Exposé - Master-Arbeitsthema - Karin Ernst, BSc (CV im Anhang)

# Species' distribution modeling and field survey on *Iberolacerta horvathi* (MÉHELY, 1904) in Austria: predicted and actual habitats considering topographical, geological and bioclimatic parameters

Master thesis topic of Karin Ernst[1].

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## 1. Abstract / Kurzfassung

The aim of this project is to contribute to the fundamental knowledge about the ecological niche preferences and the current species distribution of the Horvath's rock lizard *Iberolacerta horvathi* (MÉHELY, 1904) for the Austrian territory. As a highly diagnostic prediction-tool we will design and apply a species' distribution model (SDM) to detect and map new potential habitats. For the correlative modeling procedure we will implement and analyse species-specific habitat preferences considering geologic, topographic, bioclimatic and ecological variables relying on observed occurrence records. Subsequently, we will survey the potential distribution areas specified by the SDM in the field to finally gain new discoveries of occupied niches of *I. horvathi* in Austria. The study outcome will be a profound species characterization plus newly generated maps of the potential and actual distribution along the northernmost areal boundary of the Horvath's Rock Lizards in Austria. Moreover it will test the ability of the first SDM for *I. horvathi* in Austria, which might also provide a helpful and flexible tool for species conservation aspects.

Das Ziel dieser Studie ist, neue Erkenntnisse über die bevorzugten ökologische Nischen und die aktuelle Verbreitung der Kroatischen Gebirgseidechse *Iberolacerta horvathi* (MÉHELY, 1904) innerhalb Österreichs zu gewinnen. Eine aussagekräftige Vorhersage werden wir mittels Modellierung der potentiellen Verbreitung (SDM – Species' distribution modeling) für Österreich treffen und darstellen können. Für die korrelative Modellierung implementieren und analysieren wir artspezifische Habitat-Präferenzen unter Berücksichtigung geologischer, topografischer, bioklimatischer und ökologischer Variablen, basierend auf Daten bisher bekannter Fundorte. Eine anschließende Freilandstudie an die vom Modell berechneten Standorte mit hoher Wahrscheinlichkeit weiterer Vorkommen, soll schlussendlich zur Entdeckung noch unbekannter besetzter Nischen von *I. horvathi* in

Österreich führen. Endresultat der Studie wird eine umfassende Art-Charakterisierung und eine Verbreitungskarte der potentiellen, als auch realisierten Habitate, entlang der nördlichen Verbreitungsgrenze der Kroatischen Gebirgseidechse in Österreich sein. Außerdem testen wir die Aussagekraft der Modellierung, die zukünftig auch als hilfreiche, flexible Methode in Bezug auf Artenschutz Anwendung finden könnte.

## 2. Introduction

The worldwide distribution of the near threatened (VOGRIN et al., 2009) Horvath's Rock Lizard *Iberolacerta horvathi* (MÉHELY, 1904) is restricted to southern Austria, northeastern Italy, western Slovenia, and northwestern Croatia (CABELA et al., 2001). The northernmost natural distribution has yet been confirmed for southern Austria, more precisely in the Lienzer Dolomites (CABELA et al., 2007). Its vertical distribution in Austria refers primarily to mountainous areas between 500-2000m a.s.l. (CABELA et al., 2007), however in Slovenia it has also been recorded at 200m a.s.l. during a study conducted by ŽAGAR (2008). In the last 30 years, since the first record *of I. horvathi* in Austria 1986 (GRILLITSCH & TIEDEMANN, 1986), new occurrence records for Austria have been reported continuously (Table 1). It definitely shows the highest abundance in mountainous areas, whereas excellent climbing skills have been observed (CABELA et al., 2001; CABELA et al., 2007). Also physiological limitations in the environmental tolerance of *I. horvathi* indicate an adaptation to lower temperature and therefore higher altitudinal range. Its recently examined high metabolic activity seems to be one of the crucial advantages in thermally restrictive regions (ŽAGAR et al., 2015). The morphological characteristic of its occupied niches in Austria has been described as steep, bare rock, fissured surfaces with no or little vegetation (CABELA et al., 2007; DE LUCA, 1992; LAPINI et al.,1993).

The obviously fragmented distribution pattern suggests that the species distribution of *I. horvathi* in southern Austria, e.g. the northernmost area of natural populations is still underestimated. We hypothesize, that we could gain a deeper understanding of *I. horvathi*'s habitat preferences and potential distribution by running a species' distribution model (SDM). This SDM will be the first on *I. horvathi* for Austria, for what we will preferably apply the correlative approach (PEARSON, 2008), which takes the known occurrence records and its different environmental variables of the implemented layers into account. It will quantify correlations between the given environmental parameters and the presence or absence-probability. The outcome will enable us to describe the environmental niche preferences of *I. horvathi* in a multi-dimensional space. A subsequent field survey at suitable sites in Austria will test the predictive performance and might lead to the discovery of new populations.

Hence the newly generated data will contribute to the understanding of the species-specific habitat requirements and its potential and actual distribution in Austria. Once the species' distribution model is well fitted and validated as a reliable tool, it could also address a range of further studies or conservation questions.

**Table 1:** Historical timeline of published occurrence records of *Iberolacerta horvathi* in Austria and close to the Austrian border.

| Year | Event | Reference |
|---|---|---|
| 1955 & 1978 | Suggestions of SOCHUREK about probability of occurrence of *Lacerta horvathi* in Carinthia | (SOCHUREK, 1955a, 1955b, 1978) |
| 1982 | Occurrence records near Friaul, Italy, just few kilometers apart from Austrian boarder (N-Italy) | (LAPINI & DOLCE, 1982) |
| 1986 | First record of *Iberolacerta horvathi* in Austria, Carnic Alps along four valleys, plus one collected exemplar of *Podarcis muralis* (leg. & don. 1926 by WERNER) preserved at the Natural History Museum Vienna, was retrospectively classified as *I. horvathi* (NMW 11371:4) | (GRILLITSCH & TIEDEMANN, 1986) |
| 1987 | Two recordings at Carnic Alps & first record at Karawanks, Korpitsch-Korpitscher Alm | (TIEDEMANN, 1987) |
| 1989 | Records in northern Slovenia | (DE LUCA, 1989) |
| 1990 | Reports of five occurrences in the mountain range of the Bavarian Karwendel (Achenpaß, Pittenbachtal); *(but controversy and concernings, because habitats seemed unsuitable and I. lacerta has never been found again in that area; maybe translocated by human and unsuccessful population)* | (FRANZEN et al., 1993) (CABELA et al., 2004) |
| 1992 | Further occurrence records in Bärental, at Feistritz-streamside, in the Carnic Alps (southern Valleys of Lesach- und Gailtal above Hermagor) and at the western Karawanks between 700m und 1350m a.s.l. | (GRILLITSCH & CABELA, 1992a; TIEDEMANN, 1992) |
| 2002 | Three new locations: two locations in the eastern Gailtaler Alps (Berg im Drautal), one location in the Lienzer Dolomites (Oberdrauburg) | (CABELA et al., 2002) |
| 2004 | New records at eastern Lienzer Dolomites between Lienz (Eastern Tyrol) and Oberdrauburg (Carinthia) in the Frauenbachtal, along the stream Gailbergbach | (CABELA et al., 2004) |
| 2005 | Records at Lienzer Dolomites (Silbergraben) and Carnic Alps (Bischofalm, Würmlacher Alm, Untere Spielbodenalm, Mauthner Klamm, Wolayer Tal) | (ORTNER, 2006) |

## 3. Material and methods

The master thesis will be supported by my supervisors Silke Schweiger and Günter Gollmann, the species distribution modeling (SDM) will be done in collaboration with Christoph Plutzar. The project-time is scheduled for 12 months until October 2017.

### 3.1. Species distribution modeling (SDM)

To run the SDM for *Iberolacerta horvathi* for the southern Austrian territory, we will first summarize previously known occurrence records. The analysis' underlying data will be taken from the Herpetofaunistic Database of Austria (HFDÖ - Herpetofaunistische Datenbank Österreichs) at the Natural History Museum Vienna (version Jan. 2016), in which relevant information from diploma theses, dissertations, mapping surveys, licensors' recordings by chance, as well as data obtained from literature are gathered. The applied statistical methods and considerations will follow generally CABELA et al. (2001) and SCHWEIGER et al. (2015). We will implement all relevant parameters of physical and biological data to MAXENT (ELITH et al., 2006) to analyse the occurrence records and to check the variables of the different layers for multicollinearities. After the statistical computing process and predictive performance test, we will be able to create distribution maps of high and low potential areas.

### 3.2. Validation of the SDM and the predicted habitats

The second part of the SDM procedure will examine the validity and predictive performance test of the theoretical distribution model in praxis. Thus a field survey will be conducted by one person for 20 days, plus approximately 5 persons for 5 days. About 20-30 locations will be chosen from predicted areas with high degrees of habitat suitability classified by the SDM. To prove the SDM validity, we will also survey locations with a low degree of predicted species' occurrence. The field study will take place in four separate weeks (4 x 5 days) within the months March 2017 - May 2017. The monitoring and determination of detected individuals will either be done on sight (by close up pictures) or by catch and release. We will submit the required respective research approval and permits still this year in advance. For the handling of the species we will consider the standard guidelines for field research on reptiles of the Herpetological Animal Care and Use Committee (HACC, 2004). All individuals will be recorded on GPS-map and documented by taking macro-close up pictures. The predominant habitat parameters and environmental conditions will be measured and classified on site as well.

### 3.3. Analysis of the SDM-validation and the actual habitats - species characterization

After each field survey session we will implement the newly collected data to analyse the actual distribution map in comparison to the predicted and previous data set. Finally we will plot an upgraded map for *I. horvathi* plus a description of habitat preferences, possible interferences or limitations for presence or absence of the Horvath's Rock Lizard in Austria along its northernmost boundary of occurrence. Finally the outcome will be a comprehensive species characterization of *I. horvathi* in Austria.

## 4. Previous experience

Attendee at the **SCCS Student Conference on Conservation Science**, University of Cambridge (22.-24.03.2016)

**TBA Field Course** - East Usambara Mountains, Tanzania (26.06.–26.07.2015) Tropical Biology Association, University of Cambridge

**Nationalpark-Ranger Lehrgang 2016**, Nationalpark Donau-Auen GmbH

Courses (PP=Projektpraktika & UE=Übungen), done at the **University of Vienna** related to monitorings, field work, mountain habitats, and/or herpetology:

- PP Populationsbiologie heimischer Amphibien (2015)
- PP GIS-Feldmethoden und Verhaltensökologie & Diversität neotropischer Amphibien (2015)
- PP Erfassung von Vogelgemeinschaften in Stadtparks (2015)
- UE Ausgewählte GIS-Probleme und Lösungen für Biologen (2015)
- PP Zoologische Feldarbeit in den Alpen (2014) Bachelor-Arbeit: „Tagesverlauf und oberirdische Aktivitätsmuster beim Alpenmurmeltier *Marmota marmota* in den Zillertaler Alpen, unter Berücksichtigung äußerer Umweltfeinflüsse."
- PP Vegetations-und Landschaftsökologie - Monitoring in Großschutzgebieten (2014)
- UE Paläontologische Lehrgrabung in Höhlen (2014)
- UE Kenntnis mitteleuropäischer Lebensgemeinschaften (2013)
- UE Bestimmungsübungen heimischer Tiere (2013)
- UE Freilandpraktikum Amphibienökologie (2012)

No submissions or publications so far.

## 5. Literature

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