

## Noteworthy Record of the Mediterranean Water Shrew (*Neomys anomalus*) from South-Western Iran (Mammalia: Soricomorpha)

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**Abstract:** Three water shrew specimens were collected in the Sheshpir spring (2303 m a.s.l.), Fars province, south-western Iran. In pennial morphology, which is species-specific in the genus *Neomys* Kaup, 1829, the specimens were indistinguishable from *N. anomalus* Cabrera, 1907. The Sheshpir spring is located approximately 900 km to the south-south-west of Gorgan, the only site in Iran where *N. anomalus* has been known to occur so far. The spring is a stony basin with bare banks and poorly developed aquatic vegetation and as such is an atypical habitat for water shrews. It is noteworthy that fish are absent in the spring.

**Key Words:** *Neomys anomalus*, range extension, zoogeography, Iran

### Introduction

Of the 376 shrew species presently known (Hutterer, 2005), only a dozen of them (in 4 genera) are adapted to semi-aquatic life (Hutterer, 1985). This makes aquatic adaptation one of the rarest shrew specialisations. Semi-aquatic shrews are represented in the Near and Middle East by 2 species from the genus *Neomys* Kaup, 1829, the Mediterranean water shrew *N. anomalus* Cabrera, 1907 and Transcaucasian water shrew *N. teres* Satunin, 1913 (Kryštufek et al., 2000; Hutterer, 2005). Both of these shrews occur also in Iran, where they are known from a mesic northern part of the country (Lay, 1967; Etemad, 1984; Ziaei, 1996; Firouz, 2000; Hutterer, 2005). The southern Caspian shores are thus on the very south-eastern border of the genus, where water shrews are extremely rare. Namely, the presence of the 2 *Neomys* species in Iran is so far based on 2 voucher specimens (Lay, 1967; Hutterer, 2005). Further west, *N. teres* is common in the Caucasus (Sokolov and Tembotov, 1989) and in the Black Sea mountains of Turkey (Kryštufek et al., 1998; Kryštufek and Vohralík, 2001), while *N. anomalus* is widespread in Anatolia but absent from the Caucasus (Sokolov and Tembotov, 1989; Kryštufek and Vohralík, 2001).

In this paper, we report on an unexpected finding of the Mediterranean water shrew in south-western Iran,

which extends the known limit of the species' southern range for nearly 1000 km southward.

### Materials and Methods

Three specimens were collected in August 2006 by hand net, eventually euthanised by diethyl ether overdose, and preserved in 10% formaldehyde solution. Measuring was performed afterwards using vernier callipers adjusted to the nearest 0.5 mm. Phalli were preserved in 70% alcohol and examined under a dissecting microscope. The voucher specimens are deposited in the collections of the Biology Department, Shiraz University (CBSU).

### Results and Discussion

**Identification.** Species of water shrews resemble each other in their external appearance, cranial morphology, and dental shape. Although morphological adaptations to semi-aquatic life (large body size, relatively longer tail, fringes of stiff hairs bordering the hind foot, and a tail keel) are more developed in *N. teres* than in *N. anomalus*, character states overlap (Kryštufek et al., 2000). Three Iranian specimens at our disposal were relatively small (Table, Figure 1) and matched Turkish *N. anomalus* rather than *N. teres* (Kryštufek and Vohralík,

Table. External measurements (mm) of the 3 *Neomys anomalus* specimens from the Sheshpir spring. Relative tail length (%) is the quotient of tail length with head and body length as denominator and multiplied by 100.

| Head and body length | Tail length | Hind foot length | Relative tail length |
|----------------------|-------------|------------------|----------------------|
| 88                   | 54          | 17               | 61.4                 |
| 77                   | 63          | 17               | 81.8                 |
| 68                   | 56          | 16               | 82.4                 |

2001). Hind foot length is of particular help in distinguishing *N. anomalus* from *N. teres* (cut-off point 18.2-18.3 mm; Kryštufek and Vohralík, 2000) and all 3 Iranian animals were, in this respect, within the range of Anatolian *N. anomalus*. The tail was relatively long in our material, possibly reflecting a measuring bias since the animals were submerged in formaldehyde prior to the measuring procedure.

The shape of the glans penis is species-specific in the genus *Neomys* (Kryštufek et al., 2000); in this respect, our specimens were indistinguishable from *N. anomalus*. The glans penis was simple with a blunt apex (pointed and prolonged distally in *N. teres*), without lateral flaps (present in *N. teres*), and with sparse horny spines on the ventral surface (dense in *N. teres*; Figure 2).

Considering the current taxonomic division of the genus *Neomys* (Huterrera, 2005), the newly collected specimens from Iran can be safely identified as *N. anomalus*. They exhibited no peculiarities in colour: the back was nearly black, the belly silvery whitish, shaded by creamy tints; demarcation line along flanks was sharp (Figure 1). Semi-aquatic adaptations (prominent keel on the ventral side of tail, stiff hairs bordering the fore and hind foot) were relatively well pronounced. The skull and dentition did not deviate from the condition seen in *N. anomalus* from Anatolia.

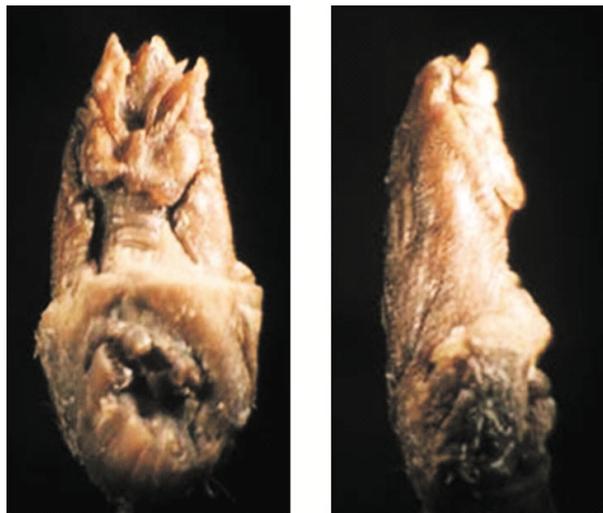


Figure 2. Glans penis of *Neomys anomalus* from the Sheshpir spring with ventral (left) and lateral (right; ventral side is to the right) views.

**Zoogeography.** We collected specimens in the Sheshpir spring (30°15'25' N, 52°03'07' E; 2303 m above sea level), 30 km north of the city of Sepidan in Fars province. The locality is in the south-eastern extension of the Zagros Mts., situated approximately 900 km to the south-south-west of the previously recorded locality at Gorgan city (Figure 3). The region is semi-humid with annual precipitation of 840 mm and mean annual temperature of 14.4 °C. Mean monthly relative humidity is modest during the winter (52%-61%) but very low in the summer (26%-28%), a period with no rain at all. The Sheshpir spring also exceeds the highest elevations at which *N. anomalus* is reported for Europe (1850 m; Spitzenberger, 1999) and for Anatolia (2100 m; Kryštufek and Vohralík, 2001).

*Neomys anomalus* possibly evolved in Anatolia and the Transcaucasian region (Kryštufek et al., 2000). Owing to the lack of consistency among molecular phylogenies

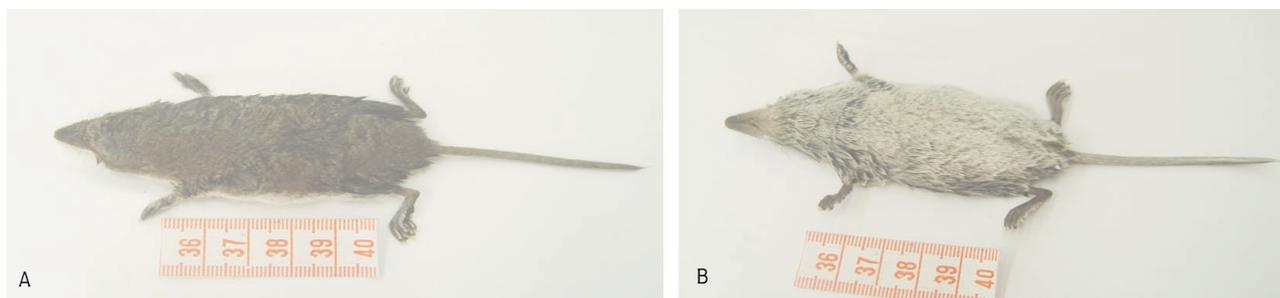


Figure 1. Mediterranean water shrew (*Neomys anomalus*) from the Sheshpir spring; dorsal (A) and ventral (B) views.



Figure 3. Records of *Neomys anomalus* in Iran: (■) Gorgan (Lay, 1967), (▲) Sheshpir spring (this paper).

(compare Kryštufek et al., 2000 and Bannikova and Kramerov, 2005), the scenario is, however, tentative. Regardless of this, our results suggest that the historical range of *N. anomalus* in south-western Asia was more extensive than the species' current range. At this stage it would be important to know the degree to which the *N. anomalus* population from the Sheshpir spring is isolated. This is a permanent water spring with an outlet to the Sheshpir River, which finally drains into the Persian Gulf.

**Biological observations.** Typical habitat of *N. anomalus* is densely vegetated edges of still brooks, rivers, lakes, and ponds, as well as bogs and marshes (Spitzenberger, 1999; Kryštufek and Vohralík, 2001). The Sheshpir spring is a rocky basin with bare shores and poorly developed aquatic vegetation (Figure 4). As such it provides little shelter and is an unusual habitat for *N. anomalus*. The spring is small (3 × 3 m) with water depth of approximately 70 cm (Figure 4). The water was clear and cold in August 2006 (7.5 °C), and of the following chemical composition: pH 6.5, nitrate 2.5 mg/l, nitrite



Figure 4. Habitat of *Neomys anomalus* at the Sheshpir spring.

0.012 mg/l, phosphate 0.93 mg/l, calcium 16.8 mg/l, and ammonium 0.08 mg/l.

The only abundant invertebrates in the spring were crustaceans, *Gammarus* sp. It is noteworthy that amphipods have so far not been recorded in the diet of *N. anomalus* (Niethammer, 1977, 1978; Churchfield and Rychlik, 2006). The spring was also free of fish, which might be an important factor enabling survival of the Mediterranean water shrew in a water body so poor in terms of shelter and so isolated in the Iranian arid landscape.

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