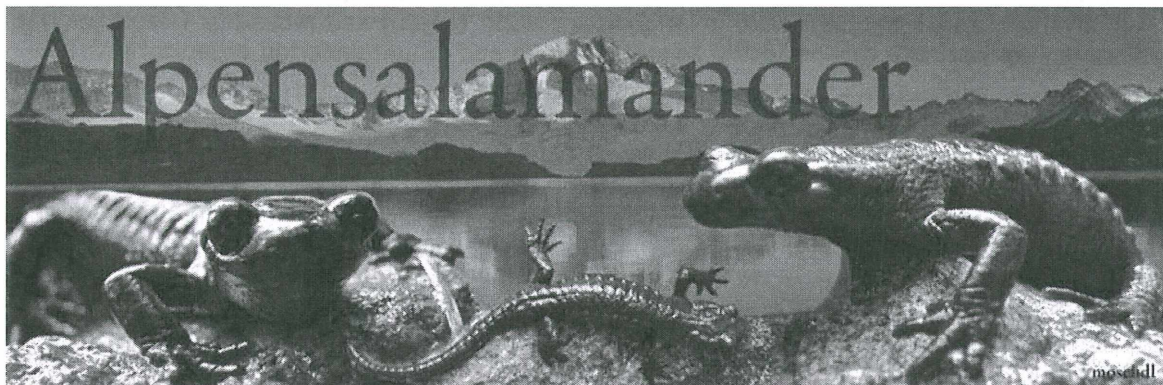


The Alpine Salamander

**Wilfried Schwarzenbacher, Uschi Reinthaler, Magdalena Meikl, Kristina Bauch,
Ulrike Berninger, Elke Zobl, Nicole Wopfner, Robert Schwarzenbacher**



The Alpine Salamander (*Salamandra atra*) is a pitch black amphibian, that lives in Alpine regions at altitudes between 600-2400m. Males and females measures up to 144mm and 151mm, respectively and live up to fifteen years. It has a slightly elongated head, with two large kidney-shaped paratoid glands. The body has 11-13 costal grooves on either side. The tail is square in cross-section. Males have a slightly more pronounced cloaca than females. When threatened, they excrete a poisonous liquid from their skin glands. *S. atra* is a fully terrestrial species and can spend most of its time underground. It is a very cryptic and quite abundant amphibian, whose activity on the surface is highly related to climate, as it prefers humid conditions. This becomes evident after heavy rainfall, when the animals become active and leave their hideouts. Densities of 2380 individuals per hectare are known to occur. The typical habitats of the *S. atra* are humid alpine meadows and woodlands, where it lives in cracks, crevices or burrows, only to emerge at night or after rainfall. The species hibernates, depending on the altitude, for a period of 6-8 months (NOELLERT & NOELLERT 1992). The lowest known sites are at altitudes of 430m in Austria and Switzerland, although South of the Alps, the species is rarely found below 900m. The altitude records are 2430m in Switzerland, and 2800m Austria (GASC 1997).

Its specific adaption to the harsh alpine environment manifests its remarkable position as an ovoviviparous amphibian, which does not require an aquatic ecosystem for reproduction. Mating involves a ventral amplexus by the male, followed by the deposition of the spermatophore. One embryo develops in each of the two uteri. The developing young first feed on fertilized, and later on unfertilized ova in the uteri. Later in development, a zona trophica develops on the border between oviduct and uterus, which continuously provides the young with a cellular material that serves as food. The young develop extremely large external gills. Gestation takes 2 years between 650 and 1000m, and 3 years between 1400 and 1700m elevation. The terrestrial, fully metamorphosed young are 40-50mm total length upon birth.

S. atra is an endemic of the alpine arc with some isolated areas in the Dinaric Alps. The Country distribution includes Albania, Austria, Bosnia and Herzegovina, Croatia, France, Germany, Italy, Liechtenstein, Montenegro, Serbia, Slovenia and Switzerland. Only some isolated massifs in Bosnia, Montenegro and Albania (Dragobya) are colonized. Some parts of the Central Alps with a predominantly dry climate Valais and Engadine in Switzerland, Valtellina and Valle Venosta in Italy are avoided. In Italy exists a subspecies *Salamandra atra aurorae* with a bright coloration on the head, back, and dorsal side of the extremities. This coloration can consist of continuous patches or be spotted or blotched. It can vary in color from whitish or yellow to greenish or gray (BONATO 2005). The range of the subspecies *S. atra aurorae* is extremely small (less than 50 square kilometers) and situated at the southern border of the total area between Trento and Asiago in Italy. The habitat consists of mixed deciduous and coniferous forests on cretaceous limestone at altitudes between 1300 and 1800m. In 2005, Bonato and Steinfartz discovered a new partly yellow spotted subspecies of *S. atra* on Monte Pasubio in Italy, named *S. atra pasubiensis* (BONATO 2005).

Despite its central role in the Alpine ecosystem our actual academic record is embarrassingly small. In fact, we know close to nothing about its present distribution in the Austrian Alps, its habitat, and

most importantly its ecology. In order to resolve this shortcoming this project explores the population and distribution of the Alpine Salamander focusing on the Nationalpark Hohe Tauern and several other Natura2000 regions. The main goal is to map occurrence, population- size and development of the Alpine Salamander.

We have established the webportal www.alpensalamander.eu where local communities can register and report their salamander observations. This community based approach enables the combination of research, education and dissemination by interactive participation. We believe that protection of amphibians and their habitats is only possible by actively involving the population. Second, an oral history of Alpine Salamander observations in the past 50 years by conducting interviews in the local community, such as alpinists, farmers, national park staff, mineral collectors, and hunters to preserve their well-versed local knowledge of the Alpine Salamander. In addition, we will collaborate with national parks (Nationalpark Hohe Tauern) and museums (Haus der Natur) to effectively disseminate this project in schools, wildlife and mountaineering organizations.

In addition we will research the distribution of the alpine salamander and analyze its genetic structure. Here, we will focus on the entire distribution of *S. atra* to learn more about its evolutionary history, and highlight different lineages in a perspective of conservation. We will also analyze its distribution on a regional scale to quantify the gene flow between distinct populations and evaluate the influence of landscape features on it. Finally we will analyze the population level to study the relatedness between individuals in relation to their spatial position. Here we will develop a monitoring method to evaluate the emigration rates between the subterranean and surface populations and determine which parameters have an influence on it. For this monitoring project, we have selected locations in three geographically and geologically different Alpine areas. These areas will be monitored periodically, which will also include other amphibians like the Fire Salamander (*Salamandra salamandra*) to investigate the ecological relationship among these species.

The alpine salamander is on the red list of endangered animals in Austria (KYEK 2006) and strictly protected according to the European FFH guidelines. The subspecies *S. a. aurorae* is highly endangered in its very small range. Possible threats to the alpine salamander are the destruction of habitats through extensive road building, widespread use of pesticides by the forest industry, intensifying and expanding of agriculture and ski-tourism. Negative effects of climate change, air pollution, rain and soil acidification are likely though not proven (GASC 1997).

Consequently, efforts to research its habitat and ecology, as well as measures for its conservation have highest priority.

References

- BÖHME Wolfgang, THIESMEIER Burkhard, GROSSENBACHER Kurt: Handbuch der Reptilien und Amphibien Europas, Bd.4/2B: Schwanzlurche (Urodela) IIB; Salamandridae III: Triturus 2, Salamandra: BD 4/IIB. Aula Verlag, 1. Auflage, Dezember 2003; S.969-1028
- BONATO L., STEINFARTZ S.: Evolution of the melansistic colour in the Alpine salamander *Salamandra atra* as revealed by a new subspecies from the Venetian Prealps. Ital. J. Zool., 2005
- GASC J.-P. (1997): Atlas of Amphibians and Reptiles in Europe. Societas Europaea Herpetologica, Bonn, Germany.
- GRIFFITHS R.A. (1996): Newts and Salamanders of Europe. T. and A. D. Poyser, London.
- KYEK M., MALETZKY A. (2006): Atlas und Rote Liste der Amphibien und Reptilien Salzburgs. Amt der Salzburger Landesregierung, Salzburg, Austria.
- NÖLLERT A. & NÖLLERT C. (1992): Die Amphibien Europas. Franckh-Kosmos Verlags-GmbH and Company, Stuttgart.
- RIBERON A., MIAUD C., GROSSENBACHER K., TABERLET P.: Phylogeography of the Alpine salamander, *Salamandra atra* (Salamandridae) and the influence of the Pleistocene climatic oscillations on population divergence. Molecular Ecology (2001) 10, 2555-2560
- STUMPEL-RIEKS S. E. (1992): Nomina Herpetofaunae Europaeae. AULA-Verlag, Wiesbaden.
- VAN DER MEIJDEN A. (<http://www.amphibiaweb.org/>)

Contact

Wilfried Schwarzenbacher	Elke Zobl	Kristina Bauch
Uschi Reinthaler	Nicole Wopfner	kristina.bauch@salzburg.gv.at
Magdalena Meikl	Robert Schwarzenbacher	Hohe Tauern National Park Salzburg
Ulrike Berninger		Gerlos Str. 18
University Salzburg, 5020 Salzburg, Austria		5730 Mittersill
www.alpensalamander.eu		Austria