Hyla *VOL. 2015., No.1, Str. 11- 17*
ISSN: 1848-2007

Original Scientific Paper
Kleewein 2015

Interactions between *Emys orbicularis* and allochthonous turtles of the family Emydidae at basking places

Interakcije između *Emys orbicularis* i alohtonih kornjača porodice Emydidae na mjestima za sunčanje

ANDREAS KLEEWEIN

University of Vienna, Department of Integrative Zoology, Althanstraße 14, A-1090 Vienna, Austria
e-mail: andreas.kleewein@gmx.net

Abstract

There are frequent remarks in literature of the supposed negative effects of *Trachemys scripta elegans* on *Emys orbicularis*. These competition effects pertain, in particular, to the securing of ideal basking places. A study under near-natural conditions now paints a different picture. Seven *Emys orbicularis* individuals were placed in an enclosure with 67 allochthonous turtles of 12 different species belonging to the family Emydidae. All interactions regarding basking places were recorded. Of a total of 149 interactions, 105 (70.5%) were neutral and therefore without consequence. Of the 44 negative interactions (29.5%), 19 had a negative result for *E. orbicularis* while 25 were negative for the allochthonous species. The study therefore indicates that there are no negative consequences of allochthonous species on *E. orbicularis* regarding behavior at basking places. A comparison of basking place selection revealed that allochthonous species are opportunistic compared to *E. orbicularis*. In a total of 124 observed cases, *E. orbicularis* selected half-shaded wood most frequently, followed by fully sun exposed wood and fully sun exposed rocks. During 42 recordings, basking duration of *E. orbicularis* at a given place ranged from 2 to 200 minutes, averaging 37 minutes.

Key words: Emydidae, interactions, basking place, basking place preference

Sažetak

Postoje brojni literaturni navodi o navodnom štetnom djelovanju *Trachemys scripta elegans* na *Emys orbicularis*. Kompeticija između ove dvije vrste, barem djelomično, zavisi o osiguravanju idealnog mjesta za sunčanje. Ova studija, provedena u poluprirodnim uvijetima, prikazuje dosta drugačije rezultate. Sedam jedinki vrste *Emys orbicularis* stavljene su zatvoreni prostor sa 67 jedinki alohtonih kornjača svrstanih u 12 različitih vrsta iz porodice Emydidae. Tijekom eksperimenta bilježene su sve interakcije vezane uz odabir mjesta za sunčanje. Od ukupno 149 interakcija, 105 (70,5 %) ih je bilo neutralno i time bez posljedica. Od 44 negativne interakcije (29,5 %), 19 ih je imalo negativne posljedice za *E. orbicularis* dok ih je 25 imalo negativne posljedice za jedinku alohtone vrste. Studija pokazuje da alohtone vrste nemaju značajan negativan utjecaj na *E. orbicularis* u aspektu ponašanja pri odabiru mjesta za sunčanje. Usporedba odabira mjesta za sunčanje otkriva da su alohtone vrste oportunisti u usporedbi sa *E. orbicularis*. U totalno 124 zabilježena promatranja, jedinke vrste *E.*

orbicularis su odabrale polu zasjenjenu drvenu podlogu za sunčanje, dok ih je značajno manje odabralo potpuno osunčano drvo ili potpuno osunčani kamen. U 42 opažanja, jedinke vrste *E. orbicularis* zadržale su se na odabranom sunčalištu od dvije do 200 min, uz prosijek od 37 min.

Ključne riječi: Emydidae, interakcije, mjesta za sunčanje, preference mjesta za sunčanje

INTRODUCTION

In Europe, proven or potential negative consequences of allochthonous turtle species of the family Emydidae, particularly of the genus *Trachemys*, provide regular material for discussion. Cadi & Joly (2003, 2004) pointed out negative effects for *Emys orbicularis*, regarding basking places, if *Trachemys scripta elegans* also occurred in the same pond. The opposite, however, was found by Macchi et al. (2008). Basking is very important for turtles and constitutes a considerable portion of their daily routine. Basking increases body temperature, quickens the metabolism and thereby also stimulates feeding (Jackson 1971; Kepenis & McManus 1974; Parmenter 1980). To date, there has been no study under near-natural conditions involving a greater diversity of allochthonous species of the family Emydidae. The aim of this study, therefore, was to replicate an extreme scenario, with considerably more allochthonous turtles than *E. orbicularis*, and to conduct the observations under near-natural habitat conditions.

MATERIAL AND METHODS

The study was conducted from the end of June until the beginning of October 2011, in roughly weekly intervals (a total of 21 field days of about five hours per day, in the open-air turtle enclosure of the Reptile Zoo Happ (WGS84 14°15‘56‘‘/46°37‘10‘‘; 441 m a.s.l.). The enclosure offers near-natural conditions with an abundance of structures that can be used as basking places. The enclosure contains 67 turtles of the following species belonging to the family Emydidae: *Trachemys scripta elegans*, *Trachemys scripta scripta*, *Trachemys scripta troostii*, *Pseudemys peninsularis*, *Pseudemys nelsoni*, *Pseudemys concinna concinna*, *Pseudemys concinna floridana*, *Chrysemys picta bellii*, *Graptemys pseudogeographica pseudogeographica*, *Graptemys pseudogeographica ouachitensis*, *Graptemys pseudogeographica khonii*, as well as hybrids between *Trachemys scripta elegans* and *Trachemys scripta scripta*. All of these species are combined in the term “allochthonous species” for data evaluation. Seven *E. orbicularis* were placed in the same enclosure with the allochthonous species, resulting in a proportion of *E. orbicularis* to allochthonous species of 1:9.

All direct interactions between *E. orbicularis* and allochthonous species were registered. “Interaction” was defined as any carapace or extremity contact during positioning at the basking places. Neutral interactions were without consequence for either individual. Negative interactions included displacement of one individual by another, pushing other individuals off their basking places into the water, bite attacks and lying on another individual’s carapace.

Furthermore, the preferred basking places of *E. orbicularis* regarding material and sun exposure were evaluated. The study enclosure provided rocks, tree-trunks, branches and reeds as basking places. Intensity of sun exposure was classed as shaded, half-shaded and full sun exposure. Basking duration of *E. orbicularis* at a given basking place was also measured.

RESULTS

Over the entire observation period, a total of 149 interactions were noted. The majority of these (n=105) were brief carapace or extremity contacts, which occurred on the way to a basking place and were without consequence for either individual (see Fig. 1). This was usually observed when a turtle emerged from the water or was searching for a suitable basking place on land. Once the moving individual had found its optimal basking place, there was no further interaction. These neutral interactions made up 70.5% of the total observed interactions.

Negative interactions were observed much less frequently. A total of 44 (29.5%) negative interactions were observed, including covering another individual's carapace, pushing another individual from its basking place into the water, displacing another individual and bite attacks. Of these 44 negative interactions, 43.2% (n=19) affected *E. orbicularis*, while 56.8% (n=25) affected allochthonous species. This indicates a slight advantage of *E. orbicularis* over allochthonous species.

Only twice was a basking *E. orbicularis* pushed aside a few centimetres by an allochthonous species. The opposite was observed three times.

Allochthonous species could be observed lying on the carapace of *E. orbicularis* six times, however the opposite was the case 15 times. On the other hand, *E. orbicularis* individuals were pushed from their basking places into the water 11 times, while this happened to allochthonous species only six times.

Even once the water level had risen after extended rainfall and basking places became scarce, no marked increase in aggressive behaviour or negative competition for basking places could be observed.

A bite attack was observed in a single case only, when a male *E. orbicularis* bit an allochthonous species.

Three cases of intraspecific competition were observed in *E. orbicularis*, including a bite attack, displacement from the basking place and being pushed into the water.

During the course of the study, it became apparent that allochthonous species differ from *E. orbicularis* in that they do not seem to differentiate between wood and rock basking places. For this reason, the allochthonous species' preferences regarding basking place were not quantified. A total of 124 observations of basking place preference were made for *E. orbicularis* during the course of the study. Wood structures were selected most often (n=90). Rocks (n=27) and reeds (n=7) were rarely used as basking places. Half-shaded (n=56) and full sun exposure (n=55) basking places were selected roughly equally, while shaded basking places (n=13) – as expected – were very rarely used.

Results therefore show a marked preference of *E. orbicularis* for half-shaded wood basking places (n=46) over fully sun exposed wood (n=31), fully sun exposed rock (n=19) and shaded wood basking places (n=11). All further combinations were only observed very rarely (see Fig. 2). *E. orbicularis* also switched from one basking place to another more frequently than could be observed for the allochthonous species.

Basking duration at a given place was measured 42 times for *E. orbicularis*, ranging from 2 to 200 min. The overall average basking duration at a given place was 37 min. In 12% of the cases (n=5 time measurements), basking lasted between 130 and 200 min at one place, always in the half-shade. In 88% of the cases (n=37 time measurements), basking duration at one place lasted between 2 and 63 min, at an average of 20 min.

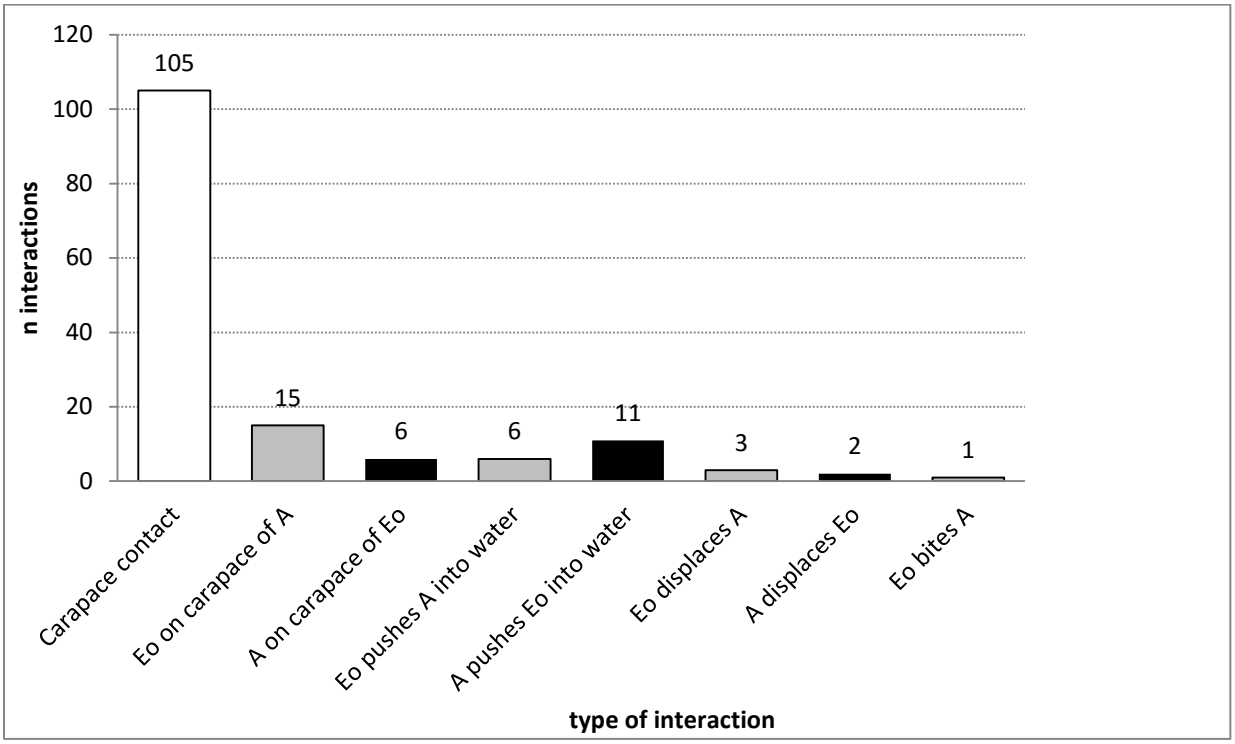

Figure 1. Interactions between *E. orbicularis* (Eo) and allochthonous species (A) at basking places. White = neutral/without consequence; grey = negative for allochthonous species; black = negative for *E. orbicularis.*

Slika 1. Interakcije između *E. orbicularis* (=Eo) I alohtonih vrsta (A) na mjestima za sunčanje. Bijela boja = neutralna/bez posljedica; siva = negativna za alohtone vrste; crna = negativna za *E. orbicularis.*

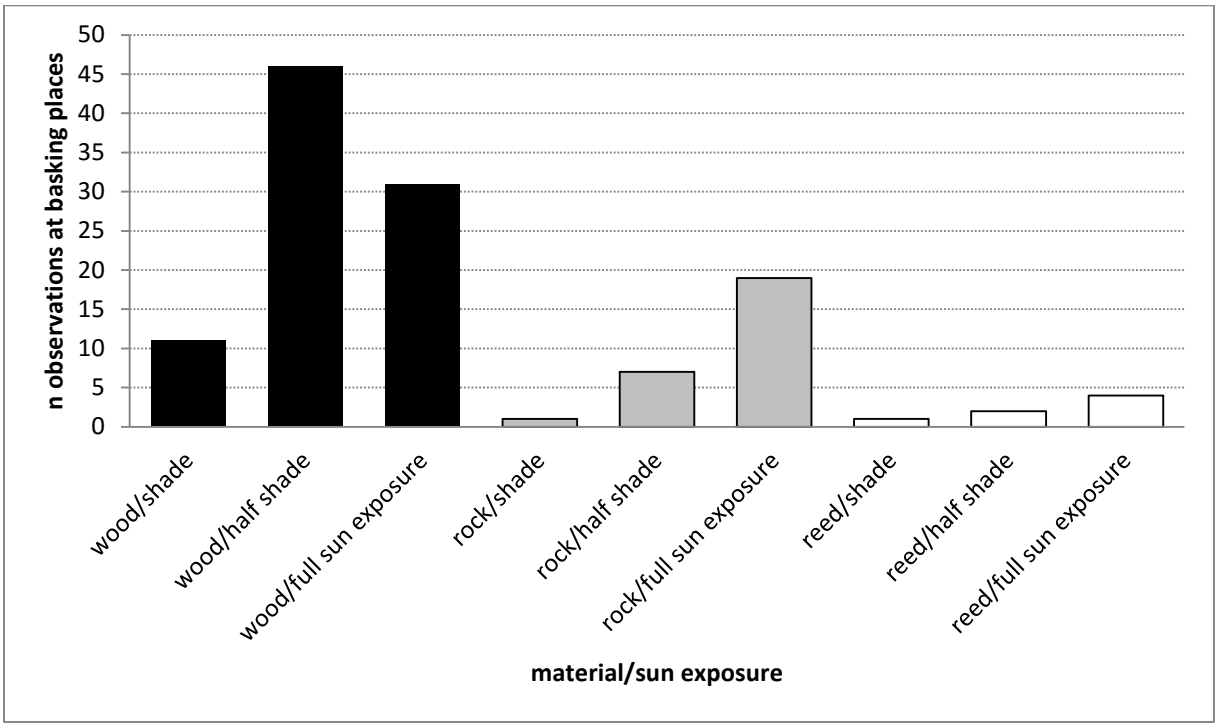

Figure 2. Comparison of basking place preference of *E. orbicularis* regarding material and sun exposure.

Slika 2. Usporedba sklonosti ka mjestima za sunčanje kod vrste *E. orbicularis* u odnosu na material i ekspoziciju.

DISCUSSION

The study revealed that there are no negative consequences through interspecific competition regarding basking places under near-natural conditions. Under strictly experimental conditions, however, such negative consequences were confirmed by Cadi & Joly (2003, 2004), for example.

During basking, the light's angle of incidence and intensity, as well as air temperature and movement are crucial factors (Boyer 1965). Turtles position themselves so that a maximum of their body surface faces the sun. Displacement from a chosen basking place affects thermoregulation through a change to the light's angle of incidence. In basking piles, meanwhile, the top animal casts a shadow on the lower animals which are, thus, at a disadvantage. Thanks to the greater body dimensions of the allochthonous species such as *Trachemys scripta* (SCL max 30 cm) and *Graptemys pseudogeographica* (SCL max 27 cm) (Ernst & Lovich 2009) compared to *E. orbicularis* (SCL max 23 cm) (Fritz 2003), one would expect *E. orbicularis* to be at a disadvantage in basking place competition (figure 3). This indeed appeared to be true in the 11 cases where an *E. orbicularis* individual was pushed into the water by an allochthonous species (versus only six opposite cases). The opposite, however, was observed in the 15 cases (versus only six opposite cases) where *E. orbicularis*, due to its smaller size, was more able to climb on top of the carapaces of adult allochthonous species, thus gaining an advantage (figure 4). In other turtle species, on the other hand, the mere presence of another species can have a negative effect. Polo-Cavia et al. (2010) showed that *Mauremys leprosa*, for example, would not pile on top of the carapace of *T. s. elegans* because it was influenced negatively by *T. s. elegans*, thereby suffering a thermoregulatory disadvantage.

Bite attacks are certainly an exceptional form of interaction, but they were observed during this study and have also been observed in the Donau-Auen National Park. In all cases, the attacks emanated from *E. orbicularis* males and targeted *T. s. elegans* females. Thus, they could be a form of aggressive courtship behaviour.

It must not be forgotten that intraspecific competition with the same negative interactions was observed in *E. orbicularis*.

Similar preferences of *T. s. elegans* and *E. orbicularis* regarding basking place, such as described by Cadi & Joly (2003), could not be determined in this study. The allochthonous species were much more opportunistic in their choice of basking place, while *E. orbicularis* showed a clear preference for half-shaded wood and fully sun exposed wood.

It was conspicuous that *E. orbicularis* mostly only stayed at a given basking place for very short intervals. This is related to its smaller body size and due to faster warming and overheating.

Overall, it appears that *E. orbicularis* is indeed able to assert itself against larger allochthonous species. Even after three years in the same pond, no mortality of *E. orbicularis* occurred in the open-air enclosure of the Reptile Zoo Happ, although it had been observed by Cadi & Joly (2004) in their experimental set-up. Nevertheless, the trade in animals ought to be more strictly regulated, and allochthonous turtles ought to be removed from the wild in the interest of animal, species and environmental protection.

Figure 3. Adult *E. orbicularis* have smaller body sizes than allochthonous species (photo: A. Kleewein)

Slika 3. Odrasli *E. orbicularis* imaju manju veličinu rijela nego alohtone vrste (fotografija: A. Kleewein)

Figure 4. *E. orbicularis* was found on the carapace of allochthonous species more frequently than *vice versa*. (photo: A. Kleewein)

Slika 4. *E. orbicularis* pronađen na karapaksu alohtionih vrsta češće nego obrnuto (fotografija: A. Kleewein)

REFERENCES

Boyer, D.R. (1965): Ecology of the basking habit in turtles. Ecology 46: 99-118.

Cadi, A. & Joly, P. (2003): Competition for basking places between the endangered European pond turtle (*Emys orbicularis galloitalica*) and the introduced red-eared slider (*Trachemys scripta elegans*). Canadian Journal of Zoology 81: 1392-1398.

Cadi, A. & Joly, P. (2004): Impact of the introduction of the red-eared slider (*Trachemys scripta elegans*) on survival rates of the European pond turtle (*Emys orbicularis*). Biodiversity and Conservation 13: 2511-2518.

Ernst, C.H. & Lovich, J.E. (2009): Turtles of the United States and Canada. Second Edition. John Hopkins University Press, Baltimore.

Fritz, U. (2003): Die Europäische Sumpfschildkröte (*Emys orbicularis*). Supplement der Zeitschrift für Feldherpetologie 1, Laurenti-Verlag Bielefeld, 224 S.

Jackson, D.C. (1971): The effect of temperature on ventilation in the turtle, *Pseudemys scripta* elegans. Respir. Physiol. 12: 131–140.

Kepenis, V. & McManus, J.J. (1974): Bioenergetics of young painted turtles *Chrysemys picta*. Comp. Biochem. Physiol. A, 48: 309-317.

Macchi, S., Balzarini, L. L. M., Scali, S., Martinoli, A. & Tosi, G. (2008): Spatial competition for basking sites between the exotic slider *Trachemys scripta* and the European Pond Turtle *Emys orbicularis*. In: CORTI C. (Ed.): Herpetologia Sardiniae. Edizioni Belvedere, Latina: 338-340.

Parmenter, R.R. (1980): Effects of food availability and water temperature on the feeding ecology of pond sliders (*Chrysemys scripta scripta*). Copeia, 1998: 235–238.

Polo-Cavia, N., Lopez, P. & Martin, J. (2010): Competitive interactions during basking between native and invasive freshwater turtle species. Biological Invasions 12 (7): 2141-2152.

ACKNOWLEDGEMENTS

Sincere thanks are due to the Reptile Zoo Happ in Klagenfurt, particularly to the directress Helga Happ, for allowing the observations and investigations for this study to take place. Thanks are also due to the Department for Integrative Zoology, especially to Walter Hödl, for material and professional support.