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# SHORT COMMUNICATION FIRST PHOTOGRAPHIC RECORDS AND NEW DISTRIBUTION RANGE OF THE ENDANGERED LONG-TAILED NESOKIA *NESOKIA BUNNII* (KHAJURIA, 1981)

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### ABSTRACT

In the 1970s, the world knew the long-tailed nesokia *Nesokia bunnii* (Khajuria, 1981) (Rodentia, Muridae) from the Mesopotamian marshes of Garden of Eden in Southern Iraq. This distinct rodent was known from only five voucher specimens collected at the confluence of Tigris and Euphrates Rivers in southern Iraq while its occurrence in Southwestern Iran had

never been reported. In the 1990s, a large extent of its natural habitat was catastrophically desiccated and the animal was last seen in the 1970s. Since then, the status of this elusive rodent was shrouded in mystery. In 2007, an extraordinary photograph of a carcass of this species came to the light from Hawizeh Marsh which was interpreted as concrete evidence of the species' persistence in the marshes of southern Iraq after the desiccation in the last century. In 2021, after more than 40 years, exclusive photographic records of living *N. bunnii* were obtained for the first time from Central Marshes in southern Iraq and from Edhe'am Marsh in southwestern Iran. The new distribution range is highlighted in this note. Furthermore, the first photographs of living *N. bunnii* are provided along with notes on its ecology and behavior.

Keywords: Conservation, Endemic, Garden of Eden, Mesopotamian Marshes, Rodents of Iraq-Iran.

#### INTRODUCTION

The long-tailed Nesokia *Nesokia bunnii* (Khajuria, 1981) (Rodentia, Muridae) is one of the morphologically elusive, rarest and enigmatic small Palaearctic mammals. It is well adapted to the extensive marshy habitats of southern Iraq which originally covered 15,000–20,000 km<sup>2</sup> but were deliberately ditched and drained to <15% of its original size by the previous political regime during the 1990s (Al-Ansari *et al.*, 2012). The animal was last seen in the 1970s, i.e. long before any drainage occurred. The prevailing opinion claimed that such a drastic ecosystem destruction "... *almost certainly lead to the global extinction*" of two mammal species, endemic to these marshes, the Iraqi smooth-coated otter *Lutrogale perspicillata maxwelli* (Hayman, 1956), and the long-tailed Nesokia (Partow, 2001; Al-Sheikhly and Nader, 2013). Due to habitat destruction/fragmentation and natural ecosystem modification, the current conservation status of *N. bunnii* has been assessed as Endangered by the IUCN Red List (Stuart, 2008).

The species is known from only five voucher specimens collected between March 1974 and January 1977 within a narrow perimeter of 30 km around Qurna, within the Mesopotamian marshes at the confluence of the Tigris and the Euphrates Rivers in Basra Province in southern Iraq (Khajuria, 1981; Kryštufek et al., 2017, 2020) (Tab. 1). Unfortunately, this valuable type material was permanently lost due to vandalizing of the Iraq Natural History Research Center and Museum (NHRCM) in 2003 (see Al-Sheikhly et al., 2015; Kryštufek et al., 2017). Based on morphology only, the species was originally described as a distinct genus Erythronesokia by Khajuria (1981) but was relegated in the early 1990s to the genus Nesokia where it is still maintained as N. bunnii. This nomenclature is currently valid and was accepted by subsequent authors (Corbet, 1984; Corbet and Hill, 1986, 1991, 1992; Nader, 1989; Nowak, 1991; Musser and Carleton, 1993, 2005; Musser and Brothers, 1994; Pavlinov et al., 1995; Panteleyev, 1998; Stuart, 2008; Al-Sheikhly and Haba, 2014; Al-Sheikhly et al., 2015; Denys et al., 2017). As an exception, Harrison and Bates (1991) examined Khajuria's record and suggested that this taxon could be a large individual of the short-tailed Nesokia indica (Gray, 1832). Its abnormally long tail putatively reflects ecological adaptation to aquatic habitat of the marshes of southern Iraq. The species shares with N. indica all traits that

distinguish *Nesokia* from the closely related *Bandicota*; however, it differs in colour, size, relative length of tail, and shape of the skull and mandible (Kryštufek *et al.*, 2016; 2017). In a craniometric study, Al-Robaae and Felten (1990) published additional three specimens of *N. bunnii* (Tab. 1), which are now in the Naturmuseum Senckenberg, Frankfurt, Germany (SMF) (see Kryštufek *et al.*, 2017, 2020). They demonstrated a close resemblance between *N. bunnii* and *N. indica* rats, concluding that *Erythronesokia* is "not more than– if at all–a subgenus of *Nesokia*, but not a separate genus." Similar conclusions were in agreement with a geometric morphometric approach of craniodental structures made by Kryštufek *et al.* (2016). Furthermore, Kryštufek *et al.* (2020) indicated that no further museum vouchers of *N. bunnii* are known to exist.

In 2003, attempts were initiated to rehabilitate the original ecosystems of the Mesopotamian marshes which started to re-expand at the rate of 800 km<sup>2</sup> per year (Al-Ansari et al., 2012). Despite that much of the species' natural habitats were potentially restored, the fate of N. bunnii was more perplexing. In 2007, an extraordinary photograph of a half-eaten leftover carcass (sacral region of the body along with hind feet and the tail) was found in the Lissan E'jeardah Marsh, on the eastern side of Hawizeh Marsh in Maysan (=Myssan) Province in southern Iraq, i.e. northward of Basra and Qurna and close to the 1970s trapping sites, and was published by Haba (2009). The photograph of the carcass had not been assigned to the species and was labeled as a "Rat". However, it clearly showed the distinctive morphological features of N. bunnii and was sufficient evidence of the species' persistence in the Mesopotamian marshes of southern Iraq since the last animal had been captured near Bani Mansor in 1977 (Kryštufek et al., 2020). Al-Sheikhly et al. (2015) indicated that the current status the species in Iraq is unknown; suggesting that it could also possibly occur in Al-Hawizeh Marsh straddling the Iraq-Iran southeastern borders. It is worth mentioning that attempts by the late Jamshid Darvish, one of the leading rodent experts in Iran, were dedicated to search for N. bunnii in the Khuzestan Province of southwestern Iran, but such efforts yielded no positive results (Kryštufek et al. 2020). Based on the habitat suitability model (see Kryštufek et al., 2020), the species is highly expected to occur in Al-Edhe'am Marsh (=Hor Al-Azim), a transboundary monotonic marshy habitat on the eastern side of Al-Hawizeh Marsh in the Khuzestan province in southwestern Iran.

In our current note, the persistent occurrence and new geographical distribution range of *N*. *bunnii* in the Mesopotamian marshes of southern Iraq and southwestern Iran is evident by recent exclusive photographic documentations of living rodents in the wild, the first after more than 40 years.

#### **Recent record**

A total of three recent records (n=4 specimens) of *N. bunnii* were obtained. Iraq-the first two records were made in the Al-Chebaeish (=Chabaish) district in the Central Marshes (Iraq's National Park, Ramsar, and UNESCO site) in Thi Qar Province, ca. 40 km to the west of Qurna (terr. typ. 31° 0'44.83"N 47°25'54.08"E) in southern Iraq. The first unsexed adult specimen was trapped by a local (see the acknowledgments) with a Harris Humane Rodent Cage Trap set on the ground in an old human settlement (old local house) on the eastern bank

of the Euphrates River (30°57'50.88"N 47° 0'54.89"E) at the southernmost edge of the Central Marshes in June 2018. Unfortunately, the captured animal was killed and discarded later on (Pl. 1A).

The second specimen was an adult male captured alive by a villager in a settlement at Al-Sahagi ( $30^{\circ}58'3.49''N 47^{\circ} 1'30.99''E$ ), on the eastern bank of the Euphrates River on the 8<sup>th</sup> of May 2021. The live animal was photographed (Pls. 1B, C), and kept in a cage for laboratory rodents (dimensions 80 x 60 cm) for 16 days. Unfortunately, this individual died due to unknown/unexplained reasons later on. The carcass, preserved in a deep freeze (-9°C) and prepared as taxidermic mount, will be deposited in the NHRCM after permission and the specimen number will be granted.

Iran-the third record was made at Shatt Ali area (31°20'55.9"N 47° 42' 42.4"E) in the Edhe'am Marsh, Khuzestan Province in Southwestern Iran, ca. 3 km from the Iraq-Iran border and ca. 45 km northeast of Iraqi Qurna. Two specimens (adult male and female) were captured alive in a Harris Humane Rodent Cage Trap set by SBM on a muddy islet on the 4<sup>th</sup> of December 2021(Pls. 1D, E). Due to their critical conservation status, the animals were kept in a laboratory cage for morphological and behavioral study for 6 days and afterwards released at the capturing place on the 11<sup>th</sup> of December 2021. The habitat of the Central Marshes and Edhe'am Marsh resembles the general landscape of the typical transboundary Tigris-Euphrates Alluvial Salt Marsh (PA0906) Ecoregion. Both sites are mixed habitats of large freshwater open lakes (2–3 meter in depth), narrow watercourses bordered with dense vegetation of common reed *Phragmites australis* and common bulrush *Typha latifolia* beds, and scattered muddy islets and riverbanks with small holes and burrows lined with riparian and steppe vegetation of *Salix* sp. and *Tamarix* sp. (Pls. 1F, G).

Natural History Research Center and Museum.												
	No	Museum	Specimen									
		collection	no.	Date	Sex	Age	Locality	Country				
	1	NHRCM (lost holotype)	75-105-78	23.iii.1974	50	adult	Qurna, Basra Province	Iraq				
	2	NHRCM (lost paratype)	81-307-78	16.xi.1974	9	young	Qurna, Basra Province	Iraq				
	3	SMF	87532	10.v.1974	8	adult	5 km north of Qurna-Basra	Iraq				
	4	SMF (neotype)	62925	18.iii.1976	Ś	adult	Saraifa, 30 km north of Qurna, Basra Province	Iraq				
	5	SMF	87531	2.i.1977	°,	adult	Bani Mansor, 25 km west of Qurna, Basra	Iraq				

 Table (1): Historical and recent records of the Long-tailed Nesokia *N. bunnii* in Iraq and Iran. SMF=Naturmuseum Senckenberg, Frankfurt, Germany; NHRCM=Iraq Natural History Research Center and Museum.

						Province	
6	wild/carcass	-	7.xii.2007	un- sexed	adult	Lissan E'jeardah Marsh, eastern side of Hawizeh Marsh, Maysan Province	Iraq
7	Live captured and died	-	??.vi. 2018	Un- sexed	adult	Central Marshes, Al- Chebaeish, ThiQar Province	Iraq
8	Live captured and died	Processed as NHRCM museum voucher	8.v.2021	ñ	adult	Al-Sahagi, Central Marshes, Al- Chebaeish, ThiQar Province	Iraq
9	Live captured and released	-	4.xii.2021	\$°	adult	Shatt Ali, Edhe'am Marsh, Khuzestan Province	Iran

Al-Sheikhly et al.

### **Morphological Description**

The external morphological traits of the recently discovered rodents correspond to those described by Kryštufek et al. (2017, 2020). Furthermore, the field observations of the captured N. bunnii in the Central Marshes and Edhe'am Marsh, in reality, were a "spitting image" of the drawn model (Figure 1) illustrated in Kryštufek et al. (2020). The size is large with a typical robust appearance of a rat. The head is large with proportionally large eyes which have deep-brown pupils; the fleshy-grey muzzle pad is small but well defined and shows a deep medial groove. The fleshy-grey mystacial vibrissae have dark grey bases of moderate length with white tips. The species has moderately long ears, the outer surface of which is thinly covered by short hairs; the inner surface is effectively nude. The steel-grey tail is about the same length as head and body; it is interspersed with thin and short whitish hairs throughout but the terminal pencil is scarce. Tail annulation is well defined and regular, with about 8 rings to centimeter at the middle. The feet are rather wide and large and seemingly adapted to swimming, densely clad with pale-grey short stiff hairs on their dorsal side; plantar and palmar surfaces are naked. The fore feet are decidedly mesaxonic, digit V is clearly shorter than digits III-IV, and the pollex is rudimentary bearing a prominent short pale nail which extends to its edge. The hind feet are robust; digit III is slightly longer that digits II and IV, which are subequal. The hallux and digit V, although definitely shorter, are still moderately large. Claws are pale-grey, stout, curved and sharp. The dorsal fur from between the eyes to the rump is of "rustic-ochre red vibrant" colour. It is soft due to woolly under hair, but interspersion of coarse hair poses a slightly harsh texture. The ventral side, including the

front feet and shoulders, is dirt white to grayish white; ventral hairs are uniformly light down to bases. The light underside color extends from cheeks to the ear base almost reaching the lower eyelid; this hair is moderately to heavily washed grey. A distinct reddish-brown stripe is extending from the snout, surpassing the eye, reaching the ear base, and defining the ventral edge of the rufous dorsal side of the pelt. The demarcation between the rufous-reddish dorsum and the whitish venter is visibly distinct both on the body and on the head. These newly discovered specimens are an extremely valuable addition to the existent museum vouchers. To our knowledge, they are the only hard evidence on the species following the Mesopotamian marshes inundation since 1990s. Therefore, a full morphological, craniodental, and behavioral study related to these new specimens will be produced subsequently.

### **Biology and Behavior**

Nesokia bunnii seems to be ecologically adapted to the aquatic habitats of the Mesopotamian marshes of southern Iraq and southwestern Iran; however, information on its biology and ecological niche after the inundation of the marshes in the 1990s are completely obscure. When the live animals exhibited to the elders of the Marsh Arabs (the indigenous inhabitants of the Mesopotamian marshes), they indicated that this rodent is locally known as the "Greathi al-hour" or "Greathi al-ethib" (= the rodent of the marsh/reed), abundantly found in the marshes in the past but had not been seen since the desiccation in the 1990s. They also claimed that this rodent is building its nests in the bases of old sticks of dense Common reed beds on the marshland edges. On the17th of May 2014, a "red rodent" was observed on a nest densely built from reed flowers and delicately woven on the bases of reed sticks at Ishan Al-Gubbah (31° 3'N 47° 1'E) in the northern extremity of the Central Marshes. After careful examination, a total of four 2-3 days old pups were found (Pl. H, I) and believed to belong to N. bunnii as there are no other rodent species known to breed in the reed beds of the Mesopotamian marshes. During our in situ surveys in the Central Marshes in 2017–2021, we tried to locate any possible reed nests to observe the adult rodents on the breeding site. No positive results were obtained and further investigation is required.

Based on few observations of the live-captured *N. bunnii* in the Central Marshes and Edhe'am Marsh (which may not reflect the normal behavior in nature), the animals showed high caution and aggression toward human presence besides a remarkable tolerance to food shortage. One animal remained without food for the first 32 hours of its 16 days captivity. The animals showed a tendency to feed on several dietary items (e.g. vegetables, fruits, rodent pellets, pieces of bred, dry seeds and cedar fruit, etc.). Moreover, when provided, they gluttonously consumed fresh small fishes (mainly Abu mullet *Liza abu* Heckel, 1843). This indicates that the species may have developed fishing behavioral abilities, but the claim requires further monitoring. Similar to other sympatric rodents [e.g. *N. indica* and Brown Rat *Rattus norvegicus* (Berkenhout, 1769)], the species exhibited a sensitivity to sunlight and excessive heat. Under midday elevated temperatures, the animals insistently tried to find the coolest and shadiest places in their cage. Erratic circular body movements were intercepted with short intervals of standing on their hind feet which was followed by fast borrowing movements by their fore feet. The animals were also alarmed and attracted by a sound. When

agitated they produced a pitched faint sound of a harsh whistle-like "Psee-pseee" in a contentious rhythm.

Our observations are very preliminary and, detailed research is urgently required to obtain a better understanding of the cryptic behavior of this mysterious rodent in the Mesopotamian marshes.

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CONFLICT OF INTEREST STATEMENT "We declare there is no conflict of interest".



Plate (1): The Long-tailed Nesokia Nesokia Nesokia bunnii: (A) Individual captured alive at the Euphrates River bank, Central Marshes, Al-Chebaeish, Thi Qar Province-Iraq, June 2008 (Photo © Ahmad Hassan Al-Asady), (B-C) Al-Sahagi, Central Marshes, Al-Chebaeish, ThiQar Province-Iraq, 8<sup>th</sup> of May 2021 (Photos © Ra'ad H. Al-Asady), (D-E) Shatt Ali, Edhe'am Marsh, Khuzestan Province-Iran, 4<sup>th</sup> of December 2021 (Photos © Sayed B. Mousavi). Typical habitat of the species at the Euphrates River bank showing the holes and burrows: (F) Al-Chebaeish, Thi Qar Province-Iraq (Photo © Omar F. Al-Sheikhly). G – Typical habitat at Edhe'am Marsh, Khuzestan Province-Iran (Photo © Sayed B. Mousavi), (H-I) The pup of *N. bunnii* found in nest at Ishan Al-Gubbah, Central Marshes, Thi Qar Province-Iraq (Photos © Nadheer A. Fazaa).

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التسجيلات الصورية الأولى مع نطاق انتشار جديد للركين طويل الذيل المهدد بخطر الأنقراض (Khajuria, 1981)

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## الخلاصة

منذ سبعينيات القرن المنصرم، عرف العالم لأول مره الركين طويل الذنب Nesokia bunnii (Khajuria, 1981) من أهوار جنة عدن في جنوب العراق. حيث عرف هذا القارض المتميز من خمسة نماذج متحفية فقط جمعت ضمن نطاق ضيق يقدر ب

30 كم حول القرنة في منطقة التقاء نهري دجلة والفرات في محافظة البصرة مابين أذار عام 1974 وكانون الثاني عام 1977. في التسعينيات، جففت مساحات شاسعة من بيئة الحيوان الطبيعية بشكل مأساوي حيث لم يشاهد في الأهوار منذ السبعينيات، أي بفترة طويلة قبل حدوث التجفيف، ومنذ ذلك الحين، اصبح وضعه الراهن محاط بالكثير من الغموض. في عام 2007، تم التقاط صور استثنائية لجثة تابعة لهذا الحيوان في هور العويزه والتي اعتبرت دليل قوي على بقاء تواجد هذا النوع في ألأهوار بعد التجفيف في القرن المنصرم. في سنة 2001، بعد أكثر من 40 عاما، تم التقاط الصور الحصرية القرن المنصرم. في سنة 2021، بعد أكثر من 40 عاما، تم التقاط الصور الحصرية الغراب المويل الذيل حياً في البرية في الأهوار الوسطى في جنوب العراق وهور دلك، السجلات الصورية الأولى للركين طويل الذيل عائم نقطة أنتشار جديدة لهذا النوع. أضافة الى دلك، السجلات الصورية الأولى للركين طويل الذين طويل الذنب الحي مع ملاحظات عن سلوكياته وبيئته تم تقديمها في هذا البحث.