2015~2019年BBS獼猴調查資料概況

表一、2015~2019年猴群記錄在各縣市的分布

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 縣市 | 資料筆數 | | | | | 有記錄的樣區數 | | | | | 有記錄的樣點數 | | | | |
| 2015 | 2016 | 2017 | 2018 | 2019 | 2015 | 2016 | 2017 | 2018 | 2019 | 2015 | 2016 | 2017 | 2018 | 2019 |
| 新北市 | 1 | - | - | 3 | 1 | 1 | - | - | 2 | 1 | 1 | - | - | 2 | 1 |
| 桃園縣 | - | - | - | - | 1 | - | - | - | - | 1 | - | - | - | - | 1 |
| 新竹縣 | - | - | - | - | 1 | - | - | - | - | 1 | - | - | - | - | 1 |
| 苗栗縣 | 1 | - | - | 3 | 1 | 1 | - | - | 1 | 1 | 1 | - | - | 3 | 1 |
| 台中市 | 8 | 2 | 2 | 4 | 6 | 5 | 2 | 1 | 4 | 4 | 8 | 2 | 2 | 4 | 5 |
| 南投縣 | 2 | 5 | 3 | 7 | 14 | 2 | 5 | 2 | 7 | 9 | 2 | 5 | 2 | 7 | 14 |
| 雲林縣 | 9 | 7 | 8 | 9 | 7 | 3 | 2 | 4 | 2 | 1 | 8 | 7 | 7 | 7 | 4 |
| 嘉義縣 | 2 | 1 | - | 3 | 2 | 2 | 1 |  | 1 | 2 | 2 | 1 | - | 3 | 2 |
| 台南市 | - | - | 2 | 4 | 2 | - | - | 1 | 1 | 1 | - | - | 2 | 3 | 2 |
| 高雄市 | 2 | 3 | 7 | 5 | 5 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 7 | 5 | 5 |
| 屏東縣 | 3 | 3 | 6 | 2 | - | 2 | 2 | 3 | 2 | - | 3 | 2 | 5 | 2 | - |
| 宜蘭縣 | 5 | 1 | - | 2 | 1 | 3 | 1 | - | 2 | 1 | 4 | 1 | - | 2 | 1 |
| 花蓮縣 | 16 | 17 | 10 | 13 | 12 | 10 | 9 | 4 | 8 | 9 | 15 | 16 | 9 | 12 | 11 |
| 台東縣 | 2 | 1 | 2 | 13 | 18 | 2 | 1 | 1 | 6 | 9 | 2 | 1 | 2 | 12 | 14 |
| 總計 | 51 | 40 | 40 | 68 | 71 | 33 | 26 | 18 | 38 | 43 | 48 | 38 | 36 | 62 | 62 |

表二、2015~2019年孤猴記錄在各縣市的分布

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 縣市 | 資料筆數 | | | | | 有記錄的樣區數 | | | | | 有記錄的樣點數 | | | | |
| 2015 | 2016 | 2017 | 2018 | 2019 | 2015 | 2016 | 2017 | 2018 | 2019 | 2015 | 2016 | 2017 | 2018 | 2019 |
| 新北市 | - | - | - | - | 1 | - | - | - | - | 1 | - | - | - | - | 1 |
| 苗栗縣 | 1 | - | - | - | - | 1 | - | - | - | - | 1 | - | - | - | - |
| 台中市 | 2 | 1 | 1 | 4 | - | 2 | 1 | 1 | 4 | - | 2 | 1 | 1 | 4 | - |
| 南投縣 | 1 | 1 | 1 | 4 | 4 | 1 | 1 | 1 | 4 | 3 | 1 | 1 | 1 | 4 | 3 |
| 雲林縣 | 4 | - | 5 | 1 | 1 | 2 | - | 2 | 1 | 1 | 4 | - | 5 | 1 | 1 |
| 嘉義縣 | 3 | - | - | 2 | - | 2 | - | - | 1 | - | 3 | - | - | 2 | - |
| 台南市 | - | - | - | - | 2 | - | - | - | - | 1 | - | - | - | - | 1 |
| 高雄市 | 6 | 4 | 3 | 1 | 4 | 2 | 3 | 2 | 1 | 4 | 6 | 4 | 3 | 1 | 4 |
| 屏東縣 | - | 3 | 2 | 1 | - | - | 2 | 1 | 1 | - | - | 3 | 2 | 1 | - |
| 宜蘭縣 | - | 3 | - | - | 1 | - | 2 | - | - | 1 | - | 3 | - | - | 1 |
| 花蓮縣 | 8 | 6 | 2 | 11 | 4 | 4 | 5 | 2 | 7 | 3 | 6 | 6 | 2 | 11 | 4 |
| 台東縣 | - | 1 | - | 4 | 1 | - | 1 | - | 4 | 1 | - | 1 | - | 4 | 1 |
| 總計 | 25 | 19 | 14 | 28 | 18 | 14 | 15 | 9 | 23 | 15 | 23 | 19 | 14 | 28 | 16 |

表三、調查樣點與猴群在不同森林類型之分布

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 年 | 旅次 | 總調查樣點數 | 調查的森林類型 (樣點數) | | | | | 猴群出現的森林類型 (樣點數) | | | | |
| 闊葉林 | 針葉林 | 竹林 | 混淆林 | 總計 | 闊葉林 | 針葉林 | 竹林 | 混淆林 | 總計 |
| 2015 | 1 | 2909 | 1294 | 159 | 176 | 100 | 1729 | 15 | 3 | - | 5 | 23 |
| 2015 | 2 | 2776 | 1217 | 157 | 179 | 97 | 1650 | 21 | 1 | - | 4 | 26 |
| 2016 | 1 | 2766 | 1173 | 125 | 192 | 105 | 1595 | 13 | 3 | - | - | 16 |
| 2016 | 2 | 2672 | 1119 | 125 | 175 | 98 | 1517 | 16 | 2 | 1 | 5 | 24 |
| 2017 | 1 | 2680 | 1102 | 132 | 180 | 102 | 1516 | 13 | 1 | 1 | 2 | 17 |
| 2017 | 2 | 2603 | 1074 | 124 | 177 | 100 | 1475 | 13 | 1 | 3 | 4 | 21 |
| 2018 | 1 | 2913 | 1245 | 147 | 206 | 107 | 1705 | 20 | 1 | 1 | 7 | 29 |
| 2018 | 2 | 2775 | 1175 | 138 | 194 | 105 | 1612 | 28 | - | 3 | 5 | 36 |
| 2019 | 1 | 2634 | 1102 | 148 | 159 | 88 | 1497 | 27 | 2 | 5 | 5 | 39 |
| 2019 | 2 | 2554 | 1077 | 129 | 156 | 86 | 1448 | 18 | 1 | 7 | 2 | 28 |

表四、2015~2019年猴群在不同海拔與植被中之分布

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 年 | 旅次 | 低海拔 (<1000m) | | | | 中海拔 (1000 ~2500m) | | | | 高海拔(>2500m) | | |
| 闊葉林 | 針葉林 | 竹林 | 混淆林 | 闊葉林 | 針葉林 | 竹林 | 混淆林 | 闊葉林 | 針葉林 | 竹林 |
| 2015 | 1 | 11 | - | - | 5 | 4 | 1 | - | - | - | 2 | - |
| 2015 | 2 | 20 | - | - | 4 | 1 | - | - | - | - | 1 | - |
| 2016 | 1 | 7 | - | - | - | 6 | 2 | - | - | - | 1 | - |
| 2016 | 2 | 15 | - | 1 | 5 | 1 | - | - | - | - | 2 | - |
| 2017 | 1 | 11 | - | 1 | 2 | 2 | 1 | - | - | - | - | - |
| 2017 | 2 | 10 | - | 2 | 4 | 3 | 1 | 1 | - | - |  | - |
| 2018 | 1 | 15 | - | - | 7 | 5 | - | - | - | - | 1 | 1 |
| 2018 | 2 | 22 | - | 3 | 5 | 4 | - | - | - | 2 | - | - |
| 2019 | 1 | 19 | 1 | 2 | 5 | 8 | - | 1 | - | - | 1 | 2 |
| 2019 | 2 | 15 | - | 7 | 2 | 3 | 1 | - | - | - | - | - |

表五、2015~2019年猴群在不同海拔與植被中之分布(累計次數)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 闊葉林 | 針葉林 | 竹林 | 混淆林 | 總計 |
| 低海拔 (<1000m) | 145 | 1 | 16 | 39 | 201 |
| 中海拔 (1000 ~2500m) | 37 | 6 | 2 | - | 45 |
| 高海拔(>2500m) | 2 | 8 | 3 | - | 13 |
| 總計 | 184 | 15 | 21 | 39 | 259 |

表六、2015~2018年使用Generalized Linear Mixed-Effects Model (GLMM, n = 12803)分析年、森林類型、海拔、旅次、分區對猴群出現之影響

Analysis of Deviance Table (Type II Wald chisquare tests)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Chisq | Df | Pr(>Chisq) |  |
| 年 | 3.4507 | 1 | 0.0632 |  |
| 森林類型 | 11.8894 | 3 | 0.0078 | \*\* |
| 海拔 | 5.5261 | 2 | 0.0631 |  |
| 旅次 | 3.8565 | 1 | 0.0496 | \* |
| 分區 | 24.4981 | 3 | 0.0000 | \*\*\* |

Summary of GLMM

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Estimate | SE | z value | P |  |
| (Intercept) | -5.2339 | 0.513 | -10.194 | 0.000 | \*\*\* |
| 年 | 0.1304 | 0.070 | 1.858 | 0.0632 |  |
| 森林類型 |  |  |  |  |  |
| 闊葉林 | reference |  |  |  |  |
| 竹林 | -0.8676 | 0.436 | -1.992 | 0.0464 | \* |
| 針葉林 | -0.7577 | 0.482 | -1.571 | 0.1163 |  |
| 混淆林 | 0.5353 | 0.328 | 1.632 | 0.1026 |  |
| 海拔 |  |  |  |  |  |
| 低海拔 | reference |  |  |  |  |
| 中海拔 | 0.7182 | 0.547 | 1.314 | 0.1889 |  |
| 高海拔 | 2.0105 | 0.910 | 2.210 | 0.0271 | \* |
| 旅次 |  |  |  |  |  |
| 第1旅次 | reference |  |  |  |  |
| 第2旅次 | 0.3003 | 0.153 | 1.964 | 0.0496 | \* |
| 分區 |  |  |  |  |  |
| 東部 | reference |  |  |  |  |
| 中部 | -1.8377 | 0.540 | -3.404 | 0.0007 | \*\*\* |
| 北部 | -2.6633 | 0.550 | -4.840 | 0.0000 | \*\*\* |
| 南部 | -1.3932 | 0.619 | -2.250 | 0.0245 | \* |

備註：年為連續變數；森林類型、海拔、旅次、分區等為類別變數；樣區為隨機變數。

表七、變數挑選過程及各變數組成模式的AICc

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Intercept | 海拔 | 分區 | 旅次 | 森林類型 | 年 | df | logLik | AICc | delta | weight |
| -5.234 | + | + | + | + | 0.1304 | 12 | -827.06 | 1678.1 | 0 | 0.324 |
| -4.897 | + | + | + | + |  | 11 | -828.79 | 1679.6 | 1.47 | 0.155 |
| -5.172 |  | + | + | + | 0.1294 | 10 | -829.93 | 1679.9 | 1.74 | 0.136 |
| -5.090 | + | + |  | + | 0.1300 | 11 | -829.00 | 1680.0 | 1.88 | 0.126 |

備註：僅呈現delta AICc < 2的模式。年為連續變數；森林類型、海拔、旅次、分區等為類別變數；樣區為隨機變數。

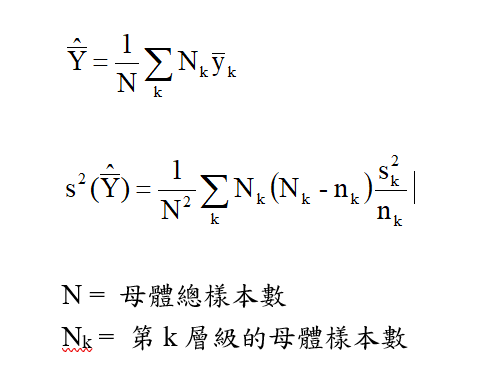
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 分區 | 森林類型 | 旅次 | 海拔 | 年 |
| Sum of weights: | 1 | 0.95 | 0.72 | 0.69 | 0.67 |
| N containing models: | 16 | 16 | 16 | 16 | 16 |

表八、各分層內的猴群平均數(Mean)、標準差(SD)及資料筆數(n)

| 分層 | 分區 | 海拔 | 森林類型 | 旅次 | Mean | SD | n |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 東部 | 低海拔 | 闊葉林 | 1 | 0.036 | 0.006 | 839 |
| 2 |  |  |  | 2 | 0.052 | 0.008 | 776 |
| 3 |  |  | 針葉林 | 1 | 0.000 | 0.000 | 11 |
| 4 |  |  |  | 2 | 0.000 | 0.000 | 10 |
| 5 |  |  | 混淆林 | 1 | 0.000 | 0.000 | 38 |
| 6 |  |  |  | 2 | 0.000 | 0.000 | 31 |
| 7 |  |  | 竹林 | 1 | 0.000 | 0.000 | 12 |
| 8 |  |  |  | 2 | 0.000 | 0.000 | 11 |
| 9 |  | 中海拔 | 闊葉林 | 1 | 0.067 | 0.038 | 45 |
| 10 |  |  |  | 2 | 0.000 | 0.000 | 37 |
| 11 |  |  | 針葉林 | 1 | 0.000 | 0.000 | 7 |
| 12 |  |  |  | 2 | 0.000 | 0.000 | 6 |
| 13 |  | 高海拔 | 針葉林 | 1 | 0.000 | 0.000 | 4 |
| 14 |  |  |  | 2 | 0.000 | 0.000 | 2 |
| 15 | 北部 | 低海拔 | 闊葉林 | 1 | 0.003 | 0.001 | 1717 |
| 16 |  |  |  | 2 | 0.006 | 0.002 | 1625 |
| 17 |  |  | 針葉林 | 1 | 0.000 | 0.000 | 31 |
| 18 |  |  |  | 2 | 0.000 | 0.000 | 30 |
| 19 |  |  | 混淆林 | 1 | 0.000 | 0.000 | 101 |
| 20 |  |  |  | 2 | 0.000 | 0.000 | 96 |
| 21 |  |  | 竹林 | 1 | 0.000 | 0.000 | 255 |
| 22 |  |  |  | 2 | 0.000 | 0.000 | 238 |
| 23 |  | 中海拔 | 闊葉林 | 1 | 0.005 | 0.005 | 199 |
| 24 |  |  |  | 2 | 0.013 | 0.009 | 152 |
| 25 |  |  | 針葉林 | 1 | 0.000 | 0.000 | 91 |
| 26 |  |  |  | 2 | 0.000 | 0.000 | 91 |
| 27 |  |  | 混淆林 | 1 | 0.000 | 0.000 | 4 |
| 28 |  |  |  | 2 | 0.000 | 0.000 | 2 |
| 29 |  |  | 竹林 | 1 | 0.000 | 0.000 | 17 |
| 30 |  |  |  | 2 | 0.000 | 0.000 | 10 |
| 31 | 中部 | 低海拔 | 闊葉林 | 1 | 0.006 | 0.003 | 863 |
| 32 |  |  |  | 2 | 0.010 | 0.003 | 860 |
| 33 |  |  | 針葉林 | 1 | 0.000 | 0.000 | 33 |
| 34 |  |  |  | 2 | 0.000 | 0.000 | 33 |
| 35 |  |  | 混淆林 | 1 | 0.052 | 0.016 | 194 |
| 36 |  |  |  | 2 | 0.082 | 0.020 | 194 |
| 37 | 中部 | 低海拔 | 竹林 | 1 | 0.005 | 0.005 | 196 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 分層 | 分區 | 海拔 | 森林類型 | 旅次 | Mean | SD | n |
| 38 | 中部 | 低海拔 | 竹林 | 2 | 0.031 | 0.013 | 193 |
| 39 |  | 中海拔 | 闊葉林 | 1 | 0.014 | 0.005 | 492 |
| 40 |  |  |  | 2 | 0.004 | 0.003 | 486 |
| 41 |  |  | 針葉林 | 1 | 0.027 | 0.015 | 112 |
| 42 |  |  |  | 2 | 0.000 | 0.000 | 110 |
| 43 |  |  | 竹林 | 1 | 0.000 | 0.000 | 57 |
| 44 |  |  |  | 2 | 0.018 | 0.018 | 57 |
| 45 |  | 高海拔 | 闊葉林 | 1 | 0.000 | 0.000 | 76 |
| 46 |  |  |  | 2 | 0.027 | 0.019 | 74 |
| 47 |  |  | 針葉林 | 1 | 0.015 | 0.008 | 261 |
| 48 |  |  |  | 2 | 0.012 | 0.007 | 249 |
| 49 |  |  | 竹林 | 1 | 0.063 | 0.063 | 16 |
| 50 |  |  |  | 2 | 0.000 | 0.000 | 16 |
| 51 | 南部 | 低海拔 | 闊葉林 | 1 | 0.008 | 0.004 | 500 |
| 52 |  |  |  | 2 | 0.022 | 0.007 | 500 |
| 53 |  |  | 針葉林 | 1 | 0.000 | NA | 1 |
| 54 |  |  |  | 2 | 0.000 | NA | 1 |
| 55 |  |  | 混淆林 | 1 | 0.058 | 0.028 | 69 |
| 56 |  |  |  | 2 | 0.029 | 0.020 | 69 |
| 57 |  |  | 竹林 | 1 | 0.000 | 0.000 | 201 |
| 58 |  |  |  | 2 | 0.000 | 0.000 | 200 |
| 59 |  | 中海拔 | 闊葉林 | 1 | 0.071 | 0.028 | 84 |
| 60 |  |  |  | 2 | 0.064 | 0.028 | 78 |
| 61 |  |  | 針葉林 | 1 | 0.083 | 0.083 | 12 |
| 62 |  |  |  | 2 | 0.083 | 0.083 | 12 |
| 63 |  |  | 混淆林 | 1 | 0.000 | 0.000 | 8 |
| 64 |  |  |  | 2 | 0.000 | 0.000 | 8 |
| 合計 | | | | | 0.015a | 0.039a | 12803 |

a ，根據分層取樣的概念，採用以下公式計算母體平均密度（）與變異數（）（Steel et al. 1997）：



第4次森林圖層類型及面積

|  |  |  |  |
| --- | --- | --- | --- |
| 森林類型 | 面積(km2) | 本計畫的森林類型 | 面積 |
| 闊葉樹林型 | 14559.55 | 闊葉林 | 14559.55 |
| 針葉樹林型 | 3006.15 | 針葉林 | 3006.15 |
| 竹林 | 1338.44 | 竹林 | 1338.44 |
| 竹針混淆林 | 7.15 | 混淆林 | 2632.27 |
| 竹針闊混淆林 | 2.33 |
| 竹闊混淆林 | 892.01 |
| 針闊葉樹混 | 1.86 |
| 針闊葉樹混淆 | 1728.92 |
| 待成林地 | 261.09 | 不納入分析 | - |
| 裸露地 | 7.72 |
| 陰影 | 0.0030 |
| 總計 | 21805.22 | 總計 | 21536.41 |

0.015 \* 21536.41 / (0.1\*0.1\*3.14) =10288.094(群)

2019年林務局獼猴調查結果統計表

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 林管處 | 旅次 | 樣點數 | 猴群 | | | | | 孤猴 | | | | |
| 竹林 | 針葉林 | 混淆林 | 闊葉林 | 總計 | 竹林 | 針葉林 | 混淆林 | 闊葉林 | 總計 |
| 羅東 | 1 | 268 | 1 | - | - | 5 | 6 | 1 | - | - | - | 1 |
|  | 2 | 57 | - | - | - | 2 | 2 | 2 | - | - | - | 2 |
| 新竹 | 1 | 335 | - | - | 1 | 5 | 6 | - | - | - | - | - |
|  | 2 | 82 | - | - | - | - | - | - | - | - | - | - |
| 東勢 | 1 | 276 | 1 | 1 | 3 | 4 | 9 | - | - | 1 | 3 | 4 |
|  | 2 | 132 | - | - | 1 | 2 | 3 | - | - |  | 1 | 1 |
| 南投 | 1 | 294 | - | 1 | - | 12 | 13 | - | - | 2 | 4 | 6 |
|  | 2 | 88 | - | - | - | 4 | 4 | - | - | - | - | - |
| 嘉義 | 1 | 292 | 3 | - | 5 | 11 | 19 | 1 | 1 | 2 | 4 | 8 |
|  | 2 | 286 | 5 | 2 | 10 | 8 | 25 | - | - | 1 | 1 | 2 |
| 屏東 | 1 | 269 | 2 | - | 2 | 25 | 29 | 1 | - | 1 | 3 | 5 |
|  | 2 | 88 | - | - | - | 12 | 12 | - | - | - | 6 | 6 |
| 花蓮 | 1 | 292 | - | 2 | 6 | 25 | 33 | - | - | 1 | 9 | 10 |
|  | 2 | 44 | - | 3 | 1 | 5 | 9 | - | 2 | 1 | 2 | 5 |
| 台東 | 1 | 105 | 1 | - | 2 | 40 | 43 | - | - | - | 10 | 10 |
|  | 2 | 15 | - | - | - | 7 | 7 | - | - | 1 | 7 | 8 |
| 總計 | | 2923 | 13 | 9 | 31 | 167 | 220 | 5 | 3 | 10 | 50 | 68 |

備註：距離森林20公尺內的獼猴資料