Coastal habitat use by bat species

In order to effectively conserve bat populations, it is imperative that their ecology and population trends are fully understood. In comparison to other habitats, such as woodland, there has been a lack of applied empirical studies into bat activity at coastal sites. Research undertaken worldwide indicates that certain coastal habitat types could be important for bat ecology, particularly coastal cliffs\(^1\,^2\) and saltmarsh\(^3\,^4\).

Coastal sites are dynamic and increasingly vulnerable to human development (commercial, industrial and residential), such as coastal defence and for tourism/recreation. Such anthropogenic impacts could affect bat distribution and populations but, due to a lack of applied empirical data and monitoring of bats at coastal sites, such effects are likely to be difficult to identify. It is therefore essential to begin to gain a baseline level of information on bat presence and habitat use around coastal areas.

Aims and objectives

The principal aim of this study was to gain a baseline level of information into how bats are using coastal habitats in Swansea Bay. The main objectives of the study were to:

- Identify the bat species present around the coastal sites of Swansea Bay.
- Identify the locations of high bat activity at coastal areas on Swansea Bay.
- Compare differences in bat activity between a sandy shore transect with a rocky shore transect.

Methods

The study was undertaken during July and August 2015, and focused on the use of coastal areas by bat species around Swansea Bay, South Wales. Two study locations were chosen that represented a sandy (Blackpill) and a rocky coastline (Mumbles Head). Walked transect routes were designed at each site, with the assistance of Rachel Taylor ACIEEM of BSG Ecology.

Blackpill is a suburban area located around Mumbles Road, which runs between Mumbles and Swansea city centre. A major part of the transect encompasses the coastline, which is predominately a sandy shore with some estuarine habitat.
The area between the coastline and Mumbles Road is a popular location for leisure activities, including golf and cycling, and is comprised of mainly parkland. Further inland, the transect runs along the edge of Clyne Woods and through Clyne Botanic Gardens, which contains a mixture of native woodland and ornamental parkland vegetation.

Mumbles Head is a headland located to the western side of Swansea Bay. The coastal area of the transect encompasses both Bracelet Bay and Limeslade Bay, which are largely rocky shores with a wrack-dominated strandline. The route also covered a suburban housing area and Mumbles Hill Local Nature Reserve (LNR). Mumbles Hill LNR covers 0.23km² and contains habitats including limestone grassland, maritime heath, scrub and woodland.

Both transects incorporated 12 stop points where the surveyors remained stationary for four minutes and recorded the number of bat passes in this time period. In order to best simulate the heterogeneity of the landscapes, it was decided that the stop points would not be evenly spaced but placed in locations where bats would be expected to forage. Twelve surveys of each transect route were undertaken, with an equal number of dusk and dawn transects. Surveyors listened for bat passes using a Magenta Bat4 heterodyne detector. The species of bat was identified where possible, and the location of the pass was recorded for later spatial analysis.

An Anabat SD1 frequency division detector was used to record bat passes during the transects. Sound files recorded were then analysed, using Analook software. Bat calls were identified to species level where possible using a set of frequency parameters described by Russ.

Results

A total of 1,059 passes by five bat species were recorded over the twenty-four surveys undertaken during the study. Species identified included common pipistrelle, soprano pipistrelle, noctule, serotine and Myotis species. A chi-squared statistical test was used to compare passes recorded at each transect. There was a significantly greater number of passes recorded at Blackpill than Mumbles Head (χ² = 217.3, P < 0.001, df = 2). Additionally, a significantly greater quantity of soprano pipistrelles (χ² = 242.1, P < 0.001, df = 1) were recorded at the Blackpill transect,
whereas a significantly greater quantity of common pipistrelle passes were recorded at the Mumbles transect ($\chi = 5, P = <0.05, df = 1$).

Hot spot analysis was performed on the spatial data using ArcGIS 10 to identify areas of high bat activity. Hot spot analysis calculates the Getis-Ord Gi* statistic for each datapoint, which produces a Z-score dependent on the level of spatial clustering. A spatially significant hot spot is determined when a high value feature is found in close proximity to numerous other high value features.

At the Blackpill transect (figure 1), significant hot spots ($Z = >1.96, P<0.05$) were identified at woodland edge and parkland habitats.

**Figure 1:** Map indicating bat pass activity hotspots along the Blackpill transect. Data points range from high clusters of activity (dark red) to low clusters of activity (blue). The stop points (red) are displayed proportionally, whereby size indicates total number of bat passes recorded.

At the Mumbles Head transect (figure 2), significant hotspots ($Z = >1.96, P<0.05$) were identified around the rocky coastlines of Bracelet Bay and Limeslade Bay, in addition to part of a suburban area.
Figure 3: Map indicating bat pass activity hotspots along the Mumbles Head transect. Data points range from high clusters of activity (red) to low clusters of activity (blue). The stop points (light blue) are displayed proportionally, whereby size indicates total number of bat passes recorded.

Discussion

The baseline surveys indicate that at least five species of bat are using coastal sites around Blackpill, and at least four species are using Mumbles Head.

At Blackpill, the most frequently recorded species were common and soprano pipistrelles, with these species accounting for 48% and 49% of all bat passes at the site respectively. At Mumbles Head, common pipistrelles accounted for 92% of the bat species recorded. The preference of soprano pipistrelles to forage in riparian habitat\(^8\) might explain their low encounter rate at Mumbles Head, as there are no fresh water habitats at the site.

Three noctule passes were recorded at the Blackpill transect; two records within woodland edge habitat and one at Blackpill beach. The single recording at the Mumbles Head transect was located on top of coastal cliffs, near the coastguard station. The passes recorded at Blackpill beach and the coastal cliffs of Mumbles
Head are unusual as they do not conform to the species’ favoured foraging habitats. It is possible that noctules are commuting offshore to forage in Swansea Bay, or further out into the Bristol Channel. A single pass by a serotine bat was recorded the entrance of Clyne Gardens.

Six Myotis sp. bat passes were recorded at the Blackpill transect and two at the Mumbles Head transect. At Blackpill, five of the recordings were located on the northern area of the golf course and a single record occurred within Clyne Gardens. At Mumbles Head, the two recordings were located at the northern area of Mumbles Hill Nature Reserve. The sonogram call attributes and the habitat present at the location of the recordings, suggests it is likely that most of the Myotis sp. recorded were Natterers' bats as they are known to exploit open habitats such as parkland.

During the Blackpill pilot survey greater and lesser horseshoe bats were recorded within the woodland edge habitat of the transect. However, the species’ lack of presence along the coastal strip could imply that most of their activity is focused within the main body of Clyne Woods.

Hotspot analysis shows a number of significant hotspots at both survey sites (figures 1 & 2). At Mumbles Head, significant hot spots of bat passes were identified at both Bracelet Bay and Limeslade Bay. Throughout the course of the study, common pipistrelles were observed foraging around cliff vegetation and on the strandline at the rocky shores of both sites. On one occasion an individual was observed landing on the strandline vegetation. In comparison, a number of cold spots were recorded along Blackpill beach, as well as large sections of the transect where no bat activity was recorded. The sandy shore, therefore, does not appear to be an important site of bat foraging activity, although visual observations were made of individual bats foraging around transitional vegetation that was located between the beach and parkland areas, including along the sea wall.

Conclusions

The project has provided a baseline level of information on bat activity at two coastal sites near Swansea by identifying the species present and the favoured foraging habitats. Coastal habitat use appears to be significantly greater at the rocky shore than the sandy shore habitat, with coastal cliff vegetation and strandlines being used
as foraging sites. It is hoped that future research can build upon this study to increase our knowledge of coastal habitat use by bat species in the U.K.

Working with BSG Ecology

The involvement of BSG Ecology was vital to the success of our project due to the guidance of Rachel Taylor in planning and undertaking a bat survey transect. Additionally, BSG Ecology provided us with an Anabat SD1 detector which allowed us to produce far more accurate results than would otherwise have been possible.


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