# Annex J) Bat Survey Report

## 1. Introduction

### 1.1 Introduction

The area of the Main Road M18 Podgorica-Danilovgrad is characterised by diverse habits: banks and groves in riverbeds, meadows under anthropogenic influence (gardens, fields, vineyards), semi-swampy and swampy areas, karst areas of hills, degraded sands of trees, etc.). Due to all of the abovementioned, this entire area, represents a favourable habitat, i.e. a feeding area for certain bat species.

Bat fauna in the subject area has been surveyed poorly and sporadically. Consequently, the available information only indicates that certain species are present, but very little is known about the seasonal dynamics of using shelters, feeding areas and habitats in this area. Additionally, it is likely that intensive surveying ma yield additional species.

For the purpose of meeting the requirements defined within the project, the survey was especially aimed at identifying locations of temporary and permanent shelters, hunting areas and summer corridors, which are used by bats in the area of impact around the newly-designed main road. Moreover, this survey was also aimed at confirming presence of registered species, as well as identification of new species.

This Report will provide the following information:

- information about the registered bat species (literature and site surveys);
- information about temporary and permanent shelters;
- information about hunting territories and corridors;
- potential impacts on bats during the construction phase and operation phase;
- impact assessment during reconstruction of the main road, as well as during operation;
- mitigation measures and activities or means of compensation which would provide conditions for reducing negative impacts.

### 1.2 Description of the surveyed area

According to the requirements stipulated as part of the Project, the entire M 18 road section Podgorica-Danilovgrad was surveyed, whereby the survey was carried out in the 500m area along the right and the left side of the road. Special attention was paid to locations which were identified through the project requirements as key areas for impact assessment. Additionally, the locations which have been recognized as favourable for bats were also surveyed with great attention.

**Table 1. Overview of the survey locations - transects (Map 1, Appendix 1)**

| Mark on the map | Location | Coordinates |
|---|---|---|
| 1 | From Public institute 'Komanski most' (next to the Mareze Canal) to restaurant "Ognjiste", above the river | From 42 26 33 N 19 12 25 E<br>To 42 27 23 N 19 11 17 E |
| 2 | From restaurant "Ognjiste" Restaurant to bridge on the river Matica | From 42 27 23 N 19 11 17 E<br>To 42 27 33 N 19 10 42 E |
| 3 | From bridge on the river Matica to "Garden Centar" | From 42 27 33 N 19 10 42 E<br>To 42 28 25 N 19 10 25 E |
| 4 | From "Garden Centar" Ltd. to Luznica | From 42 28 25 N 19 10 25 E<br>To 42 28 51 N 19 10 6 E |
| 5 | From Luznica to bridge on the river Susica | From 42 28 51 N 19 10 6 E<br>To 42 30 26 N 19 8 9 E |
| 6 | From bridge on the river Susica to roundabout Danilovgrad | From 42 30 26 N 19 8 9 E<br>To 42 32 46 N 19 6 2 E |

**Table 2. Overview of the site survey locations – Counting points** (Map 1, Appendix 1)

| Mark on the map | Location | Coordinates |
|---|---|---|
| A | Public institute 'Komanski most' (next to the Mareza channel) | 42 26 33 N 19 12 25 E |
| B | Bridge on the river Sitnica, under the bridge | 42 26 43 N 19 12 13 E |
| C | Restaurant Ognjiste | 42 27 23 N 19 11 17 E |
| D | Garden Centar Ltd. | 42 27 33 N 19 10 42 E<br>42 28 7 N 19 10 26 E |
| E | Bridge on the river Susici | 42 30 26 N 19 8 9 E |

### 1.3 Preparations for the survey

Preparations for the survey included analysis of the available literature resources, legal regulations, guidelines, recommendations (both national and international) which are related to methodology, protection and measures for mitigation of impact of the roadway on the bats (see chapter Literature).

### 1.4 Limitations of the survey

Site survey was carried out in the period from 01$^{st}$ until 04$^{th}$ of July 2019, which represents a relatively short time for determining the exact locations of permanent habitats, hunting territories

and corridors, since a minimum two years is usually necessary for gathering complete data on the mammal fauna in a certain area.

Notwithstanding the abovementioned constraint, the data obtained through this survey is relevant and indicative of the way the bats use this area during summer.

# 2. Methodology

The Bat survey consisted of visual monitoring, transect method, counting at the observation points and searching for shelters.
Species detection was done by using an ultrasound detector (Petterson D240x), which allowed for identifying bat species as accurately as possible. Bat ultrasound signals were recorded by means of a Zoom H2 audio recorder, and the recordings were then analysed via BatSound 4.03 (© Pettersson Elektronik AB) software.

## 2.1 Transect method

Six transects (Table 1) were made in order to cover all parts of the survey area, as well as all the main habitat structures.

All transects represent an area with structural elements (water channels, bushes, stands of trees along the road, karst, rivers, swampy and semi-swampy areas, agricultural land...) which presents a high diversity of habitats. Positions, directions and lengths are marked on Map 1.

Records were made about the contacts achieved during each of the transect walks (one or several specimens of a certain species at one location), duration of contact, identification, number of specimens and their behaviour.

The goal of transect walks was to gather information about composition of the bat species and their distribution in the surveyed area, as well as about the significance of different habitat structures in the subject area.

Results of six transect walks have been presented, analysed and estimated as part of this survey.

## 2.2 Observation points (counting)

Five observation points used for counting (Table 2, Map 1) were chosen for the purpose of obtaining the best possible overview of habitat diversity (from the aspect of ecology of bats) in the survey area.

## 2.3 Shelter survey

Survey of potential shelters in the subject area was also carried out (under the bridges, abandoned objects, certain industrial facilities, holes in trees, etc.), whereby these activities were also carried out in the proximate vicinity (village Komani, cave on the Zelenika hill, cave "Megara", "Vilina

pećina" (cave) – Ćafa). Additionally, interviews were conducted with the local population regarding observation of bats and the shelters which are known to be used by them.

## 3. Results

Based on the available literature resources and the site survey which was carried out in the subject area, 10 bat species were identified in the area.

**Table 3. The list of the identified species in the subject area**

| No. | Location with coordinates | Latin name | English name | Endemism | Status (IUCN) | Status |
|---|---|---|---|---|---|---|
| 1. | Mareza channel (42 26 33 N 19 12 25 E), Bridge on the river Susica ("Vilina pećina" - cave), Cafa (424538 N 191760°E) | *Rhinolophus ferrumequinum* | Greater horseshoe bat | no | NT | Annex II and IV Habitat Directive |
| 2. | Semi-swampy part from bridge on the river Matica "Vilina pećina" - cave, Cafa (42,4538°N, 19,1760°E) | *Rhinolphus hipposideros* | Lesser horseshoe bat | no | NT | Annex II and IV Habitat Directive |
| 3. | Part in front of the first bridge to Komanski bridge, around the bridge on the river Susica, near the street lamps near the roundabout Danilovgrad | *Pipistrellus kuhlii* | Kuhl's pipistrelle | no | LC | Annex IV Habitat Directive |
| 4 | Near the "Komanski" bridge | *Pipistrellus pipistrellus* | | no | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 5. | Near the river Susica around the street lamps along the road | *Pipistrellus pygmaeus* | Soprano pipistrelle | no | LC | Annex IV Habitat Directive |
| 6. | Near the Susica River, street lamps on a roundabout, in front of the first bridge to Komanski Bridge | *Pipistrellus nathusii* | Nathusius' pipistrelle | no | LC | Annex IV Habitat Directive |
| 7. | Above the "Ognjiste" restaurant, meadows - Novo Selo to Danilovgrad | *Myotis mystacinus* | Whiskered bat | no | NT | Annex IV Habitat Directive |
| 8. | Above the restaurant "Ognjiste", Along the River Matica | *Myotis capaccinii* | Long-fingered bat | no | NT | Annex II i IV Habitat Directive |
| 9. | Above the river - restaurant "Ognjiste" | *Myotis daubentonii* | | | | |
| 10. | From the bridge on the Matica River, a semi-swampy and swamp part, "Garden centre" | *Nyctalus noctula* | | | | |

### 3.1 Discussion of the obtained results

**Transects**

Site survey has shown that the activity of bats was higher at some locations along the road route, thus, the following conclusions may be made on the basis of the obtained results:

Three species were identified in the area of the transect 1 (Mareza channel, bridge close to the Komanski institute): *Rhinolophus ferumequinum, Pipistrellus pipistrellus and Pipistrellus kuhlii*.

Based on analysis of these species (a detailed overview may be found in Appendix 1), it is deemed that the mere identification of the species *Rhinolophus ferumequinum* does provide the grounds

drawing a conclusion that it uses this area as a feeding place (hunting area). Species *Pipistrellus pipistrellus* and *Pipistrellus kuhlii* were identified during three separate nights, which provides the grounds for drawing a conclusion that the yuse this area as a feeding place.
Three species were identified at the location of the restaurant "Ognjiste", which belongs to the transect 2: *Myotis capaccinii, Myotis mystacinus* and *Myotis daubentoniid*, out of which the first two were identified in the area closer to the road, i.e. above the restaurant, while *M. daubentoniid* was mostly identified above the river itself. Activity of these species was low to moderate. It may be deemed that these species are rather keen on using this area as a feeding place.
Activity of two species was recorded in the semi-swampy area, which spreads from the Matica Bridge (Transect 3): *Rhinolophus hipposideros* and *Nyctalus noctule.* These species were only registered during their flight, thus the importance of this area (in respect to feeding) may not be determined based on this data.

Four species were identified in the area around the Sušica Bridge (Transect 6): *Rhinolophus ferumequinum*, *Pipistrellus kuhlii, P. pygmaeus* and *P. nathusii.* Activity of these species was relatively low and sporadic, which indicates that this area may potentially be interesting as a hunting territory.
Activity of *Pipistrellus kuhlii /nathusii* was recorded in the area close to the Danilovgrad roundabout. Their activity was mostly recorded around the lamp posts and it was characterised by low intensity (Appendix 2: Detailed overview of the survey).

**Observation points (counting)**
Total activity was recorded at the counting points (number of contacts, etc.), and based on data analysis, it may be concluded that a relatively low number of contacts was recorded at observation points A, C and E (see Table 2). On the other hand, the number of contacts recorded at other observation points was negligible (a detailed overview is provided in Appendix 2).

**Shelter survey**
During the site survey, bat sounds were monitored from the early morning hours and this part of survey was dedicated to locating the permanent or temporary shelters which are used by bats in this area. Visual inspection and inspection using detectors were carried out for this purpose. Based on the assessment that was made, this method could not provide the grounds for determining whether bats use any of the habitats (either as permanent or temporary) which are located in proximity to the existing main road.
Results of the shelter survey which was conducted during the day confirmed that there are no temporary or permanent bat shelters in the proximity to the main road and the area of impact. It should be noted that all the favourable structures were inspected during this survey (Appendix 3: Overview of the potential shelters which have been inspected).
The local population provided information that there is a cave on the Zelenika hill (located outside of the area of impact) which is inhabited by bats. Site survey was carried out for the purpose of locating this cave, but it was not found.
Based on interviews with the local population, it was concluded that several caves may be used as temporary or permanent bat habitats ("Vilina" cave – Ćafa, "Magara", and "Turski grad" above Mareza – located outside of the area of impact). These facts were also partially confirmed through the data obtained from the literature.

### 3.2 Assessment of importance of the entire area in respect to bats

Taking into account the diversity of habitats, it may be concluded that the entire survey area has moderate to significant importance with respect to bats; especially with respect to feeding. The entire area around rivers is of high habitat importance as compared to the other parts of the survey area.

## 4. Impact assessment

Construction activities may destroy the bat habitat and its functional elements (shelters, flight corridors, hunting areas, migratory corridors). However equally likely, the additional road lighting will draw higher insect populations that in turn attract more feeding bats.

The following table provides a general overview of significance of certain bat habitats, as well as the significance of impact which may have a negative effect on bats, and which may be caused by some activities that will be carried out during construction and reconstruction of the road.

**Table 4: Significance of the type of habitats for life functions of bats**

| **Life functions** | Type of habitat | | | | | | |
|---|---|---|---|---|---|---|---|
| | Forests | Bushy | Meadows | Wetland | Rocky | Underground | Artificial |
| Shelters | **xxx** | o | **xxx** | **xxx** | xx | **xxx** | **xxx** |
| Hunting territories | **xxx** | **xxx** | **xx** | **xxx** | **xx** | o | **xxx** |
| Flight corridors | **xxx** | **xxx** | **xx** | **xxx** | o | o | **xxx** |
| Migratory corridors | **xxx** | x | ? | **xxx** | ? | o | x |

**Legend**

x low significance, xx moderate significance, xxx high significance, o no significance, ? potential significance, but there is insufficient data.

**Table 5: Likelihood of impact that certain activities may have on bats**

| Activity | **Life functions** | | | | | | Bat casualties (directly caused by the activities) |
|---|---|---|---|---|---|---|---|
| | Shelters | | | | | | |
| | Trees | Overground artificial | Underground | Hunting territories | Hunting corridor | Migratory corridor | |
| Removal of | xxx | x | x | xxx | xxx | X - xxx | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| woody vegetation | | | | | | | |
| Infrastructure upgrade and/or reconstruction | 0 | xxx | xxx | xx | Xx - xxx* | x-xx* | 1 |
| Artificial light | x-xxx* | 0-xxx* | xxx | xxx/+* | 0-xxx* | 0-xxx* | 0 |
| Road traffic | x | 0 | 0-x | x-xxx* | x-xxx* | 0 | 1 |

**Legend**

x low likelihood of adverse impact, xx relatively high likelihood of adverse impact, xxx very high likelihood of adverse impact, 0 no likelihood of adverse impact + positive impact is likely, occurrence of bat casualties is likely, * depends of species' ecology

Based on all the parameters, guidelines and data obtained through analysis, impact assessment for certain activities during reconstruction and operation of the newly-designed Main Road Podgorica-Danilovgrad is provided in the following table.

**Table 6: Impact assessment during reconstruction of the Main Road M18**

| Species | Type of impact | Overall assessment in respect to life functions of bats |
|---|---|---|
| Bats - *Chiroptera* | Removal of woody vegetation | Likelihood of adverse impact ranges from not likely to highly likely (0 – X) |
| | Removal of swampy vegetation | Likelihood of adverse impact ranges from not likely to highly likely (0 – X) |
| | Reconstruction (construction works, noise, vibration) | Likelihood of adverse impact ranges from not likely to highly likely (0 – X) |

**Table 7: Impact assessment during the operation phase of the Main Road M18**

| Species | Type of impact | Overall assessment in respect to life functions of bats |
|---|---|---|

| | | |
|---|---|---|
| Bats - *Chiroptera* | Interruption of flight corridors and hunting areas: | Likelihood of adverse impact ranges from low likelihood to relatively high likelihood (X-XX) |
| | Bat casualties due to roadkills; | Likelihood of adverse impact ranges from low likelihood to relatively high likelihood (X-XX) |
| | Artificial light | Likelihood of adverse impact ranges from low likelihood to relatively high likelihood (X-XX) |

Susceptibility to negative impacts and the degree of those impacts depends on flight patterns of certain bat species (their behaviour during flight). In this regard, bats may be divided into three groups: bats dependent on objects, bats dependent on water and bats which are independent of objects. Roadways and traffic mostly affect the species which belong to the first group because they "cut" through the objects which are used by these species for the orientation during their flight. Likelihood of roadkills among these species is increased in this way. Additionally, wide roadways may represent an obstacle because bats avoid flying over them if there are no main structures they could use for orientation on this type of roads (e.g. forest belts). Flight routes of the species which use water courses for orientation may be interrupted by culverts or bridges which are too narrow. Mortality rate caused by traffic depends on traffic speed and density (Limpens et al, 2005). Heavy traffic has a more prominent impact on diversion of bats, than it is the case with diversion of individual vehicles. The higher the speed of a vehicle, the more difficult it is for bats to avoid it. The order of possibilities of reduction of bat roadkills is as follows: fast individual vehicles > heavy traffic > slow individual vehicles > slow heavy traffic.

Bats experience some disturbances of a temporary nature during construction. Additionally, One segment of vegetation structure, which is used for orientation, will be lost, but it is considered that these impacts will be moderate and acceptable.

During the operation phase of the road, there may be partial loss of communication (fragmentation of habitats, interruption of flight corridors and hunting territories) at certain locations where the activity of bats has been recorded (between the left and the right side of the road), but it cannot yet be assessed whether those negative impacts are going to be significant (more information is provided in Chapter 5). In time, bats may habituate to changing noise levels which in any case, are likely to be less at night when the bats are feeding.

Additionally, bat roadkill represents a potential danger for bats, which are using certain parts of this area, but it is also not possible to make this assessment (more information is provided in Chapter 5).

Taking into account significance of the overall subject area in respect to bats, it may be estimated that reconstruction and operation of the main road will cause certain adverse impacts on bats. Just as likely are positive impacts on feeding where road lighting is increased. However, based on data which has been obtained through the site survey, it is considered that those impacts will be

acceptable and that they will not lead to irrevocable disturbance of bats' functions in the subject area.

### 4.1 Measures for mitigation, reduction and elimination of negative impacts

The goal is to prevent the occurrence of circumstances under which the roadway could disturb/interrupt the flight corridors which connect shelters and hunting territories, as well as the (seasonal) migratory corridors which connect summer and winter habitats/shelters. Additionally, one of the goals is to avoid high rates of bat casualties during construction, operation and maintenance of the road.

The existing measures for mitigation, reduction and elimination of the abovementioned negative impacts have not yet been completely proven in practice. Adequacy of an impact mostly depends on the species, i.e. on their behaviour. A recommendation regarding mitigation measures for certain bat species is provided in the publication "Bats and Road Construction", Limpens et al. 2005.

These recommendations should be taken into account during construction and reconstruction of the road, and they should be complied with in proportion to the significance that certain areas have with respect to bats.

General recommendations are provided, and they should be taken into account during reconstruction of the Main Road M18. It is especially important to do this at the locations which have been estimated as potentially important for bats (locations where bat species have been identified – "Komanski most" Institute, "Sitnica" bridge, restaurant "Ognjište", "Matica" bridge, "Sušica" bridge).

In order to ensure continuity in respect to the habitats (i.e. summer corridors and hunting territories), an overview of the type of corridors which may be used by bats is provided in the following figure.

**Figure 1** Type of corridors which are adequate for certain bat species (taken from Limpens et al, 2005).

| | | **Under-the-road-structures** | | | | | **Over-the-road-structures** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | High above the landscape | Over the tops of the trees | Over the vegetation | Over the vegetation and | Over or along the overpass | Culvert for watercourses (hxw=1x2m) | Bridges (h≤1m) | Tunnels (hxw=4x4m) | Bridges (h≥2m) | Tunnels (hxw=6x6m) | Under the overpass (h>6m) | Bridges (h<6m) | |
| A | Lesser horseshoe bat *(Rhinolophus hipposideros)* | | | | ° | ° | ° | ° | ° | ° | ° | ° | ° | Structures of small to large dimensions. Hunting is close to or within vegetation and landscape structures. Route tracking is facilitated by vegetation |
| | Geoffroy's bat *(Myotis emarginatus)* | | | | ° | ° | | ° | ° | ° | ° | ° | ° | |
| | Natterer's bat *(Myotis nattereri)* | | | | ° | ° | ° | ° | ° | ° | ° | ° | ° | |
| | Bechstein's bat *(Myotis bechsteinii)* | | | | ° | ° | | ° | ° | ° | ° | ° | ° | |
| | Brown long-eared bat *(Plecotus auritus)* | | | | ° | ° | | ° | ° | ° | ° | ° | ° | |
| | Grey long-eared bat *(Plecotus austriacus)* | | | | ° | ° | | ° | ° | ° | ° | ° | ° | |
| | Greater horseshoe bat *(Rhinolophus ferrumequinum)* | | | | ° | ° | | | ° | ° | ° | ° | ° | |
| B | The greater mouse-eared bat *(Myotis myotis)* | | | ° | ° | ° | | | | ° | ° | ° | ° | Large species which hunt close to vegetation, following the structure, but also cross open areas. |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Whiskered bat *(Myotis mystacinus)* | | | ° | ° | ° | | | ° | ° | ° | ° | ° | From small to large species which hunt along the boundary structure and accompanying structures |
| | Brandt's bat *(Myotis brandtii)* | | | ° | ° | ° | | | ° | ° | ° | ° | ° | |
| | Western barbastelle *(Barbastella barbastellus)* | | | ° | ° | ° | | | ° | ° | ° | ° | ° | |
| | Daubenton's bat *(Myotis daubentonii)* | | | ° | ° | | ° | ° | ° | ° | ° | ° | ° | From small to large species which hunt over water and follow the structure. |
| | Pond bat *(Myotis dasycneme)* | | | ° | ° | | ° | ° | ° | ° | ° | ° | ° | |
| C | Soprano pipistrelle *(Pipistrellus pygmaeus)* | | ° | ° | ° | ° | | | ° | ° | ° | ° | ° | From small to large species, they hunt along structures toward the semi-open areas and follow the structure |
| | Common pipistrelle *(Pipistrellus pipistrellus)* | | ° | ° | ° | ° | | | ° | ° | ° | ° | ° | |
| | Nathusius's pipistrelle *(Pipistrellus nathusii)* | | ° | ° | ° | ° | | | ° | ° | ° | ° | ° | |
| | Northern bat *(Eptesicus nilssonii)* | ° | ° | ° | ° | ° | | | | | ° | ° | ° | From small to large species, they hunt in semi-open to open areas and sometimes follow the structure. |
| | Parti-coloured bat *(Vespertilio murinus)* | ° | ° | ° | ° | ° | | | | | ° | ° | ° | |
| | Serotine bat *(Eptesicus serotinus)* | ° | ° | ° | ° | ° | | | | | ° | ° | ° | |
| | Common noctule *(Nyctalus noctula)* | ° | ° | ° | ° | ° | | | | | ° | ° | ° | |

**A**: Species which use vegetation for orientation during flight are directed towards higher altitude, which enables the bats to "hop-over" the roadway by the means of structures which span over the road ("closed screen");
**B** and **C**: Species which may be directed to higher altitude by vegetation;
**C:** Species which independently follow the height of tree crowns (Limpens et al., 2005)

Transverse interruption of vegetation structures which are used by bats for the purpose of orientation during their flights may be mitigated through implementation of the "*hop-over*" structures and tree crowns. This is especially relevant in the context of less important roadways (which have up to two traffic lanes). In case the road has more than two lanes, it is necessary to plant vegetation, which also increases the risk of roadkills, so this method is still questionable.

In some guides, the *"hop-over"* structures are always placed along the crash barriers (which are located along the road), whereby they reach height up to 4m (Brinkmann et al., 2012). Another possibility is to use vegetation which reaches height up to 6m.

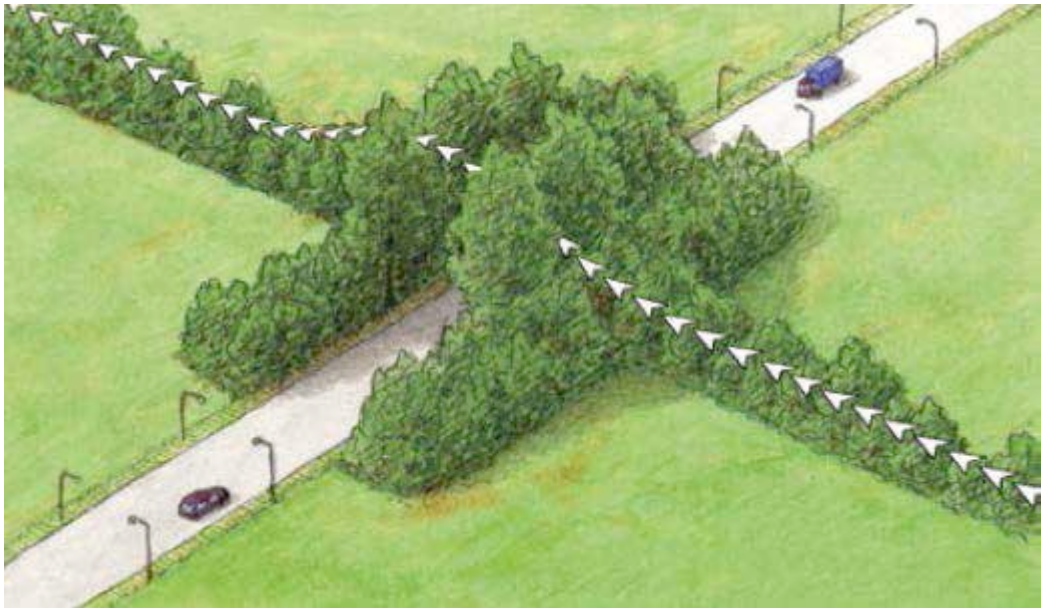

**Figure 2 "*Hop-over*" for bats (Limpens et al., 2005)**

Bats can also use under-the-road-structures to fly beneath roads (underpasses, tunnels, bridges). Dimensions which are required for these under-the-road-structures depend on the species, thus: *Pipistrellus pipistrellus* may use 4x4m under-the-road-structures; *Eptesicus serotinus* requires bigger under-the-road-structures, thus their height should be 6-7m, while their width should be 5-7m; while *Myotis nattereri* also uses under-the-road-structures. It is key to have a good main structure which will enable the bats to find entrance to the under-the-road-structure. Under-the-road-structures and tunnels must not be equipped with lighting.

**Table 8. Overview of the mitigation measures**

| Species | Measure |
|---|---|
| Bats | **1.** It is recommended to use sodium-vapor lamps (where possible) and directed lamps – dimmed lamps (which emit light horizontally and which relatively do not attract insects) as part of the lighting system along the newly-designed main road.<br>**2.** Monitoring should be carried out (determining the black spots at which bat roadkills are recorded), especially during the mating and migration phase (over the course of 2 years, April-October), in order to determine the "critical points" and implement the appropriate measures, i.e. installation of a "hop-over" structure or planting of vegetation, etc. |

# 5. Conclusion

Representation of 10 bat species has been determined in the subject area: *R. ferumequinum, R. hipposideros, Pipistrellus pipistrellus, P. pigmeus, P. kuhlii, P. nathusii, Myotis capaccinii, M.daubentoni, M. mystacinus, Nictalus noctula.*

Overall activity of all the species in the surveyed area has been estimates as low to medium. It has been determined that the entire area has medium significance in respect to bats.

Overall impact caused by reconstruction of the main road has been assessed as moderate.

It is considered that reconstruction of the main road and its future operation is not going to have an irrecoverable impact on bats.

It is recommended to comply with and implement the mitigation measures which have been defined in regard to negative impacts.

**List of tables:**



**List of appendices:**



**List of figures:**



**List of maps:**

**References:**


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## Appendices

**Appendix 1: Overview of a part of the inspected locations – transects and observation points**

Above the river which is located next to the restaurant "Ognjiste"

Tree alley close to the "Komanski most"

Channel next to the "Komanski most" Institute

Under the "Sitnica " bridge

**Appendix 2** Detailed overview of the survey along the transects and observation points

| Date | Distribution or transects and observation points | Weather | Activity of bats |
|---|---|---|---|
| 01st July | 1, A, 2, B, 3, C, D | Clear, 34 °C, young moon | *Pipistrelus kuhlii/nathusii* - 4 contacts<br>*M.dubentoni/cappacinii*- 2 contacts<br>*Pipistrellus pipistrellus* – 1 contact<br>*Rhinolphus hipposideros* – *1* contact |
| 02nd July | 6, 5, E, 4, D, 3, B | Clear, 36 C, first quarter moon | *Pipistrellus pygmeus- 3* contacts<br>*Pipistrellus nathusii- 2* contacts<br>*Pipistrellus kuhlii- 2* contacts<br>*Nyctalus noctula – 1* contact |
| 03rd July | 1, A, 2, B, 3, C, D, 4, 5, E | Clear, 35 C, second quarter moon | *Pipistrellus kuhlii/nathusii -2* contacts<br>*Rhilopphus ferumequinum- 2* contacts<br>*M.dubentoni/cappacinii- 2* contacts<br>*Myotis mystacinus- 1* contact |
| 04th July | 6, 5, E, 4, D, 3, B, 2, A, 1 | Clear, mild wind, 32 °C, third quarter moon | *Rhilopphus ferumequinum- 1* contact<br>*Pipistrellus kuhlii- 3* contacts<br>*M.daubentoni/cappacinii- 2* contacts<br>*Nyctalus noctula* – 2 contacts |

**Appendix 3** Overview of the potential shelters which have been inspected

## Appendix 4) Data on Location, Time and Registered Species

*Table 1. Location, time and registered species (Transects and points)*

| **Locations** | **Date and time of day the survey was conduct** | **Time was spent at each location** | **Registered species** |
|---|---|---|---|
| Public institute 'Komanski most' (near the Mareza channel) 42 26 33 N 19 12 25 E – start point A. | 01. 07. 2019.<br>19.50 h - 21.20 h | 1 hour and 30 minutes | *Pipistrellus pipistrellus* , *Pipistrellus kuhlii/nathusii*, *Rhinolophus ferumequinum.* |
| Transect 1- From A point (42 26 33 N 19 12 25 E ) to restaurant "Ognjiste" 42 27 23 N 19 11 17 E | 01. 07. 2019.<br>21.20 h - 22. 30 h | 1 hour and 10 minutes | *Pipistrellus kuhlii/nathusii (under the Matica bridge-, near the water)* |
| Restaurant „Ognjiste" 42 27 23 N 19 11 17 E- Point C | 01. 07. 2019.<br>22.30 h - 00.00 h | 1 hour and 30 minutes | *Myotis sp.* |
| Transect 2- from restaurant „Ognjiste" 42 27 23 N 19 11 17 E to bridge 42 27 33 N 19 10 42 E | 01. 07. 2019.<br>00.00 h - 01.30 h | 1 hour and 30 minutes | - |
| Transect 3- from the bridge 42 27 33 N 19 10 42 E , point D to Garden center 42 28 25 N 19 10 25 E | 01. 07. 2019.<br>01.30 h - 02.30 h | 1 hour | *Rhinolophus hipposideros*<br>(after the bridge at the semi-swampy area) |
| Transect 6 – From roundabout Danilovgrad 42 32 46 N 19 6 2 E to the bridge at Susica 42 30 26 N 19 8 9 E | 02. 07. 2019.<br>20.00 h - 21.30 h | 1 hour and 30 minutes | *Pipistrellus kuhlii/nathusii, Nyctalus noctula* (on the part of the road from the Danilovgrad roundabout to Podgorica).<br>*Pipistrellus pygmeus (near the bridge at the Susica river)* |
| Bridge at Susica 42 30 26 N 19 8 9 E, point E | 02. 07. 2019.<br>21.30 h - 23.30 h | 1 hour and 30 minutes | *P.kuhlii/ nathusii,*<br>*Pipistrellus pygmeus,*<br>*Rhinolophus ferumequinum* |
| Transekt 5 –From the Susica bridge 42 30 26 N 19 8 9 E to the Luznica 42 28 51 N 19 10 6 E | 02. 07. 2019.<br>23.30 h - 00.30 h | 1 hour and 30 minutes | *P.kuhlii/ nathusii*<br>(Luznice, along the edge of the forest along the road) |

| | | | |
|---|---|---|---|
| Transekt 4 – from the Luznica 42 28 51 N 19 10 6 E to the Garden centre 42 28 25 N 19 10 25 E | 02. 07. 2019.<br><br>00.30 h - 01.30 h | 1 hour and 30 minutes | - |
| Transekt 3 – from the Garden centre 42 28 25 N 19 10 25 E to the bridge 42 27 33 N 19 10 42 E | 02. 07. 2019.<br><br>01.30 h - 02.30 h | 1 hour | *Nyctalus noctula* (Garden center) |
| Complete route M18 (all transits and points, 2 teams - one from Danilovgrad, the other from Podgorica, both started at the same time) | 03.07. 2019.<br><br>19.40 h - 00.40 h | 9 hours | *Pipistrellus kuhlii/nathusii (Mareza channel, Danilovgrad roundabout), Rhinolopphus ferumequinum (bridge at the Susica river), Myotis sp. (restaurant „Ognjiste"), Pipistrellus pipistrellus* (Mareza channel, the first bridge at the Public institute „Komanski most" |
| Complete route M18 (all transits and points, 2 teams - one from Danilovgrad, the other from Podgorica, both started at the same time) | 04. 07. 2019.<br><br>19.40 h - 00.40 h | 9 hours | *Rhinolopphus ferumequinum* (bridge at the Susica river)<br><br>*Pipistrellus kuhlii/nathusii* (roundabout Danilovgrad, Mareza channel), *Pipistrellus pygmeus (*Luznice)<br><br>*Myotis sp (*restaurant „Ognjiste")<br><br>*Nyctalus noctula* (Semi-swampy part of the bridge on Sitnica) |

*Table 2 Activity of individual types of bats (total number of contacts each night and for each transect / point)*

| DATE | No. of hours | TRANSECT/ Point | Pipistrell. pipistrellus | Pipistr. kuhlii/ nathusii | Myotis sp. | Nyctalus sp | Pipistrell. Pygmeus | Rhinoloph. Ferum equinum | Rhinoloph Hipposideros | Total number of contacts |
|---|---|---|---|---|---|---|---|---|---|---|
| 01.07. | 1,5 | Point A | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 4 |
| 01.07. | 1,2 | Tr.1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 01.07. | 1,5 | Point C | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 01.07. | 1,5 | Tr.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 01.07. | 1,0 | Tr.3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 02.07. | 1,5 | Tr.6 | 0 | 3 | 0 | 1 | 1 | 0 | 0 | 5 |
| 02.07. | 1,5 | Point E | 0 | 1 | 0 | 2 | 2 | 2 | 0 | 7 |
| 02.07. | 1,5 | Tr.5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 02.07. | 1,5 | Tr.4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 02.07. | 1,0 | Tr.3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 03.07. | 1,0 | Point A | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 4 |
| 03.07. | 1,0 | Tr.1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 03.07. | 1,0 | Point C | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 03.07. | 1,0 | Tr.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 03.07. | 1,0 | Tr.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 03.07. | 1,0 | Tr.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 03.07. | 1,0 | Tr.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 03.07. | 1,0 | Point E | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 5 |
| 03.07. | 1,0 | Tr.6 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 4 |
| 04.07. | 1,0 | Point A | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| 04.07. | 1,0 | Tr.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 04.07. | 1,0 | Point C | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 04.0 | 1,0 | Tr.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

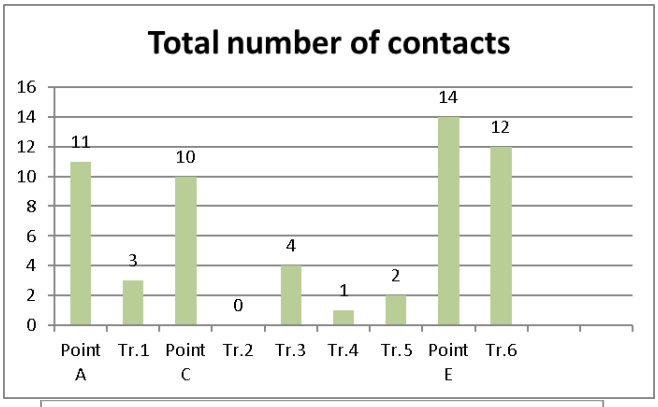
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 7. | | | | | | | | | | |
| 04.07. | 1,0 | Tr.3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| 04.07. | 1,0 | Tr.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 04.07. | 1,0 | Tr.5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 04.07. | 1,0 | Point E | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| 04.07. | 1,0 | Tr.6 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| Total contacts | 3,5 | Point A | 2 | 8 | 0 | 0 | 0 | 1 | 0 | 11 |
| | 3,2 | Tr.1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| | 3,5 | Point C | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| | 3,5 | Tr.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4,0 | Tr.3 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 4 |
| | 3,5 | Tr.4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | 3,5 | Tr.5 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 2 |
| | 3,5 | Point E | 0 | 1 | 0 | 3 | 4 | 6 | 0 | 14 |
| | 3,5 | Tr.6 | 1 | 9 | 0 | 1 | 1 | 0 | 0 | 12 |
| **totali** | **31,67** | | **5** | **20** | **10** | **8** | **6** | **7** | **1** | **57** |
| Percentage of contacts | | Point A | 18,18% | 72,73% | 0,00% | 0,00% | 0,00% | 9,09% | 0,00% | 100,00% |
| | | Tr.1 | 66,67% | 33,33% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 100,00% |
| | | Point C | 0,00% | 0,00% | 100,00% | 0,00% | 0,00% | 0,00% | 0,00% | 100,00% |
| | | Tr.2 | | | | | | | | 0,00% |
| | | Tr.3 | 0,00% | 0,00% | 0,00% | 75,00% | 0,00% | 0,00% | 25,00% | 100,00% |
| | | Tr.4 | 0,00% | 0,00% | 0,00% | 100,00% | 0,00% | 0,00% | 0,00% | 100,00% |
| | | Tr.5 | 0,00% | 50,00% | 0,00% | 0,00% | 50,00% | 0,00% | 0,00% | 100,00% |
| | | Point E | 0,00% | 7,14% | 0,00% | 21,43% | 28,57% | 42,86% | 0,00% | 100,00% |
| | | Tr.6 | 8,33% | 75,00% | 0,00% | 8,33% | 8,33% | 0,00% | 0,00% | 100,00% |
| **C** | | | **8,77%** | **35,09%** | **17,54%** | **14,04%** | **10,53%** | **12,28%** | **1,75%** | **100,00%** |

*Table 3 Standardized activity of individual types of bats (number of contacts / h during each night and for each transect and point)*

| DATE | no. hours | TRANSECT/ Point | Pipistrell. pipistrellus | Pipistr.kuhlii /nathusii | Myotis sp. | Nyctalus sp | Pipistrell. Pygmeus | Rhinoloph. Ferum equinum | Rhinoloph. Hipposideros | Total number of contacts / h |
|---|---|---|---|---|---|---|---|---|---|---|
| 01.07. | 1,5 | Point A | 0,7 | 1,3 | 0,0 | 0,0 | 0,0 | 0,7 | 0,0 | 2,7 |
| 01.07. | 1,167 | Tr.1 | 0,0 | 0,9 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,9 |
| 01.07. | 1,5 | Point C | 0,0 | 0,0 | 2,0 | 0,0 | 0,0 | 0,0 | 0,0 | 2,0 |
| 01.07. | 1,5 | Tr.2 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| 01.07. | 1 | Tr.3 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 1,0 | 1,0 |
| 02.07. | 1,5 | Tr.6 | 0,0 | 2,0 | 0,0 | 0,7 | 0,7 | 0,0 | 0,0 | 3,3 |
| 02.07. | 1,5 | Point E | 0,0 | 0,7 | 0,0 | 1,3 | 1,3 | 1,3 | 0,0 | 4,7 |
| 02.07. | 1,5 | Tr.5 | 0,0 | 0,7 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,7 |
| 02.07. | 1,5 | Tr.4 | 0,0 | 0,0 | 0,0 | 0,7 | 0,0 | 0,0 | 0,0 | 0,7 |
| 02.07. | 1 | Tr.3 | 0,0 | 0,0 | 0,0 | 1,0 | 0,0 | 0,0 | 0,0 | 1,0 |
| 03.07. | 1 | Point A | 1,0 | 3,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 4,0 |
| 03.07. | 1 | Tr.1 | 2,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 2,0 |
| 03.07. | 1 | Point C | 0,0 | 0,0 | 3,0 | 0,0 | 0,0 | 0,0 | 0,0 | 3,0 |
| 03.07. | 1 | Tr.2 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| 03.07. | 1 | Tr.3 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| 03.07. | 1 | Tr.4 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| 03.07. | 1 | Tr.5 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| 03.07. | 1 | Point E | 0,0 | 0,0 | 0,0 | 1,0 | 2,0 | 2,0 | 0,0 | 5,0 |
| 03.07. | 1 | Tr.6 | 1,0 | 3,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 4,0 |
| 04.07. | 1 | Point A | 0,0 | 3,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 3,0 |
| 04.07. | 1 | Tr.1 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| 04.07. | 1 | Point C | 0,0 | 0,0 | 4,0 | 0,0 | 0,0 | 0,0 | 0,0 | 4,0 |
| 04.07. | 1 | Tr.2 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| 04.07. | 1 | Tr.3 | 0,0 | 0,0 | 0,0 | 2,0 | 0,0 | 0,0 | 0,0 | 2,0 |
| 04.07. | 1 | Tr.4 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| 04.07. | 1 | Tr.5 | 0,0 | 0,0 | 0,0 | 0,0 | 1,0 | 0,0 | 0,0 | 1,0 |
| 04.07. | 1 | Point E | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 2,0 | 0,0 | 2,0 |
| 04.07. | 1 | Tr.6 | 0,0 | 3,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 3,0 |
| Total contacts / h | 3,5 | Point A | 0,6 | 2,3 | 0,0 | 0,0 | 0,0 | 0,3 | 0,0 | 3,1 |
| | 3,167 | Tr.1 | 0,6 | 0,3 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,9 |
| | 3,5 | Point C | 0,0 | 0,0 | 2,9 | 0,0 | 0,0 | 0,0 | 0,0 | 2,9 |
| | 3,5 | Tr.2 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| | 4 | Tr.3 | 0,0 | 0,0 | 0,0 | 0,8 | 0,0 | 0,0 | 0,3 | 1,0 |
| | 3,5 | Tr.4 | 0,0 | 0,0 | 0,0 | 0,3 | 0,0 | 0,0 | 0,0 | 0,3 |
| | 3,5 | Tr.5 | 0,0 | 0,3 | 0,0 | 0,0 | 0,3 | 0,0 | 0,0 | 0,6 |
| | 3,5 | Point | 0,0 | 0,3 | 0,0 | 0,9 | 1,1 | 1,7 | 0,0 | 4,0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | E | | | | | | | | |
| | 3,5 | Tr.6 | 0,3 | 2,6 | 0,0 | 0,3 | 0,3 | 0,0 | 0,0 | 3,4 |
| **Total** | **31,67** | | **0,2** | **0,6** | **0,3** | **0,2** | **0,2** | **0,2** | **0,0** | **1,8** |

***Figure 1**. Activity of bats within each transect / point (left: total number of contacts recorded during the transect movement, right: average number of contacts / hour)*



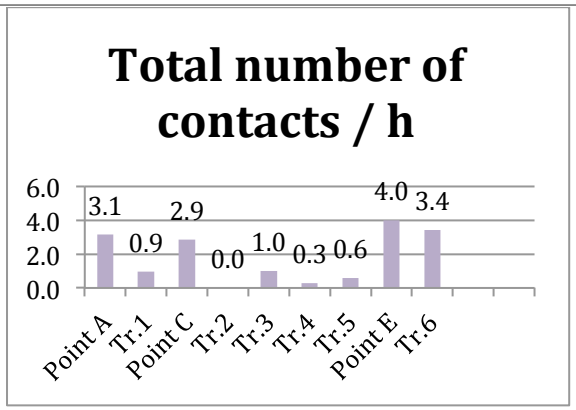




***Table 4.** The average activity of bats (number of contacts / h) on all transects*

***From 01/07/2019. - 04/07/2019.***

| DATE | *Pipistrell. pipistrellus* | *Pipistr.kuhlii/nathusii* | *Myotis sp.* | *Nyctalus sp* | *Pipistrel l. Pygmeus* | *Rhinoloph. Hipposideros* | Total number of contacts / h |
|---|---|---|---|---|---|---|---|
| **01.07.** | 0,7 | 2,2 | 2,0 | 0,0 | 0,0 | 1,0 | 6,5 |
| **02.07.** | 0,0 | 3,3 | 0,0 | 3,7 | 2,0 | 0,0 | 10,3 |
| **03.07.** | 4,0 | 6,0 | 3,0 | 1,0 | 2,0 | 0,0 | 18,0 |
| **04.07.** | 0,0 | 6,0 | 4,0 | 2,0 | 1,0 | 0,0 | 15,0 |
| **Grand Total** | 4,7 | 17,5 | 9,0 | 6,7 | 5,0 | 1,0 | 49,9 |

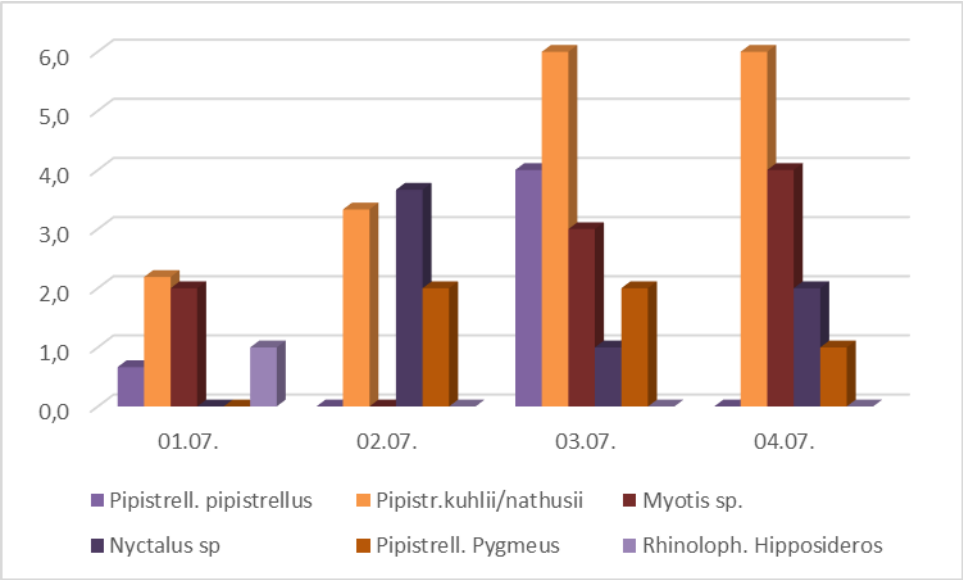
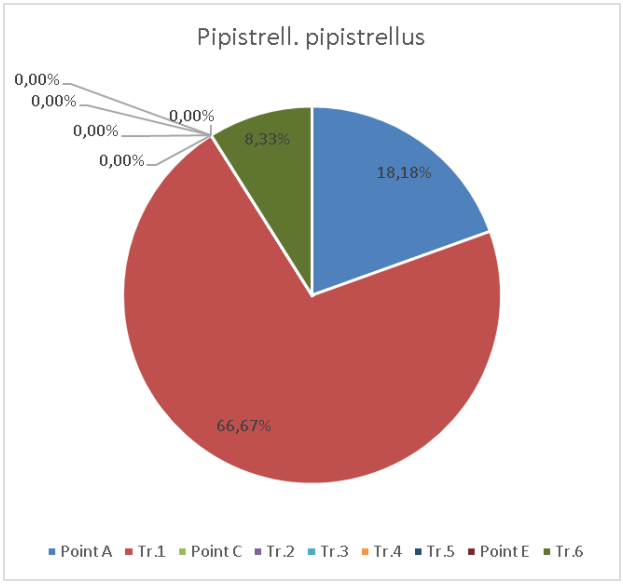
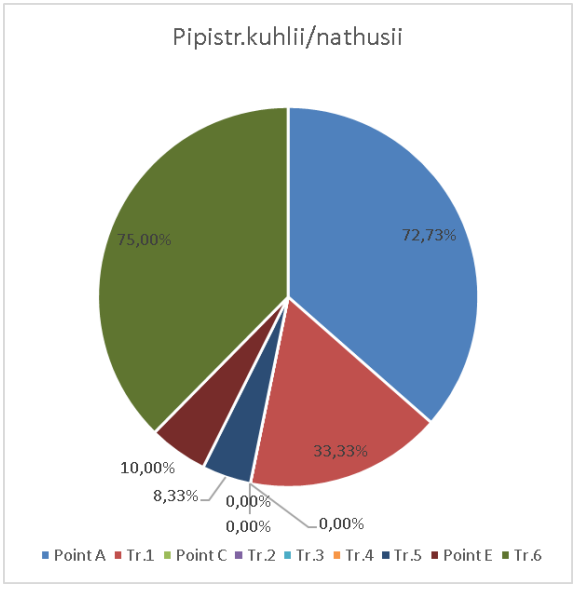
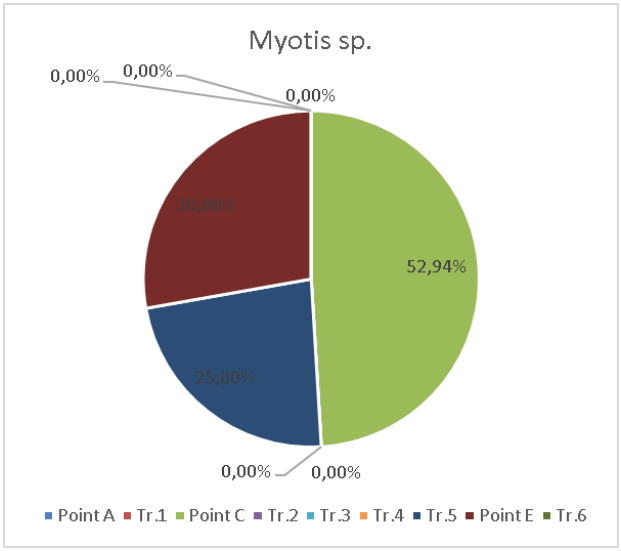
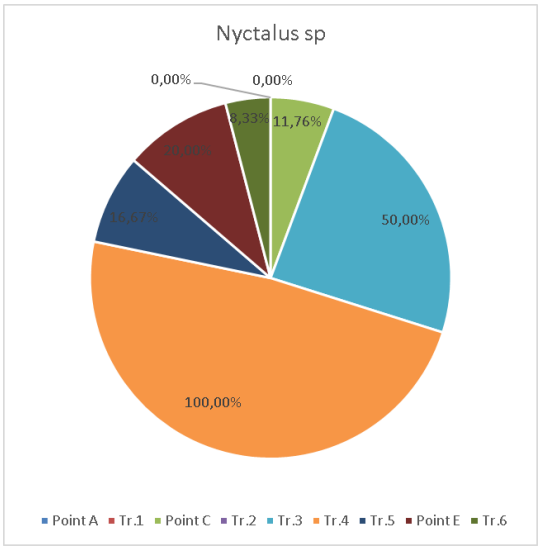

6,0
5,0
4,0
3,0
2,0
1,0
0,0
01.07.
02.07.
03.07.
04.07.
Pipistrell. pipistrellus
Pipistr.kuhlii/nathusii
Myotis sp.
Nyctalus sp
Pipistrell. Pygmeus
Rhinoloph. Hipposideros

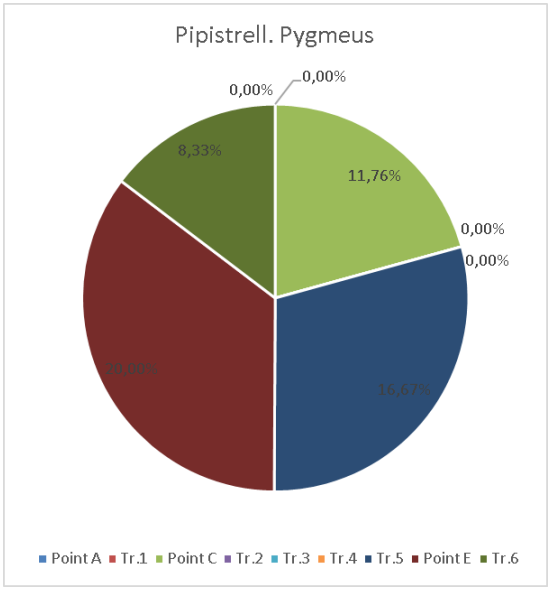
***Figure 2**. Percentage representation by species*

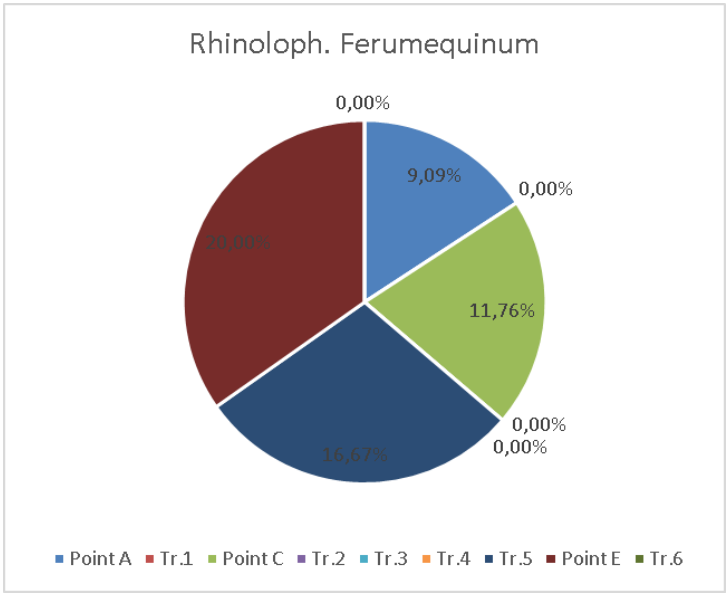


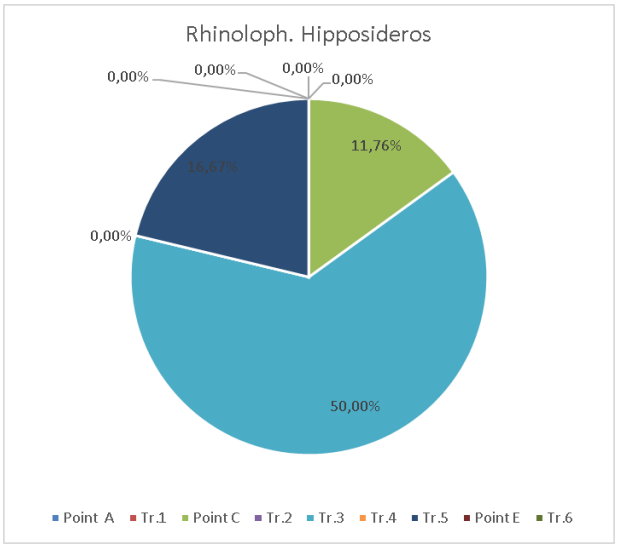




Myotis sp.
0,00%
0,00%
0,00%
30,00%
52,94%
25,00%
0,00%
0,00%
Point A
Tr.1
Point C
Tr.2
Tr.3
Tr.4
Tr.5
Point E
Tr.6


Nyctalus sp
0,00%
0,00%
4,33%
11,76%
50,00%
100,00%
16,67%
20,00%
Point A
Tr.1
Point C
Tr.2
Tr.3
Tr.4
Tr.5
Point E
Tr.6


Pipistrell. Pygmeus
0,00%
0,00%
8,33%
11,76%
0,00%
0,00%
20,00%
16,67%
Point A
Tr.1
Point C
Tr.2
Tr.3
Tr.4
Tr.5
Point E
Tr.6


Rhinoloph. Ferumequinum
0,00%
9,09%
0,00%
20,00%
11,76%
0,00%
0,00%
16,67%
Point A
Tr.1
Point C
Tr.2
Tr.3
Tr.4
Tr.5
Point E
Tr.6


Rhinoloph. Hipposideros
0,00%
0,00%
0,00%
0,00%
11,76%
16,67%
0,00%
50,00%
Point A
Tr.1
Point C
Tr.2
Tr.3
Tr.4
Tr.5
Point E
Tr.6

| Sum of Total number of contacts | |
|---|---|
| TRANSECT/POINT | Total |
| Point A | 11 |
| Point C | 10 |
| Point E | 14 |
| Tr.1 | 3 |
| Tr.2 | 0 |
| Tr.3 | 4 |
| Tr.4 | 1 |
| Tr.5 | 2 |
| Tr.6 | 12 |
| Grand Total | 57 |