**Correlated evolution of wing morphology and echolocation calls in bats**

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**Table S1** Original data in this study

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Species | Family | Mass  (kg) | Aspect ratio | Wing loading  (N/m2) | Relative wing loading | Dura  (ms) | FPeak  (kHz) | NCall | Context | Guild |
| *Neoromicia nana* (*Pipistrellus nanus*) | Vespertilionidae | 0.00421 | 5.80001 | 4.60001 | 28.50551 | 4.002 | 70.002 | NA | Hand release2 | EA3 |
| *Neoromicia capensis* | Vespertilionidae | 0.00631 | 5.70001 | 6.90001 | 37.35331 | 5.104 | 39.404 | 104 | Hand release4 | EA3 |
| *Nycticeinops schlieffeni* | Vespertilionidae | 0.00505 | 6.90005 | 6.70005 | 39.17495 | 3.504 | 42.504 | 24 | Hand release4 | EA6 |
| *Tylonycteris robustula* | Vespertilionidae | 0.00805 | 8.30005 | 13.30005 | 66.48935 | 3.307 | 51.037 | 47 | Combination7 | EA3 |
| *Vespertilio* *murinus* | Vespertilionidae | 0.01155 | 7.00005 | 10.20005 | 45.18245 | 13.278-10 | 25.598-10 | 1558-10 | Free flight8-10 | OA3 |
| *Vespertilio murinus* | Vespertilionidae | 0.01155 | 7.00005 | 10.20005 | 45.18245 | 11.3011 | 26.0011 | NA | Free flight11 | OA3 |
| *Pipistrellus kuhlii* | Vespertilionidae | 0.00475 | 6.30005 | 8.50005 | 50.73515 | 7.648-10 | 38.098-10 | 1428-10 | Free flight8-10 | EA3 |
| *Pipistrellus kuhlii* | Vespertilionidae | 0.00475 | 6.30005 | 8.50005 | 50.73515 | 6.4012 | 39.7012 | 3112 | Combination12 | EA3 |
| *Pipistrellus kuhlii* | Vespertilionidae | 0.00475 | 6.30005 | 8.50005 | 50.73515 | 5.7013 | 41.4013 | 10713 | Combination13 | EA3 |
| *Pipistrellus hesperidus* | Vespertilionidae | 0.00621 | 6.00001 | 6.30001 | 34.28751 | 2.504 | 59.104 | NA | Hand release4 | EA3 |
| *Pipistrellus* *pygmaeus* | Vespertilionidae | 0.00583 | 7.50003 | 8.10003 | 45.07493 | 6.718-10 | 54.988-10 | 1438-10 | Free flight8-10 | EA3 |
| *Pipistrellus* *pygmaeus* | Vespertilionidae | 0.00583 | 7.50003 | 8.10003 | 45.07493 | 5.5013 | 57.7013 | 2713 | Combination13 | EA3 |
| *Pipistrellus pipistrellus* | Vespertilionidae | 0.00525 | 7.50005 | 8.10005 | 46.74565 | 6.868-10 | 46.828-10 | 1538-10 | Free flight8-10 | EA3 |
| *Pipistrellus* *pipistrellus* | Vespertilionidae | 0.00525 | 7.50005 | 8.10005 | 46.74565 | 5.7012 | 48.6012 | 4712 | Combination12 | EA3 |
| *Pipistrellus pipistrellus* | Vespertilionidae | 0.00525 | 7.50005 | 8.10005 | 46.74565 | 5.9013 | 46.9013 | 6113 | Combination13 | EA3 |
| *Nyctalus* *leisleri* | Vespertilionidae | 0.01695 | 7.90005 | 19.30005 | 75.19745 | 10.828-10 | 25.598-10 | 1238-10 | Free flight8-10 | OA14 |
| *Nyctalus leisleri* | Vespertilionidae | 0.01695 | 7.90005 | 19.30005 | 75.19745 | 5.3013 | 30.7013 | 1313 | Combination | OA14 |
| *Nyctalus noctula* | Vespertilionidae | 0.02655 | 7.40005 | 16.10005 | 53.99565 | 14.508-10 | 22.308-10 | 1708-10 | Free flight8-10 | OA3 |
| *Nyctalus noctula* | Vespertilionidae | 0.02655 | 7.40005 | 16.10005 | 53.99565 | 10.9012 | 25.3012 | 2212 | Combination12 | OA3 |
| *Nyctalus noctula* | Vespertilionidae | 0.02655 | 7.40005 | 16.10005 | 53.99565 | 14.8012 | 22.3012 | 2612 | Combination12 | OA3 |
| *Nyctalus noctula* | Vespertilionidae | 0.02655 | 7.40005 | 16.10005 | 53.99565 | 14.7013 | 24.5013 | 4213 | Combination13 | OA3 |
| *Nyctalus noctula* | Vespertilionidae | 0.02655 | 7.40005 | 16.10005 | 53.99565 | 22.1013 | 20.7013 | 4213 | Combination13 | OA3 |
| *Pipistrellus nathusii* | Vespertilionidae | 0.00675 | 7.20005 | 9.80005 | 51.97515 | 7.658-10 | 40.358-10 | 1238-10 | Free flight8-10 | EA3 |
| *Pipistrellus* *nathusii* | Vespertilionidae | 0.00675 | 7.20005 | 9.80005 | 51.97515 | 6.2012 | 40.8012 | 112 | Hand release12 | EA3 |
| *Pipistrellus stenopterus* | Vespertilionidae | 0.015215 | 6.800015 | 17.700015 | 71.443815 | 9.7016 | 37.0016 | 1816 | Hand release16 | EA3 |
| *Pipistrellus stenopterus* | Vespertilionidae | 0.015215 | 6.800015 | 17.700015 | 71.443815 | 13.8016 | 31.0016 | 2016 | Hand release16 | EA3 |
| *Pipistrellus stenopterus* | Vespertilionidae | 0.015215 | 6.800015 | 17.700015 | 71.443815 | 8.3016 | 38.6016 | 616 | Hand release16 | EA3 |
| *Eptesicus nilssoni* | Vespertilionidae | 0.00925 | 6.60005 | 8.10005 | 38.65045 | 13.188-10 | 28.598-10 | 1678-10 | Free flight8-10 | EA14 |
| *Eptesicus nilssoni* | Vespertilionidae | 0.00925 | 6.60005 | 8.10005 | 38.65045 | 6.3017 | 30.5017 | 1217 | Roost emergence17 | EA14 |
| *Eptesicus serotinus* | Vespertilionidae | 0.02235 | 6.50005 | 12.20005 | 43.33815 | 8.388-10 | 30.408-10 | 2258-10 | Free flight8-10 | OA3 |
| *Eptesicus serotinus* | Vespertilionidae | 0.02235 | 6.50005 | 12.20005 | 43.33815 | 6.0012 | 31.7012 | 2412 | Combination12 | OA3 |
| *Eptesicus serotinus* | Vespertilionidae | 0.02235 | 6.50005 | 12.20005 | 43.33815 | 7.3013 | 29.9013 | 1513 | Combination13 | OA3 |
| *Eptesicus furinalis* | Vespertilionidae | 0.007618 | 6.200018 | 7.300018 | 37.123418 | 6.9119 | 39.7719 | 10019 | Combination19 | EA20 |
| *Eptesicus* *brasiliensis* | Vespertilionidae | 0.009515 | 6.332921 | NA | 33.557521 | 3.0022 | 41.1022 | 222 | Hand release22 | EA20 |
| *Eptesicus fuscus* | Vespertilionidae | 0.01595 | 6.40005 | 9.40005 | 37.37685 | 10.6023 | 27.6023 | 83523 | Free flight23 | OA3 |
| *Ia io* | Vespertilionidae | 0.054924 | 6.520024 | 16.190024 | 42.593924 | 2.4025 | 27.6025 | NA | Hand release25 | OA14 |
| *Ia io* | Vespertilionidae | 0.054924 | 6.520024 | 16.190024 | 42.593924 | 3.8025 | 24.8025 | NA | Hand release25 | OA14 |
| *Glauconycteris variegate* (*Chalinolobus variegatus*) | Vespertilionidae | 0.01286 | 6.20006 | 8.60006 | 36.75916 | 5.3026 | 37.5026 | 21126 | Free flight26 | EA6 |
| *Lasionycteris noctivagans* | Vespertilionidae | 0.01065 | 6.60005 | 8.20005 | 37.32325 | 9.4027 | 28.2027 | NA | Free flight27 | EA3 |
| *Plecotus auritus* | Vespertilionidae | 0.00905 | 5.70005 | 7.10005 | 34.12795 | 3.408-10 | 34.48-10 | 2248-10 | Free flight8-10 | NG3 |
| *Plecotus austriacus* | Vespertilionidae | 0.01005 | 6.10005 | 7.90005 | 36.66295 | 3.308-10 | 30.98-10 | 2168-10 | Free flight8-10 | NG3 |
| *Otonycteris hemprichii* | Vespertilionidae | 0.026028 | 6.000028 | 9.590028 | 32.000028 | 5.1929 | 24.4529 | 6829 | Free flight29 | NG14 |
| *Barbastella barbastellus* | Vespertilionidae | 0.01035 | 6.00005 | 9.10005 | 41.81805 | 4.118-10 | 37.858-10 | 558-10 | Free flight8-10 | OA3 |
| *Barbastella barbastellus* | Vespertilionidae | 0.01035 | 6.00005 | 9.10005 | 41.81805 | 3.4013 | 33.2013 | 1013 | Combination13 | OA3 |
| *Barbastella barbastellus* | Vespertilionidae | 0.01035 | 6.00005 | 9.10005 | 41.81805 | 4.3013 | 38.9013 | 1013 | Combination13 | OA3 |
| *Antrozous pallidus* | Vespertilionidae | 0.01735 | 6.10005 | 8.10005 | 31.31445 | 5.6319 | 36.4619 | 10019 | Hand release19 | NG30 |
| *Lasiurus borealis* | Vespertilionidae | 0.01675 | 6.70005 | 14.00005 | 54.76425 | 10.5031 | 33.9031 | NA | Free flight31 | EA3 |
| *Lasiurus* *borealis* | Vespertilionidae | 0.01675 | 6.70005 | 14.00005 | 54.76425 | 9.1523 | 36.4523 | 63923 | Free flight23 | EA3 |
| *Lasiurus intermedius* | Vespertilionidae | 0.020218 | 7.700018 | 10.800018 | 39.650618 | 9.8032 | 28.3032 | 2032 | Free flight32 | EA33 |
| *Lasiurus cinereus* | Vespertilionidae | 0.03305 | 8.10005 | 16.50005 | 51.43555 | 8.0034 | 27.8034 | NA | Free flight34 | EA3 |
| *Lasiurus ega* | Vespertilionidae | 0.010718 | 7.600018 | 7.200018 | 32.669218 | 8.7032 | 32.2032 | 3432 | Free flight32 | EA20 |
| *Scotophilus dinganii* | Vespertilionidae | 0.02405 | 7.30005 | 12.40005 | 42.98315 | 4.904 | 33.604 | NA | Hand release4 | EA3 |
| *Scotophilus heathii* | Vespertilionidae | 0.03455 | 8.00005 | 15.00005 | 46.07195 | 2.4035 | 41.2035 | NA | Hand release35 | OA3 |
| *Scotophilus kuhlii* | Vespertilionidae | 0.019936 | 7.000036 | 16.800036 | 61.997536 | 2.9635 | 45.2635 | NA | Hand release35 | EA3 |
| *Myotis ricketti*  (*Myotis pilosus*) | Vespertilionidae | 0.017524 | 5.300024 | 8.800024 | 33.890524 | 4.0037 | 45.3037 | 537 | Free flight37 | ET38 |
| *Myotis adversus* | Vespertilionidae | 0.01035 | 6.70005 | 7.90005 | 36.30355 | 4.6836 | 46.2036 | 24336 | Hand release36 | ET3 |
| *Myotis dasycneme* | Vespertilionidae | 0.01145 | 6.80005 | 10.40005 | 46.20275 | 8.9839 | 33.7939 | NA | Free flight39 | ET3 |
| *Myotis muricola* | Vespertilionidae | 0.005024 | 5.880024 | 4.400024 | 25.726824 | 1.9037 | 66.2037 | 437 | Hand release37 | NG40 |
| *Myotis* *nattereri* | Vespertilionidae | 0.00705 | 6.40005 | 6.10005 | 31.88305 | 4.078-10 | 54.398-10 | 1728-10 | Free flight8-10 | NG3 |
| *Myotis* *nattereri* | Vespertilionidae | 0.00705 | 6.40005 | 6.10005 | 31.88305 | 4.7013 | 46.9013 | 1213 | Hand release13 | NG3 |
| *Myotis chinensis* | Vespertilionidae | 0.031824 | 5.460024 | 9.530024 | 30.077024 | 3.6037 | 49.0037 | 837 | Hand release37 | NG41 |
| *Myotis blythii* | Vespertilionidae | 0.021028 | 6.700028 | 10.209328 | 37.000028 | 5.278-10 | 39.858-10 | 1248-10 | Free flight8-10 | NG3 |
| *Myotis blythii* | Vespertilionidae | 0.021028 | 6.700028 | 10.209328 | 37.000028 | 4.3013 | 41.4013 | 4913 | Hand release13 | NG3 |
| *Myotis myotis* | Vespertilionidae | 0.02655 | 6.30005 | 11.20005 | 37.56215 | 5.588-10 | 40.048-10 | 2318-10 | Free flight8-10 | NG3 |
| *Myotis myotis* | Vespertilionidae | 0.02655 | 6.30005 | 11.20005 | 37.56215 | 4.6012 | 39.4012 | 4712 | Hand release12 | NG3 |
| *Myotis myotis* | Vespertilionidae | 0.02655 | 6.30005 | 11.20005 | 37.56215 | 4.6013 | 39.1013 | 4213 | Hand release13 | NG3 |
| *Myotis bechsteinii* | Vespertilionidae | 0.01015 | 6.00005 | 9.00005 | 41.62965 | 4.678-10 | 49.708-10 | 2208-10 | Free flight8-10 | NG14 |
| *Myotis bechsteinii* | Vespertilionidae | 0.01015 | 6.00005 | 9.00005 | 41.62965 | 4.6012 | 44.3012 | 112 | Hand release12 | NG14 |
| *Myotis daubentonii* | Vespertilionidae | 0.00705 | 6.30005 | 7.00005 | 36.58705 | 4.178-10 | 47.918-10 | 2018-10 | Free flight8-10 | ET3 |
| *Myotis daubentonii* | Vespertilionidae | 0.00705 | 6.30005 | 7.00005 | 36.58705 | 4.2012 | 49.3012 | 612 | Hand release12 | ET3 |
| *Myotis emarginatus* | Vespertilionidae | 0.00675 | 5.90005 | 7.10005 | 37.65545 | 3.6013 | 58.0013 | 5213 | Combination13 | NG3 |
| *Myotis tricolor* | Vespertilionidae | 0.01605 | 6.20005 | 8.20005 | 32.53725 | 3.304 | 47.804 | NA | Hand release4 | EA3 |
| *Myotis albescens* | Vespertilionidae | 0.00595 | 6.90005 | 7.50005 | 41.49895 | 2.5042 | 43.0043 | NA | Free flight43 | ET20 |
| *Myotis nigricans* | Vespertilionidae | 0.00425 | 6.50005 | 6.10005 | 37.80085 | 7.2044 | 54.2044 | 37244 | Free flight44 | EA20 |
| *Myotis nigricans* | Vespertilionidae | 0.00425 | 6.50005 | 6.10005 | 37.80085 | 4.3044 | 55.0044 | 43044 | Free flight44 | EA20 |
| *Myotis keaysi* | Vespertilionidae | 0.003818 | 6.400018 | 5.300018 | 33.957418 | 3.3019 | 60.8719 | 10019 | Combination19 | EA45 |
| *Myotis thysanodes* | Vespertilionidae | 0.00845 | 6.10005 | 6.20005 | 30.49515 | 3.7119 | 29.0219 | 10019 | Hand release19 | EA46 |
| *Myotis lucifugus* | Vespertilionidae | 0.00715 | 6.00005 | 7.50005 | 39.01555 | 5.002 | 45.002 | NA | Hand release2 | NG3 |
| *Myotis lucifugus* | Vespertilionidae | 0.00715 | 6.00005 | 7.50005 | 39.01555 | 6.6047 | 45.9047 | 4047 | Hand release47 | NG3 |
| *Myotis leibii* | Vespertilionidae | 0.00655 | 6.10005 | 6.70005 | 35.89475 | 5.002 | 44.002 | NA | Hand release2 | NG46 |
| *Myotis leibii* | Vespertilionidae | 0.00655 | 6.10005 | 6.70005 | 35.89475 | 5.3047 | 48.5047 | 4047 | Hand release47 | NG46 |
| *Myotis californicus* | Vespertilionidae | 0.00425 | 5.60005 | 4.80005 | 29.74495 | 6.002 | 43.002 | NA | Hand release2 | EA48 |
| *Myotis volans* | Vespertilionidae | 0.01045 | 5.80005 | 8.30005 | 38.01905 | 10.002 | 46.002 | NA | Hand release2 | EA3 |
| *Myotis brandtii* | Vespertilionidae | 0.005315 | 6.200015 | 6.500015 | 37.274515 | 3.0649 | 47.9049 | 4249 | Combination49 | EA50 |
| *Myotis mystacinus* | Vespertilionidae | 0.00545 | 6.00005 | 7.10005 | 40.46245 | 3.8012 | 47.7012 | 112 | Hand release12 | EA14 |
| *Myotis* *mystacinus* | Vespertilionidae | 0.00545 | 6.00005 | 7.10005 | 40.46245 | 4.2013 | 47.5013 | 1313 | Hand release13 | EA14 |
| *Murina suilla* | Vespertilionidae | 0.004015 | 5.500015 | 4.900015 | 30.862415 | 2.917 | 101.937 | 347 | Combination7 | NG3 |
| *Murina cyclotis* | Vespertilionidae | 0.006124 | 4.390024 | 5.460024 | 29.877424 | 1.787 | 93.817 | 287 | Combination7 | NG46 |
| *Miniopterus natalensis* | Miniopteridae | 0.01221 | 5.90001 | 7.90001 | 34.31181 | 3.404 | 51.404 | NA | Hand release4 | EA3 |
| *Miniopterus fraterculus* | Miniopteridae | 0.00851 | 5.70001 | 6.40001 | 31.35481 | 3.704 | 62.104 | NA | Hand release4 | EA3 |
| *Miniopterus australis* | Miniopteridae | 0.006751 | 6.790051 | 5.770051 | 30.601751 | 4.427 | 61.467 | 57 | Combination7 | EA3 |
| *Miniopterus schreibersii* | Miniopteridae | 0.013951 | 6.660051 | 9.710051 | 40.378751 | 9.208-10 | 53.278-10 | 1148-10 | Free flight8-10 | EA3 |
| *Miniopterus schreibersii* | Miniopteridae | 0.013951 | 6.660051 | 9.710051 | 40.378751 | 6.7012 | 54.9012 | 6112 | Combination12 | EA3 |
| *Miniopterus schreibersii* | Miniopteridae | 0.013951 | 6.660051 | 9.710051 | 40.378751 | 5.8013 | 54.2013 | 11713 | Combination13 | EA3 |
| *Eumops glaucinus* | Molossidae | 0.037028 | 7.800028 | 16.470028 | 48.900028 | 14.2052 | 17.9052 | 26952 | Free flight52 | OA20 |
| *Nyctinomops laticaudatus* | Vespertilionidae | 0.01303 | 12.70003 | 12.70003 | 54.0041 | 4.8519 | 25.6819 | 5719 | Combination19 | OA20 |
| *Molossus rufus* | Molossidae | 0.02803 | 9.00003 | 23.40003 | 77.0510 | 13.2032 | 29.4032 | 832 | Free flight32 | OA45 |
| *Molossus rufus* | Molossidae | 0.02803 | 9.00003 | 23.40003 | 77.0510 | 13.4032 | 33.0032 | 832 | Free flight32 | OA45 |
| *Molossus molossus* | Molossidae | 0.01625 | 8.70005 | 16.00005 | 63.2250 | 11.3553 | 34.5053 | NA | Free flight53 | OA20 |
| *Molossus molossus* | Molossidae | 0.01625 | 8.70005 | 16.00005 | 63.2250 | 11.5053 | 39.6553 | NA | Free flight53 | OA20 |
| *Mops condylurus* | Molossidae | 0.02831 | 7.40001 | 18.50001 | 60.70041 | 10.004 | 26.704 | NA | Hand release4 | OA3 |
| *Chaerephon* *pumilus* | Molossidae | 0.01131 | 7.40001 | 10.80001 | 48.12081 | 13.6054 | 23.9054 | 6054 | Roost emergence54 | OA3 |
| *Tadarida aegyptiaca* | Molossidae | 0.01604 | 8.12494 | 13.53104 | 53.69054 | 15.5055 | 19.4455 | 12055 | Roost emergence55 | OA3 |
| *Tadarida brasiliensis* | Molossidae | 0.01255 | 8.20005 | 11.50005 | 49.54485 | 11.8456 | 27.0756 | 390156 | Hand release56 | OA45 |
| *Tadarida teniotis* | Molossidae | 0.02503 | 9.80003 | 19.00003 | 64.97113 | 15.068-10 | 12.148-10 | 1158-10 | Free flight8-10 | OA3 |
| *Tadarida* *teniotis* | Molossidae | 0.02503 | 9.80003 | 19.00003 | 64.97113 | 18.4012 | 13.2012 | 1012 | Free flight12 | OA3 |
| *Tadarida teniotis* | Molossidae | 0.02503 | 9.80003 | 19.00003 | 64.97113 | 16.6013 | 13.0013 | 2113 | Free flight13 | OA3 |
| *Tadarida* *fulminans* | Molossidae | 0.03305 | 14.30005 | 20.20005 | 62.96965 | 20.002 | 17.002 | NA | Hand release2 | OA6 |
| *Artibeus lituratus* | Phyllostomidae | 0.05965 | 6.10005 | 17.70005 | 45.3089 | 2.0419 | 61.4419 | 2419 | Hand release19 | NG20 |
| *Artibeus jamaicensis* | Phyllostomidae | 0.04705 | 6.40005 | 16.60005 | 45.9936 | 2.4519 | 57.0419 | 10019 | Hand release19 | NG20 |
| *Phyllops falcatus* | Phyllostomidae | 0.020957 | 6.570057 | 10.880057 | 39.4934 | 4.2058 | 56.2058 | 6458 | Free flight58 | NG57 |
| *Stenoderma rufum* | Phyllostomidae | 0.02235 | 5.90005 | 18.20005 | 64.6519 | 3.1059 | 67.6059 | NA | Hand release59 | NG60, 61 |
| *Platyrrhinus helleri* | Phyllostomidae | 0.013515 | 6.468021 | NA | 43.861821 | 1.3022 | 99.0022 | 522 | Hand release22 | NG20 |
| *Chiroderma villosum* | Phyllostomidae | 0.02295 | 6.40005 | 14.00005 | 49.2941 | 1.4022 | 91.8022 | 422 | Hand release22 | NG20 |
| *Chiroderma trinitatum* | Phyllostomidae | 0.013715 | 6.341021 | NA | 37.455321 | 1.5022 | 96.9022 | 322 | Hand release22 | NG20 |
| *Uroderma bilobatum* | Phyllostomidae | 0.01545 | 6.30005 | 10.10005 | 40.5902 | 1.6022 | 74.7022 | 922 | Hand release22 | NG20 |
| *Sturnira lilium* | Phyllostomidae | 0.01505 | 6.50005 | 12.20005 | 49.4617 | 2.7059 | 73.1059 | NA | Hand release59 | NG62 |
| *Carollia perspicillata* | Phyllostomidae | 0.01915 | 6.10005 | 11.40005 | 42.6419 | 1.8022 | 74.9022 | 1922 | Hand release22 | NG20 |
| *Phyllostomus hastatus* | Phyllostomidae | 0.10705 | 7.60005 | 25.20005 | 53.0771 | 2.7022 | 47.1022 | 322 | Hand release22 | NG20 |
| *Mimon crenulatum* | Phyllostomidae | 0.01485 | 8.30005 | 8.10005 | 32.9865 | 1.5022 | 66.1022 | 322 | Hand release22 | NG20 |
| *Tonatia saurophila* | Phyllostomidae | 0.02296 | 5.905021 | NA | 30.424421 | 1.4022 | 56.5022 | 622 | Hand release22 | NG20 |
| *Macrophyllum macrophyllum* | Phyllostomidae | 0.008963 | 5.500063 | 9.100063 | 43.9871 | 2.3064 | 55.0064 | 2164 | Free flight64 | ET65 |
| *Macrophyllum macrophyllum* | Phyllostomidae | 0.008963 | 5.500063 | 9.100063 | 43.9871 | 3.6064 | 58.0064 | 19564 | Free flight64 | ET65 |
| *Vampyrum spectrum* | Phyllostomidae | 0.15805 | 5.40005 | 18.40005 | 34.0334 | 2.8022 | 79.4022 | 122 | Hand release22 | NG20 |
| *Glossophaga longirostris* | Phyllostomidae | 0.011959 | 6.440059 | 9.340059 | 40.9041 | 1.6059 | 90.8059 | NA | Hand release59 | NG45 |
| *Glossophaga soricina* | Phyllostomidae | 0.01065 | 6.40005 | 10.50005 | 47.7920 | 2.0022 | 94.5022 | 2722 | Hand release22 | NG20 |
| *Monophyllus* *plethodon* | Phyllostomidae | 0.014815 | 6.500015 | 11.500015 | 46.8222 | 1.3059 | 85.6059 | NA | Hand release59 | NG61, 66 |
| *Erophylla bombifrons* | Phyllostomidae | 0.016359 | 6.230059 | 9.570059 | 37.7389 | 4.7059 | 37.9059 | NA | Hand release59 | NG67 |
| *Erophylla sezekorni* | Phyllostomidae | 0.01635 | 6.10005 | 13.10005 | 51.6594 | 2.3031 | 65.3031 | NA | Roost emergence31 | NG46 |
| *Brachyphylla cavernarum* | Phyllostomidae | 0.046215 | 6.400015 | 13.600015 | 37.9060 | 2.6059 | 51.4059 | NA | Hand release59 | NG46 |
| *Choeroniscus minor* | Phyllostomidae | 0.00885 | 6.20005 | 10.40005 | 50.3660 | 1.5022 | 97.9022 | 522 | Hand release22 | NG68 |
| *Desmodus rotundus* | Phyllostomidae | 0.02855 | 6.70005 | 14.00005 | 45.8277 | 2.5419 | 56.8719 | 4119 | Hand release19 | NG20 |
| *Micronycteris megalotis* | Phyllostomidae | 0.00715 | 5.60005 | 7.30005 | 37.9751 | 1.5022 | 98.1022 | 622 | Hand release22 | NG45 |
| *Micronycteris hirsuta* | Phyllostomidae | 0.012415 | 5.388821 | NA | 33.755221 | 1.4022 | 80.8022 | 522 | Hand release22 | NG20 |
| *Micronycteris minuta* | Phyllostomidae | 0.006515 | 5.812021 | NA | 40.766921 | 1.6022 | 61.2022 | 322 | Hand release22 | NG68 |
| *Macrotus waterhousii* | Phyllostomidae | 0.00955 | 9.00005 | 7.30005 | 34.4626 | 1.3031 | 69.2031 | NA | Roost emergence31 | NG69 |
| *Pteronotus macleayii* | Mormoopidae | 0.007170 | 7.100070 | 5.900070 | 30.6922 | 4.0371 | 69.0271 | 17171 | Hand release71 | EA72 |
| *Pteronotus personatus* | Mormoopidae | 0.00803 | 5.80003 | 7.90003 | 39.4936 | 5.7119 | 70.5319 | 10019 | Combination19 | EA20 |
| *Pteronotus davyi* | Mormoopidae | 0.009959 | 6.350059 | 6.330059 | 29.4753 | 4.6059 | 67.0059 | NA | Hand release59 | EA33 |
| *Pteronotus parnellii* | Mormoopidae | 0.019715 | 6.700015 | 6.500015 | 24.0762 | 22.0059 | 61.3059 | NA | Hand release59 | NF3 |
| *Mormoops megalophylla* | Mormoopidae | 0.01705 | 7.10005 | 11.20005 | 43.5521 | 6.8032 | 51.6032 | 1632 | Free flight32 | EA45 |
| *Noctilio leporinus* | Noctilionidae | 0.05905 | 9.00005 | 15.20005 | 39.0408 | 8.4119 | 31.0319 | 5219 | Combination19 | ET3 |
| *Noctilio albiventris* | Noctilionidae | 0.02965 | 7.80005 | 13.90005 | 44.9297 | 10.5073 | 70.0043 | NA | Free flight43 | ET3 |
| *Mystacina tuberculata* | Mystacinidae | 0.01355 | 7.00005 | 12.30005 | 51.6494 | 2.5074 | 49.3074 | 3174 | Combination74 | NG75 |
| *Mystacina tuberculata* | Mystacinidae | 0.01355 | 7.00005 | 12.30005 | 51.6494 | 3.5074 | 45.5074 | 1174 | Combination74 | NG75 |
| *Peropteryx macrotis* | Emballonuridae | 0.006118 | 7.600018 | 5.900018 | 32.2851 | 7.3019 | 41.6119 | 10019 | Free flight19 | OA3 |
| *Peropteryx kappleri* | Emballonuridae | 0.00703 | 9.00003 | 8.50003 | 44.4271 | 9.6076 | 31.6076 | 14076 | Free flight76 | OA3 |
| *Cormura brevirostris* | Emballonuridae | 0.00903 | 7.20003 | 8.20003 | 39.4153 | 8.2076 | 25.2076 | 7676 | Free flight76 | EA20 |
| *Cormura brevirostris* | Emballonuridae | 0.00903 | 7.20003 | 8.20003 | 39.4153 | 8.2076 | 28.1076 | 10576 | Free flight76 | EA20 |
| *Cormura brevirostris* | Emballonuridae | 0.00903 | 7.20003 | 8.20003 | 39.4153 | 8.6076 | 31.4076 | 10276 | Free flight76 | EA20 |
| *Diclidurus albus* | Emballonuridae | 0.02303 | 9.00003 | 12.90003 | 45.3551 | 9.4076 | 23.5076 | 6276 | Free flight76 | OA20 |
| *Diclidurus albus* | Emballonuridae | 0.02303 | 9.00003 | 12.90003 | 45.3551 | 9.6076 | 23.5076 | 3676 | Free flight76 | OA3 |
| *Diclidurus albus* | Emballonuridae | 0.02303 | 9.00003 | 12.90003 | 45.3551 | 9.7076 | 25.8076 | 3476 | Free flight76 | OA3 |
| *Cyttarops alecto* | Emballonuridae | 0.00653 | 5.80003 | 6.10003 | 32.6803 | 9.8076 | 35.9076 | 12376 | Free flight76 | EA20 |
| *Saccopteryx bilineata* | Emballonuridae | 0.00755 | 6.10005 | 5.90005 | 30.1366 | 8.8032 | 46.8032 | 2532 | Free flight32 | EA20 |
| *Saccopteryx bilineata* | Emballonuridae | 0.00755 | 6.10005 | 5.90005 | 30.1366 | 9.2032 | 44.5032 | 2532 | Free flight32 | EA20 |
| *Centronycteris centralis* | Emballonuridae | 0.00553 | 5.80003 | 5.40003 | 30.5866 | 5.9076 | 41.3076 | 15676 | Free flight76 | EA20 |
| *Rhynchonycteris naso* | Emballonuridae | 0.00395 | 6.50005 | 4.30005 | 27.3128 | 4.3819 | 95.7919 | 10019 | Free flight19 | EA62 |
| *Emballonura monticola* | Emballonuridae | 0.00535 | 7.70005 | 5.80005 | 33.2604 | 5.427 | 51.247 | 177 | Combination7 | EA3 |
| *Taphozous mauritianus* | Emballonuridae | 0.03404 | 7.21674 | 15.42744 | 47.6157 | 7.404 | 25.904 | NA | Hand release4 | OA3 |
| *Taphozous melanopogon* | Emballonuridae | 0.03915 | 10.00005 | 25.90005 | 76.3005 | 6.027 | 29.717 | 337 | Combination7 | OA3 |
| *Saccolaimus saccolaimus* | Emballonuridae | 0.046436 | 8.600036 | 18.400036 | 51.1997 | 12.2036 | 22.6036 | 19836 | Hand release36 | OA3 |
| *Nycteris tragata* | Nycteridae | 0.016536 | 4.700036 | 7.700036 | 30.2415 | 2.877 | 97.647 | 167 | Combination7 | NG3 |
| *Nycteris macrotis* | Nycteridae | 0.01155 | 5.20005 | 7.10005 | 31.4505 | 1.204 | 76.704 | NA | Hand release4 | NG77 |
| *Nycteris thebaica* | Nycteridae | 0.01105 | 5.50005 | 6.30005 | 28.3233 | 1.3529 | 70.1829 | 1329 | Free flight29 | NG3 |
| *Rhinolophus* *hildebrandti* | Rhinolophidae | 0.02435 | 6.80005 | 9.80005 | 33.8301 | 45.2078 | 42.1078 | 1278 | Hand release78 | NF61, 79 |
| *Rhinolophus hildebrandti* | Rhinolophidae | 0.02435 | 6.80005 | 9.80005 | 33.8301 | 57.7078 | 42.8078 | 2478 | Hand release78 | NF61, 79 |
| *Rhinolophus* *hildebrandti* | Rhinolophidae | 0.02435 | 6.80005 | 9.80005 | 33.8301 | 46.908 | 42.2078 | 1978 | Free flight78 | NF61, 79 |
| *Rhinolophus ferrumequinum* | Rhinolophidae | 0.02265 | 6.10005 | 12.20005 | 43.1455 | 45.008-10 | 82.408-10 | 538-10 | Free flight8-10 | NF3, 80 |
| *Rhinolophus ferrumequinum* | Rhinolophidae | 0.02265 | 6.10005 | 12.20005 | 43.1455 | 49.4049 | 82.3049 | 2149 | Combination49 | NF3, 80 |
| *Rhinolophus ferrumequinum* | Rhinolophidae | 0.02265 | 6.10005 | 12.20005 | 43.1455 | 53.8012 | 78.7012 | 2812 | Combination12 | NF3, 80 |
| *Rhinolophus ferrumequinum* | Rhinolophidae | 0.02265 | 6.10005 | 12.20005 | 43.1455 | 50.5013 | 81.3013 | 6313 | Combination13 | NF3, 80 |
| *Rhinolophus euryale* | Rhinolophidae | 0.01095 | 6.20005 | 8.10005 | 36.5267 | 53.8012 | 104.8012 | 3812 | Combination12 | NF81 |
| *Rhinolophus euryale* | Rhinolophidae | 0.01095 | 6.20005 | 8.10005 | 36.5267 | 40.6013 | 102.4013 | 4513 | Combination13 | NF81 |
| *Rhinolophus mehelyi* | Rhinolophidae | 0.01582 | 6.6882 | 9.2582 | 37.5017 | 35.9012 | 109.5012 | 1612 | Combination12 | NF81 |
| *Rhinolophus landeri* | Rhinolophidae | 0.00905 | 6.10005 | 6.70005 | 32.2052 | 43.1078 | 109.0078 | 878 | Hand release78 | NF61, 77 |
| *Rhinolophus hipposideros* | Rhinolophidae | 0.00685 | 5.70005 | 7.10005 | 37.4700 | 43.6013 | 111.1013 | 3413 | Combination13 | NF3, 80 |
| *Rhinolophus hipposideros* | Rhinolophidae | 0.00685 | 5.70005 | 7.10005 | 37.4700 | 45.7049 | 109.0049 | 2449 | Combination49 | NF3, 80 |
| *Rhinolophus luctus* | Rhinolophidae | 0.033915 | 5.600015 | 9.100015 | 28.1142 | 69.9036 | 42.6036 | 2836 | Hand release36 | NF3 |
| *Rhinolophus trifoliatus* | Rhinolophidae | 0.012336 | 4.500036 | 6.300036 | 27.2661 | 44.5036 | 53.1036 | 4036 | Hand release36 | NF3 |
| *Rhinolophus macrotis* | Rhinolophidae | 0.005224 | 5.020024 | 4.800024 | 27.7011 | 30.4037 | 66.4037 | 1137 | Hand release37 | NF61, 83 |
| *Rhinolophus pusillus* | Rhinolophidae | 0.004324 | 5.090024 | 4.680024 | 28.7747 | 31.6037 | 105.0037 | 1037 | Combination37 | NF3 |
| *Rhinolophus lepidus* | Rhinolophidae | 0.006536 | 5.000036 | 6.200036 | 33.2502 | 25.2335 | 102.3135 | NA | Hand release35 | NF3 |
| *Rhinolophus lepidus* | Rhinolophidae | 0.006536 | 5.000036 | 6.200036 | 33.2502 | 28.3036 | 97.8036 | 24036 | Hand release36 | NF3 |
| *Rhinolophus sinicus* | Rhinolophidae | 0.011924 | 5.320024 | 8.440024 | 36.9626 | 33.8037 | 76.8037 | 737 | Hand release37 | NF61, 84 |
| *Rhinolophus stheno* | Rhinolophidae | 0.007915 | 6.000015 | 6.400015 | 32.1293 | 30.5037 | 91.1037 | 637 | Hand release37 | NF3 |
| *Rhinolophus affinis* | Rhinolophidae | 0.013924 | 5.140024 | 7.200024 | 29.9410 | 43.2037 | 71.1037 | 1837 | Combination37 | NF61, 85 |
| *Rhinolophus pearsonii* | Rhinolophidae | 0.015724 | 4.990024 | 7.290024 | 29.1095 | 41.5037 | 53.0037 | 1837 | Combination37 | NF61, 86 |
| *Hipposideros speoris* | Hipposideridae | 0.01105 | 6.50005 | 8.90005 | 40.0123 | 6.9987 | 130.4987 | NA | Combination 87 | NF3 |
| *Hipposideros pomona* | Hipposideridae | 0.006724 | 4.800024 | 5.440024 | 28.8515 | 7.0037 | 125.1037 | 737 | Combination37 | NF61, 88 |
| *Hipposideros caffer* | Hipposideridae | 0.00935 | 6.30005 | 6.60005 | 31.3797 | 8.0089 | 145.4089 | NA | Free flight89 | NF3 |
| *Hipposideros ruber* | Hipposideridae | 0.010115 | 6.600015 | 8.000015 | 36.9919 | 8.0675 | 131.9675 | 2275 | Free flight75 | NF61, 75 |
| *Hipposideros armiger* | Hipposideridae | 0.062124 | 5.570024 | 12.210024 | 30.8303 | 11.1037 | 65.0037 | 2937 | Combination37 | NF61, 90 |
| *Hipposideros larvatus* | Hipposideridae | 0.018824 | 5.300024 | 8.880024 | 33.3915 | 7.8037 | 86.5037 | 3237 | Combination37 | NF61, 90 |
| *Aselliscus stoliczkanus* | Hipposideridae | 0.005824 | 5.650024 | 4.900024 | 27.2675 | 4.7037 | 127.5037 | 537 | Combination37 | NF61, 90 |
| *Asellia tridens* | Hipposideridae | 0.011915 | 7.000015 | 9.000015 | 39.3820 | 10.3091 | 117.9091 | 1591 | Free flight91 | NF61, 75 |
| *Asellia tridens* | Hipposideridae | 0.011915 | 7.000015 | 9.000015 | 39.3820 | 7.9729 | 116.6029 | 5629 | Free flight29 | NF61, 75 |
| *Hipposideros* *commersoni* | Hipposideridae | 0.08905 | 7.70005 | 15.70005 | 35.1615 | 12.002 | 61.002 | NA | Hand release2 | NF46, 61 |
| *Triaenops persicus* | Rhinonycteridae | 0.01095 | 7.40005 | 9.20005 | 41.4871 | 8.5078 | 83.0078 | 1178 | Hand release78 | NF6 |
| *Rhinopoma microphyllum* | Rhinopomatidae | 0.03205 | 8.00005 | 20.50005 | 64.5635 | 8.3729 | 29.4229 | 11629 | Free flight29 | OA92 |
| *Rhinopoma hardwickii* | Rhinopomatidae | 0.01635 | 6.90005 | 14.00005 | 55.2085 | 8.5729 | 33.9929 | 25729 | Free flight29 | OA92 |
| *Craseonycteris thonglongyai* | Craseonycteridae | 0.00195 | 7.10005 | 5.20005 | 41.9754 | 3.5093 | 73.2093 | NA | Free flight93 | NG92 |
| *Cardioderma cor* | Megadermatidae | 0.030028 | 5.2028 | 9.633528 | 31.000028 | 1.3495 | 49.1395 | 35495 | Combination95 | NG92 |
| *Megaderma lyra* | Megadermatidae | 0.044624 | 5.240024 | 11.710024 | 33.0167 | 2.6037 | 42.5037 | 837 | Hand release37 | NG92 |
| *Megaderma spasma* | Megadermatidae | 0.027028 | 5.0028 | 9.901228 | 33.000028 | 2.0635 | 55.9035 | 535 | Hand release35 | NG92 |

Data are taken from published literature. Dura: call duration. FPeak: peak frequency. Guild: foraging guild. NCall: number of echolocation calls analyzed. NA: not available. OA: open-space aerial forager. EA: edge-space aerial forager. ET: edge-space trawling forager. NG: narrow-space gleaning forager. NF: narrow-space flutter-detecting forager. Superscript numbers indicate the source of the references (see below).

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**Table S2.** Relationship between wing morphology and size-corrected echolocation call parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bats | Parameter | Predictors | Model | AICc | *R2* | Estimate | *P* |
| All bats studied  (*N* = 152) | Size-corrected call duration (SCCD) | Relative wing loading | BM | -4.00 | 0.79 | -0.32 | 0.056 |
| OU | 162.20 | 0.076 | -0.17 | 0.58 |
| **λ** | **-18.70** | **0.81** | **0.11** | **0.57** |
| OLS | 162.30 | 0.075 | -0.17 | 0.58 |
| Aspect ratio | BM | -2.00 | 0.79 | 0.20 | 0.54 |
| OU | 161.20 | 0.078 | 0.36 | 0.39 |
| **λ** | **-20.10** | **0.81** | **0.26** | **0.38** |
| OLS | 161.30 | 0.078 | 0.36 | 0.39 |
| Size-corrected peak frequency (SCPF) | Relative wing loading | BM | -156.60 | 0.73 | 0.35 | 0.0005 |
| OU | -50.60 | 0.11 | -0.62 | < 0.0001 |
| **λ** | **-184.10** | **0.73** | **-0.24** | **0.037** |
| OLS | -50.90 | 0.11 | -0.62 | < 0.0001 |
| Aspect ratio | BM | -152.90 | 0.74 | -0.53 | 0.0079 |
| OU | -69.50 | 0.21 | -1.20 | < 0.0001 |
| **λ** | **-201.40** | **0.75** | **-0.56** | **0.0008** |
| OLS | -69.50 | 0.21 | -1.19 | < 0.0001 |
| Bats excluding narrow-  space flutter-  detecting  foragers  (*N* = 126) | Size-corrected call duration (SCCD) | Relative wing loading | BM | -12.00 | 0.62 | -0.19 | 0.27 |
| OU | 51.00 | 0.18 | 0.82 | < 0.0001 |
| **λ** | **-36.50** | **0.68** | **0.48** | **0.014** |
| OLS | 50.90 | 0.18 | 0.82 | < 0.0001 |
| Aspect ratio | BM | -13.20 | 0.62 | 0.35 | 0.30 |
| OU | 32.30 | 0.29 | 1.75 | < 0.0001 |
| **λ** | **-37.40** | **0.66** | **0.65** | **0.032** |
| OLS | 32.50 | 0.29 | 1.75 | < 0.0001 |
| Size-corrected peak frequency (SCPF) | Relative wing loading | BM | -130.90 | 0.66 | 0.36 | 0.0007 |
| OU | -63.40 | 0.10 | -0.41 | 0.0067 |
| **λ** | **-164.80** | **0.69** | **-0.23** | **0.047** |
| OLS | -63.50 | 0.11 | -0.41 | 0.0062 |
| Aspect ratio | BM | -129.00 | 0.68 | -0.61 | 0.0047 |
| OU | -86.30 | 0.25 | -1.08 | < 0.0001 |
| **λ** | **-180.60** | **0.72** | **-0.69** | **0.0001** |
| OLS | -86.30 | 0.25 | -1.08 | < 0.0001 |

SCCD and SCPF refer to the residuals extracted from the best-fitting phylogenetic generalized least square (PGLS) regressions of log10 body mass on log10 call duration and log10 peak frequency, respectively. RWL: relative wing loading. AR: aspect ratio. BM: Brownian motion model. OU: Ornstein-Uhlenbeck model. λ: lambda model. OLS: ordinary least square regression. AICc: Akaike’s information criterion corrected for a small sample size. The best-fitting models are shown in bold.

**Table S3.** Relationship between wing morphology and echolocation call parameters after weighting for sample size

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of bat species | Parameter | Predictors | Model | AICc | *R2* | Estimate | *P* |
| 117 | Call duration | Relative wing loading | BM | 102.20 | 0.83 | 1.17 | < 0.0001 |
| OU | 165.70 | 0.15 | 1.06 | 0.0002 |
| **λ** | **97.80** | **0.82** | **1.19** | **< 0.0001** |
| OLS | 165.70 | 0.035 | 1.06 | 0.0002 |
| Aspect ratio | BM | 110.20 | 0.81 | 1.21 | 0.0008 |
| OU | 166.90 | 0.084 | 1.36 | 0.0006 |
| **λ** | **105.40** | **0.80** | **1.27** | **0.0003** |
| OLS | 166.90 | 0.037 | 1.36 | 0.0006 |
| Peak frequency | Relative wing loading | BM | 10.40 | 0.64 | -0.77 | < 0.0001 |
| OU | 34.20 | 0.15 | -1.07 | < 0.0001 |
| **λ** | **8.40** | **0.60** | **-0.87** | **< 0.0001** |
| OLS | 34.20 | 0.20 | -1.07 | < 0.0001 |
| Aspect ratio | **BM** | **-4.30** | **0.65** | **-1.33** | **< 0.0001** |
| OU | 17.60 | 0.30 | -1.69 | < 0.0001 |
| λ | -3.90 | 0.63 | -1.34 | < 0.0001 |
| OLS | 7.30 | 0.31 | -1.69 | < 0.0001 |

BM: Brownian motion model. OU: Ornstein-Uhlenbeck model. λ: lambda model. OLS: ordinary least square

regression. AICc: Akaike’s information criterion corrected for a small sample size. The best-fitting models are

shown in bold.