Final Project Report (to be submitted by 30th September 2016)

Instructions:

- Document length: maximum 10 pages, excluding this cover page and the last page on project tags.
- Start with an abstract (max 1 page).
- Final report text: Do not forget to mention your methodology; the people involved (who, how many, what organization they are from – if applicable); and the expected added value for biodiversity, society and the company. Finally, state whether the results of your project can be implemented at a later stage, and please mention the ideal timing and estimated costs of implementation.
- Annexes are allowed but will not be taken into account by the jury and must be sent separately.
- Word/PDF Final Report files must be less than 10 MB.
- If you choose to submit your final report in your local language, you are required to also upload your final report in English if you wish to take part in the international competition.
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- In case of questions, please liaise with your national coordinator.

1. Contestant profile

▪ Contestant name:	**Gerd Wettstein**
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▪ Number of people in your team:	**5**

2. Project overview

Title:	Dazzling fliers on the road to success - Bee-eaters conquer the Nussloch quarry
Contest:	Germany & Worldwide
Quarry name:	Steinbruch Nussloch
Prize category: (select all appropriate)	☐ Education and Raising Awareness ☑Habitat and Species Research ☑Biodiversity Management ☐ Student Project ☑Beyond Quarry Borders

Abstract

The bee-eater (Merops apiaster) is without a doubt one of the most flamboyant phenomena of our local avifauna. The breeding population in Baden-Wuerttemberg is spread over a total of four key areas, the Kaiserstuhl, the districts of Heidenheim and Sigmaringen and the northern Kraichgau in Wiesloch. In particular, the latter instance is one of the oldest populations in Baden-Wuerttemberg and has a turbulent past. After the population was destroyed in 1976, a lasting repopulation has taken place since the turn of the century in the former nesting area. Since the first years of the repopulation were restricted primarily to the former nesting habitat, the Nussloch quarry and another location have for a number of years served as additional nesting and regular habitat for the bee-eaters in northern Kraichgau. As part of this research project, the bee-eater task force examined not only the birds' prevalence in the Nussloch quarry, but at other sites in a working radius of ca. 15 km^2 during the brooding period. 18 of the 56 documented broods occurred in the Nussloch quarry, whereas the others were concentrated in two former marl pits within the study area. With the limitations of weather and predation conditions, the hatching season only registered a below-average success rate. The losses to predation this year were particularly devastating in the quarry area, where around 78% of all broods fell prey to the stone martens. However, with the help of a detailed examination of the nesting areas it was possible to prove that although many of the currently heavily populated brooding areas around the quarry are almost at the point of overutilisation and subsequent abandonment, the Nussloch quarry is gaining enormous significance for the conservation of the bee-eaters.

Final report

1. Bee-eaters in the Nussloch quarry - Historical evolution and biological foundations

The bee-eater (Merops apiaster) is the only member of the bee-eater family (Meropidae), generally widespread in tropical environments, which breeds regularly in Europe. As a species of bird that thrives in warm climates, it mainly appears in the Mediterranean area of Europe - from the Iberian Peninsula and Northwest Africa eastwards to the Near East (Bauer et al. 2005). Expansion of the bee-eater's territory to the north (primarily Central Europe) can be traced back to the 16th and 17th centuries and is always linked with favourable climate changes (ibid.). The historical development of the Central European brood also corresponds with the documented broods from Kraichgau, where the first report of a brood in Wiesloch was made in 1850 - even before the existence of the Nussloch quarry (Hölzinger et al. 2001). Further reliable evidence of broods in the Wiesloch area only started emerging again after the mid-1960s: From 1965 to 1977 no colony was occupied every year - with a maximum of 10 breeding pairs in 1976. However, shortly afterwards the colony dissolved due to major disruptions in the breeding grounds. Thus it took 20 years for the bee-eaters to settle in the region again - initially in their former nesting grounds near Maisbach, not far from the quarry. Since 2000 there have been broods there every year and the growing bee-eater population has led to newly settled breeding grounds at Baiertal Schatzgrundhof (2005) and at the Nussloch quarry since 2012, where broods were able to be registered annually until the present day.

The bee-eater makes its habitat in open or half-open landscapes in sunny, warm areas with a rich supply of insects (Südbeck et al., 2005). Its diet consists exclusively of flying insects with a preferred size of > 10mm (Bauer et al. 2005). Alongside the bees after whom they are called, these also include bumblebees, wasps, beetles (primarily scarabs), butterflies and larger flies (ibid.). The bee-eater mostly captures its prey in flight, waiting to pounce from perches (e.g. poles, fences, dry branches, cables). The latter thus are an important element within its habitat, which can also be used to rest, mate, and feeding. The bee-eater lives in the flock all year round and mostly breeds in larger colonies, although solitary breeding can occur (ibid.). The birds dig their nests in the ground, and for this purpose frequently use vertical structures such as undercuts on riverbanks, gullies and crevices in gravel, sand, and clay pits. The soil properties play a decisive role in this matter (Bastian et al. 2016). Loess walls, such as those that can be found in the upper periphery of the Nussloch quarry and in other places in the region and which are used as breeding grounds, offer ideal conditions for laying nests.

As a migrant bird species, the bee-eaters reach their breeding grounds in Baden-Wuerttemberg between the end of April and mid/late June, the main arrivals taking place in the second half of May (Hölzinger et al. 2001). Mating behaviour (feeding mates, mating calls, copulation) in the period of arrival indicates that the area may potentially become established as a breeding ground. As observations from the past few years have shown, the colonies are generally abandoned shortly after the fledging of the young (mid/late July to the end of August), at which point the birds move around in family units and larger troupes (in a larger environment). Bee-eaters use communal sleeping grounds during and after the breeding season, preferably in larger trees.

2. Study area

The study area is concentrated on certain focal points during the brooding period of the bee-eaters within the ca. 15 km² working radius, established over the past few years, around the Nussloch quarry, which encompasses the surrounding localities of Nussloch, Wiesloch, Dielheim, Schatthausen and Baiertal (cf. Appendix 1). The Nussloch quarry, the Sandritter marl pit and the excavation site at Schatzgrundhof can thus be described as the core of the working radius. Geographically speaking, the examination area is thus in Kraichgau, which is part of the Neckar and Tauber catchment area (Ssymank 1994). From a geological perspective, the existing ground is primarily distinctive due to its partially thick loess sediment, which covers the chalk or Keuper underneath (Eberle et al. 2010). These in turn form the foundations for the high yields of luvisols and pararendzina (Staatliche Archivverwaltung Baden-Württemberg 1974). The climate of the study area is similar to that of the Rhine valley, so that an average annual precipitation level of 770mm and an annual average temperature of 9.4°C can be reckoned with (Gradmann 1931). With regard to the growing climate, the study area thus proves itself to be climatically favourable so that it can also provide suitable conditions for vineyards (ibid.).

To the present day, manifold factors related to utilisation have made their mark on the natural forest landscape of Kraichgau and have created the current, intricately structured landscape of this area. The agricultural usage in the study area is predominantly focussed on arable farming with the cultivation of crops, root or oil plants, yet viticulture and orcharding or grassland management in the form of keeping suckler cows can also be found (Willaschek et al. 1988). Further uses of the land, primarily stone and marl quarrying, shaped and shape the landscape in that a range of valuable consequential biotopes such as loess and rock faces, gullies, succession zones or fugacious standing water emerged. The local traditions of transhumant beekeeping when the acacias are blossoming can be considered another regionally specific feature, with up to 200 bee populations moving within the area of the quarry (Bezirksimkerverein Wiesloch, oral statement).

3. Targets

In order to guarantee that the bee-eater and its fellow species are successfully and sustainably protected and preserved in the study area, there needs to be a sustainable and practical protection plan which can be not only integrated into existing uses but also that takes the current population into account in a regional context. This context results in the following aim or question for the research concept at hand:

A) How large is the existing bee-eater population in the study area and how is its spread and use of space characterised inside and outside the quarry?

B) What characterises the range of potential nesting areas in the quarry and in the rest of the study area and what condition are these in?

C) Which important companion species are to be found in the area surrounding the bee-eaters' nesting areas and are there those which benefit from the bee-eaters' construction activity?

D) Which recommended actions should be deduced from research for those birds prevalent in Nussloch quarry and the rest of the research area?

4. Materials and methodologies

A wide range of methods were applied as part of this research project. The main research methods are listed below:

Recording the bee-eater population: In order to facilitate as standardised a record of the entire bee-eater population as possible, the provisions of the DDA Methodology Standard should be taken as a guideline according to Südbeck et al. (2005). Thus all potential nesting habitats were checked for the presence of bee-eaters that may have been breeding at regular intervals. After the demarcation of the documented nesting habitats, the number of documented nests and the range of prey of the bee-eaters was also able to be checked with the help of Focal Animal Sampling (cf. also Martin & Bateson 2007).

Endoscope analysis: In order to be able to determine more about the breeding success, potential causes of death or nest predation, the task force examined numerous nests after the departure of the young birds with the help of endoscopes. The resultant photos and video recordings were then viewed on PCs and interpreted.

Synchronous observation of space usage: To localise preferred feeding habitats and nesting trees, the project group organised multiple synchronous observation sessions of space usage, at which the individual project team members distributed themselves across several manageable sections of the study area over a certain period of time, in order to be able to record both the bee-eaters and their movements in the area. In a subsequent synthesis, the freshly acquired information was discussed and processed accordingly.

Documentation of bee-eaters by beekeepers: As already mentioned in Chapter 3, transhumant and stationary beekeeping is an important tradition in the study area, which can also be incorporated into direct ecological context with bee-eaters. As, according to experience, the stocks of bees are found to be part of the bee-eater's search for food, the task force was able to enlist two beekeepers to document their observations of bee-eaters in a standardised log form with details about the observation site, the time and the weather (cf. Appendix 4).The random observations thus obtained were added to the team's bee-eater observations and accordingly taken into account in the evaluation.

Assessment of the nesting areas: As the bee-eater is permitted an adequate range of open nesting places in clay, sand or gravel pits to build his nest (Südbeck et al. 2005), all potentially suitable nesting areas in the study area were examined and evaluated with a standardised approach. For this purpose all nests were given ID numbers and the respective soil type and the exposition of the nest were determined. In one further step, the height of the faces, the vegetation growth and the degree of use (perforation through the digging activities of the bee-eaters) were then each assessed according to three frequency classes (low, medium, high or heavy).

References: The standards applied to the documentation of the population are based on Südbeck et al. (2005). Ability to determine sex and age, as well as the biological and phenological specifics are of decisive relevance to field work. Thus the appropriate fundamental works and regional avifauna were consulted to prepare and classify the team's observations (Bauer et al. 2005; Hölzinger et al.2001; Bastian et al. 2016).Moreover, references in regional literature to historical appearances of the bee-eater were sought out (Willaschek et al. 1988) in order to classify the birds' local presence, along with the species' evolution over time and according to importance.

GIS evaluations: In order to obtain as comprehensive a synthesis of all areas processed as possible, all data acquired in the field were digitalised in the Q-Gis 2.16.1 Essen program using the open layer plug-in. On the basis of an additional aerial photo analysis of the landscape structure of the study area, the proportion of valuable feeding habitats was also investigated (grassland and robinia forests).Furthermore all breeding habitats and nesting trees were also digitalised and prepared for mapping.

Documentation of fellow bird species in the Nussloch quarry: In order to be able to learn more about the avifauna of the Nussloch quarry, the members of the bee-eater task force always recorded all the species of bird they encountered on every visit to the quarry. The species recorded in this way were then archived with the help of the online tool, Ornitho.de, and subsequently evaluated in the form of a list. In doing so, differentiations were made between breeding birds, birds visiting to feed and migratory birds.

5. Results and Discussions

5.1. Breeding population and space usage during the project period

In the breeding season in 2016, a total of 56 broods or attempts to breed by the bee-eaters were able to be documented in the study area. These were distributed across various nests throughout the entire area. As can be seen from Table 1 below, 18 of the 56 breeding attempted took place in the Nussloch quarry, whereby the faces in the northeast section were clearly preferred with 15 breeding attempts. A further 38 breeding attempts were distributed across both of the former loess quarries in the area. The Sandritter marl pit should be highlighted in this regard, which not only accommodated 64% of all of this year's breeding attempts in its three faces, but also can be considered a source habitat for the entire population (Hölzinger et al. 2001).

Table 1:Overview of the distribution of breeding and breeding success of the bee-eater in the study area (own research)

Breeding site ID	Area	Breeding attempts (n)	Successful broods (n)	Total loss to predation (n)	Percentage of loss to predation (%)
1a	NE Quarry	6	0	6	100.0%
1b	NE Quarry	6	2	4	66.7%
1c	NE Quarry	2	0	2	100.0%
1d	NE Quarry	1	0	0	0.0%
2	SW Quarry	2	1	1	50.0%
3	SW Quarry	1	0	1	100.0%
Quarry total		***18***	***3***	***14***	***77.8%***
4a	Sandritter marl pit	27	27	0	0.0%
4b	Sandritter marl pit	3	1	0	0.0%
4c	Sandritter marl pit	6	5	0	0.0%
5	Schatzgrundhof	2	2	0	0.0%
Loess quarries total		***38***	***35***	***0***	***0.0%***
Total area		***56***	***38***	***14***	***25.0%***

If the number of breeding attempts is compared with the number of successful broods it becomes clear that only around 68% of the documented breeding attempts were performed successfully. This can particularly be traced back to the fact that around 78% of all breeding attempts in the quarry fell prey to the stone martens (*Martes foina*). This figure seems particularly considering the recorded total losses at three of the six nesting places in the Nussloch quarry. Observing potential second broods after predation of the nests, this year's population in the study area amounted to 49 breeding pairs or 98 breeding birds. In comparison with the previous year, 2015 (27 BC), a population increase of ca. 81% was able to be registered, which fits very well with the overall positive bee-eater population trends in Baden-Wuerttemberg (Baust 2016). With regard to the breeding success, the task force was able to identify at least 72 hatchlings, which equates to 1.5 hatchlings per breeding pair amongst 49 breeding pairs. This value, in comparison to previous surveys in the study area, is below average (2015: 3.6 hatchlings per breeding pair). The majority of the poor breeding success is thus owing predominantly to mass predation, however a portion can also be attributed to the poor weather. Thus in this vein Dr. Bastian wrote to us that, according to endoscopic studies this year, only 2-3 hatchlings/pair became fully fledged in the Palatinate, whilst in previous years an average of 4 hatchlings per breeding pair in the Palatinate (Bastian, written statement).

In another module of the research project, an attempt was made to discover more about the space usage and the proportion of certain habitat requisites in the breeding habitat. As was able to be convincingly proved in the assessments, the working radius of the bee-eaters expanded as the breeding season went on. Whilst at first it was focussed on about 15 km² around the quarry (cf. Appendix 1), towards the end of the breeding season it stretched to about 39 km². This phenomenon also shows particularly clear parallels with the choice of nesting tree. As a result, the bee-eaters apparently slept at the beginning of the breeding season in the immediate vicinity of the breeding grounds and only from 8 July were the first approaches to nests across Baiertal able to be registered. With the completion of the breeding season, the chosen nesting tree then reached its maximum distance from the breeding area, in that it was in Dielheim, not far from the southern edge of the study area (for the sites of all recorded nesting trees, cf. Appendix 2). There is still no explanation for this behaviour. If the habitat requisite of nesting trees is considered in detail, it becomes clear that all occupied nesting trees were tall trees with thick foliage, which moreover were near streams, hollows or in small valleys with open all-round visibility. There was a preference for trees of the following species: Willows (Salix spec.), poplars (Populus spec.), acorns (Acer spec.) and walnuts (Juglans regia). Before moving into the respective nesting trees, the birds hunted across the neighbouring fields and meadows or bathed together in the warm evening sun in sparse, partially damaged trees (primarily cheery trees (Prunus avium)). In the evenings, we were even often able to see them taking sand baths in the warm loess in the fields. According to the observations of the task force, other significant habitat requisites for the bee-eater may include, particularly from the point of view of diet and an ecological perspective, grasslands, robinia forests, water, bee populations and succession zones with butterfly bushes (Buddleja davidii). Whilst bee houses were found to be feeding habitats throughout the day and also primarily during consistent rainy weather, the bee-eaters make use of the lush supply in the other habitat requisites predominantly in favourable weather conditions in the form of hunting in flight. Furthermore, intensive feeding flights over farmland were observed. That is, for example, over blossoming rape fields at the start of the breeding season, over blossoming pea fields or during harvesting. The flowing and standing waters in the area are another element that forms the basis for ensuring that dragonflies are on the move during the main feeding period in the second half of July and in August. As the food supply in the quarry and in the surrounding area plays a significant role in this time period due to the considerably shorter hunting sessions (greater need to feed the hatchlings), it is predominantly the neighbouring grasslands and bodies of water in the quarry and the abundant butterfly bushes that form the foundation for a secure food supply. During hunting, according to the team's observations, prey consisted predominantly of dragonflies (Odonata), butterflies (*Lepidoptera*), wasps (*Vespinae*), bees (*Apiformes*), bumble bees (*Bombus*) and crickets (*Tettigonia*). After the departure of the broods, we were able to observe the family units on the hunt for food in the entire observation area, however the nesting area was visited again and again by the birds. In conclusion, based on the GIS analysis all habitat requisites from the point of view of diet and ecology occupied around a third of the ca. 15 km² working radius during the breeding season. However, at this point it should be noted that the main focus of their distribution was in the immediate vicinity of the breeding grounds.

5.2. Investigation and assessment of potential nests

As already mentioned in Chapter 5.1, there are currently ten bee-eater nesting areas within the study area. Six of these are in the Nussloch quarry, three nesting areas in the former Sandritter marl pit and one nesting area in the area around the Schatzgrundhof. In spite of a thorough search, no other potentially suitable nesting areas were able to be recorded. As can be seen from Table 2, all nesting areas have the same soil type. Furthermore, four of the nesting areas were positioned facing west, another four facing south, one facing north and one facing northwest. Taking the nesting density into account, it also becomes clear that 71% of the breeding attempts recorded this year took place in nesting areas facing west, whilst the other breeding attempts were distributed amongst the other specimens in considerably lower proportions.

Table 2:Assessment of potential nesting areas in the study area (own research)

Breeding site ID	Area	Specimen	Soil type	Height of the nesting area	Vegetation	Degree of use
1a	NE Quarry	W	Loess	Moderate	Strong	High
1b	NE Quarry	W	Loess	High	Moderate	Moderate
1c	NE Quarry	S	Loess	Low	Moderate	Low
1d	NE Quarry	S	Loess	Moderate	Strong	Low
2	SW Quarry	N	Loess	High	Low	Low
3	SW Quarry	W	Loess	High	Low	Low
4a	Sandritter marl pit	W	Loess	High	Moderate	High
4b	Sandritter marl pit	S	Loess	Moderate	Low	Low
4c	Sandritter marl pit	NW	Loess	High	Strong	High
5	Schatzgrundhof	S	Loess	Moderate	Moderate	Low

In terms of height, five nesting areas proved to be high, four areas as medium-high and one as low. Whilst the high areas with one exception had moderate to very low vegetation, half of all medium-high nesting areas had heavy robinia vegetation. The lowest vegetation was recorded at both of the high nesting areas in the SW of the quarry and at a recently dug-out face in the Sandritter marl pit. If in conclusion we consider the degree of use (perforation of the face due to one-off nests) of the nesting areas it becomes clear that two of the three nesting areas in the Sandritter marl pit and one area in the northeast of the quarry demonstrate a high degree of use and thus are almost at the point of overutilisation and subsequent abandonment. Thus, in the mid-term, the importance of the so far hardly frequented and mostly unused nesting areas in the quarry is increasing. For an overview of the nesting area sites, cf. Appendix 2.

5.3. Fellow bird species in the Nussloch quarry

Alongside the bee-eaters, a total of 71 other bird species were able to be encountered in the Nussloch quarry, 60 of which were either probably or certainly breeding birds. Appendix 3 provides insight into all recorded species and their respective status. The most significant species recorded other than the bee-eater was the sand marten (Riparia riparia). Due to the loss of their natural breeding habitat, this bird species has now been strongly pushed into replacement habitats, such as sand, gravel and clay pits or quarries (Hölzinger 1999). During our observation period we were able to identify eight successful breeding pairs with two annual broods. They bred in the immediate vicinity of the bee-eaters in the upper third of the steepest southern face. The Nussloch quarry, with its ideal conditions, helps to ensure the survival of the population of bird species that are on the endangered list in Baden-Wuerttemberg (Bauer et al. in progress). Alongside the sand marten, we were able to observe other bird species on our visits which shared the loess face habitats with the bee-eaters. Thus house sparrows (Passer domsesticus), Eurasian tree sparrows (*Passer montanus*) and black redstarts (*Phoenicurus ochruros*) regularly used abandoned nests as nesting places. Yet the regularly spotted starling (Sturnus vulgaris) and wrynecks (Jynx torquilla) use abandoned nests as potential nesting sites.

6. Recommended action and perspectives

According to Weiss (oral statement), since bee-eaters abandon established nesting areas after a certain degree of usage and the traditional breeding ground of the Sandritter loess pit is almost completely exhausted, it can be assumed that in the next few years more and more breeding pairs will shift to the Nussloch quarry, as there is no shortage of suitable loess nesting places. The northeast corner of the quarry was preferred, yet two other faces in the southwest of the quarry also became occupied. As already described in Chapters 5.1 and 5.2, this year saw losses to mass predation in all nesting places in the quarry due to the stone martens. More than 75% of the broods were preyed upon. In order to be able to preserve the quarry which, from a demographic and ecological perspective, is a significant breeding habitat for the bee-eater, the marten's predation must be inhibited in the coming breeding seasons. A selective depletion of the marten population by aversive conditioning and trapping, according to experience, would only bring about the desired effect successfully after a very long period of time, as the area is always being occupied again and again by other martens. Consequently, this approach should only be used in moderation and in combination with habitat improvement measures. It appears that the most important thing this winter is to clear the faces in the northeast part of the quarry of the ever thickening robinia and buddleia vegetation with fresh quarrying. According to the team's observations, these fast-growing plants grow primarily in places where the faces have been levelled by erosion or interrupted by berms or trails. The restoration of as many high, vertical faces without ledges as possible is thus essential. Perhaps it would also be technically possible during the quarrying to create a gentle overhang or gradations which would also make it hard for the martens to reach the nests. Regardless of the clearing of the breeding areas, the following habitat requisites should additionally be provided and preserved in the Nussloch quarry as feeding habitats for the bee-eaters: ephemeral standing water (conservation of the dragonfly population), mesophytic or xerothermal fringes (habitat with numerous insects) and insular succession zones consisting of buddleia and robinia (sources of food for larger insects linked to diet and ecology). With the help of the list of suggested measures, the bee-eater will

also be able to be preserved as popular figures for mining sites and a deeply rooted gem of the avifauna of our region in the study area in the long-term. We shall be glad to provide HeidelbergCement with advice on all other measures for the protection of bee-eaters.

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- ☐Cooperation programmes
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- ☐Invasive species
- ☒Landscape management - rehabilitation
- ☐Rehabilitation
- ☐Scientific research
- ☒Soil management
- ☐Urban ecology
- ☐Water management

Flora:

- ☐Conifers and cycads
- ☐Ferns
- ☒Flowering plants
- ☐Fungi
- ☐Mosses and liverworts

Fauna:

- ☐Amphibians
- ☒Birds
- ☒Dragonflies & Butterflies
- ☐Fish
- ☒Mammals
- ☐Reptiles
- ☐Spiders
- ☒Other insects
- ☐Other species

Habitat:

- ☐Cave
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- ☒Fields - crops/culture
- ☒Forest
- ☒Grassland
- ☐Human settlement
- ☒Open areas of rocky grounds
- ☐Recreational areas
- ☒Screes
- ☒Shrubs & groves
- ☒Soil
- ☐Wander biotopes
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- ☐Authorities
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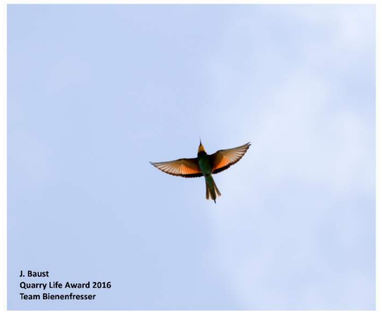
- ☒NGOs
- ☐Schools
- ☐Universities

THE QUARRY LIFE AWARD 3rd edition 2016

DAZZLING FLIERS ON THE ROAD TO SUCCESS - BEE-EATERS CONQUER THE NUSSLOCH QUARRY



J. Baust
Quarry Life Award 2016
Team Bienenfresser

Appendix 1

Map of the investigation area and homerange of the bee-eaters during the nesting season in 2016

Map legend

- Bee-eater homerange
- Investigation area

Created by the project team 'bee-eater' in September 2016.

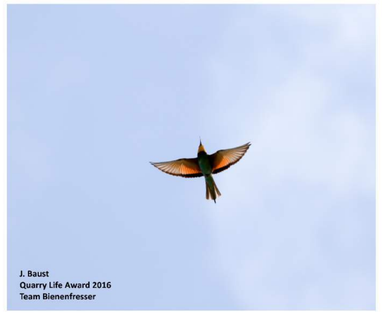
Data source: Google Maps 2016 via Open Layer Plugin in QGIS (Google Maps 2016: AeroWest, DigitalGlobe, GeoBasis-DE/BKB, GeoContentm, Landsat).

N

0.5 0 0.5 1 km

THE QUARRY LIFE AWARD 3rd edition 2016

DAZZLING FLIERS ON THE ROAD TO SUCCESS - BEE-EATERS CONQUER THE NUSSLOCH QUARRY



Appendix 2

Map of the nesting sites, roosting trees and valuable habitat features

Map legend

- Roosting trees
- Nesting sites
- Grassland
- Robinia forest
- Bee-eater homerange
- Investigation area

Created by the project team 'bee-eater' in September 2016.

Data source: Google Maps 2016 via Open Layer Plugin in QGIS (Google Maps 2016: AeroWest, DigitalGlobe, GeoBasis-DE/BKB, GeoContentm, Landsat).

N

0.5 0 0.5 1 km

Appendix 3: List of all recorded bird species in the Nussloch quarry from 9th of April to 3rd of August 2016

based on own data collected via Internet Data Base www.ornitho.de

German name	English name	Scientific name	N records	Max. individuals	from date	to date	Status
Stockente	Mallard	*Anas platyrhynchos*	3	2	09.04.	08.06.	wB
Wachtel	Common Quail	*Coturnix coturnix*	2	1	26.05.	08.07.	mB
Jagdfasan	Common Pheasant	*Phasianus colchicus*	7	3	09.04.	08.07.	wB
Kormoran	Great Cormorant	*Phalacrocorax carbo*	3	1	09.04.	26.05.	D
Graureiher	Grey Heron	*Ardea cinerea*	7	2	09.04.	08.07.	NG
Wespenbussard	European Honey Buzzard	*Pernis apivorus*	2	1	26.05.	08.07.	mB
Sperber	Eurasian Sparrowhawk	*Accipiter nisus*	1	1	08.07.	08.07.	mB
Rotmilan	Red Kite	*Milvus milvus*	12	2	09.04.	17.07.	mB
Schwarzmilan	Black Kite	*Milvus migrans*	9	2	20.05.	22.07.	mB
Mäusebussard	Common Buzzard	*Buteo buteo*	18	4	09.04.	29.07.	wB
Baumfalke	Eurasian Hobby	*Falco subbuteo*	1	1	14.05.	14.05.	NG
Turmfalke	Common Kestrel	*Falco tinnunculus*	13	3	15.04.	20.07.	mB
Flussregenpfeifer	Little Ringed Plover	*Charadrius dubius*	1	1	09.04.	09.04.	mB
Waldwasserläufer	Green Sandpiper	*Tringa ochropus*	1	1	26.05.	26.05.	NG/D
Grünschenkel	Common Greenshank	*Tringa nebularia*	1	1	22.07.	22.07.	NG/D
Hohltaube	Stock Dove	*Columba oenas*	9	8	09.04.	22.07.	mB
Ringeltaube	Common Wood Pigeon	*Columba palumbus*	7	20	09.04.	20.07.	wB
Turteltaube	European Turtle Dove	*Streptopelia turtur*	1	1	22.07.	22.07.	mB
Uhu	Eurasian Eagle-Owl	*Bubo bubo*	3	2	09.04.	14.05.	wB
Kuckuck	Common Cuckoo	*Cuculus canorus*	5	3	09.04.	06.06.	mB
Mauersegler	Common Swift	*Apus apus*	4	10	14.05.	20.07.	NG
Wendehals	**Eurasian Wryneck**	***Jynx torquilla***	**11**	**4**	**09.04.**	**20.07.**	**sB**
Grünspecht	European Green Woodpecker	*Picus viridis*	9	2	09.04.	22.07.	wB
Buntspecht	Great Spotted Woodpecker	*Dendrocopos major*	4	1	09.04.	08.07.	wB
Pirol	Eurasian Golden Oriole	*Oriolus oriolus*	3	2	21.05.	06.06.	wB
Neuntöter	**Red-backed Shrike**	***Lanius collurio***	**11**	**3**	**11.05.**	**23.07.**	**sB**
Elster	Eurasian Magpie	*Pica pica*	6	5	09.04.	20.07.	wB
Eichelhäher	Eurasian Jay	*Garrulus glandarius*	8	3	09.04.	23.07.	wB
Dohle	Western Jackdaw	*Coloeus monedula*	2	3	09.05.	26.05.	wB
Rabenkrähe	Carrion Crow	*Corvus corone*	11	15	09.04.	20.07.	wB
Kolkrabe	Northern Raven	*Corvus corax*	2	2	20.06.	19.07.	NG/D
Blaumeise	**Eurasian Blue Tit**	***Parus caeruleus***	**5**	**5**	**09.04.**	**20.07.**	**sB**
Kohlmeise	Great Tit	*Parus major*	9	9	09.04.	29.07.	wB
Sumpfmeise	Marsh Tit	*Parus palustris*	2	4	09.04.	15.04.	wB
Feldlerche	Eurasian Skylark	*Alauda arvensis*	4	3	09.04.	08.07.	wB
Uferschwalbe	Sand Martin	*Riparia riparia*	**15**	**20**	**05.05.**	**29.07.**	**sB**
Rauchschwalbe	Barn Swallow	*Hirundo rustica*	7	10	09.04.	29.07.	NG
Mehlschwalbe	Common House Martin	*Delichon urbicum*	7	80	19.04.	03.08.	NG
Schwanzmeise	Long-tailed Tit	*Aegithalos caudatus*	1	4	09.04.	09.04.	wB
Fitis	Willow Warbler	*Phylloscopus trochilus*	2	4	09.04.	26.05.	wB
Zilpzalp	Common Chiffchaff	*Phylloscopus collybita*	9	5	09.04.	20.07.	wB
Sumpfrohrsänger	Marsh Warbler	*Acrocephalus palustris*	3	1	26.05.	20.06.	mB
Teichrohrsänger	Eurasian Reed Warbler	*Acrocephalus scirpaceus*	1	1	26.05.	26.05.	mB
Mönchsgrasmücke	Eurasian Blackcap	*Sylvia atricapilla*	10	20	09.04.	20.07.	wB
Gartengrasmücke	**Garden Warbler**	***Sylvia borin***	**10**	**5**	**11.05.**	**20.07.**	**sB**
Klappergrasmücke	Lesser Whitethroat	*Sylvia curruca*	1	1	26.05.	26.05.	wB
Dorngrasmücke	**Common Whitethroat**	***Sylvia communis***	**9**	**15**	**05.05.**	**20.07.**	**sB**
Sommergoldhähnchen	Common Firecrest	*Regulus ignicapilla*	1	1	09.04.	09.04.	mB
Kleiber	Eurasian Nuthatch	*Sitta europaea*	1	1	26.05.	26.05.	wB
Gartenbaumläufer	Short-toed Treecreeper	*Certhia brachydactyla*	3	5	09.04.	26.05.	wB
Zaunkönig	Eurasian Wren	*Troglodytes troglodytes*	4	13	09.04.	08.07.	wB
Star	Common Starling	*Sturnus vulgaris*	10	30	09.04.	22.07.	wB
Amsel	Common Blackbird	*Turdus merula*	7	15	09.04.	29.07.	wB
Singdrossel	Song Thrush	*Turdus philomelos*	5	5	09.04.	20.07.	wB
Grauschnäpper	Spotted Flycatcher	*Muscicapa striata*	3	1	26.05.	20.07.	mB
Rotkehlchen	European Robin	*Erithacus rubecula*	3	10	09.04.	26.05.	wB
Hausrotschwanz	**Black Redstart**	***Phoenicurus ochruros***	**15**	**26**	**09.04.**	**22.07.**	**sB**
Heckenbraunelle	**Dunnock**	***Prunella modularis***	**4**	**6**	**09.04.**	**08.07.**	**sB**
Haussperling	House Sparrow	*Passer domesticus*	1	2	08.07.	08.07.	mB
Feldsperling	**Eurasian Tree Sparrow**	***Passer montanus***	**4**	**2**	**09.04.**	**08.07.**	**sB**
Baumpieper	Tree Pipit	*Anthus trivialis*	1	1	09.04.	09.04.	D
Wiesenpieper	Meadow Pipit	*Anthus pratensis*	1	2	09.04.	09.04.	D
Gebirgsstelze	Grey Wagtail	*Motacilla cinerea*	1	2	21.05.	21.05.	mB
Bachstelze	White Wagtail	*Motacilla alba*	10	9	09.04.	20.07.	wB
Buchfink	**Common Chaffinch**	***Fringilla coelebs***	**6**	**14**	**09.04.**	**20.07.**	**sB**
Kernbeißer	Hawfinch	*Coccothraustes coccothraustes*	3	2	09.04.	08.07.	wB
Girlitz	European Serin	*Serinus serinus*	10	12	09.04.	22.07.	wB
Grünfink	European Greenfinch	*Carduelis chloris*	5	2	09.04.	20.07.	wB
Stieglitz	European Goldfinch	*Carduelis carduelis*	10	8	09.04.	03.08.	wB
Bluthänfling	Common Linnet	*Carduelis cannabina*	6	8	09.04.	20.07.	wB
Goldammer	Yellowhammer	*Emberiza citrinella*	19	7	09.04.	29.07.	wB

Status: mB = mögliches Brüten (possible breeding, Kategorie A), wB = wahrscheinliches Brüten (presumable breeding, Kat. B), **sB = sicheres Brüten (proofed breeding, Kat. C)**, NG = Nahrungsgast (species using quarry only as feeding habitat), D = Durchzügler (species only on passage)

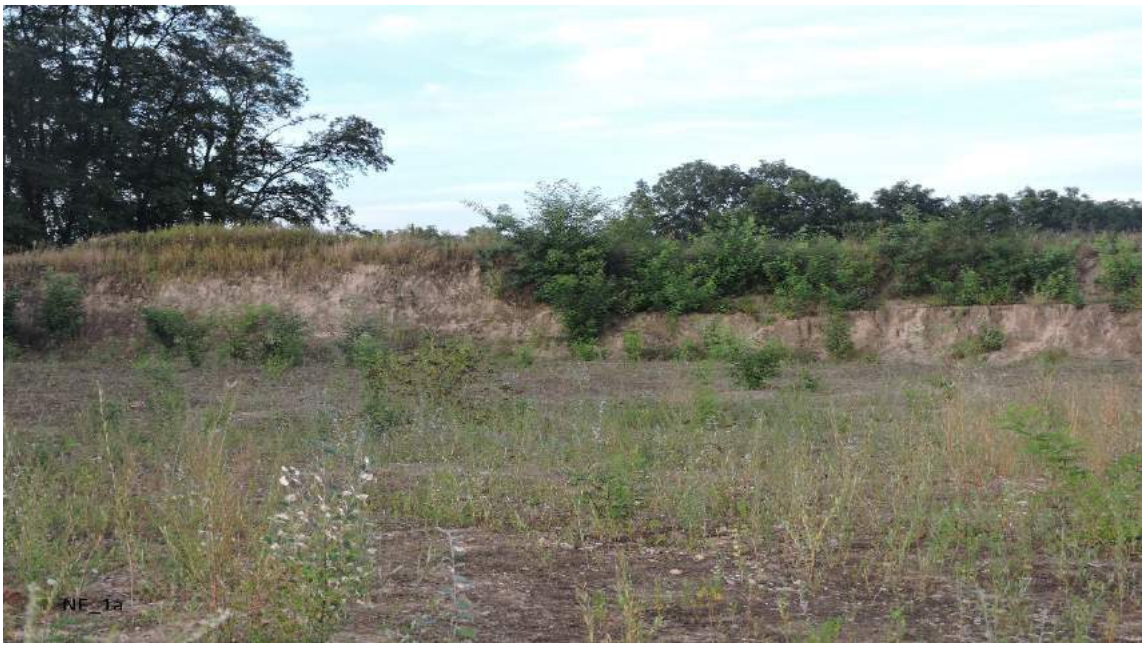
Appendix 4: Record sheet for the bee-eater observation by beekeepers

Protokollbogen zur Erfassung von Bienenfresserbeobachtungen im Großraum Wiesloch

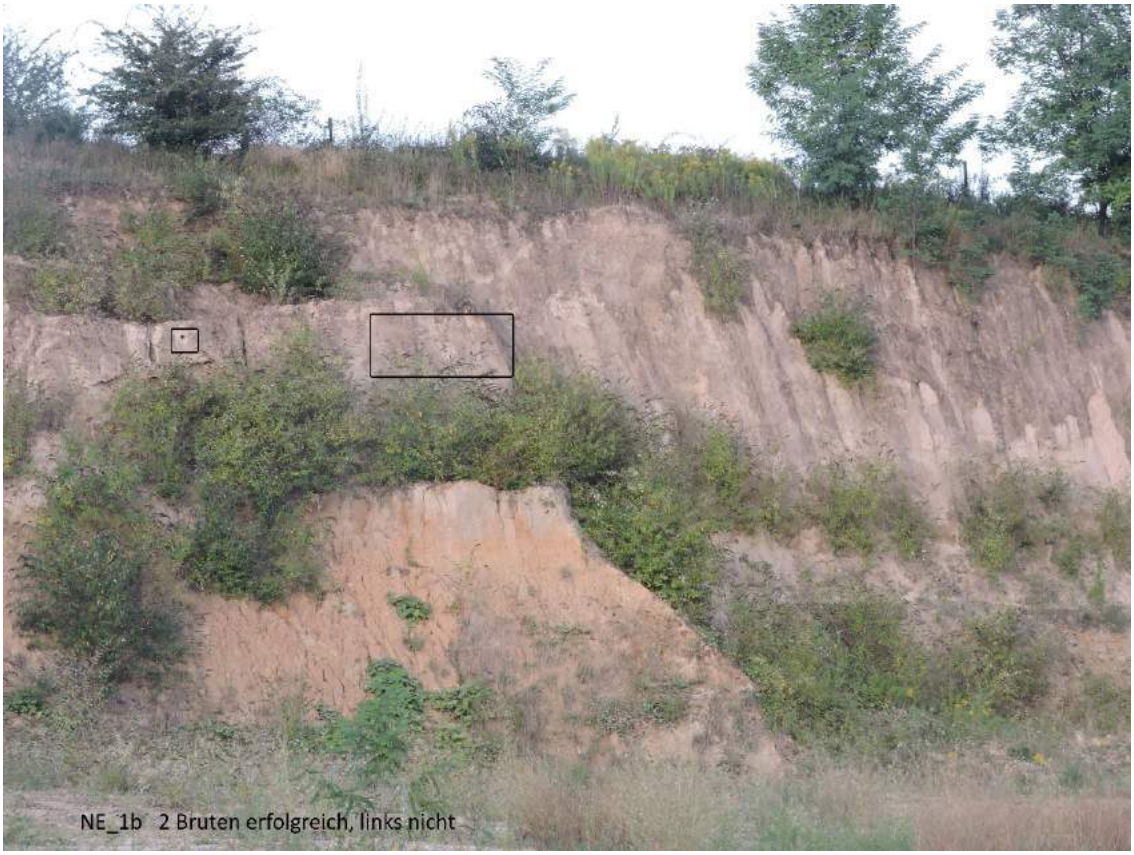
Datum	Beobachter	Ort	Uhrzeit	Witterung	Anzahl	Bemerkung

Appendix 5: Image series of nesting areas in the Nussloch Quarry

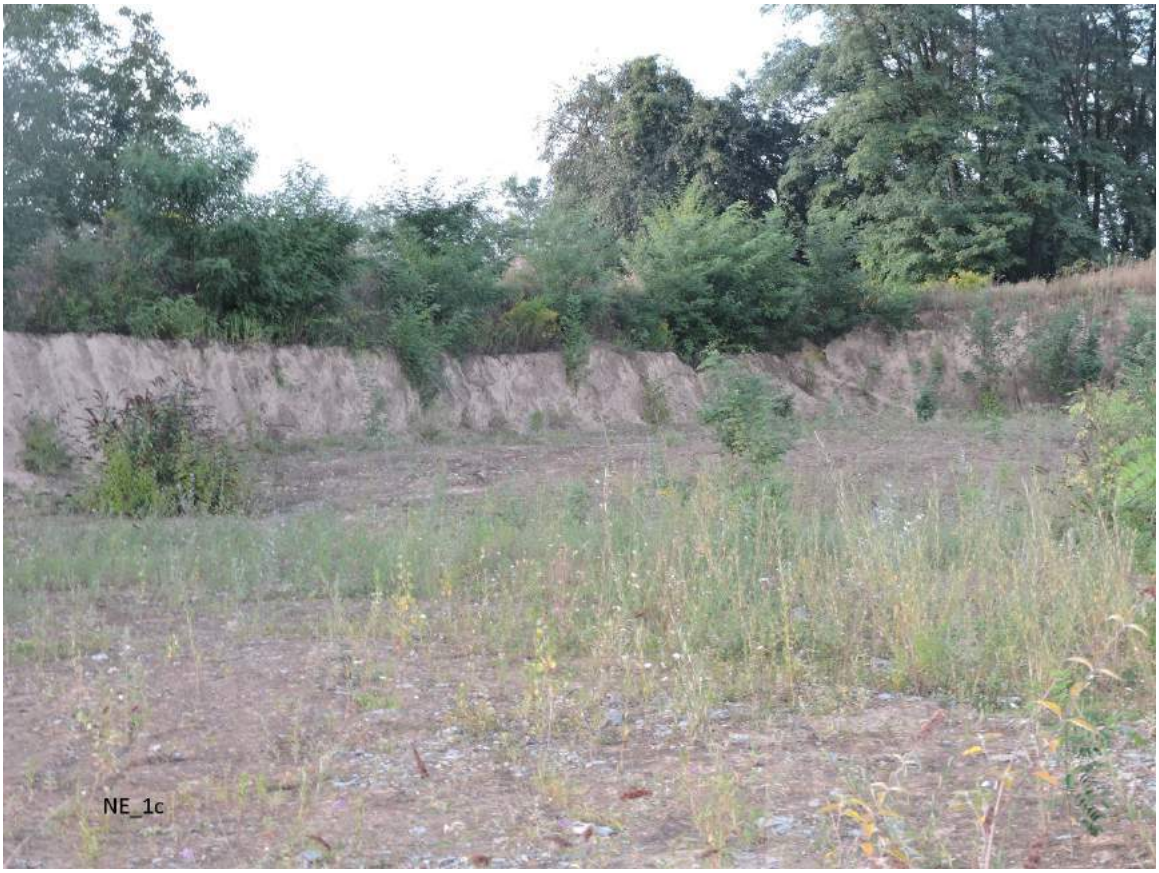
Nesting area 1a (Nussloch Quarry northeast)



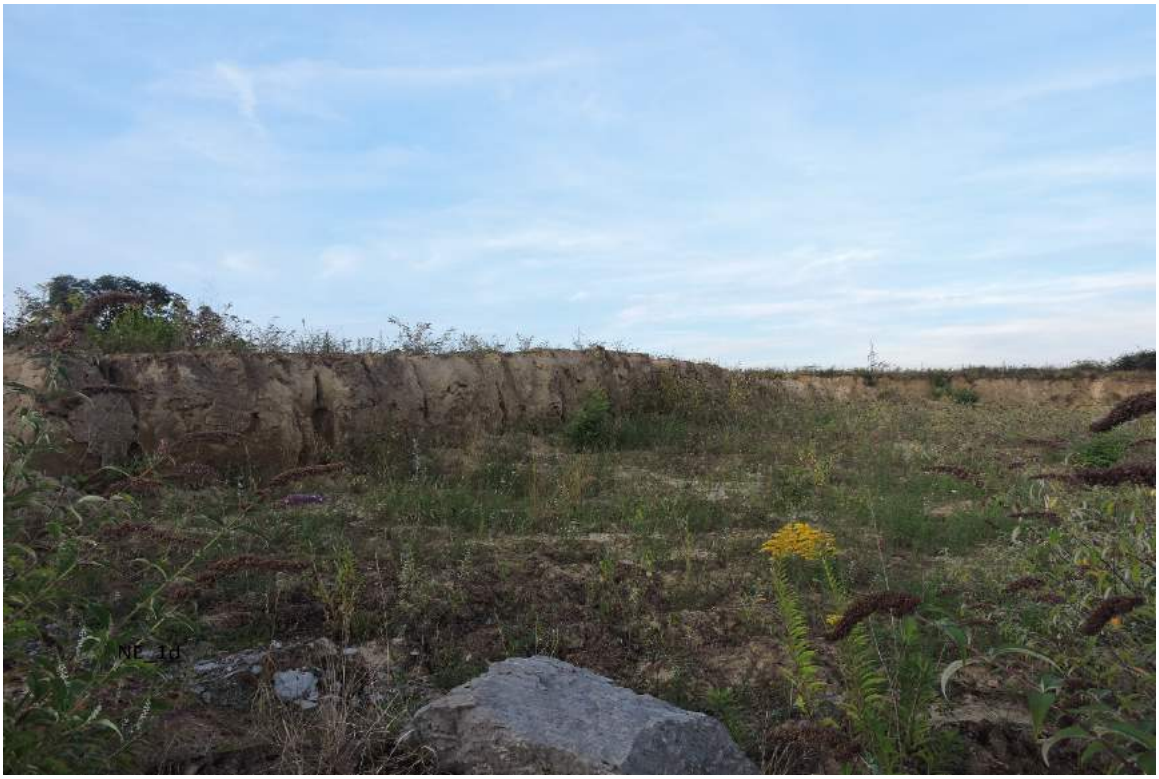
Nesting area 1b (Nussloch Quarry northeast)



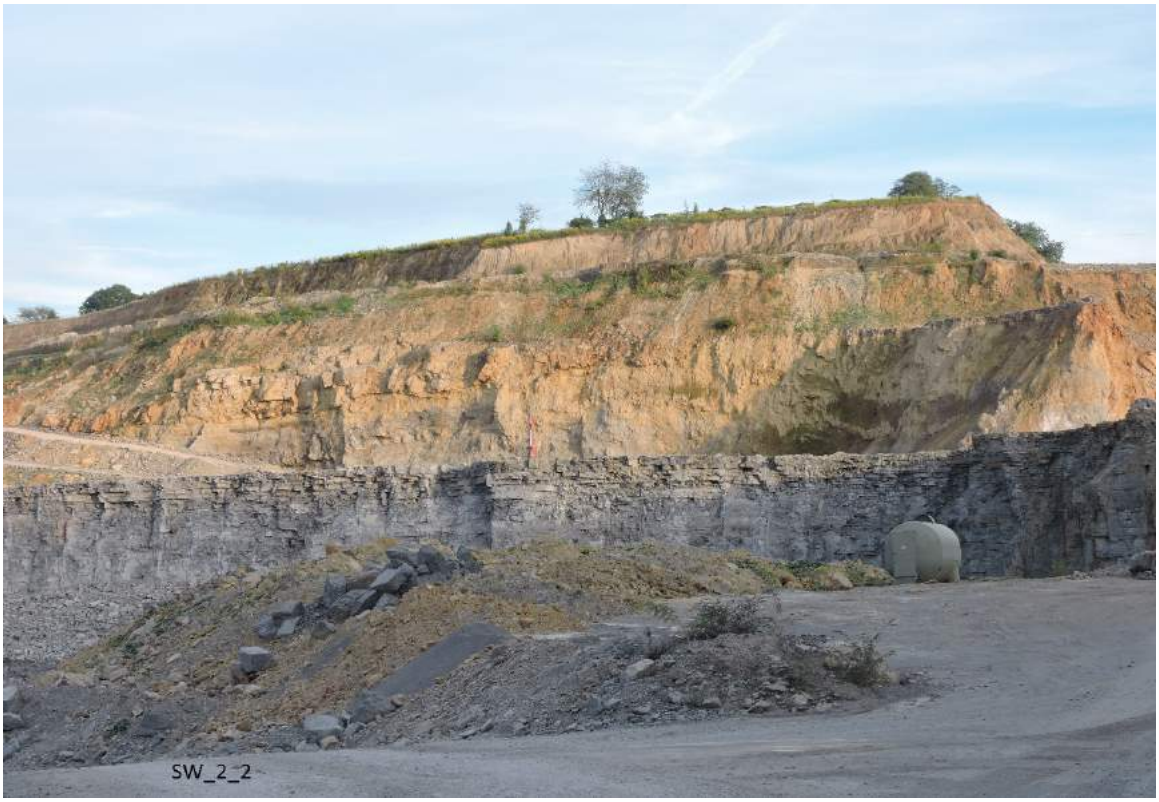
Nesting area 1c (Nussloch Quarry northeast)



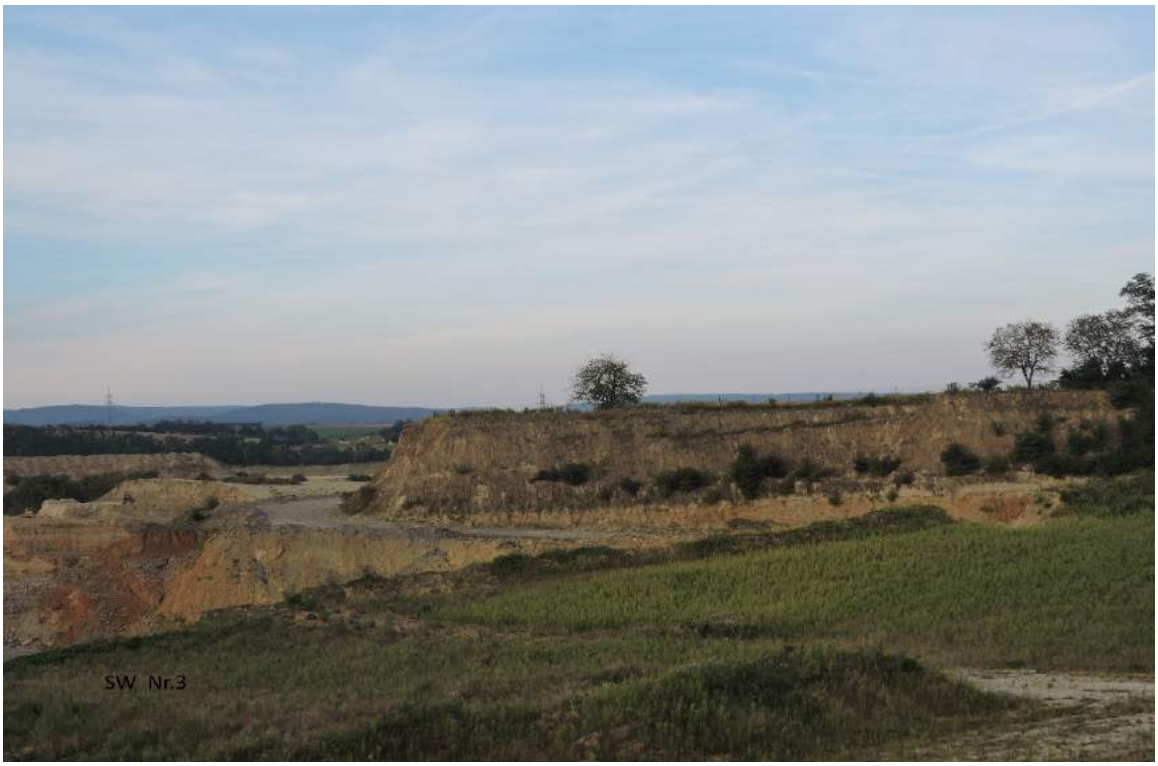
Nesting area 1d (Nussloch Quarry northeast)



Nesting area 2 (Nussloch Quarry southwest)



Nesting area 3 (Nussloch Quarry southwest)



Appendix 6: Observed field data

	Bienenfressersichtungen 2016									
Ort:	Steinbruch NO,SW,S									
		Uhrzeit	Anzahl	Individuen			Paare	angefl.	besetzte	Wetter
Beobachter	Datum	von … bis	ges.	m	w	j		Nistr.	Nistr.	Temperatur, Bemerkung
GW	05.05.16	9:45-11:45	0					0	0	12°,k. Ostwind
GW	08.05.16	11:10-11:30	5					0	0	22° Ostw. Böen
GK	09.05.16	09:00-11:00	16	3	3		4	3		15°-24° starker W.,sonnig
GW	09.05.16	15:30-16:00	0							25° alle Bienenk.
GK/GW	09.05.16	17:00-19:00	18	6	6		6	1		25°,sonnig, leichter Wind
GK,GW	10.05.16	17:00-19:00	18	5	5		5	3		26°
GW	11.05.16	10:00-11:15	10	4	4		4	3		17°-19° bewölkt
GK,GW	11.05.16	11:15-12:50	11	5	5		5	4		19°-22°, Sonne
GK	14.05.16	12:00-13:30	14	5	5		5	5		12° bewölkt, windig
JW/GK	17.05.16	11:45-13:30	11	4	4		4	7		14° sonnig/bewölkt/kalter Wind
GK/GW	20.05.16	13:15-15:00	35	10	10		10	10	2	17°-20° sonnig/bewölkt
GK/GW	21.05.16	9:00-11:00	22	11	11		11	10	5	18°-20° sonnig/Wolken
GK,GW,JW,TL	26.05.16	8:00-13:00	25	13	12		12	11	5	18°-25° sonnig,
GK,GW	04.06.16	15:00-16:15	12	6	5		6	6	5	25° sonnig, nur oben beob. !!!
GK	08.06.16	9:00-11:30	30	7	7		14	15	14	
GK,GW	15.06.16	10:00-11:45	3	1	1		1	2	1	18°,Regen,alle Bienenk. 0
GW	18.06.16	14:45-15:45	2	1	1		1	1		SW, trüb, 18°
GK,JW,TL,GW	18.06.16	16:00-17:30	7	?	?		?	0	?	NO, trüb 17° ab 17:15 Starkregen
GK,GW	20.06.16	11:15-13:15	10	5	5		5	4	3	NO, Sonne 20°
GK,GW	23.06.16	9:00-10:30	10				4	4	3	NO, Sonne 24°
GW	23.06.16	10:30-11:30	2	1	1		1	1	?	SW, Sonne 29°
GK	27.06.16	15:00-16:00	6	3	3		3	3	3	**NO 3 NR-Fütterung**
GW,TL	27.06.16	15:30-16:00	6				1	1	1	SW,bewölkt 22°
GK,GW,TL	27.06.16	16:00-16:30	6	1	1		1			S 6 P. US
GK,GW,TL	27.06.16	16:30-17:00	2							W, alter qu. Futtersuche
GK	29.06.16	9:30-10:15	6							SW 20°, 8 US
GK,GW	29.06.16	10:00-11:30	6	3	3		3	3	3	**NO, Fütterung ca. alle 10 Min**

Bienenfressersichtungen 2016

Ort: Steinbruch NO,S und SW

		Uhrzeit	Anzahl	Individuen			Paare	angefl.	besetzte	Wetter	Bemerkung	Begleitarten
Beobachter	Datum	von … bis	ges.	m	w	j		Niströhren	Niströhren	Temperatur	Futter etc.	Kurzform
GK,GW	04.07.	15:00-15:45	5				1		1	24°	SW	US ständig
GK,GW		16:00-17:00	7				3		3	25°	NO fütternd	
GK,GW	06.07.	18:00-19:00	6				3	6*	3	21° Sonne	NO fütternd	ca 60 MS
JW,JB		19:00-20:30	5				1		1	20°	S neu!	UHU, 14 US, juv.
GW	08.07.	15:20-16:20	7				1	7*	1	30°	SW Film-	
GK,GW		16:50-17:50	6				3	1,2,7*	3	32°	NO Team	alle Greife
TL.JW		18:15-19:30	5				2	3,1*	2	33° bew.	S neu?	US fütternd 7BH?
GK,GW	13.07.	17:45-18:30	4	2	2		2	2	2	20°	S neu!	US ausgefl.!
GW	16.07.	14:30-15:10	4	2	2		2	0,13,5*/30M	2	20°	NO Nr.1 nicht !	2 SM,2 MB, 1TF
GW		15:15-15:45	3	1	1		1	5*/30Min	1	21°	S Nr.6 nicht,	**Störung!**
GW		16:00-16:30	2				0	0	0	21°	**SW Nr.4 ausgegr.**	**Nr. 1 auch !?**
GK,GW,JB	17.07.	10:15-11:15	4				2	R2,5*	1	22°	NO	N1 u. N3 ??
GW		10:15-10:45	4				2	R5,4*,R6,3*	2	22°	S	R6, anfl. 3 Vögel!
GW	19.07.	15:00-15:30	3	1	1	**1**	1	R5 oft, 3V.	1	30° Sonne	**S Nr.6 ausgegr.**	8 US füttern
GK,GW		15:30-17:00	8	2	2	**2**	2	R2,R3 oft	2	30° Sonne	NO	14 cm-Höhlen!
GK,GW,	20.7.	15:00-15:45	8	2	2	2	2	häufig	2	35° Sonne	NO, N1 Marder!	Prof. Rademacher
JW,TL --MR		15:45-16:30	3	1	1	1	1	"	1	"	S, Nr4 u 6 "	8 US füttern
GK,GW,	22.07.	17:00-18:00	2	2	2	2	2	"	2	28°	NO Kratzspuren!	Jörn,Andreas
JW,JW,A		18:00-18:45	0						?	29° schwül	S	5 US fütternd
GW	25.7	16:30-17:00	3	1	1	1	1		1	27° "	S	"
GK,GW		17:00-18:30	9				?	ausgefl.		28° "	NO	
GW,RM	28.07.	9:30-10:00	1					"		21°	S	4 US füttern
		10:00-10:30	2					"		22°	NO	ruhend
GK,GW,T,J	03.08.	17:30-19:00	5				3			25°	NO, Endoskopie	4 Marderlöcher
GK,JW,TL	17.08.	18:00-19:15									NO, Endoskopie	
GK	24.08.	11:30-12:30	0							29°	SW	2 US füttern noch

Bienenfressersichtungen 2016

Schlafbäume (siehe Google Earth)

Beobachter		Uhrzeit	Anzahl	angefl.	entgültiger	Wetter	Bemerkung	andere Arten
	Datum	von ... bis	ges.	Schlafbäume	Schlafbaum	Temperatur		Kurzform
GK,GW	28.07.	8:10-9:00	75	1,2,3	4	bew. Z.T. Regen		
GW	29.07.	8:10-9:10	85	4	1	Sonne 20-18°	12,2,21->4;25,15->1+25<-4	
GK	31.07.	8:00-9:00	0			regen,gewittrig		20 FS,RS,MS
GK,GW	01.08.	8:00-8:50	0			23° Sonne		20 FS,TF,MB
GK,GW,JW,TL	3.8	7:45-9:15	>80	5 Schatzgr	?	24°	evtl. Golfplatz	
GK,GW	6.8.	7:45-8:45	>80-100	6 Klingenbr.	6 Pappel	22°	20,15,8,4,36	TF, Rs
GK,GW,TL	7.8.	7:30-8:45	>90-100	7 Klingenbr.	7	27°	2 gruppen je ca 45	
GK	8.8.	19:00-21:00	160	Klingenbr.	?		Sperber scheucht Bf auf	
GK,JW,TL	18.8.	19:30-21:00	170	K'bruch,Sportpl.	Hundepl.			
GK,GW	26.8.	18:50-20:30	35	Sportpl. Ost	?	31°	20, 15 Vorbeifl. Die-> GK	TF, MB
GK,JW,GW	30.8.	18:15-20:00	>80-100	" "	Hundepl.			
GW	02.09.	18.00-20:00	>10-15	Steinbr. SW		24°	Bewertung der Wände	Uhu
GK, GW	05.09.	18:00-19:45	15	Acker/Bank	ob. Sportpl-	18° auf Acker sitzen	zuletzt ca. 120 Vögel	
GW	10.09.	17:45-19:30	0			22°	evtl. westl. Baiertal abfliegend ?	

Appendix 7: Bee-eater data observed by the beekeepers

Protokollbogen zur Erfassung von Bienenfresserbeobachtungen im Großraum Wiesloch

Datum	Beobachter	Ort	Uhrzeit	Witterung	Anzahl	Bemerkungen
24.06.16	D. Lepp	Baiertal Wingert	18^{10}	sonnig 35°C	4	Marktelwand Wingertsgasse
08.07.16	"	Baiertal Ost	6^{00}	wolkig 3/8 18°C	6	überflug von O-W
10.07.16	"	Baiertal Ost	20^{45}	sonnig 30°C	8	überflug von W-O
11.07.16	"	Baiertal Ost	20^{30}	wolkig 5/8 23°C	10	überflug von W-O
21.07.16	"	Baiertal Ost	6^{45}	sonnig 19°C	12	überflug von O-W niedrig
27.07.16	"	Baiertal Ost	6^{00}	wolkig 3/8 20°C	26	überflug von O-W hoch verstreut
29.07.16	"	Baiert. Wingas.	6^{30}	bedeckt 8/8 19°C	unbekannt	sitzend verstreut.
24.07.16	"	Baiertal Ost	19^{45}	sonnig 24°C	12	überflug hoch W-O verstreut
30.07.16	"	Baiertal Wingert	6^{30}	sonnig 20°C	unbekannt	sitzend/liegend verstreut
01.08.16	"	Baiertal Wingert	19^{00}	wolkig 3/8 24°C	unbekannt	jagend verstreut/sitzend
03.08.16	"	Baiertal Wingert	17^{30}	sonnig 0/8 22°C	unbekannt	jagend verstreut/rufend
03.08.16	"	Baiertal Ost	19^{30}	sonnig 0/8 21°C	6	überfliegend von W-O
04.08.16	"	Baiertal Ortsmitte	6^{45}	wolkig 4/8 18°C	2	jagend mit Schleierwolken
05.08.16	"	Baiertal Ost	20^{00}	sonnig 3/8 21°C	28 W→O	überflug locker verteilt, lautstark
06.08.16	"	Baiertal Ost	07:^{30}	wolkig 6/8 19°C	unbekannt	überflug - kreisend → Ost
06.08.16	"	Baiertal Ost	15^{30}	wolkig 20°C	12	überflug kreisend → Ost
08.08.16	"	Baiertal Sandberg	19^{00}	sonnig 2/8 23°C	> 20	jagend - kreisend - lautstark
08.08.16	"	Baiertal Ost	20^{00}	sonnig 3/8 22°C	12	überfliegend von W-O
11.08.16	"	Baiertal Ost	8^{00} - 19^{30}	wolkig 4/8 20°C	> 15	ganztägig jagend mit Schwalben
12.08.16	"	Baiertal Ost	20^{00}	wolkig 5/8 21°C	> 15	versammelt/überflug/jagend
13.08.16	"	Baiertal Sandberg	9^{00}	sonnig 2/8 20°C	> 20	sitzend, jagend, rufend
13.08.16	"	Baiertal Ost	19^{00}	sonnig 3/8 25°C	> 20	überflug W-O
14.08.16	"	Baiertal Sandberg	10^{00}	sonnig 25°C	> 23	sitzend, jagend, kreisend
14.08.16	"	Baiertal Wingert	19^{30}	sonnig 25°C	> 10	kreisend u. rufend
14.08.16	"	Baiertal Ost	20^{00}	sonnig 23°C	> 15	überflug von W-O

Protokollbogen zur Erfassung von Bienenfresserbeobachtungen im Großraum Wiesloch

Datum	Beobachter	Ort	Uhrzeit	Witterung	Anzahl	Bemerkungen
15.08.16	D. Lipp	Baiertal Wiesenw.	19^{30}	Sonnig 25°C	>20	jagend, kreisend, Lautstark rufend
16.08.16	"	"	19^{00}	Sonnig 24°C	<10	jagend, sitzend, rufend lautstark
19.08.16	"	Baiertal Seeberg	19^{30}	bewölkt 22°C	<6	kreisend und jagend rufend
20.08.16	"	Baiertal O.T.	18^{20}	regen 20°C	8	Überflug von W-O
23.08.16	"	Baiertal Seeberg	18^{00}	Sonnig 27°C	<8	jagend, kreisend, rufend
23.08.16	"	Baiertal Wingert.	18^{30}	Sonnig 27°C	<10	jagend, kreisend, lautstark
24.08.16	"	Baiertal Seeberg	19^{00}	Sonnig 27°C	4	kreisend, rufend, sitzend
24.08.16	"	Baiertal Wingert.	19^{30}	Sonnig 26°C	<10	kreisend jagend über Feld
26.08.16	"	Baiertal Seeb.	19^{15}	Sonnig 28°C	<5	jagend mit ansitzen
26.08.16	"	Baiertal Wingert.	19^{30}	Sonnig 28°C	<5	jagend kreisend laut rufend
26.08.16	"	Baiertal Ort	19^{45}	Sonnig 28°C	>30	überfliegend von W-O rufend
28.08.16	"	Baiertal Wing.	18^{30}	Sonnig 27°C	>8	jagend, kreisend und rufend
28.08.16	"	Baiertal Seeberg	18^{45}	Sonnig 27°C	>10	jagend, sitzend, lautstark
29.08.16	"	Baiertal Wing	17^{30}	Sonnig 28°C	>20	über Feld jagend rufend.
31.08.16	"	Baiertal Wing.	17^{15}	Sonnig 27°C	>15	jagend mit Rauchsch. über Feld
31.08.16	"	Baiertal Ort	19^{30}	Sonnig 27°C	>10	überflug rufend von W-O

Protokollbogen zur Erfassung von Bienenfresserbeobachtungen im Großraum Wiesloch

Datum	Beobachter	Ort	Uhrzeit	Witterung	Anzahl	Bemerkungen
April	Gerhard Keller	Mergelgrube Sandrichter	zu jeder Zeit	bei jedem Wetter	5 – 30	wenn ich in meinem Bienenhaus arbeite, höre ich sie ständig. Das Haus ist etwa 200 m von der Brutwand entfernt. Hier in Schatthausen (nächster Ort) wo ich auch Bienen halte auch unsere Schwiegertochter + der Nachbar (etwa 15 Völker) hören u. sehen wir sie.
Mai		auf der Straße rechts zu Baiertal + Maisbach und bei meinem Bienenhaus				
Juni						
Juli						
August						
bis						

Appendix 8: Record sheet

Erfassungsbogen - Bienenfresser (Stand: V2, 01.06.2015)

Name des Beobachters:

Datum: Uhrzeit (von... bis...):

Brutwand/Schlafbaum/Gebiet:

Anzahl der beobachteten Individuen:	
davon Weibchen:	
davon Männchen:	
davon Junge:	

Anzahl Paare: (Balzrucken, Balzfüttern, Kopula)

Niströhren (Nr. auf Foto vermerkt ?!)

	Röhre 1	Röhre 2	Röhre 3	Röhre 4	Röhre 5	Röhre 6
auf Foto? bitte: X						
wird beflogen						
Füttern						
Abflug vorwärts						
Abflug rückwärts						
Junge am Eingang						

Anmerkungen:
(Wetter, Auffälliges, Art des Futters etc.)

OAG Rhein-Neckar

AK Bienenfresser