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Discovery of the Bank Vole (*Myodes glareolus*) on Ushant Island (Brittany, France)

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Olivier Lorvelec*, Pascal Rolland, Patricia Le Quilliec, François Quénot, and Alain Butet

Discovery of the Bank Vole (*Myodes glareolus*) on Ushant Island (Brittany, France)

[Découverte du Campagnol roussâtre (*Myodes glareolus*) sur l'île d'Ouessant (Bretagne, France)]

Running title: O. Lorvelec et al.: Bank Vole on Ushant Island

Abstract: Ecological monitoring of small mammals by trapping revealed the presence of the Bank Vole (*Myodes glareolus*) on Ushant Island (Brittany, France) in September 2017. It was the first report of the Bank Vole on this island. Comparison with prior monitoring efforts and an analysis of several batches of Barn Owl pellets allowed us to conclude that arrival on the island is recent, in any case sometime after 1995, and dating from the beginning of 2017 at the latest. It will be necessary to verify if the current population, still incompletely distributed into suitable habitats of the island, are maintaining themselves on a long term basis.

Keywords: *Myodes glareolus*, island, Ushant, Brittany, introduction

In the Atlas of Brittany's Mammals, Rolland and Hamon (2015) report the presence of four species of Rodents (Long-tailed Field Mouse, House Mouse, Roof Rat, and Brown Rat), only one Lagomorph (European Rabbit), and two "Insectivores" (Lesser White-toothed Shrew and West European Hedgehog) on Ushant Island (Department of Finistère, Brittany, France, 1558 ha, latitude 48.461, longitude -5.080). During ecological monitoring of small mammals conducted from 25 to 29 September 2017 on this island, as well as on its satellite, Keller Island (28 ha), and most of its peripheral rocky islets with perennial terrestrial vegetation (i.e., Enez Kadoran, Ledenez Arlan, Enez ar Bougeviou Glas, Youc'h Arland, Roc'h Nel, Enez Penn ar Roc'h, Youc'h Korz, Youc'h Kreiz, and Youc'h Meur), we detected the presence of the Bank Vole on the main island.

The Bank Vole, *Myodes glareolus* (Schreber, 1780), is a Rodent belonging to the subfamily Arvicolinae within the family Cricetidae. In the past, *Evotomys glareolus* then *Clethrionomys glareolus* were names often used for this species, but *Evotomys* and *Clethrionomys* are currently in the list of synonyms of the genus name *Myodes*. A discussion about these complex nomenclatural issues is available especially in Carleton and Musser (2005) and

***Corresponding author: Olivier Lorvelec**, ESE (Ecology and Ecosystem Health), INRA, Agrocampus Ouest, 35042 Rennes, France, e-mail: olivier.lorvelec@inra.fr

Pascal Rolland: Groupe mammalogique Breton, GMB, Maison de la Rivière, 29450 Sizun, France, e-mail: pjr.rolland@laposte.net

Patricia Le Quilliec: ESE (Ecology and Ecosystem Health), INRA, Agrocampus Ouest, 35042 Rennes, France, e-mail : patricia.le-quilliec@inra.fr

François Quénot: Centre d'étude du milieu d'Ouessant, CEMO, Ar Gouzoul, 29242 Ouessant, France, e-mail: fanch.quenot@gmail.com

Alain Butet: Univ. Rennes, CNRS, ECOBIO (Écosystèmes, biodiversité, évolution) – UMR 6553, 35000 Rennes, France, e-mail: alain.butet@univ-rennes1.fr

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3 Carleton *et al.* (2014). Formerly, because of a significant morphological variability, authors
4 defined tens of subspecies but, in 2005, Carleton and Musser recognize none as valid.

5 Within the Western Palearctic, its distribution area extends from Lake Baikal to north
6 of the Iberian Peninsula, Great Britain and south-west Ireland, where its presence is the
7 result of an introduction. To the north, its range extends very clearly beyond the Arctic Circle
8 in the Scandinavian Peninsula. To the south, it extends to the Turkish Black Sea coast,
9 northern Greece and the southern Italian Peninsula (Spitzenberger 1999, Carleton and
10 Musser 2005, Hutterer *et al.* 2016). In France, the Bank Vole is present everywhere with the
11 exception of the Mediterranean coast and Corsica (Saint Girons 1984). In particular, it is
12 present everywhere in Brittany (Department of Loire-Atlantique included, Verger 2015). This
13 species may find favourable habitats in different woodland or hedgerow habitats with
14 relatively high humidity (Spitzenberger 1999, Le Louarn *et al.* 2003). However, when Voles of
15 the genus *Microtus* are absent, as it is the case in Belle-Île (see below), the Bank Vole is
16 able to colonize open fields (Saint Girons and Beaucournu 1970). In France, it has no legal
17 status. Anonymous (2017) assessed the risk of extinction of the species as "Least Concern".
18

19
20 Until the end of the 20th century, Belle-Île (Department of Morbihan, 8563 ha) was the only
21 French Island where the presence of the Bank Vole was known (Heim de Balsac 1940, Saint
22 Girons 1984). However, this species was also recorded (Miller 1908, Saint Girons and
23 Beaucournu 1970) on the Channel Island of Jersey (11 820 ha). These two islands host
24 individuals that are darker and larger than individuals of close continental areas (Saint Girons
25 and Beaucournu 1970, Saint Girons 1973). Because of their insularity and special
26 colouration, authors originally defined these morphs as insular endemic taxa: *Clethrionomys*
27 *glareolus insulæ-bellæ* Heim de Balsac, 1940 for Belle-Île, *Evotomys cæsarius* Miller, 1908
28 for Jersey Island. These names are currently included in the list of synonyms of *Myodes*
29 *glareolus*, e.g., in Carleton and Musser (2005). That seems consistent with the fact that
30 isolation of Ponant and Channel Islands, which are Holocene Islands, is too recent to allow
31 speciation or sub-speciation. In addition, we do not know if the Bank Vole was already
32 present in these territories at the time of their isolation, or if its presence results from an old
33 introduction.
34

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36 In the 21st century, authors reported the presence of the Bank Vole on three new Brittany
37 Islands (Rolland and Hamon 2015). On "Île des Morts" (Roadstead of Brest, Department of
38 Finistère, 7 ha), the presence of an individual was mentioned during the 2005 Brown rat
39 (*Rattus norvegicus*) eradication campaign, whereas the species was not found during a 2004
40 ecological monitoring of small mammals, which was based on 125 nights x traps (Louis
41 Dutouquet, pers. comm., February 2018). However, because of a lack of information, this
42 mention is an unconfirmed observation that necessitates validation with new monitoring. The
43 first surveys on Dumet Island (Department of Loire-Atlantique, 7,6 ha), probably based in
44 part on Barn Owl pellet analysis, did not mention the presence of the Bank Vole (Baudouin-
45 Bodin 1976, 1982, Saint Girons and Nicolau-Guillaumet 1987, Saint Girons 1988). On
46 December 7, 2013, live individuals and skulls in Barn Owl (*Tyto alba*) pellets were reported
47 (Montfort 2014, Rolland and Hamon 2015). During a survey conducted by INRA
48 parasitologists and one of the authors (AB) in October 2016, the species was again
49 observed. Therefore, historical data suggests an introduction of the Bank Vole on Dumet
50 Island sometime after the 1980s, although doubt remains because of a lack of information
51 relating to samplings and their completeness. In this regard, (i) we know that a shrew lived
52 on Dumet Islands in 1972 while the Bank Vole was there unknown (Baudouin-Bodin 1976)
53 and (ii) that pellets collected in January 1973 had been sent to the Natural History Museum
54 of Nantes (Pierre Davoust, pers. comm., 2009). On Hœdic Island (Department of Morbihan,
55 208 ha), a dried corpse of Bank Vole was discovered near the harbour on June 18, 2016
56 (Rolland, in press), but subsequent trappings could not confirm the presence of this species.
57 We do not know if this specimen was introduced, via the harbour, alive or already dead,
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3 which seems most likely to us, or whether this specimen indicates the presence of an
4 established population. We only know that on Hœdic and Houat (291 ha) Islands, the Bank
5 Vole was not mentioned in a 2002 ecological monitoring of small mammals by trapping,
6 carried by the French Coastal Protection Agency (CELRL, Louis Dutouquet, pers. comm.,
7 February 2018).

8
9 On Ushant Island, where the Bank Vole was discovered on September 26th, 2017, a total of
10 299 traps (1190 trap x nights) were positioned to sample the primary ecological habitats of
11 the island. For this survey we used INRA live-traps (Aubry 1950), solid aluminium boxes of
12 dimensions 160x45x45mm for captures of small mammals less than 40g. A plastic dorm box,
13 containing an absorbent paper sheet and the bait (a mixture of peanut paste and oat flakes)
14 was added to traps in order to improve trapping efficiency and reduce mortality of individuals
15 during capture. We captured voles on the southwest, central and northeast portions of the
16 island along a two kilometers wide strip linking Lampaul village to the sea lighthouse of Stiff.
17 Captures occurred inside or at the borders of dense intermediate plant associations that are
18 actually becoming dominant on the island (Loncle and Bioret 2010): ferns and bramble
19 bushes, thickets of gorse (*Ulex europaeus*) and willow copses. Among the 27 individuals
20 caught, 10 were autopsied at the laboratory and 5 skulls were examined to confirm species
21 identification.
22

23
24 To deduce whether the species' presence might be the result of a possible recent
25 introduction in connection with the arrivals of materials by boat (firewood, fodder, etc.), we
26 conducted a retrospective analysis of past sampling campaigns and more recently collected
27 Barn Owl pellets that were available for this island.
28

29 A first inventory of mammals living on the main Ushant Island was conducted
30 between 1992 and 1995 (Howell and Bioret 1995, Pascal et al. 2002). The trapping design
31 included up to 86 trapping plots per year, featuring two small mammal trap models (INRA
32 and Sherman). This trapping campaign was performed in all habitats of the eastern part of the
33 island, equal to a third of the island's total area. Despite this important trapping effort, no
34 Bank Vole was caught and no signs of its presence were found as well. It is unlikely that the
35 species went unnoticed during this first trapping period. Nevertheless, it should be noted that
36 out of the whole trapping stations used at this period, only four were localized in optimal
37 habitats of this species and situated close to our trapping plots that captured Bank Voles in
38 2017.

39 Although predation rate of the Bank Vole by Barn Owl is lower than for most other
40 small rodent species (Saint Girons 1973), this Vole is systematically detected in rejection
41 pellets when populations are well established locally. A pair of Barn Owls settled on Ushant
42 Island at the end of the 2000s in the central part of the island. Pellets found close to the nest
43 after fledging in 2010, 2011, 2015 and 2017 were collected and analyzed by two of the
44 authors (FQ and PR). Pellets collected in 2010 and 2011 contained 277 mammals, and those
45 from 2015 contained 278. Bank Voles were not detected among prey items in these years. In
46 September 2017, collected pellet batches were bulky, but lower strata were highly degraded
47 by moisture. Only 30 pellets from 2017 were sufficiently well formed to permit analysis, but
48 nevertheless revealed 152 mammal prey items, including 7 Bank Voles (4.6% of total prey).
49 A rapid examination of the most degraded material allowed identification of two more Bank
50 Voles that were probably predated earlier in 2017 or at the end of 2016. It is important to
51 note that the percentage of 4.6% in the batch of 2017 is high for this rodent species, and
52 higher than what is generally found on the continent (3% in Finistère, 2.9% in Brittany,
53 Verger 2015). Such comparisons are nevertheless to be taken with caution given the
54 diversity of situations according to the sites and periods. This suggests that the Bank Vole is
55 likely well established on the island, at least in places corresponding to hunting areas of the
56 Barn Owl pair.
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Both pellet analysis and results of censuses, more than 20 years apart, argue for a recent arrival of the Bank Vole, which probably occurred at the end of 2016 or early 2017. We cannot exclude the possibility that the Bank Vole may have been introduced some years before but with a distribution and a density too low to appear in owl pellets. Furthermore, this rodent, as with other vole species, displays high numerical fluctuations that might also explain its absence in small pellet collections. Only a continuous intensive monitoring through pellet analysis, would have helped to ascertain a more ancient presence posterior to trapping campaigns of the 1990s. The erratic presence of the Barn Owl on Ushant Island before 2010 did not permit such research. In September 2017, during the most recent trapping, the Bank Vole was not detected in numerous sampled habitats we judged to be good, suggesting that colonization of the island is still in progress.

To conclude, we may consider the Bank Vole as a new species of the mammal community on the main Ushant Island. Its presence has been confirmed in 2017 by both trapping and Barn Owl pellet analysis. The arrival of this small rodent is obviously posterior to 1995 and is not later than early 2017. We will have to verify if this population, still actively colonizing bushy habitats of the island, is likely to maintain itself over time. Likewise, future work should examine phenotypic drift resulting from a founding effect. In this regard, it should be noted that the 10 autopsied individuals displayed a yellowish color of the belly in contrast to the typical greyish colors of continental individuals. However, weakness of our sample calls for caution and further observations will be necessary to validate difference in the coloring of the animals of the island to those of the near continent.

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Translation of French acronyms. CEMO: Study Center for the Environment of Ushant Island. ONG: non-governmental organization. UMR: joint research unit. ECOBIO: Ecosystems, Biodiversity, Evolution. CNRS: National Center for Scientific Research. PACEA: From Prehistory to the Present: Culture, Environment and Anthropology. GMB: Breton Mammalogical Group. BioEPA: Biology, Epidemiology and Risk Analysis in animal health. INRA: National Institute for Agronomic Research. ONIRIS: Nantes-Atlantic National College of Veterinary

Medicine, Food Science and Engineering. ESE: Ecology and Ecosystems Health. Agrocampus Ouest: Institute for life, food and horticultural sciences and landscaping. LPO: Bird Protection League (French BirdLife partner). RNN Sept-Îles: National Nature Reserve of the Sept-Îles. CESCO: Centre for Ecology and Conservation Sciences. MNHN: National Museum of Natural History. ISYEB: Institute of Systematics, Evolution, Biodiversity. EPHE: École Pratique des Hautes Études. PATRINAT: Natural Heritage. AFB: French Agency for Biodiversity. ONCFS: National Hunting and Wildlife Agency. BMI: Mobile Intervention Brigade. Bretagne – Pays de la Loire: two administrative regions. Finistère: a county. PNMI: Iroise Marine Natural Park. PNRA: Armorica Regional Natural Park.

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