatia, should be central to this process and will enable a clear set of goals, targets and funding requirements for conservation actions to be produced.

A. Urgent Priority Actions

Action 4.6.1. Determine the historical range of *Rana latastei* in Switzerland, Italy, Slovenia and Croatia, as well as the current range of this species, to assist with the development of specific targets for habitat restoration and re-creation plans, as well as species re-introduction strategies.

B. Medium Priority Actions

Action 4.6.2. Develop standardised GIS-based methods for the mapping and measuring of prime habitats specifically used by Italian agile frogs (as opposed to broader habitat categories) to enable the future assessment of changes in the extent and quality of these habitats at all sites.

Action 4.6.3. Produce a standardised methodology for monitoring and calculating the condition of individual *Rana latastei* populations and any future changes to their status. Monitoring should also take place adjacent to, and between key areas, as this species may otherwise be overlooked in suboptimal habitats, such as overgrown ditches in agricultural land.

Action 4.6.4. Inform the national governments of Switzerland, Italy, Slovenia and Croatia, plus the Standing Committee of the Bern Convention and other relevant parties, of all monitoring results.

4.7. Scientific Research

Appropriate scientific research can be used to inform and refine conservation management. Significant bodies of work on various aspects of *Rana latastei* ecology have already been published but there is still a lot to learn about this species. As much support as possible should therefore be given to academic institutions planning to conduct research on the Italian agile frog, especially where this is relevant to the objectives of this Action Plan.

B. Medium Priority Actions

Action 4.7.1. Encourage and support scientific research investigating the general ecology, behaviour and habitat use of the Italian agile frog.

Action 4.7.2. With experienced scientists, develop a series of applied research goals that are relevant to the conservation of *Rana latastei*, especially empirical work investigating the response of frogs to various forms of habitat management.

Action 4.7.3. Expand on previous studies into the genetic variation of declining and isolated *Rana latastei* populations and use the results to inform recovery and re-introduction strategies for this species.

Action 4.7.4. Develop research projects investigating the potential impacts on populations of *Rana latastei* (and the degree of immunity they possess) to pathogens such as *Ranavirus* and *Batrachochytrium*.

Action 4.7.5. Investigate the potential for research projects looking into the effects of climate change on populations Italian agile frogs to help inform any resulting changes to habitat management that may be necessary, as well as the planning of alternative dispersal corridors if required.

4.8. Improved Liaison and Coordination

Conservation efforts to halt the decline of the Italian agile frog have often progressed slowly, and have suffered a number of setbacks, so there is still much to be done to ensure the long-term viability of this species in Europe. Although conservation is always more effective when carried out by local workers (within their own country), international liaison has clearly been highly beneficial in the past and there is still a need to further improve cooperation in order to facilitate the exchange of information and ideas and to provide mutual support. *Rana latastei* populations in each of the four range countries should not be treated in isolation, especially in border areas, and co-ordinated efforts should be made to manage the European population as a whole across its entire range.

A. Urgent Priority Actions

Action 4.8.1. Ensure that the Governments and relevant conservation bodies of Switzerland, Italy, Slovenia and Croatia implement this Action Plan.

B. Medium Priority Actions

Action 4.8.2. Coordinate an international European Recovery Plan for *Rana latastei* and ensure that it is formally adopted by the Italian, Swiss, Slovenian and Croatian Governments and is thus binding on all key players. In particular, increased effort should be made to manage Swiss and Slovenian populations in conjunction with neighbouring Italian populations.

Action 4.8.3. Where these do not already exist, encourage the production and implementation of national *Rana latastei* Recovery Plans for Switzerland, Italy, Slovenia and Croatia. These should be produced in a standard format and be coordinated with, and meet the requirements of, the European Recovery Plan for *Rana latastei*. Ensure that these national Recovery Plans are formally adopted by the relevant Governments and are thus binding on all key players, e.g. the relevant Ministries, National Park Administrations and local governments.

Action 4.8.4. Develop a common, agreed protocol to standardise further distribution surveys and habitat mapping, as well as the effective population and conservation status monitoring of Italian agile frogs, in the range countries of Switzerland, Italy, Slovenia and Croatia.

4.9. Public Awareness

General public support carries enormous political weight and is therefore crucial for the successful implementation of Species Action Plans such as this. Conservation can be a challenge, however, when local people need to be convinced that certain damaging activities should be controlled or even prohibited, especially when such restrictions may have economic implications. Adequate financial compensation for lost potential revenue, mainly via agri-environment funding, will therefore be an important adjunct to public awareness campaigns in order to gain the support and goodwill of some farming communities within the range of the Italian agile frog.

B. Medium Priority Actions

Action 4.9.1. The public awareness and educational campaigns initiated by several of the Life funded projects in Italy should be extended to all other areas of the country. Similar campaigns that stress the conservation significance of this species should be established for the benefit of other *Rana latastei* populations in Switzerland, Slovenia and Croatia.

Action 4.9.2. Ensure that local communities are aware of habitat and species protection measures and, in particular, the importance of managing and controlling water extraction around key *Rana latastei* habitats in Europe - and also that they are informed of any relevant financial compensation mechanisms.

Action 4.9.3. Develop educational material aimed at informing the public about problems caused by introduced species such as predatory fish and bullfrogs.

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