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# A new approach for surveying the Alpine Salamander (*Salamandra atra*) in Austria

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**Abstract**. The Alpine Salamander is a small pitch black amphibian which is endemic to the European Alps and the Dinarides. It is strictly protected according to the European FFH guidelines. Despite its central role in the alpine ecosystem our actual published record in Austria is small. In order to resolve this shortcoming our project explores its distribution in Austria. It uses a participatory and community based approach to gather data. Everybody can enter and look at Alpine Salamander observations on our website www.alpensalamander.eu. This approach also allows us to establish an "oral history" of salamander observations in the past 50 years by conducting interviews in the local community. Since July 2009 the website and salamander report database are online. From the actual data (more than 5600 records) we already obtained an overview about the present distribution and data quality. The data are an excellent basis for detailed scientific studies on these remarkable amphibians. With this new and highly interactive approach science and education are combined to initiate protection measures with the public.

**Keywords**. Alpine Salamander, *Salamandra atra*, Amphibian, Austria, Alps.

The Alpine Salamander is on the red list of endangered animals in Austria (Klewen, 1991; Nöllert and Nöllert, 1992; Greven, 1998; Guex and Grossenbacher, 2003; Kyek and Maletzky, 2006) and strictly protected according to the European Habitats Directive on the conservation of natural habitats and of wild fauna and flora (European Union Law, 2010). With less than 800 observations, the actual amount of published records in Austria is very small. In fact, its present distribution tendency in the Austrian Alps, its ecology and its habitat are still unknown. In order to resolve this shortcoming, our project explores the distribution of the Alpine Salamander focusing on Austria. In the next years this effort will be extended to the other alpine countries, where the Alpine Salamander occurs. The main goal is to map occurrence, population size and development as well as the genetic structure of the Alpine Salamander.

We have established the website *www.alpensalamander.eu*, where everybody can report Alpine and Fire Salamander observations. This community based approach enables the combination of research, education and dissemination by interactive participation.

Some technical details of the *alpensalamander.eu* portal database:

www.alpensalamander.eu is a standalone wordpress blog that contains information about the salamanders, the research project and a video-blog. It is the central resource for users and hosts the Salamander Report Interface. The Salamander Report Interface is an embedded Google Map running an Application Programming Interface (API) that allows for navigation, location and entry of salamander observations, which are subsequently stored in the MySQL database. The data base stores the entry identification number, date and time, the name and the email address of the user, the type and number of salamanders (Alpine or Fire Salamander), the latitude, longitude and the altitude of the location of the salamander observation, a remark (text entry), and a photograph. The weather conditions, such as sun/rain, temperature and humidity are collected from the ZAMG (Zentralanstalt für Meteorologie und Geodynamik, Austria) according to coordinates and date.

Currently all entries are recorded and manually inspected by the research team for their credibility. Questionable entries such as putative misidentifications between Alpine Salamander and Alpine newt, are investigated by contacting the user. Questionable data are deleted or flagged, and can be excluded for analysis at will. The dataset is freely available to academia.

This web 2.0 approach is a new step to involve the population actively in research and protection of these vulnerable amphibians and their habitats.

A second part of our project is to record "the oral history" of the Alpine Salamander observations in the past 50 years, to see whether the populations are stable or decreasing. Therefore, we conducted interviews in the local community with alpinists, farmers, hunters, national park staff and mineral collectors to preserve their well-versed local knowledge of the Alpine Salamander. There were also several articles in national and local newspapers to inform the population and ask for participation. In addition we collaborate with several national parks (Hohe Tauern, Berchtesgaden) and museums to establish the project in schools, wildlife and mountaineering organizations.

Website and salamander report database are online since July 2009. As of August 2010, more than 5681 Alpine Salamander reports in Austria were gathered. Until now there are 1058 different users, 338 are regular users and the community is still growing. The 5681 records are displayed as 578 clusters (Fig. 1). The criteria for clustering the salamander records are more than 4 Individuals per hectare. Although the project is still in the initial stages, the data already picture a preview of the Alpine Salamander distribution in Austria and allow for a preliminary analysis including the assessment of data quality. As mentioned before, all records were evaluated in person. Obviously questionable reports, like coordinates in a lake, were checked by contacting the user and corrected or deleted.

This aggregated data set is the basis for our preliminary analysis where we consolidated the data with different maps. The results are shown on the following pages. The datum in percent is related to the clusters as described before.

Compared to the geology (Fig. 1A), the main distribution of the Alpine Salamander is in the Northern Limestone Alps (47.2%) and the Central Alps (42.7%). We observed 6.6% in the Grauwackenzone and 2.6% in the Flysch zone. Only a few findings were in the

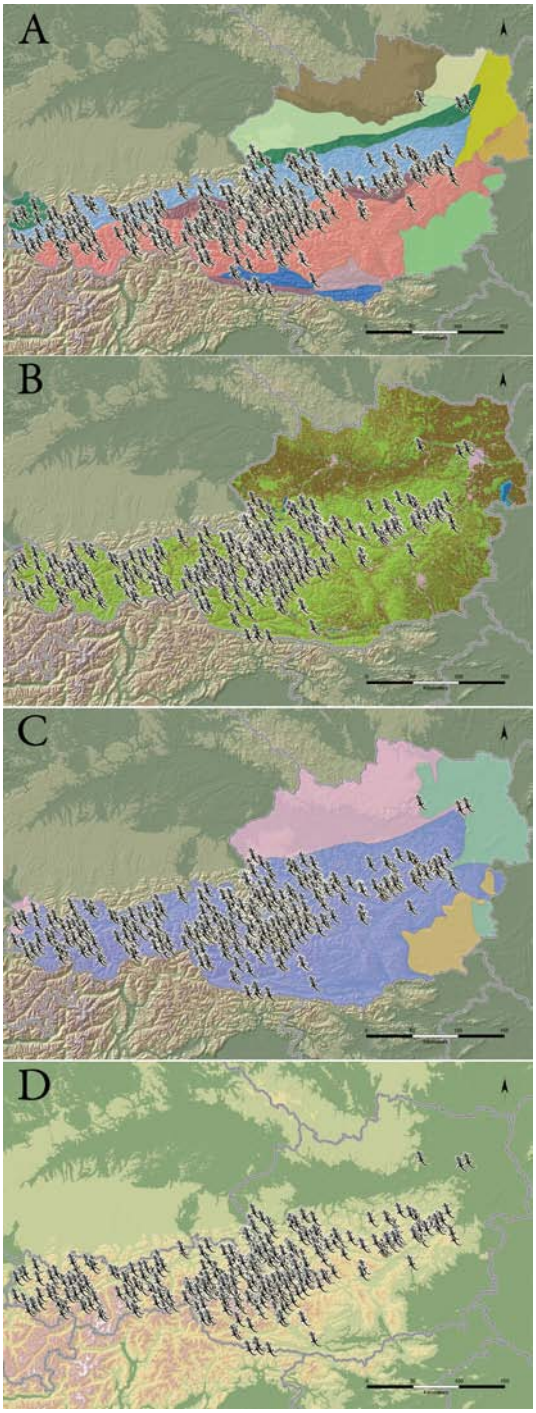


**Figure 1.** Distribution of *Salamandra atra* in Austria. Dataset collected from June 2009 - to August 2010.

a) The distribution of *Salamandra atra* in comparison with different geology. Pink: Central Alps; dark blue: Southern Limestone Alps; light blue: Northern Limestone Alps; yellow: Vienna Basin; light green: South-eastern Foothills of the Alps; orange: Eastern Foothills of the Alps; violet: Grauwacken Zone; lavender: Basin of Klagenfurt; brown: Granite- and Gneiss Upland; dark green: Flysch Zone.

b) The distribution of *Salamandra atra* across land covered areas. Brown: agricultural areas; rose: artificial surfaces; green: forest and seminatural areas; dark blue: water bodies; light blue: wet lands.

c) The distribution of *Salamandra atra* in the different Austrian climate types: dark blue: alpine climate; rose: middle-Europe transitional climate; light blue: pannonian climate; orange: illyric climate.

d) The distribution of *Salamandra atra* per altitude (m a.s.l.). Dark green: 115 – 500; light green: 500 – 1000; light orange: 1000 – 1500; orange: 1500 -2000; pink: 2000 – 2500; lavender: 2500 – 3000; white: 3000 - 3798.

Southern Limestone Alps (0.15%) as well as in the Foothills of the Alps (0.15%) and the Granite and Gneiss Upland (0.3%).There are no records for the Vienna Basin, the South-eastern and North-eastern Foothills of the Alps.

The second map (Fig. 1B) shows the distribution of *Salamandra atra* across land covered areas in accordance to the CORINE landcover classification from 2000. In this map it is shown that over 91.5% of the Alpine Salamanders were found in forest or in semi-natural areas. Only 5% was found in agricultural areas and 3.1 % was found in artificial surfaces.

On the third map (Fig. 1C) the distribution of *Salamandra atra* is compared with the Austrian climate types. 95.8% of the recorded salamanders can be found at an alpine climate. This climate predominates mostly in the Alpine regions of the Austrian federal states Vorarlberg, Tyrol, Salzburg as well as parts of Styria, Upper- and Lower Austria.

The other 4.2% were recorded on middle European transitional climate. These observations took place in lower Austria, some spots in Upper Austria and in the west of Vorarlberg.

Fig. 1D shows the distribution of *Salamandra atra* per altitude. Most of the Alpine Salamanders (42.6%) were found on altitudes between 1500 and 2000 meter a.s.l., 33.8% was found on lower sides at 1000 – 1500 m. Only 0.3% was observed at high altitudes between 2500–3000 m. In lower regions, ranging from 115–500 m, five Salamanders (0.9%) were recorded. The records correlate with increasing altitude, the best altitude for Alpine Salamander observations seems to be between 1500 and 2000 meters.

Taken together, our new approach that involves the community in a scientific project proofs very successful for monitoring the Alpine Salamander in Austria. Since July 2009 we were able to record 5681 Alpine Salamander reports. A broad community was built in short time with the help of 1058 different users and this community is still growing. The records on our website increased in correlation to our degree of popularity. To get even more attention, we started publishing reports in different national and local newspapers. In these articles we invited the population to report salamanders when they find some. The feedback was actually positive. A second positive effect is that the population is getting more attentive on the small black salamanders and so it gets easier to protect those animals.

In comparison, the biodiversity database from the Natural History Museum in Vienna contains 754 recordings for the Alpine Salamander (Cabela et al., 2001).

Our community based approach generates much more data and immediately publishes them to the public. On our website anybody is able to report findings of salamanders. In comparison with other amphibians, it is very difficult to find the Alpine Salamander; they only come to the surface when the weather is adequate (i.e., in the early morning hours or while/after a summer rain). With the vast amount of records it is possible to plan further monitoring activities much more efficiently. Some positive effects of these data are:

- A salamander distribution map was generated with almost no cost for Austria.
- The map is updated continuously and allows monitoring salamander populations.
- Dense salamander occurrences and peculiar observations, like high altitude populations, can be used for research studies like a genetic monitoring to analyze the relationships between the individuals.

With the different geological maps (see results), it becomes obvious that these animals appear basically in the alpine climate on altitudes between 1500 and 2000 m. Our data

are in line with published findings of (Cabela et al., 2001, as well as Guex and Grossenbacher, 2003). This indicates that the data from the public are of high quality and that the abuse of the database is negligible. The main distribution area of the Alpine Salamander is in Austria. So it is necessary to sensitize the population and especially the children, to spark their interest for these amazing animals. We are aimed at collaborating with National parks and museums throughout Europe to effectively disseminate the project and its results in wildlife and mountaineering organizations but also at schools and universities.

The web portal *www.alpensalamander.eu* allows collection of salamander observations by the public which is serving two main purposes as i) data collection for new scientific project initiatives and ii) education of the public through direct and interactive dissemination of salamander observations. We believe that protection of amphibians and their habitats is only possible by actively involving the population, as participatory research has shown.

The Alpine Salamander is one of the heraldic animals of Europe and it is our obligation to put every effort into research on it, in order to preserve the significant moment of observing these amazing animals for future generations.

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