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Social interactions between female and juvenile *Zootoca vivipara*

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Summary

Observations on social interactions between one female and one juvenile *Zootoca vivipara* made in eastern Jutland, Denmark, in late summer 2009 are described and illustrated. They were basking on top of a pole and remained close together for most of a 39 minute period between rain showers. Regularly tongue-flicking occurred.

Other hitherto unpublished and published data of similar nature have also been summarised. It is concluded that there are most probably social bonds between mother and young in viviparous forms of *Z. vivipara* whereas they are most probably absent in oviparous populations. Apparently it is a common behaviour in this species though often overlooked.

Zusammenfassung

Es wird über die in Ost-Jütland, Dänemark, im Spätsommer 2009 gemachten Beobachtungen sozialer Interaktionen zwischen einer adulten weiblichen und einer juvenilen *Zootoca vivipara* berichtet. Die beiden Eidechsen sonnten sich auf einem Holzpfosten und blieben zwischen Regenschauern über eine Zeitspanne von 39 Minuten für die meiste Zeit eng beieinander. Dabei bezüngelten sich die Tiere regelmäßig.

Andere bisher unveröffentlichte und veröffentlichte Daten über ähnliches Verhalten werden zusammengefasst. Es wird gefolgert, dass es aller Wahrscheinlichkeit nach soziale Bindungen zwischen Mutter und Jungen in viviparen (lebendgebärenden) Populationen von *Z. vivipara* gibt, während sie in oviparen (eierlegenden) Populationen höchstwahrscheinlich fehlen. Anscheinend handelt es sich dabei um ein übliches Verhalten dieser Art, das allerdings oftmals übersehen wird.

Introduction

Zootoca vivipara (Lichtenstein, 1823) is the most widely distributed European reptile. It may even have the largest distribution among all non-marine reptilians in the world; on a west-east axis (measured at the latitude 50° N) it covers 11,000 km (Glandt 2001). In several cold or wet regions it is the only reptile species present.

Scattered studies on social behaviour of this species have been made. Though a few provide well documented information, they have remained poorly known.

In several ways this species is very well adapted to the wide variety of environments which it inhabits throughout its huge geographical range. It exhibits two modes of reproduction. In the vast majority of the populations females are viviparous (lecithotrophic), however, in two southern areas of Europe oviparous forms are known: The southwestern *Z. v. louislantzi* from the Cantabrian mountains, the Pyrenees and Aquitaine of Spain and France; and the more eastern *Z. v. carniolica* from Slovenia and Carinthia across the southern Alps to northwest Italy (Mayer et al. 2000, Surget-Groba

et al. 2002, Arribas 2009, Lindtke et al. 2010). A distribution map in Glandt (2010) depicts the ranges of these two subspecies. *Zootoca vivipara louislantzi* is geographically isolated from the viviparous forms which means that hybridisation between the oviparous and viviparous forms will not occur in the wild, however, experimental hybridisation has been demonstrated. For *Z. v. carniolica* there is a parapatric occurrence of oviparous and viviparous populations. Natural hybridisation between the two reproductive strains yielding at least partially fertile offspring has recently been described (Lindtke et al. 2010). So far published observations on juvenile behaviour have dealt exclusively with viviparous populations.

In France juvenile dispersal in populations and other aspects of metapopulation dynamics have been studied (Glandt 2001, Cote & Clobert 2007). In recent years the research has been extended to also cover social personalities in *Z. vivipara* (see discussion).

This report will cover a case of social behaviour involving one female and one juvenile of *Z. vivipara* (i. e. a viviparous population) observed in a natural area in Denmark which was designated a national park on 29 August 2009.

Observations

In late August 2009 I spent four days of field excursions in Mols Bjerge (which means "Mols Mountains", the highest point being 137 m above sea level!) northeast of Aarhus in eastern Jutland, Denmark. My observations on social behaviour in *Zootoca vivipara* were made in the area named Den italienske sti ("The Italian trail") in the afternoon of

Fig. 1. Cattle pasture habitat, surrounded by deciduous forest. The locality was in Mols Bjerge, eastern Jutland, Denmark. – All photos: Henrik Bringsøe

Abb. 1. Von Laubwald umgebene Rinderweide in Mols Bjerge, Ost-Jütland, Dänemark.

Fig. 2. The microhabitat in the pasture for *Zootoca vivipara*. The observations on one adult female and one juvenile were made on top of the unpainted pole, to the left of the white gate.

Abb. 2. Das Mikrohabitat von *Zootoca vivipara* auf der Weide. Die an einem adulten Weibchen und einem juvenilem Exemplar gemachten Beobachtungen erfolgten auf der oberen Fläche des nicht gestrichenen Holzpfostens, der sich links neben dem weißen Tor befindet.

30 August. The habitat consisted of mainly deciduous forest and pasture. The weather conditions proved unpredictable, with heavy rain showers as well as sun breaks. The air temperature ranged between 15 °C and 18 °C. Just after such a shower I checked a small cattle pasture in the forest. The pasture was surveyed from approx. 14:20 to 15:25.

Fig. 3. The nearly horizontal part of the unpainted pole with the female and juvenile basking. On this photo the two individuals are not close together.

Abb. 3. Die nahezu horizontale Fläche des nicht angestrichenen Holzpfostens, auf dem sich die weibliche und die juvenile Eidechse sonnen. Auf diesem Foto sind die beiden Tiere noch nicht eng beieinander.

Fig. 4. The female and juvenile are close together.

Abb. 4. Das Weibchen und das juvenile Exemplar in nächster Nähe zueinander.

Fig. 5. The female approaches and investigates the juvenile and performs tongue-flicking which is, however, not visible on this picture.

Abb. 5. Das Weibchen nähert sich dem juvenilen Tier und erforscht und bezüngelt dieses, wobei das Bezüngeln nicht auf dem Bild zu erkennen ist.

Fig. 6. During basking the female remains relaxed, sometimes with closed eyes while the juvenile moves to her side.

Abb. 6. Während des Sonnens bleibt das Weibchen entspannt, manchmal mit geschlossenen Augen, während sich die juvenile Eidechse an seine Seite begibt.

Fig. 7. The juvenile stays close to the rear part of the female.

Abb. 7. Das Jungtier bleibt dicht am Hinterteil des Weibchens.

On the nearly horizontal top of one pole two *Z. vivipara* were basking: One adult female and one juvenile. These poles supporting a barbed wire fence, were more or less the only dry and sun-exposed spots as all vegetation was wet after the rain. Later a male and another juvenile appeared on the lower vertical part of the pole.

The female and juvenile on top of the pole were followed closely and photographed intensively. From the shooting information recorded automatically, I can see that I photographed the two lizards for 39 minutes, i.e. from 14:38 to 15:17 during which I took 138 photos. During that time the weather was sunny and calm. It stopped raining about 10–15 minutes before my arrival to the observation point and it started raining again around 15:20.

In the female and the juvenile atop the pole a little tongue-flicking from both individuals was observed. They moved about on nearly the entire horizontal top part of the pole, however, for most of the 39 minute period they were close together. No measurements of time or their mutual position were made, but as a rough estimate they remained within a distance of 2 cm from each other during 60–80 % of the 39 minute observation period.

No interaction with the other two individuals which appeared on the lower parts of the pole was noticed.

Discussion

Viviparous *Z. vivipara*, at least in northerly and upland populations, produce only one clutch per year. In Denmark birth occurs from late July until early August (Jensen 1983, Fog et al. 1997) which means that the juveniles observed on 30 August have probably been approx. one month old.

Social interactions involving juveniles of *Zootoca vivipara* have been investigated and documented in a limited number of publications, however, in many field books most information merely consists of superficial notes.

Parental care in *Z. vivipara* has been described by Strijbosch & van Gelder (1996). Among viviparous females the authors observed that mothers cared for the newly deposited non-calcified eggs which had been placed under layers of moss if for instance the

Fig. 8. The male is basking at the lower part of the pole without approaching the two individuals on top of the pole.

Abb. 8. Das Männchen sonnt sich am unteren Teil des Holzpfostens, ohne sich den beiden Exemplaren auf der Oberseite zu nähern.

moss was disturbed. Then the female would react aggressively and cover the eggs again. The eggs hatched after a few hours, after which parental care was no longer observed. Egg-guarding occurred among nearly 50 % of the egg-laying females. It is noteworthy that this striking behaviour was first observed only 15 years ago, considering it is an extremely abundant and widespread species!

An important study of social behaviour of *Z. vivipara* (viviparous form) is the work of Verbeek (1972) which has been summarised by Dely & Böhme (1984). He observed that juveniles are very social as they often bask in groups and regularly remain overnight communally in holes in the ground. The juveniles stay together until their second summer as the groups disintegrate. Moreover, it is extremely rare that an adult would attack juveniles.

Detailed records of social interactions involving young *Z. vivipara* have also been made by Strijbosch (pers. comm. 2009) and his research team during several years of detailed studies in the Netherlands in the mid-1980's. His results deserve to be published separately though he has emphasised that too low numbers of replicas were collected to build sets of data that could be tested statistically. Often a clutch of juveniles plus the mother were seen together on the same spot for considerable periods of time. Strijbosch's main conclusions were as follows:

- Lizards reacted clearly to each other by augmenting their tongue-flick frequencies.
- The behaviour indicated that *Z. vivipara* is capable of recognising other individuals of the species.

- The mother and the juvenile(s) seem to know each other which will keep potential aggressive reactions to a minimum.
- The threshold to aggressive reactions is comparatively high in this species.
- Especially when suitable basking sites are scarce, several basking individuals of different sexes and different age groups may lie side by side or even atop one another.

In many accounts on *Z. vivipara* details on social behaviour are either missing, are superficial or even faulty. Jensen (1983) states that juveniles often remain close together for their first few days after birth, but no social interactions among them have been recorded and gradually they will disperse. According to Street (1979) the female shows no interest in her newly-born offspring. Blauscheck (1985) provides better information as he mentions that "sun basking communities" are observed regularly as several juveniles and adults stay together.

A good photo of a group of three adult females and two juveniles basking together has been provided by Simms (1970). Rödder & Schulte (2010) present a similar photo of one female and two young staying very close together; the photographer Thiesmeier (pers. comm. 2010) has made such observations several times. Additionally Oefinger (pers. comm. 2009, presented at www.fieldherping.eu) has in the Eifel mountains in western Germany observed and photographed one new-born juvenile which followed one female. The observation took place in late July 2009. Thus, we have documented this behaviour and we have strong indications that it is common in *Z. vivipara*.

In studies of natal dispersal it was evident that juveniles recognised conspecifics on the basis of their odour (Cote et al. 2007, Cote & Clobert 2007). Pronounced social personality polymorphism was recorded as juveniles exhibited varying degrees of social bonds which depended greatly on population density. That corresponds well with Strijbosch's and my observations of tongue-flicking.

Similar social behavioural traits involving odour of juveniles towards adults are known from other lizards. In two viviparous Australian skinks, *Tiliqua rugosa* and *Egernia stokesii*, in which maternal care has been observed, newborn lizards discriminate between their mothers and other females by means of olfactory cues (Main & Bull 1996).

My own observations of one female and one juvenile on top of the pole in eastern Jutland, Denmark, are in line with the details provided by Strijbosch. "Sun basking community" (cf. Blauscheck 1985) may be an appropriate description of the situation because there were very few dry basking places available after the rain shower. But there were certainly also indications of closer social bonds between the two individuals. The fact that tongue-flicking from both individuals was observed and that they stayed close together for 60–80 % of the 39 minute observation period, supports that there might have been a social connection between them, in accordance with Strijbosch's (pers. comm. 2009) conclusions. During tongue-flicks, lizards sample chemicals in the surrounding environment and deliver molecules to the vomeronasal organ (Cooper & Burghardt 1990, Cooper 1994). Studies on chemosensory behaviour in lizards representing most families, including *Z. vivipara*, have not only focused on intraspecific social communication, but to a high degree also on prey discrimination and detection and predator avoidance (Cooper 1994).

The total lack of observations on juvenile social interactions with adults of oviparous forms may well reflect that such behaviour is non-existing, at least in *Z. v. louislantzi* according to Arribas (pers. comm. 2010) who has made detailed studies in this

extremely southwestern subspecies. Considering that the female leaves the nest area right after egg deposition and that it takes nearly 20 days before the eggs hatch, he finds it very unlikely that mother and young should exhibit any kind social interaction.

In terms of viviparous *Zootoca vivipara*, my paper highlights the need to be more attentive to documenting this common, but neglected biological trait.

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