Remarks about some noteworthy bats from northeastern Italy (Friuli Venezia Giulia Region: Chiroptera: Vespertilionidae: *Myotis bechsteinii, Myotis capaccinii, Myotis daubentonii, Nyctalus lasiopterus, Nyctalus noctula*).

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Abstract

The Authors refer new data on some noteworthy vespertilionid bats from north-eastern Italy (*Myotis bechsteinii*, *Myotis capaccinii*, *Myotis daubentonii*, *Nyctalus lasiopterus*, *Nyctalus noctula*). The knowledge of these rare or particularly elusive taxa is due to the integration of different data collection methods. Of particular importance are the collaborations with the Wild Fauna Recovery Centers (CRAS), with the staff of the Regional Forestry Corps, with citizens and enthusiast people. These collaborations must be integrated with different research methods, such as bio-acoustic surveys, capture of individuals, counts and visual monitoring of nurseries. The obtained results have particular biogeographical relevance, but above all a great value for the conservation of these species, protected by the 43/92 Directive "Habitat".

Keywords: distribution, north-eastern Italy, Friuli Venezia Giulia Region, *Myotis bechsteinii*, *Myotis capaccinii*, *Myotis daubentonii*, *Nyctalus lasiopterus*, *Nyctalus noctula*.

Riassunto

Osservazioni su alcuni pipistrelli degni di nota provenienti dall'Italia nord-orientale (Friuli Venezia Giulia Regione: Chirotteri: Vespertilionidae:* Myotis bechsteinii, Myotis capaccinii, Myotis daubentonii, Nyctalus lasiopterus, Nyctalus noctula*).
Gli Autori riferiscono nuovi dati su alcuni Vespertilionidi rari o poco conosciuti dell'Italia nordorientale (*Myotis bechsteinii*, *Myotis capaccinii*, *Myotis daubentonii*, *Nyctalus lasiopterus*, *Nyctalus noctula*). La conoscenza di questi taxa rari o particolarmente elusivi si deve in particolar modo all'integrazione di diverse modalità di raccolta dati. Di particolare importanza sono le collaborazioni con Centri di Recupero della fauna Selvatica (CRAS), con il personale del Corpo Forestale Regionale, con cittadini e appassionati. Queste collaborazioni devono essere integrate con diverse metodologie di ricerca, quali survey bio-acustiche, eventuale cattura di qualche esemplare, conteggi e monitoraggio visivo delle nursery. I risultati ottenuti hanno una particolare rilevanza biogeografica, ma soprattutto un grande valore per la conservazione di queste specie ai sensi della Direttiva 92/43 "Habitat".

Parole chiave: distribuzione, Italia nordorientale, Regione Friuli Venezia Giulia, *Myotis bechsteinii*, *Myotis capaccinii*, *Myotis daubentonii*, *Nyctalus lasiopterus*, *Nyctalus noctula*.

Introduction

The study of dead or injuried bats gathers important data, often of rare species (Agnelli *et al.*, 2004).
Some European bat species and genera are difficult to distinguish by using bat detector surveys (e. g. genera *Myotis* and *Nyctalus*), and sometimes they are only rarely found death or injuried because of peculiar semiaquatic behaviour (e.g. *Myotis daubentonii* and *Myotis capaccinii*). Anyway, the cooperation with the Regional Wild Animal Recovery Centres of the Friuli Venezia Giulia Region constitutes a source of interesting data, together with the cooperation of various citizens and nature lovers. This cooperation is often necessary to study maternal roosts hidden in private or public constructions. In north-eastern Italy these data have been already utilised for various studies on *Vespertilio murinus* and *Eptesicus nilssonii*: Lapini *et al.*, 2015, 2017a, b;

2019), in the frame of a region-wide bat-monitoring program partially granted by the public Administration of the Autonomous Friuli Venezia Giulia Region (Lapini & Dorigo, 2011; Lapini & Dorigo, 2015). This long-lasting monitoring had been used for various six-year reporting on the conservation of the species of Unional interest, protected by the 92/43 Habitat Directive (e. g. Lapini *et al.*, 2014). In the present paper we report new data on various rare or particularly difficult to study species, based on the recovery of injuried bats, bat detector surveys and field sampling conducted by using mist nets.

Materials and methods

The study of injuried bats recovered in some Wild Animal Recovery Centres (CRAS-Centri di Recupero Animali Selvatici) of the Friuli Venezia Giulia Region was the main source of new data. Specimens were determined mostly following Lanza (2012) and Dietz *et al.* (2009), measured, sexed, if necessary fed, rehydrated and released in the wild as soon as possible. In some cases they were determined only on the basis of good photographs, but this was generally possible only with species with unmistakable diagnostic characters (Lapini *et al.*, 2017a, b; 2019).

Opportunistic inspections in buildings requested by both private citizen and public entities gathered other important data. They are sometimes necessary to define the selection of maternal roosts operated by various rare elusive bats.

Simultaneous bio-acoustic surveys constituted an integrative source of data. They were mostly used to verify the presence of some rare species recovered in the Wild Animal Recovery Centres, searching for them in and around the collecting sites of the recovered bats.

Bat detector surveys were performed in various cases, always by using a D1000x Pettersson Bat Detector set in Time-expansion 10x mode. All the recorded sounds have been then studied by using the software Batsound-4 (Pettersson) (Fig. 1).

Mist-nets were also used both to confirm the presence of a given species, and to assess the presence some semi-aquatic taxa, only rarely recovered in the above mentioned Centres.

The systematic and nomenclatural assessment adopted in this paper refers to Loy *et al.* (2019) and Ruedi *et al.* (2019).

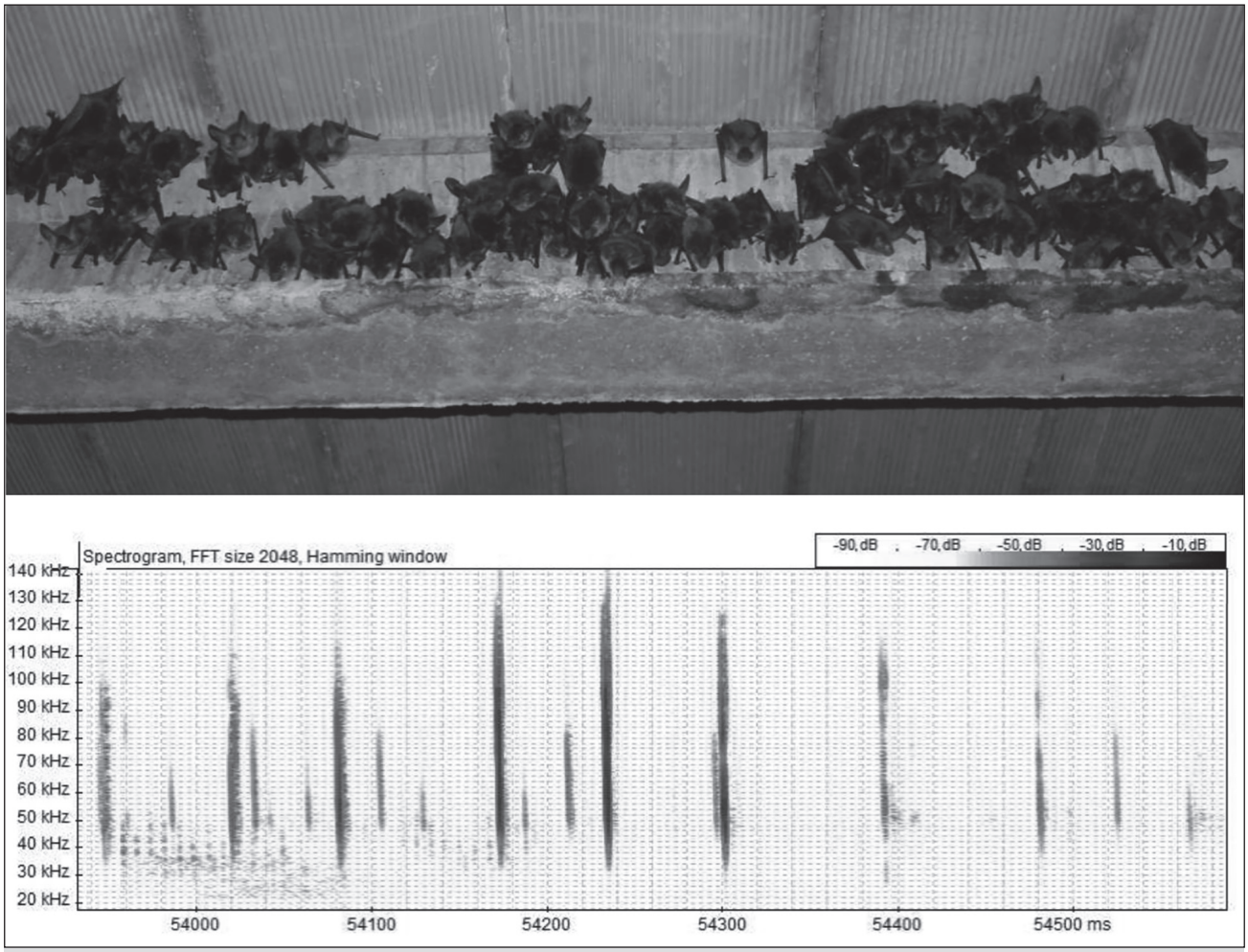

Fig. 1. Above: partial vision of a 90 specimens cluster in a maternal roost of *Myotis bechsteinii* located in a building from Carnic Pre-Alps. In the same big attic under construction there were five similar clusters, for a complexive number of at least 450 specimens (Tolmezzo, Udine, July, 26th, 2018, photo L. Lapini).
Below: spectrograms of their echolocation calls, recorded from flying specimens in the same occasion.

Fig. 2. Details of another 90 specimens reproductive aggregation, out of five similar maternal roosts located in the same attic (July, 31th, 2019, photo L. Lapini). It is possible to distinguish the young of the year for their grey colouration.

Results

Bechstein's bat *Myotis bechsteinii* (Kuhl, 1817)

Typically a wood bat, this long-eared vespertilionid is surely one of the rarest European bats. Widely distributed in Europe and Asia (Paunović, 2016a), and yet in Italy seems to be quite rare (Vergari *et al.*, 1998; GIRC, 2004; Lanza, 2012; Agnelli *et al.*, 2013).

In north-eastern Italy it has been recorded only in some localities from Carnic Pre-Alps (Province of Pordenone) and another from the Karst of the Province of Trieste (Lapini *et al.*, 1996; Ruffo & Stoch, 2006; Zagmajster *et al.*, 2012; Lapini *et al.*, 2014). Another locality frequented by this bat has been recently localized also in Julian Pre-Alps (Racchiuso, Attimis, Udine), but it remains the rarest bat of the High Adriatic Hinterland.

It must however be noted that its rarity could be only apparent, due to its peculiar specialized forest behaviour. The species, indeed, is strictly linked to woodpecker holes that usually uses as reproductive roosts, while its hybernacula are often located in natural or artificial caves.

Usually its maternal roosts are constituted by 10-20 reproductive females, each with one offspring. Up to now a maximum number of 80 pregnant females was recorded in a single nursery (Dietz *et al.*, 2009).

During the summer 2018 a monospecific nursery of about 450 individuals (fig. 1-2) was found in a big attic (base of 10x30 meters, average height 2,5) of an industrial building under construction located between a riparian wood on the left bank of the River Bût and the mixed deciduous forest of the Mount Strabut in the surroundings of Tolmezzo (Udine). The specimens were observed at close distance and photographed, to confirm the absence of other species within the nursery. The attic houses air vents and air conditioning equipment of the building. For various bureaucratic problems it has remained for a long time closed and unused. The big attic, indeed, seemed not to have been open at least from 2006 up to the spring of 2018, when the nursery was discovered by construction workers.

The first visual census on this long-time undisturbed nursery was made on July, 26th,2018. At this time it was constituted by about 450 specimens, subdivided in at least five clusters within the same attic.

During this first visual access to the attic was also possible to make a short bio-acoustic survey, by using a D1000x Pettersson bat-detector (fig. 1), while in the second access it was pos-

sible to individuate the single entrance/emergency hole, existing in a temporary wooden wall of the attic.
In the following weeks few other visual checks were carried out in order to reduce the disturbance, but the overall estimated number of bats naturally decreased (Tab. I).
So far, this represents the largest known nursery for this rare species, perhaps resulting from the aggregation of dozens of related nurseries originally housed in a lot of woodpecker holes dispersed in the surroundings woods.
In Friuli Venezia Giulia, anyway, this is not the only known nursery of *M. bechsteinii* located in a building. Another small nursery constituted by 6-7 specimens, had been photographed on July, 24th,2017, by F. Cantagalli (Forestry worker) in a public bathroom of a wooded protected area administrated by the Regional Admninistration of Friuli Venezia Giulia (named "Bosco Plessiva", Cormons Municipality, Province of Gorizia). This nursery seems to be still active, with the same number of bats recorded also in the summer 2019. On July,16th, 2019, indeed, A. Voncini (Forestry worker) photographed the same six-specimens nursery in the same place. Since this roost is located in a public bathroom of a 33 hectares protected area, would be quite easy to protect with simple and cheap public interventions, at present under study.

Long-fingered bat *Myotis capaccinii* (Bonaparte, 1827)
Distributed in the Mediterranean side of Europe, West Africa and Asia, with isolated populations in the Middle East (Paunović, 2016b), seems to be relatively rare both in Italy (GIRC, 2004; Lanza, 2012; Agnelli *et al.*, 2013) and in Friuli Venezia Giulia Region (Lapini *et al.*, 1996; Lapini *et al.*, 2014). Its rarity could be due to its peculiar roosts selection, mostly very humid caves. In the Region Friuli Venezia Giulia up to now there are only two records of this species: the first referred to a male collected by G. B. De Gasperi, on December, 24th, 1913, in the cave "Foràn del Agànis" (Julian Pre-Alps, Torreano Municipality, Province of Udine), still alcohol preserved in the Mammal Collection of the Museum "De La Specola", Firenze, with the n. 7153 (E. Calabresi don., Ex Coll. Senna), the second to cranial remains from Carnic Pre-Alps, Province of Pordenone (Dall'Asta, 1995-1996; Lapini *et al.*, 1996). Also in neighbouring Slovenia the species seems to be quite rare (Mihelić & Zidar, 2013), but some Slovenian data come from areas very near to the Karst of Trieste Province (Kryštufek & Rešek Donev, 2005; Lapini *et al.*, 2014). The echolocation calls of *Myotis capaccinii* are not distinguishable from those of the widespread *Myotis daubentonii*, and the bio-acoustic surveys are not efficient to study their distribution. Moreover, these trawling bats are strictly linked to rivers and wet habitats, in most cases escaping also to the occasional recovery of live or damaged specimens.
On August, 23th, 2019, one alive young female of *Myotis capaccinii* had been found by mr. A. Glavina near the sea shore in Porto San Rocco (Muggia, Trieste). It was recovered in the Wild Fauna Recovery Centre of Friuli Venezia Giulia Region managed by the Trieste Section of ENPA (Ente Nazionale di Protezione degli Animali/National Organisation for Animal Protection). The bat seemed to be in good health conditions, was measured and photographed by M. Lapia (forearm: 40 mm), and released in the "Oasi del Farneto", headquarter of the ENPA. The photos of the bat were then sent to one of the Authors (L. L.), that determined the species (fig. 3).

Daubenton's bat *Myotis daubentonii* (Kuhl, 1817)
Widely distributed in Eurasia, it is considered as least concern, but with increasing trends all over ist range (Stubbe *et al.*, 2008). Also in Italy it had been considered quite common (Lanza, 2012); indeed, it is poorly known but widespread probably because of its adaptability to various habitat and roosts (trees, bridges, caves, buildings, etc.) (Agnelli *et al.*, 2013). In Friuli Venezia Giulia the species was still considered quite rare (Dall'Asta, 1995-1996; Lapini *et al.*, 1996), due to a general scarcity of data. Also its ultrasonic emissions are not useful to study its distribution, because they are not distinguishable from those of other *Myotis*, particularly from those of *M. capaccinii*.
Only recent specialized surveys gathered some data about the distribution of maternal roosts of *Myotis daubentonii* (Lapini & Dorigo, 2015; Lapini *et al.*, 2014), revealing that this species is quite common and widespread along rivers and lakes of north-eastern Italy. The knowledge on the species is quickly increasing: at present at least nine nurseries have been discovered from the lowlands of Friuli Venezia Giulia Region, located both in private and public buildings and under various river bridges (Villa Ottelio-Savorgnan, Ariis, Udine; Palazzolo del-

Date	Method	Total estimated specimens	Note
July, 26th, 2018	Visual census	450	In at least five clusters
July, 31th,2018	Visual census	250	Various clusters
August, 6th, 2018	Counts in evening emergengy conducted by using infrared viewers outside the building	196	Between 9.10 and 9.40 p.m., from the exit hole
August, 16th,2018	Visual census	110-115	In a single medium-sized cluster
September, 13th, 2018	Visual census	6-7	Grouped close to the exit hole

Table 1. Temporal evolution of the surveyed nursery in the late summer 2018.

Fig. 3. Young female of *Myotis capaccinii* collected by mr A. Glavina on the sea shore in Porto San Rocco (Muggia, Trieste), on August, 23th, 2019. Photo M. Lapia/ENPA TS.

lo Stella, bridge on the River Stella, Udine; Palude Contesa Loc., bridge on the River Cormôr, Castions di Strada, Udine; Pocenia, highway bridge on the River Stella, Udine; building of the Municipal asylum of Teor, Udine; bridge on the River Torre near San Vito al Torre, Udine (fig. 4); Bridge on the River Torre near Villesse, Gorizia; Private buildings of Villa Vicentina, Udine), for an overall number estimated in at least 2000 individuals. To minimize the impact on a maternal roost located in an historic building under renovation, the Public Administration of the Friuli Venezia Giulia Region has even funded a specific expertise (Lapini, 2013).

In spite of the rarity of data on this trawling bat (only two road-killed specimens collected from the provinces of Gorizia and Trieste), with only one recovery in the Wild Fauna Recovery Centres of the Region, *Myotis daubentonii* (a single male collected in Piazza Goldoni,Trieste, has been recovered in the CRAS ENPA-TS on September, 18th, 2019) seems to be common and widespread, probably all over the Region.

Giant noctule *Nyctalus lasiopterus* (Schreber, 1774)

Widely distributed in central and southern Eurasia, in Europe was recently considered Vulnerable (VU) (Alcaldé *et al.*, 2016). Nevertheless, in Italy it has been considered CR (Critically Endangered) by Agnelli *et al.* (2013), having been collected in the country more or less about twenty times at all (Agnelli *et al.*, 2019). It must be however noted that this elusive migratory species uses hidden in big tree holes and for this reasons is very difficult to find. Moreover, the bio-acoustic study of this bat is problematic because its ultrasonic echolocation calls are rather similar to those of *Tadarida teniotis*. Anyway, its presence in Slovenia was recently confirmed by a bio acoustic record (Presetnik & Knapić, 2015) after more than 85 years from the last available data, one specimen collected in loc. Piran (Lanza, 2012). On the contrary, preliminary bio-acoustic surveys conducted in Friuli Venezia Giulia Region (Lapini & Dorigo, 2015) have allowed to verify the presence of *Tadarida teniotis* (Zagmajster *et al.*, 2015), but not of *N. lasiopterus*. In north-eastern Italy it was collected only once in Boschetto Loc. (today named "Oasi del Farneto"), near Trieste, at the begin-

ning of the twentieth century (Dall'Asta, 1995-1996; Lapini *et al.*, 1996; Lanza, 2012; Lapini *et al.*, 2014).

On May, 3th, 2019, a big bat was admitted at the rescue centre after a private citizen had found it weak on the floor for three consecutive days in the village of Passons (Pasian di Prato, Udine). It was recovered in the Centre of Campoformido (Udine), where it was misidentified as *Vespertilio murinus*. One of the Authors (L. L.) subsequently determined the specimen, a big female of giant noctule (forearm: 67 mm), very lean and weakened. Given the health condition of the bat, it was taken into care and soon gained weight. From its teeth erosion and from the aspects of the articular cartilages of the phalanges of its wings it was possible to evaluate that it was a young adult. The bat, moreover, showed clear signs of pregnancy and five recent bites on the patagium above the shoulders, probably the results of some intra specific interactions.

Despite various bio-acoustic surveys performed in the area surrounding the collecting site, we were not allowed to hear the low vocalization of the species. The release in the wild of the big bat, however, it was possible only after a month, on June, 3th, 2019, when the weather warming allowed it. It was released in a 170 hectares Ash and Oak lowland wood, a Site of Community interest from the Municipality of Muzzana del Turgnano, Udine. Given the presence of old woodland standings, the area seemed particularly suitable to the release of the giant noctule (fig. 5), the first recovered in Friuli Venezia Giulia since 1927 (Dall'Asta, 1995-1996; Lapini *et al.*, 1996; Lanza, 2012; Lapini *et al.*, 2014).

Common noctule *Nyctalus noctula* (Schreber, 1774)

Distributed in large parts of Europe, Asia and northern Africa, seems to be extinct in Portugal (Csorba & Hutson, 2016). In Italy the species has been recently considered Vulnerable (C1) and in a declining phases, but still present in all Italian regions (Agnelli *et al.*, 2013). Strictly linked to old trees for its nursing activities (Lanza, 2012; Dietz *et al.*, 2009) in Friuli Venezia Giulia is generally considered not common, but the scarcity of data could be due to its elusive habitat selection (Lapini & Dorigo, 2014). In this region, anyway, it uses also buildings for its summer nursing activities, sometimes together

Fig. 4. *Myotis daubentonii* mistnetted below a maternal roost located under a bridge on the River Torre near S. Vito al Torre, Udine (August, 24th, 2019, photo L. Lapini).

with other species (*Nyctalus leisleri*, *Myotis daubentonii* and *Pipistrellus kuhlii*: Lapini & Dorigo, 2011, 2015).

During the monitoring of bats of Friuli Venezia Giulia, indeed, was recently possible to localize various nursery of this large bat located in buildings, villages and under bridges. On June, 28th,2018, mr R. De Michele (Aiello del Friuli, Udine) demanded the intervention of one of the Authors (M. Lu.) because a chimney of its house seemed to be totally occlused by bats. A visual inspection in the same chimney, conducted together with mr De Michele has shown the presence of various adult females of *Nyctalus noctula* and a very high number of volant pups (fig. 6), probably more than 150 specimens. A provisional count in evening emergency performed between 9 and 9,30 p.m. of the same date indicate the presence of at least 184 flying individuals. On June, 29th, 2018, it was possible to repeat more precisely the same count, with five independent observers, between 9,00 and 10,00 p.m. The evening emergency of the bats from the chimney (fig. 6) was also video and audio recorded, to obtain more detailed information mediated by a detailed bat detector analysis. The comparison between the independent counts of five observers indicated a total of 214 flying specimens. The bat detector analysis of the recorded vocalizations indicate the predominance of vocalizations higher than 14 kHz, tipically emitted by *Nyctalus noctula* during

Fig. 5. Female of giant noctule (*Nyctalus lasiopterus*) collected in a private house of Passons Village (Pasian di Prato, Udine) on April, 30th, 2019. The picture had been taken during its release in the wild (Bosco Coda Manin, Muzzana del Turgnano, Udine, June, 3th, 2019, photo M. Luca).

Fig. 6. Above on the left: partial vision of a nursery of 214 specimens located in a chimney of a private house from Aiello del Friuli, Udine. Above on the right: the arrow indicates the chimney which hosts the nursery: photo M. Luca, summer 2018).The utilize of buildings and bridges as maternal roosts by *Nyctalus noctula* seems to be quite common in north-eastern Italy, with a maximum of 324 specimens emerging in the late summer from a single nursery roost.
Below on the left: young *Nyctalus noctula* mistnetted under its nursery, located in a crevices open on the West side of a bridge on the River Torre near Villesse (border between the Provinces of Gorizia and Udine).
Below on the right: an arrow indicate the location of the same nursery in the crevices of the bridge (photo L. Lapini)

the evening emergency (D. Russo, *ex verbis*). All the visual inspections conducted in the chimney in June and July 2018, indeed, allowed to exclude the contemporary presences of *Eptesicus serotinus*.

Following counts in evening emergency indicated decreasing number of bats: 196 individuals on July, 6th,2018; 166 specimens on July, 24th,2018. At the beginning of August the roost was naturally abandoned. In the following months the chimney had been modified, due to various independent roof renovation works.

For this reason during the year 2019 the bats didn't use the same chimney, presumably shifting their nursing roosts in other similar chimneys. New roosts were located at about 150 meters from the roost of 2018, in a big condominium of the centre of Aiello del Friuli (Udine), and they were probably occupied by the same bats. The monitoring of the evening emergency from these new roosts indicated very high numbers of flying bats, difficult to count because very mobile and dispersed in various chimneys of the condominium. Some of these roosts, however, were surely constituted by at least 60-70 specimens. Also in this occasion it was possible to make bioacoustic verification of species identity.

A different big nursery of *Nyctalus noctula* had been recently located also under a bridge on the River Torre (Municipality of Villesse, Gorizia). On August, 17th,2019, a first evening emergency count conducted by two independent observers (M. Lu. & L. L.) indicated at least 324 *Nyctalus noctula*. A simultaneous bio acoustic surveys conducted in the surroundings confirmed the presence of common noctules in evening emergency, *Myotis* sp. and *Pipistrellus kuhlii/nathusii*. To increase these first indications, on August,19th, 2019, it was possible to caught two *Myotis daubentonii* with mist nets, while the count of emerging noctules indicated 271 flying specimens. To increase the resolution of information about the roost of common noctules, on August, 23th, 2019, a mistnetting session has been conducted under the roost. In few minutes it was possible to caught two males and four young females of *Nyctalus noctula*, confirming their identity with no doubts. So far, this is the largest Italian nursery of *Nyctalus noctula* and one of the most numerous in Europe. Moreover, it must be noted that a smaller nursery is located in a similar position, but on the Est side of the same bridge. The evening emergency from the eastern maternal roost was not surveyed; the overall number of common noctules nursing in the bridge is surely higher.

Coclusions

Our new data confirm the need to consider with particular attention the bats recovered in the Italian Wild Animal Recovery Centres (CRAS), often rare species or taxa difficult to study in the wild. These data, together with the systematic verification of occasional data referred to buildings and other artificial structures, are essential to integrate faunal inventories and Regional Atlases, gathering a better resolution of the overall picture of bat community. Information produced with other specific field methods could complete the picture, producing data on various species rarely recovered in Wild Animal Recovery Centres both for their rarity and peculiar habitat selection, such as some trawling bats of the genus *Myotis*. These and other species, indeed, are not distinguishable with bio-acoustic surveys and they must be necessarily caught by mistnetting.

Acknowledgements

We wish to thank various people for their constant cooperation in the monitoring of the bats community from north eastern Italy: P. Agnelli (Natural History Museum of Florence University "La Specola"); E. Antoniutti (Regional Forestry Corp of the Autonomous Region Friuli Venezia Giulia); D. Baradel (Terranova, San Canzian d'Isonzo, Gorizia); P. Benedetti/Regione FVG, Udine; W. Boschin (Regional Forestry Corp of the Autonomous Region Friuli Venezia Giulia); A. D'Andrea (Circolo Speleologico Idrologico Friulano, Udine); E. De Belli (Regional Forestry Corp of the Autonomous Region Friuli Venezia Giulia); V. Bergamo (Fontanafredda, Pordenone); F. Cantagalli (Monfalcone, Gorizia); R. De Michele (Aiello del Friuli, Udine); ENPA (Ente Nazionale di Protezione degli Animali/National Organisation for Animal Protection) Trieste Section; U. Fattori/Regione FVG, Udine; O. Gonano/Uti Carnia, Tolmezzo, Udine; A. Mareschi (Regional Forestry Corp of the Autonomous Region Friuli Venezia Giulia); E. Mauri (Adriatic Speleologic Society, Trieste); G. Masarin (Adriatic Speleologic Society, Trieste); F. Moretti/Uti Carnia, Tolmezzo, Udine; G. Muscio (Friulian Natural History Museum, Udine); D. Ota (Regional Forestry Corp of the Autonomous Region Friuli Venezia Giulia); D. Russo (Napoli University); F. Tacus/Uti Carnia, Tolmezzo, Udine; A. Voncini (Gorizia); C. Zuccolo (Pasian di Prato, Udine); G. Zufferli/Regione FVG; M. Zuliani (Campoformido, Udine).

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