

Status of the European pond turtle, *Emys orbicularis* (Reptilia: Testudines: Emydidae) in Vorarlberg, Austria

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Abstract. Prehistoric and historic records of *Emys orbicularis* (Linnaeus, 1758) for the western Austrian province of Vorarlberg and adjacent regions are reviewed. Two recently captured pond turtles allowed the first analyses of mitochondrial cytochrome *b* haplotypes for the province. Both turtles represent lineage IV haplotypes, whereas lineage II is expected to be native. We conclude that native *E. orbicularis* are extinct in Vorarlberg.

Keywords. *Emys orbicularis*, Austria, Vorarlberg, mtDNA, distribution

The possible occurrence of the European pond turtle, *Emys orbicularis* (Linnaeus, 1758), in the western Austrian province of Vorarlberg has long been debated (Gemel, 2001). It is well known that these animals were formerly massively traded as Lenten food and as pets (Fritz, 2001; Fritz et al., 2004), so that any records could also refer to escaped or released non-native turtles. However, since prehistoric pond turtle records are known for Vorarlberg, the occurrence of native turtles cannot be completely excluded. Nevertheless, *E. orbicularis* is no longer included as a native species in the newest red list for the herpetofauna of Vorarlberg (Aschauer et al., 2008). For the entirety of Austria, the species is classified as 'Critically Endangered' (Gollmann, 2007), and in older red lists for Austria it was concluded that the occurrence of *E. orbicularis* in Vorarlberg could only be secured by constant reintroduction (Häupl and Tiedemann, 1983).

The aim of this study is to review the present status of *E. orbicularis* in Vorarlberg and to examine two newly discovered pond turtles genetically to clarify whether these individuals could be native. Theoretically, native turtles may still occur in regions with historic or prehistoric records, as is the case with Vorarlberg (compare Kinzelbach, 1988; Sommer et al., 2007). It should be

highlighted that the oldest prehistoric *E. orbicularis* in Austria were discovered in the Rhine valley near Koblach, Vorarlberg. These remains originate from the late Mesolithic, approximately 8,000 years ago (Kunst and Gemel, 2000). Moreover, European pond turtles probably served as food for prehistoric humans in Vorarlberg, as indicated by turtle bones in prehistoric settlements (Vonbank, 1965). According to historic records, the European pond turtle was once widespread around Lake Constance, and turtles were ordered from local fishermen by the dukes of Baden (Bernauer and Jacoby, 1994; Gemel, 2001). It should therefore be assumed that *E. orbicularis* once was also abundant in the Vorarlberg portion of Lake Constance and in the neighbouring Rhine valley. However, Budde (1996) considers the species as extinct in the Lake Constance area and in Upper Swabia, while Gemel (2001) believes that *E. orbicularis* disappeared in the Austrian Lake Constance region only towards the end of the 20th century. Grillitsch and Cabela (2001) consider that *E. orbicularis* is 'localized' and 'released' in Vorarlberg and the Lake Constance region.

Whether any European pond turtle caught in Vorarlberg is native or not can be, at least in part, elucidated by genetic analyses. Using the mitochondrial cytochrome *b*

gene as a marker (Fritz et al., 2007, 2009), it is often possible to differentiate between native and introduced turtles (Fritz et al., 2004). Recent research has shown that ten deeply divergent mitochondrial lineages with many haplotypes exist, which correspond to a pronounced phylogeographic structure (Lenk et al., 1999; Fritz et al., 2007, 2009). According to the general distribution pattern of extant and extinct pond turtle populations (cf. Sommer et al., 2009), the expected mitochondrial lineage in Vorarlberg is lineage II. Consequently, any pond turtle bearing haplotypes of other lineages cannot be native.

During a project on allochthonous turtles in Vorarlberg, supported by the 'inatura - Erlebnis Naturschau GmbH', the authors studied in 2011 a wild-caught couple of *E. orbicularis*. The male was discovered in the same year in the municipality of Mäder, Feldkirch district, on a parking lot beneath a car (47°20'57"N, 9°36'56"E; 415 m a.s.l.) and had, when examined, a carapace length of 15.7 cm and a body mass of 552 g. The female was discovered in 2010 in the market municipality of Lustenau, Dornbirn district (47°24'27"N, 9°39'19"E; 406 m a.s.l.). In 2011, its carapace measured 18.2 cm and its body mass was 911 g. The turtles had been taken into care and were therefore available for study. Buccal swabs of both turtles were sent to a laboratory for determining the haplotype of the mitochondrial cytochrome *b* gene. Haplotype classification followed Lenk et al. (1999) and Fritz et al. (2007, 2009). The obtained sequences were compared to GenBank data.

The male turtle represents a lineage IV haplotype, which could not be more closely determined due to short sequence length, and the female bears haplotype IVb. The latter haplotype has so far only been found on the island of Cephalonia, off the west coast of Greece (Fritz et al., 2007), indicating that this turtle is not native. However, turtles from Cephalonia are known to be very small, with carapacial lengths below 12 cm (Richter and Mayer, 1990; Fritz, 2001). Hence, the large size of the Vorarlberg female suggests that it was raised in captivity and possibly even presents a captive-bred mixture of different lineages. West of the Adriatic, the range of lineage IV stretches from the coastal Po valley down to southern Italy, while it reaches from Istria and Dalmatia to the Peloponnese and Boeotia on the Adriatic east coast (Lenk et al., 1999; Fritz et al., 2007, 2009). Thus, both examined specimens were either released or escaped from garden ponds.

The situation in Vorarlberg seems therefore to be similar to what Fritz (2001) described for southern Germany, Switzerland, the rest of Austria and the Bohemian Depression. Most pond turtle populations have disappeared there very early, due to the human impact. However, the situation is further complicated by the historic trade

with European pond turtles. Since *E. orbicularis* was not considered meat in historic times, it could be eaten during lent and there was a demand, leading to the massive import of turtles from elsewhere (Fritz, 2001). In addition, until approximately 1980, huge numbers of European pond turtles were sold as pets, including turtles originating from regions where lineage II haplotypes occur (Fritz et al., 2004). Therefore, we can assume that turtles bearing different haplotypes were also imported to Vorarlberg, and some of them may have been released or escaped, like in other Austrian provinces (Kunst and Gemel, 2000). Thus, even any future record of lineage II turtles in Vorarlberg would be no unambiguous evidence for the native occurrence of pond turtles. Taking all available evidence together, we conclude that native *E. orbicularis* should be considered extinct in the whole of Vorarlberg.

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