# CRRP Bat Diet Composition

## Bat Scat Collection

Bat faecal samples were analysed using genetics to determine insect prey for bats roosting in the Canning River Regional Park (CRRP). In total, 90 samples of bat faeces were collected and analysed as part of this project. The table below shows the number of samples collected from under each bat box on each date.

Table 1. Bat faecal samples collected from Caning River Regional park bat boxes between 2015 and 2018.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bat Box ID | | | | | | | | Annual |
| Year | Date | 1 | 2 | 4 | 5 | 6 | 8 | 9 | 13 | Total |
| 2015 | 12/02/15 |  |  |  |  |  | 6 |  |  | 10 |
|  | 12/10/15 |  |  |  |  |  |  |  | 4 |  |
| 2016 | 29/09/16 |  | 2 |  |  |  |  |  | 3 | 13 |
|  | 28/10/16 | 7 |  |  |  |  |  |  | 1 |  |
| 2017 | 3/01/17 | 1 |  | 1 |  | 3 |  |  |  | 24 |
|  | 23/02/17 |  |  | 1 |  | 3 |  |  |  |  |
|  | 30/03/17 | 10 |  |  |  |  |  |  |  |  |
|  | 20/10/17 | 1 |  |  |  |  |  |  |  |  |
|  | 23/10/17 | 2 |  |  |  |  |  |  |  |  |
|  | 10/12/17 |  |  |  |  |  |  |  | 2 |  |
| 2018 | 4/02/18 |  | 2 |  |  |  |  | 8 |  | 43 |
|  | 22/02/18 |  |  |  |  |  |  | 5 |  |  |
|  | 13/03/18 | 6 |  |  |  |  |  |  |  |  |
|  | 1/09/18 |  |  |  |  |  |  |  | 1 |  |
|  | 2/09/18 |  |  |  |  |  |  |  | 1 |  |
|  | 5/10/18 |  |  |  |  |  |  |  | 1 |  |
|  | 5/12/18 |  |  |  |  |  |  |  | 6 |  |
|  | 13/12/18 |  |  |  |  |  |  |  | 9 |  |
|  | Unknown |  |  |  | 4 |  |  |  |  |  |
| Box Total |  | 27 | 4 | 2 | 4 | 6 | 6 | 13 | 28 | 90 |

All bat scat samples belonged to Gould’s Wattled Bat (*Chalinolobus gouldii,* Gray 1841), collected from eight bat boxes within the CRRP. Prey DNA was successfully extracted and processed from 88 samples, yielding a total of 1378 prey DNA sequences, comprising 292 unique Operational Taxonomic Units (OTUs). There was a mean of 16 unique OTUs within each bat sample (Standard Error = 0.7; range 4 to 37).

All sequences were compared against publicly available nucleotide database collections for Lepidoptera, Coleoptera, and Diptera using the National Center for Biotechnology Information (NCBI) nucleotide Basic Local Alignment Search Tool (BLAST; version BLASTN 2.10.0+ <https://blast.ncbi.nlm.nih.gov/Blast.cgi>) (Altschul, 1997). The top 10 hits were downloaded for each sequence but only the first hit was used to determine prey species. The majority of OTUs matched to sequences within Lepidoptera, then Diptera and Coleoptera (202, 70, and 20, respectively).

Following Burgar et al., (2014) an OTU was matched to an insect (Coleoptera, Diptera, or Lepidoptera) DNA sequence found in the BOLD database based on the following criteria: for a species match, the OTU must have >99% sequence similarity with the BOLD sequence and the insect must have occurrence records in Western Australia; for a genus match, the OTU must have between 98-99% similarity and occurrence records in WA or have >99% similarity and occurrence records elsewhere in Australia. OTUs with <98% similarity to BOLD sequences were not considered of sufficient quality for matching. From the 292 unique OTUs only 73 met these criteria: 52 “species” matches and 25 “genus” matches. Note that there was some overlap in species identification between the two categories, with the similarity score dictating the category and thus the discrepancy between the 73 unique OTUs and 77 matches. Bat samples contained a mean of 5 OTUs that matched, at the species or genus level, to Lepidoptera, Diperta or Coleoptera (Standard Error = 0.3; range 1 to 17).

Gould’s Wattled Bat, like all bats, is an important species in terms of ecosystem services. Prey for Gould’s Wattled Bat comprises pests to humans, in terms of disease and agriculture. Mosquito DNA was found in 10% of the samples. In addition 20 agricultural pest species were found in 77 bat faecal samples; i.e., nearly 88% of samples contained at least one prey item that poses a threat to agriculture either in its adult or larval form. See Table 2 for a complete listing of OTUs that matched at the species or genus level to Lepidoptera, Coleoptera, and Diptera.

Table 2. Best “species” and “genus” matches based on >99% or 98-99% similarity and records from Western Australia (WA) or Australia (Aus). Grey highlighted cells are genus level matches. Common names are provided when possible. # Sequences refers to the number of bat faecal sample sequences that contained a match (some samples contained >1 match for the same species). Please note that DNA sequences extracted from bat feacal samples were only compared against BOLD databases for Coleoptera, Diptera and Lepidoptera. \* Denotes species without records in the online Atlas of Living Australia (ALA) database; occurrence records were found in the online BOLD database.

| Order | Family | Species | Common Name | # Sequences | WA record? | Aus record? |
| --- | --- | --- | --- | --- | --- | --- |
| Coleoptera | Curculionidae | *Orthorhinus cylindrirostris* | Elephant Beetle, Elephant Weevil | 1 | ✔ | ✔ |
| Diptera | Culicoidea | *Culex australicus* | Mosquito | 5 | ✔ | ✔ |
|  | Culicoidea | *Culex pipiens* | Mosquito | 4 | ✔ | ✔ |
|  | Tephritidae | *Ceratitis capitata* | Medfly | 1 | ✔ | ✔ |
| Lepidoptera | Carposinidae | *Carposina leptoneura* |  | 2 | ✔ | ✔ |
|  | Crambidae | *Achyra affinitalis* | Cotton web spinner | 16 | ✔ | ✔ |
|  | Crambidae | *Hellula hydralis* | Cabbage Centre Grub | 41 | ✔ | ✔ |
|  | Crambidae | *Herpetogramma licarsisalis* | Grass Webworm; Tropical Grass Webworm | 7 | ✔ | ✔ |
|  | Crambidae | *Hygraula nitens* |  | 3 | ✔ | ✔ |
|  | Crambidae | *Nomophila corticalis* |  | 1 | ✔ | ✔ |
|  | Crambidae | *Syntonarcha iriastis* |  | 1 | ✔ | ✔ |
|  | Depressariidae | *Eupselia sp. ANICMK55* |  | 1 | ✔ | ✔ |
|  | Depressariidae | *Thudaca haplonota* |  | 1 | ✔ | ✔ |
|  | Erebidae | *Calathusa ischnodes* |  | 1 | ✔ | ✔ |
|  | Erebidae | *Pandesma submurina* |  | 3 | ✔ | ✔ |
|  | Galacticidae | *Homadaula myriospila* |  | 1 | ✔ | ✗ |
|  | Gelechiidae | *Anarsia molybdota* |  | 1 | ✔ | ✔ |
|  | Geometridae | *Chlenomorpha lygdina* |  | 3 | ✔ | ✗ |
|  | Geometridae | *Chloroclystis insigillata* |  | 6 | ✔ | ✔ |
|  | Geometridae | *Ciampa arietaria* | Brown Pasture Looper | 1 | ✔ | ✔ |
|  | Geometridae | *Poecilasthena pulchraria* | Green Looping caterpillar | 3 | ✔ | ✔ |
|  | Geometridae | *Syneora nigrilinea* |  | 1 | ✔ | ✗ |
|  | Hepialidae | *Abantiades hydrographus* |  | 2 | ✔ | ✗ |
|  | Hepialidae | *Oxycanus occidentalis* |  | 1 | ✔ | ✗ |
|  | Lasiocampinae | *Entometa decorata* |  | 11 | ✔ | ✔ |
|  | Limacodidae | *Pseudanapaea dentifascia\** |  | 2 | ✔ | ✔ |
|  | Lymantriidae | *Leptocneria reducta* | White Cedar Moth | 14 | ✔ | ✔ |
|  | Noctuidae | *Agrotis ipsilon* | Dark Sword-grass; Black Cutworm | 14 | ✔ | ✔ |
|  | Noctuidae | *Agrotis munda* | Brown Cutworm; Pink Cutworm | 53 | ✔ | ✔ |
|  | Noctuidae | *Agrotis porphyricollis* | Variable Cutworm | 17 | ✔ | ✔ |
|  | Noctuidae | *Aquita tactalis* |  | 1 | ✔ | ✔ |
|  | Noctuidae | *Athetis tenuis* |  | 3 | ✔ | ✔ |
|  | Noctuidae | *Commonia hesychima* |  | 1 | ✔ | ✔ |
|  | Noctuidae | *Helicoverpa punctigera* | Native Budworm; Australian Budworm | 1 | ✔ | ✔ |
|  | Noctuidae | *Heliothis punctifera* | Lesser Budworm | 4 | ✔ | ✔ |
|  | Noctuidae | *Leucania stenographa* |  | 2 | ✔ | ✔ |
|  | Noctuidae | *Mythimna convecta* |  | 2 | ✔ | ✔ |
|  | Noctuidae | *Neumichtis sp. ANIC2* |  | 1 | ✔ | ✔ |
|  | Noctuidae | *Nola pycnopasta* |  | 2 | ✔ | ✔ |
|  | Noctuidae | *Persectania ewingii* | Southern Armyworm | 1 | ✔ | ✔ |
|  | Noctuidae | *Proteuxoa tibiata* |  | 3 | ✔ | ✔ |
|  | Noctuidae | *Spodoptera litura* | Tobacco Cutworm; Cotton Leafworm | 2 | ✔ | ✔ |
|  | Oecophoridae | *Palimmeces sp. ANIC58* |  | 1 | ✔ | ✗ |
|  | Oecophoridae | *Prionocris sp. ANIC2\** |  | 1 | ✔ | ✔ |
|  | Oecophoridae | *Prionocris sp. ANIC3\** |  | 9 | ✔ | ✔ |
|  | Pyralidae | *Endotricha pyrosalis* |  | 1 | ✔ | ✔ |
|  | Pyralidae | *Faveria tritalis* |  | 47 | ✔ | ✔ |
|  | Pyralidae | *Spectrotrota fimbrialis* |  | 3 | ✔ | ✔ |
|  | Scythrididae | *Scythris sp. ANIC15\** |  | 1 | ✔ | ✔ |
|  | Sphingidae | *Hippotion celerio* | Vine Hawk-moth; Silver-striped Hawk-moth | 4 | ✔ | ✔ |
|  | Sphingidae | *Hyles livornicoides* | Yeperenye caterpillar (larval form) | 15 | ✔ | ✔ |
|  | Tortricidae | *Zomariana doxasticana* |  | 2 | ✔ | ✔ |
| Coleoptera | Carabidae | *Bembidion opulentum* |  | 1 | ✗ | ✔ |
| Diptera | Tephritidae | *Bactrocera tryoni* | Queensland Fruit Fly | 3 | ✗ | ✔ |
| Lepidoptera | Crambidae | *Achyra affinitalis* | Cotton web spinner | 3 | ✔ | ✔ |
|  | Crambidae | *Calamotropha paludella* |  | 1 | ✗ | ✔ |
|  | Crambidae | *Herpetogramma licarsisalis* | Grass Webworm; Tropical Grass Webworm | 4 | ✔ | ✔ |
|  | Crambidae | *Palpita vitrealis* | Jasmine Moth | 1 | ✗ | ✔ |
|  | Erebidae | *Calathusa thermosticha* |  | 1 | ✗ | ✔ |
|  | Gelechiidae | *Anarsia dryinopa* |  | 9 | ✗ | ✔ |
|  | Gelechiidae | *Ardozyga catarrhacta* |  | 3 | ✗ | ✔ |
|  | Geometridae | *Dichromodes indicataria* |  | 1 | ✗ | ✔ |
|  | Geometridae | *Poecilasthena pulchraria* | Green Looping caterpillar | 2 | ✔ | ✔ |
|  | Noctuidae | *Mataeomera coccophaga* |  | 1 | ✗ | ✔ |
|  | Noctuidae | *Mythimna separata* | Northern Armyworm; Oriental Armyworm | 17 | ✗ | ✔ |
|  | Oecophoridae | *Chrysonoma fascialis\** |  | 2 | ✗ | ✔ |
|  | Oecophoridae | *Eochrois dejunctella* |  | 4 | ✗ | ✔ |
|  | Oecophoridae | *Garrha pudica* |  | 4 | ✗ | ✔ |
|  | Oecophoridae | *Nephogenes sp. ANIC4* |  | 4 | ✗ | ✔ |
|  | Oecophoridae | *Prionocris sp. ANIC3* |  | 1 | ✔ | ✔ |
|  | Oecophoridae | *Tymbophora peltastis* |  | 2 | ✗ | ✔ |
|  | Pyralidae | *Aglossa caprealis* |  | 1 | ✗ | ✔ |
|  | Pyralidae | *Cadra cautella* | Almond Moth; Tropical Warehouse Moth | 1 | ✗ | ✔ |
|  | Pyralidae | *Cadra figulilella* | Raisin Moth | 4 | ✗ | ✔ |
|  | Pyralidae | *Catamola funerea* | Snout Moth | 7 | ✗ | ✔ |
|  | Pyralidae | *Cryptoblabes euraphella* | Snout Moth | 1 | ✗ | ✔ |
|  | Pyralidae | *Ephestiopsis oenobarella* |  | 4 | ✗ | ✔ |

References:

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