

Fieldnotes on the ecology and distribution of *Neureergus crocatus* COPE, 1862 and *Neureergus strauchii strauchii* (STEINDACHNER, 1887) in Turkey (Amphibia: Caudata: Salamandridae)

Beobachtungen zur Ökologie und Verbreitung von *Neureergus crocatus* COPE, 1862 und *Neureergus strauchii strauchii* (STEINDACHNER, 1887) in der Türkei
(Amphibia: Caudata: Salamandridae)

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KURZFASSUNG

Beobachtungen zur Ökologie und Verbreitung der beiden wenig bekannten Bergbachmolcharten *Neureergus strauchii strauchii* (STEINDACHNER, 1887) und *Neureergus crocatus* COPE, 1862, erfolgten während zweier herpetologischer Reisen in die Osttürkei im Frühjahr 2008 und 2009. Es werden ökologische Parameter der von *N. strauchii* besiedelten Bachläufe erörtert, die Unterschiede in der saisonalen Nutzung durch die Molche verursachen. Die Dauer der aquatilen Phase und die allgemeine Eignung der Bachläufe für *N. strauchii* scheint wesentlich von der Wassertemperatur abhängig zu sein. Für diese wiederum spielt die umgebende Vegetation, insbesondere deren Beschattungswirkung direkt entlang der Bachufer eine wichtige Rolle. Weiterhin wird ein neuer Fundpunkt für *N. crocatus* nahe der Stadt Şemdinli, Bezirk Hakkari vorgestellt. Der Lebensraum dieser Molchpopulation und das Aussehen der Tiere werden beschrieben. Für *N. crocatus* wird zum ersten Mal die unterschiedliche Schwanzfärbung als Merkmal zur Geschlechterdifferenzierung für adulte Molche aufgezeigt.

ABSTRACT

Observations on the ecology and distribution of the little known mountain brook newts, *Neureergus strauchii strauchii* (STEINDACHNER, 1887) and *Neureergus crocatus* COPE, 1862 made during two herpetological trips to east Turkey in spring 2008 and 2009 are presented. The authors discuss ecological parameters of inhabited streams, which cause differences in the seasonal use of brooks by *N. strauchii strauchii*. The duration of the aquatic period of *N. strauchii* and the general suitability of brooks for this newt seemed to be dependent on the water temperature. The surrounding vegetation, especially its shading effect directly along the brookside played an essential role. Furthermore a new locality for *N. crocatus* close to the city of Şemdinli, district of Hakkari, is presented. Besides the population's habitat and the animals appearance, a sexual dimorphism in the tail coloration of adult *N. crocatus* is described for the first time.

KEY WORDS

Amphibia: Caudata: Salamandridae: *Neureergus strauchii strauchii*, *Neureergus crocatus*, ecology, habitat requirements, distribution, new records, color-pattern, sexual dimorphism, Hakkari and Bitlis districts, SE Turkey

INTRODUCTION

The geographic distribution of the four mountain brook newt species of the genus *Neureergus* extends from the mountains of southeast Turkey and the Turkey-Iraq and Iraq-Iran borders, into the southern Zagros Mountains of Iran (STEINFARTZ et al. 2002). It includes parts of east Turkey, northern Iraq and western Iran. *Neureergus strauchii* (STEINDACHNER, 1887), comprising two subspecies, is autochthonous to Turkey. The western subspecies *N. strauchii barani* ÖZ, 1994 inhabits a small distribution area west

of the River Euphrates, at the Kubbe Mountain (PASMANS et al. 2006). The nominate form *N. strauchii strauchii*, has a significantly larger distribution range, extending from the Euphrates River in the west, to Lake Van in the east, and is the most studied species of the genus (BOGAERTS et al. 2006). Nevertheless, information about its natural history is limited. *Neureergus crocatus* COPE, 1862 inhabits parts of Turkey, Iran and Iraq. It is assumed that *N. crocatus* has one of the largest distribution ranges among all *Neurer-*

gus species (PAPENFUSS et al. 2008), though there is almost no data about its biology and exact distribution (STEINFARTZ et al. 2002; PAPENFUSS et al. 2008). This may be attributed mainly to geographic inaccessibility, permanent ethnic tensions, and decade-long military conflicts. The little that is known, dates back several decades (SPARREBOOM 2009) when *N. crocatus* was found in a single location in southeastern Turkey, at Beytüşşebap (BARAN & ÖZ 1986). However, in 2008 and 2009 two new localities for *N. crocatus* in Turkey were published. The first source, a local newspaper, mentions only vaguely where they were found,

at the Sümbül Mountains south of Hakkari (ANONYMOUS 2008; BIRIÇIK 2009), whereas an article from 2009 deals with animals collected close to Beytüşşebap at the village Başaran (ÖZDEMİR et al. 2009).

Our aim was to extend the knowledge of both species in the area south east of Bitlis and south of Lake Van. We focused on searching for brooks and small streams to find adults, larvae or eggs of *Neurergus*. The investigation took place during two trips to the southeastern Turkish provinces Hakkari and Bitlis at the end of May, beginning of June in 2008 (05.25. - 06.05.) and 2009 (05.31. - 06.10.).

MATERIALS AND METHODS

Streams were selected using Google Earth® and on-site decision based upon size and flowing conditions. The presence of newts was verified by walking along the brookside during the day and visually detecting adult animals or by finding spawn

under rocks. Between half an hour to three hours were spent searching each stream. Seventeen streams were visited one to three times each. Local people were asked about the presence of newts in these streams. Images of *Neurergus* were shown to the

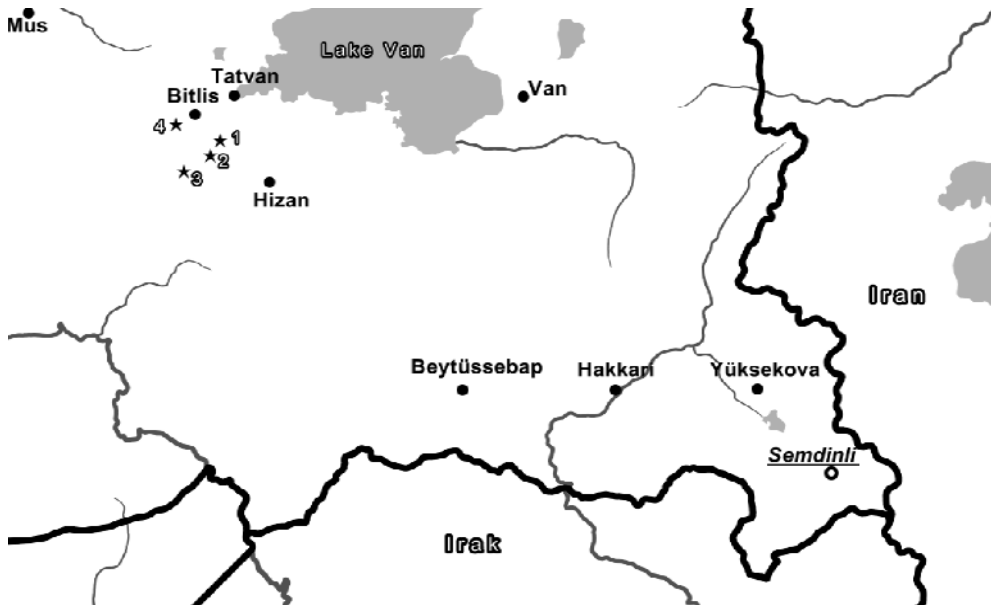


Fig. 1: Map of southeastern Turkey. Numbers 1-4 southwest of Lake Van refer to record localities of *Neurergus strauchii* (STEINDACHNER, 1887) characterized in Table 1.

Abb. 1: Karte der Südosttürkei. Die Ziffern 1-4 südwestlich des Van Sees beziehen sich auf in Tabelle 1 charakterisierte Fundorte von *Neurergus strauchii* (STEINDACHNER, 1887).

Table 1: Ten streams southwest of Lake Van, east Turkey, were investigated for the presence of *Neuregus strauchii* (STEINDACHNER, 1887). Selected characteristics of the streams are detailed. Stream numbers (No.) 1 through 4 refer to corresponding numbers in the map Figure 1.

Tab. 1: Zehn Bäche südwestlich des Vanssees, Osttürkei, die auf das Vorkommen von *Neuregus strauchii* (STEINDACHNER, 1887) untersucht wurden. Ausgewählte Gewässermerkmale werden angegeben. Die Nummerierung der Bäche (Nr.) 1 bis 4 korrespondiert mit Ziffern in der Karte Abb. 1.

| Locality Coordinates Fundort-koordinaten | (No.) [investigated stream length, km] (Nr.) [untersuchte Bachlänge, km] | Altitude [m a.s.l.] Seehöhe [m ü. M.] | Water temperature [°C] (date of visit) Wassertemperatur [°C] (Datum des Besuchs) | Estimated surface of water shaded by vegetation [%] Durch Vegetation beschatteter Anteil der Wasserfläche [%] | Average width of stream [m] Mittlere Bachbreite [m] | Further date of visit Weitere Besuche | Observation of <i>Neuregus</i> Beobachtung von <i>Neuregus</i> |
|---|---|--|---|--|--|--|--|
| 38°20'N, 42°14'E | (1) [1.5] | 1695 | 14.6 (28.05.09) 14.7 (11.06.09) | > 50 | 1.5-2 | 23.05.08 | Adults, fresh spawn, advanced larvae Adulte, frischer Laich, weit entwickelte Larven |
| 38°18'N, 42°12'E | (2) [2.0] | 1565 | 19.3 (28.05.09) | > 50 lower reaches < 10 upper flow | 2 | 11.06.09 | Spawn and recently hatched clutch Laich, und ein frisch geschlüpftes Gelege |
| 38°15'N, 42°06'E | (3) [0.5] | 1205 | 18.6 (28.05.09) | < 10 | 1-1.5 | | Spawn / Laich |
| 38°23'N, 42°04'E | (4) [1.0] | 1675 | 9.8-19.0 (28.05.09) | < 10 (no shade at all) | 1.5 | 11.06.09 | Spawn / Laich |
| 38°20'N, 42°11'E | [-0.5] | 1670 | 21.5 (11.06.09) | < 10 | 1-2 | | No record / kein Nachweis |
| 38°20'N, 42°08'E | [-0.5] | 1490 | 20.4 (28.05.09) | < 10 | 2-3 | | No record / kein Nachweis |
| 38°21'N, 42°05'E | [-0.5] | 1520 | 21.9 (11.06.09) | < 10 | 2-2.5 | | No record / kein Nachweis |
| 38°21'N, 42°41'E | [-0.5] | 1840 | Not measured (11.06.09) keine Messung | < 25 | 3-3.5 | | No record / kein Nachweis; strong water current / starke Wasserströmung |
| 38°07'N, 43°07'E | [-0.5] | 2110 | Not measured (04.06.08) keine Messung | < 10 | 2 | | No record / kein Nachweis; probably outside range / wahrscheinlich außerhalb des Verbreitungsgebietes |
| 38°06'N, 43°08'E | [-0.5] | 2020 | Not measured (04.06.08) keine Messung | < 10 | 3 | | No record / kein Nachweis; probably outside range wahrscheinlich außerhalb des Verbreitungsgebietes |

locals to identify and verify the presence of newts. Water temperature was measured by utilizing a digital thermometer (Greisinger® GTH 175/MO, accuracy 0.1 °C). Moreover, water samples from streams inhabited by *N. crocatus* were analyzed for total hardness, carbonate hardness and pH, using standard test stripes (Sera Quick-test®). The streams and the surrounding land habitat were photographed and the proportion of the water surface shaded by vegetation of the streams

inhabited by *Neurergus* was estimated. The length of the streams on the surface is indicated in Tables 1 and 2. Digital images of newts were taken and the geographical positions of the streams (in most cases the place where a street crossed or passed by) were determined by means of a Global Position Device. The total length (tip of snout to tip of tail) of ten randomly selected adult *N. crocatus* was measured with a caliper in order to gain size data of the animals.

RESULTS

Province of Bitlis *Neurergus strauchii*

Southwest of Lake Van, ten streams were investigated (Fig. 1, Table 1). In six of them neither newts nor their spawn were observed.

In three more brooks (Nos. 2, 3, 4 in Table 1) spawn in different stages of development was found. Adult animals were no longer present. The water temperature was between 8.9 °C (spring outlet No. 4) and 19.3 °C (stream No. 2). In all three streams the spawn was already in an advanced stage of development. Generally, the spawn was attached to the underside of rocks or boulders in deeper pools of the streams. The clutches consisted of 15 to 120 (probably from several clutches) eggs on individual rocks; about 35 eggs represented a common clutch size. The number of clutches found was four (stream No. 1), three (stream No. 2), one (stream No. 3), and 10 (stream No. 4) but cannot be taken as representative of the abundance of newts since rocks and boulders were not inspected in a systematic way. On the 11th of June 2009, we found a clutch in stream No. 2 with all larvae but one already hatched. The stream was situated in a deep valley with trees and bushes at its waterside and slopes, only the first few hundred meters running through an open area of meadow. Brook No. 3, close to the village of Çeltikli in the southern Bitlis province, was surrounded by steep hills covered by scattered oak trees on rocky ground. It drained into a larger river valley in which rice was grown. Stream No. 4 was the only water body the surrounding hills of which

were completely devoid of forest. Exclusively in the lower reaches, large trees nearby houses provided some shadow.

Only one stream (No. 1, Fig. 5) was detected in which adult *N. strauchii* were still present. Two adult newts were found on 23.05.08 when further research was not possible because of village guards preventing our activity in that area, 25 adults and one clutch were found on 28.05.09 and 12 adult animals, three clutches and three larvae on 11.06.09. In summary, during three visits of the stream and a total of 3.5 hours spent searching for newts, 39 animals (10 males, 29 females) were found. All adults were in reproductive condition. Beside the adults, four clutches in their first third of development (maybe originating from more than four females) as well as three large larvae were present. The maximum number of adults observed was 1.7 animals per 100 meters (28.05.09). The water temperature along the course of the stream was relatively constant at 14.7 °C (11.06.2009). In Table 1 the collected data on the characteristics of the streams are presented.

Province of Hakkari *Neurergus crocatus*

In the Hakkari province, seven streams were studied (Fig. 1, Table 2). Five streams in the surrounding of the city of Hakkari were investigated without finding any *Neurergus*. Locals were not familiar with the animals shown on photographs.

However, *N. crocatus* was found in the southeastern part of the province bordering

Table 2: Seven streams in the Hakkari province, southeast Turkey, investigated for the presence of *Neuregerus crocatus* COPE, 1862. Selected characteristics of the streams are detailed. 'Stream length' means investigated stream length.

Tab. 2: Sieben Bäche in der Provinz Hakkari, Südosttürkei, welche auf das Vorkommen von *Neuregerus crocatus* COPE, 1862 untersucht wurden. Ausgewählte Gewässermerkmale werden angegeben. 'Bachlänge' bedeutet untersuchte Bachlänge.

| Locality Coordinates Fundortkoordinaten | Altitude [m a.s.l.] (Stream length, km) Seehöhe [m ü. M.] (Bachlänge, km) | Water temperature [°C] (date of visit) Wassertemperatur [°C] (Datum des Besuchs) | Estimated surface of water shaded by vegetation [%] Durch Vegetation beschatteter Anteil der Wasseroberfläche [%] | Average width of stream [m] Mittlere Bach- breite [m] | Carbonate hardness [German degrees] Karbonathärte [°dH] | Total hardness [German degrees] Gesamthärte [°dH] | pH |
|--|--|---|--|---|--|--|-----|
| 37°21'N, 44°31'E | 1510 (-0.5) | 13.2 (10.06.09) | > 50 | 2 | 8 | 9 | 8 |
| 37°21'N, 44°30'E | 1560 (-0.5) | 14.0 (10.06.09) | > 50 | 1.5-2 | 8 | 8.5 | 7.5 |
| 37°30'N, 43°43'E | (-0.5) | (01.06.08) | No evidence or indication for the occurrence | / kein | Nachweis oder Hinweis auf Vorkommen | | |
| 37°35'N, 43°42'E | (-0.5) | (01.06.08) | No evidence or indication for the occurrence | / kein | Nachweis oder Hinweis auf Vorkommen | | |
| 37°35'N, 43°48'E | (-0.5) | (03.06.08) | No evidence or indication for the occurrence | / kein | Nachweis oder Hinweis auf Vorkommen | | |
| 37°41'N, 43°49'E | (-0.5) | (01.06.08) | No evidence or indication for the occurrence | / kein | Nachweis oder Hinweis auf Vorkommen | | |
| 37°42'N, 44°01'E | (-0.5) | (03.06.08) | No evidence or indication for the occurrence | / kein | Nachweis oder Hinweis auf Vorkommen | | |

Iraq and Iran. Here, newts were observed close to the city of Şemdinli in two neighboring streams located at a distance of about five km from each other. The animals were called "Kaşkaduk" by the local Kurds. The breeding streams of *N. crocatus* were visited on the 2nd of June 2008 and 10th of June 2009. In 2008 an average of two to three animals was detected in each larger pool (Fig. 4) and within two hours, we observed 25 animals. They were resting at the bottom of pools mainly in the shade. According to the corpulence of the females, they were still carrying eggs. Fresh spawn (six clutches, but stones were turned only randomly) was found on the underside of rocks. The size of the clutches varied between 20-40 eggs. Two animals were detected on land between the roots of trees stabilizing the brookside. For the latter two streams the observed abundance of newts was 2.5 newts per 100 m in 2008 (2nd of June) and 0.7 per 100 m in 2009 (10th of June).

Water temperature was almost equal in both streams measuring 14.0 and 13.2 °C, respectively. It did not vary significantly along their courses. The streams were situated in steep valleys facing northwest. Surrounding slopes were covered by dense oak forest, growing on sandy soil with only a few rocks scattered in between. In the lower reaches of the streams grew large walnut trees. Most parts of the brooks were shaded by ash and oak trees, dog rose, willow, stinging nettle, blackberry and diverse herbage. This vegetation provided the stream with plenty of shade. In a few sections horsetail and algae grew within the stream, and stones directly along its run were covered by moss. Sand sediment, pebble, cobbles and boulder alternated as substrates of the stream bed. The altitude was about 1600 m a.s.l. See Table 2 for all collected data on characteristics of the streams. The stream valleys were only used for grazing of sheep and goats. On the 10th of June 2009, about a week later than the previous year, a markedly lower number of animals were observed in these water courses – only seven newts were found (four males, three females) as compared to 25 in the year before.

Aquatic adults or larvae may potentially feed on *Gammarus* species, larvae of



Fig. 2: Pair of *Neuregerus crocatus* COPE, 1862 from a stream near the city of Şemdinli, SE Turkey.
The male is on the left side.

Abb. 2. Ein Pärchen von *Neuregerus crocatus* COPE, 1862 aus einem Bach nahe der Stadt Şemdinli, Südosttürkei; Männchen links.



Fig. 3: Ventral aspect of a male *Neuregerus crocatus* COPE, 1862 from a stream near the city of Şemdinli, SE Turkey.

Abb. 3: Bauchseite eines männlichen *Neuregerus crocatus* COPE, 1862 aus einem Bach nahe der Stadt Şemdinli, Südosttürkei.



Fig. 4: *Neuregerus crocatus* COPE, 1862 within its breeding stream near the city of Şemdinli, SE Turkey.
Abb. 4: *Neuregerus crocatus* COPE, 1862 in seinen Laichgewässer nahe der Stadt Şemdinli, Südosttürkei.



Fig. 5: Stream No. 1, southwest of Lake Van, east Turkey,
in which numerous *Neuregerus strauchii* (STEINDACHNER, 1887) were found.
Abb. 5: Bach Nr. 1, südwestlich des Wansees, Osttürkei,
in welchem zahlreiche *Neuregerus strauchii* (STEINDACHNER, 1887) gefangen wurden.

Table 3: Total length (cm) of four male (m) and six female (f) *Neurergus crocatus* COPE, 1862 from streams near the city of Şemdinli, SE Turkey (comp. Fig. 1, Table 2).

Tab. 3: Gesamtlänge (cm) von vier Männchen (m) und sechs Weibchen (f) von *Neurergus crocatus* COPE, 1862 aus Bächen nahe Şemdinli, Südosttürkei (vergl. Abb. 1, Tab. 2).

| Sex | m | m | m | m | f | f | f | f | f | f |
|----------------------------|--|------|------|----|------|------|------|------|------|------|
| Total length / Gesamtlänge | 14.0 | 14.0 | 15.7 | 12 | 15.5 | 13.5 | 16.5 | 15.5 | 16.1 | 15.0 |
| Males / Männchen | <i>n</i> = 4, range: 12.0-15.7, mean: 13.9, standard deviation: 1.51 | | | | | | | | | |
| Females / Weibchen | <i>n</i> = 6, range: 13.5-16.5, mean: 15.4, standard deviation: 1.05 | | | | | | | | | |

stone flies, ephemera and caddis flies which were present in the stream. Total length [in cm] of four adult males was 12.0-15.7 (mean: 13.9, standard deviation: 1.51) and 13.5-16.5 (mean: 15.4, standard deviation: 1.05) of six adult females (Table 3). Males appeared to be smaller and more slender.

Within the spawning period, beside of an enlarged cloaca, the males showed bright shiny, large white spots on the dorsal tail, arranged in a single line. Females in contrast, had smaller and irregularly arranged spots and blotches on the tail which were yellow. Both sexes had spots, blotches and

speckles on the dorsum which were sulfur yellow with black ground coloration. Laterally, the spots and blotches were slightly larger, regular in shape and changed the color into whitish. Most animals had a single larger spot at the base of all four limbs. That spot sometimes formed a kind of band around the limb, its color varied from yellow to white, sometimes even reddish (Fig. 2). The ventral side, including that of the extremities was uniformly orange-red or yellow-orange (Fig. 3). Occasionally, dark stripes or blotches extending from the flanks were seen on the margins of the belly.

DISCUSSION

Neurergus strauchii strauchii. The species which had been known from the south-western area of Lake Van only, was recently found to have a far more widespread distribution range (BOGAERTS et al. 2006). The present investigation was conducted in the eastern part of the distribution area bordering Lake Van.

Aquatic period.— After their hibernation in early spring, during or after the snow melting, *N. strauchii strauchii* migrate into the brooks in order to mate and lay their eggs. Later, after spawning the adults leave the water to return to the land. Information about the duration of the aquatic phase is contradictory. SCHWEIGER (2009) claims only a few days, whereas SCHMIDTLER & SCHMIDTLER (1970) reported that locals observed adult newts in the water until September. Remarkably, in the present study, adult *N. strauchii strauchi* were detected only in one stream (stream No. 1) out of ten at the end of May / beginning of June; they obviously had already left three other ones at that time. According to the advanced

developmental status of the spawn in these three streams (streams nos. 2-4), the egg laying period must have ended several weeks before. This estimate was roughly derived from an embryonic developmental period of about three weeks at cool captive conditions (SCHULTSCHIK 2010) that is certainly prolonged at significantly lower temperatures. On the contrary, in stream No. 1 where adult newts and larvae were found, the spawn had been laid recently, and the spawning period had not been over yet. The detected large larvae had certainly hibernated in the brook (comp. SCHMIDTLER & SCHMIDTLER 1970; SCHMIDTLER 1994).

Habitat requirements.— This latter stream (No. 1, Fig. 5) lay at an altitude similar to stream No. 4 (1695 vs. 1675 m a.s.l.), and its structure is comparable to the lower reaches of stream No. 2 (2 m wide; > 50% of water surface shaded). The substrate consisted of rocks, large stones, rubble and sand sediment as in all of these streams. But the low and constant water temperature of 14.6 °C clearly distinguished stream No. 1

from all others investigated. Neither the altitude nor the proportion of shade in general, but the shade by vegetation in the headwater region seems to be essential for low water temperatures. Moreover, stream No. 1 was relatively untouched, in particular the brookside. In addition stream No. 1 was characterized by a variety of deep pools, fast flowing and calmer sections. These structures were created by rocks, dammed up branches and roots growing into the stream bed. All along its length, the temperature was constant due to the shade cast by the trees growing along its banks. In contrast, the other brooks, heavily marked by human impact, had deforested riverbanks and hills surrounding it.

Conclusions.— Our observations of *N. strauchii* indicate that the duration of the aquatic phase is strongly influenced by environmental factors. Natural vegetation like oak forest or willows along the streams was depleted by human land-use practices. Water temperature alternates seasonally but this is amplified by activities such as grazing or deforestation, additionally water temperature increases rapidly along the course of the brook. Human adverse impact results in the destruction of vegetation which would otherwise provide shade along the stream, thereby maintaining a lower temperature. The most extreme example is stream No. 4. At the very spring outlet the water temperature was only 8.9 °C but flowing through a completely deforested and heavily grazed valley, the temperature rose about two degrees per 100 meter up to 19 °C. Still, it seems to be tolerated by *N. strauchii*, probably only hastening the development of the larvae and shortening or shifting the aquatic phase in the adults. Other impacts such as drifting of larvae because of the lack of a well structured aquatic environment are harder to assess but could have negative impact. Streams which apparently did not contain any *N. strauchii* were either more than two meters wide, had a high water velocity, or at the date of our visits a water temperature above 19.5 °C (see Table 1). The shift in the sex ratio towards females could probably be explained by the advanced date; male newts had possibly already migrated back to their terrestrial habitat (BOGAERTS et al. 2010).

Neurergus crocatus. The main information concerning *N. crocatus* in the wild originates from Iraq, almost exclusively from the region around Aqrah (VILLWOCK 1961; NADER 1969). Large portions of the range area are difficult to access. Parts of the Turkish-Iraq border were military off-limit areas during our visits, including the Sümbül Mountains. Additionally, the biogeographical interesting region of Çukurca (south of Hakkari and at the foothills of the Sümbül Dağı), neighboring the Beytüşşebap valley, is inaccessible to foreigners. Several earlier attempts to visit Beytüşşebap were unsuccessful (M. SCHWEIGER, S. BOGAERTS pers. comm.) which is why the authors refrained from getting there.

New records for the Hakkari province.— Although difficult to enter, the Şemdinli region was accessible. There we found *N. crocatus* in two brooks (Fig. 4). Furthermore, a number of people in the city of Şemdinli who live in the eponymous district, confirmed the presence of *Neurergus* in streams nearby their hometowns. Investigation of streams in the vicinity of the town of Hakkari, one of them even several kilometers south of the city, brought no confirmation of the presence of *Neurergus*. The locals were not familiar with *N. crocatus* shown on photographs.

Sexual dimorphism in color-pattern.— Sexual dimorphism occurs in *N. strauchii* in the form of a silver-blue coloration on the lateral side of the tail in males (STEINFARTZ 1995; SPARREBOOM et al. 2000) but was not known for *N. crocatus*. Strikingly, adult males had few, intensively white and shiny large dots on the tail, which were arranged in a single line. The females in comparison had several irregularly arranged dots, colored as yellow as the dots on the rest of the body. Thus there was a clearly distinguishable coloration pattern for both sexes in the *N. crocatus* population studied (Fig. 2). These observations are in contrast to the presumption of a missing distinctive sexual coloration pattern in *N. crocatus* (SCHMIDTLER & SCHMIDTLER 1975).

Aquatic period.— At Beytüşşebap *N. crocatus* were observed in their aquatic habitats as early as at the end of April (BARAN & ÖZ 1986). NADER (1969) found Iraqi specimens in March as well as May, and

stated that the reproductive period began in the second half of May. In 2008, the authors found numerous aquatic newts on June 2nd 2008 near Şemdinli, southeast Turkey, at about 1500 m a.s.l. Due to the low number of seven adult *N. crocatus* in the water and the obviously declined breeding facilities observed on June 10th, 2009, we conclude that the end of the aquatic phase had approached. Nevertheless, the spawn was at an early developmental stage at that time. In the previous year, the animals had been right within the spawning period one week earlier. On the top of the surrounding mountains snow was visible at both visits, and along the streams signs of a previous flood, most likely from melting snow, were seen. According to the region's locals, snow is often still present in April. It is difficult to back-calculate or estimate the date when the animals entered the water, but it seems unlikely that they can inhabit a rapidly flowing stream during snowmelt.

Habitat requirements.— The streams where the authors found aquatic *N. crocatus* as well as the stream in which *N. strauchii* were observed are characterized by dense riparian vegetation, reflecting low

human adverse impact. The general situation of the aquatic habitat as well as the breeding patterns seem to be very similar in both species.

Systematic implications.— *Neurergus crocatus* from Beytüşşebap, southeastern Turkey, illustrated and described by BARAN & ÖZ (1986) bear numerous small spots. One of these animals clearly resembles *N. crocatus* from our new locality. The other published illustrations of *N. crocatus* represent animals from Aqrah, Iraq (FREYTAG 1957; NADER 1969; STEINFARTZ 1995; STEINFARTZ & SCHULTSCHIK 1997) and depict animals with large blotches. The same pattern is seen in the paratype originating from the type locality west of Lake Urmia (Orumiyeh), Iran (FREYTAG 1957). Both, Aqrah and the area west of Lake Urmia (Orumiyeh) lie within a radius of less than 100 km from the new locality near Şemdinli. A clear geographical barrier between those regions is not recognizable. It still has to be investigated if the morphological differences within *N. crocatus* are of systematic relevance (comp. ÖZDEMİR et al. 2009).

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