**Supplementary material**

A map of a city

Description automatically generated with low confidence

**Fig. 2** Pre-programmed mission flight with the thermal drone (DJI Mavic 2 enterprise advanced) for survey 6 (enclosure 1) and for survey 13 (enclosure 2) in the the Endangered Primate Rescue Center’s semi-wild enclosures

**Table 2.** Drone survey details for enclosure 1 and enclosure 2: date, time, environment data (T: external temperature, CC: cloud cover, P: atmospheric pressure, H: humidity, WS: wind speed at ground level), flight parameters (gimbal setting, thermal imaging colour palettes, flight height, number of waypoints, \*indicates when mission flights are the same), flight output (Dur: duration, Max dist: Maximum distance from takeoff point, Tot m: Total meters), and Delacour’s Langur (DL), southern Yellow-Cheeked Gibbons (YCG), Grey-Shanked Douc Langur (GSDL), and Hatinh langur (HL) detection and count.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Survey**  **No.** | **Date**  **Time** | **Environmental data** | **Flight parameters** | **Flight output** | **Primate detection** | **Notes** |
| **Enclosure 1** | | | | | | |
| 1 | 04/04/2022  07:09 am | T : 15.5 °C, CC : 66 %,  P : 1023 hPA , H: 73 %, WS: 1.5 m/s | Gimbal focus on flight plan  WhiteHot palette  Flight height: 60 m  10 waypoints | Dur : 7m53s  Max dist: 119 m  Tot m: 386 m | No detection | Impossible to detect individuals due to wrong gimbal setting.  YCG stressed by takeoff: flight and cover under canopy. |
| 2 | 04/04/2022  07:23 am | T : 15.9 °C, CC : 68 %, P : 1023 hPA , H: 71 %, WS: 1.5 m/s | Gimbal manual  WhiteHot palette  Flight height: 50 m  8 waypoints | Dur : 9m00s  Max dist: 116 m  Tot m: 317 m | 3 DL | Detection not clear enough with WhiteHot palette and low detection due to lack of drone rotation during survey (yaw axis). DL: avoidance when drone is sighted. YCG stressed by takeoff: flight and cover under canopy. |
| 3 | 04/04/2022  04:06 pm | T : 22.9 °C, CC : 21 %, P : 1018 hPA , H: 48 %, WS: 4.0 m/s | Gimbal manual  Ironbow palette  Flight height: 50 m  10 waypoints | Dur : 7m25s  Max dist: 109 m  Tot m: 398 m | 3 DL and 2 YCG | DL: avoidance when drone is sighted.  YCG: avoidance when drone is sighted. |
| 4 | 04/04/2022  4:21 pm | T : 22.8 °C, CC : 19 %, P : 1018 hPA , H: 49 %, WS: 4.0 m/s | Gimbal manual  Ironbow palette  Flight height: 50 m  11 waypoints\* | Dur : 8m38s  Max dist: 108 m  Tot m: 330 m | 6 DL and 1 YCG | DL : Flight when drone is sighted.  YCG: avoidance when drone is sighted. |
| 5 | 05/04/2022  6:43 am | T : 15.7 °C, CC : 64 %, P : 1022 hPA , H: 80 %, WS: 1.4 m/s | Gimbal manual  Ironbow palette  Flight height: 50 m  11 waypoints\* | Dur : 9m53s  Max dist: 107 m  Tot m: 407 m | 4 DL and 2 YCG | DL: avoidance when drone is sighted. |
| 6 | 05/04/2022  7:03 am | T : 16.4 °C, CC : 63 %, P : 1022 hPA , H: 82 %, WS: 1.5 m/s | Gimbal manual  Ironbow palette  Flight height: 50 m  11 waypoints\* | Dur : 9m29s  Max dist: 108 m  Tot m: 332 m | 6 DL | DL: continue to forage once drone is sighted. |
| **Enclosure 2** | | | | | | |
| 7 | 05/04/2022  5:05 pm | T : 24.3 °C, CC : 70 %, P : 1017 hPA , H: 57 %, WS: 3.0 m/s | Gimbal manual  Ironbow palette  Flight height: 80 m  7 waypoints | Dur : 6m15s  Max dist: 37 m  Tot m: 164 m | 1 GSDL | External temperature too high for good detection. |
| 8 | 05/04/2022  05:16 pm | T : 24.1 °C, CC : 69 %, P : 1017 hPA , H: 57 %, WS: 3.0 m/s | Gimbal manual  Ironbow palette  Flight height: 60 m  10 waypoints | Dur : 7m19s  Max dist: 438 m  Tot m: 205 m | 1 GSDL | External temperature too high for good detection. |
| 9 | 05/04/2022  05:32 pm | T : 23.9 °C, CC : 67 %, P : 1017 hPA , H: 58 %, WS: 3.1 m/s | Gimbal manual  Ironbow palette  Flight height: 50 m  13 waypoints\*\* | Dur : 9m36s  Max dist: 61 m  Tot m: 302 m | 1 GSDL | External temperature too high for good detection. |
| 10 | 06/04/2022  7:03 am | T : 18.3 °C, CC : 39 %, P : 1020 hPA , H: 77 %, WS: 1.2 m/s | Gimbal manual  Ironbow palette  Flight height: 50 m  13 waypoints\*\* | Dur : 8m54s  Max dist: 78 m  Tot m: 344 m | 3 GSDL | GSDL stressed by takeoff: flight coupled with alarm call. |
| 11 | 06/04/2022  7:23 am | T : 18.9 °C, CC : 39 %, P : 1020 hPA , H: 74 %, WS: 1.3 m/s | Gimbal manual  Ironbow palette  Flight height: 50 m  16 waypoints\*\*\* | Dur : 10m40s  Max dist: 95 m  Tot m: 383 m | 2 GSDL,  (1 HL) | GSDL watch curiously and then avoidance of drone takeoff. Suspected detection of one other GSDL and one HL but no confirmation possible. |
| 12 | 07/04/2022  6:53 am | T : 20.9 °C, CC : 68 %, P : 1018 hPA , H: 74 %, WS: 2.0 m/s | Gimbal manual  Ironbow palette  Flight height: 50 m  16 waypoints\*\*\* | Dur : 11m21s  Max dist: 93 m  Tot m: 385 m | 4 GSDL,  5 HL (1 young HL) | Video did not save when we tried to performed manual flight. One larger shape detected: likely to be female carrying young. GSDL: continue to forage once drone is sighted. |
| 13 | 07/04/2022  7:07 am | T : 21.2 °C, CC : 68 %, P : 1018 hPA , H: 71 %, WS: 2.1 m/s | Gimbal manual  Ironbow palette  Flight height: 50 m  16 waypoints\*\*\* | Dur : 13m28s  Max dist: 93 m  Tot m: 411 m | 4 GSDL, 5 HL (1 young HL) | Survey confirmed detection during survey 12.  GSDL: continue to forage once drone is sighted. |

**Table 3.** Maximum surface temperatures of primate species detected (above and below canopy cover) and surrounding temperatures (temp.) measured with the thermal camera (extracted from picture). Thermal Signature: identifiable Body Shape (BS) or thermal Spot (S).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Survey**  **No.** | **Det. No.** | **External temp. (°C)** | **Background surface temp. (°C)** | **Species surface temp.** **(°C)** | **Thermal signature** |
| **Delacour’s Langur** | | | | | |
| 3 | 2 | 22.9 | 18.6, 18.0 | 21.9, 20.5 | 1 BS, 1 S |
| 3 | 3 | 22.9 | 20.8 | 25.6 | 1 S |
| 4 | 2 | 22.8 | 23.6 | 26.8 | 1 S |
| 5 | 1 | 15.7 | 12.9 | 18.1 | 1 S |
| 5 | 3 | 15.7 | 12.1 | 17.7 | 1 S |
| 5 | 4 | 15.7 | 14.2 | 22 | 1 S |
| 6 | 1 | 16.4 | 18.4 | 24.7 | 1 S |
| 6 | 1 | 16.4 | 16.5 | 19.1 | 1 S |
| 6 | 1 | 16.4 | 13.9 | 23 | 1 S |
| 6 | 1 | 16.4 | 14.4, 14.4, 14.5 | 21.2, 18.3, 23.7 | 1 BS, 2 S |
| 6 | 2 | 16.4 | 13.5, 13.6 | 16.2, 15.3 | 2 BS |
| 6 | 2 | 16.4 | 13.2, 13.1, 13.1, 13.3 | 16.5, 20.4, 14.8, 20.7 | 4 S |
| 6 | 2 | 16.4 | 14.4, 14.3, 14.3, 14.4 | 16.3, 19.4, 21.4, 22.8 | 2 BS, 2 S |
| 6 | 2 | 16.4 | 14.1, 14.1, 14.0 | 20.9, 21.2, 24.0 | 1 BS, 2 S |
| 6 | 2 | 16.4 | 13.7, 13.6, 13.8, 13.5, 13.5, 13.5 | 23.9, 22.2, 16.6, 18.4, 22.8, 15.6 | 1 BS, 5 S |
| 6 | 2 | 16.4 | 14.3, 14.3, 14.2, 14.3, 14.1 | 17.6, 24.0, 21.2, 17.0, 15.2 | 1 BS, 4 S |
| **Southern yellow-cheeked gibbon** | | | | | |
| 3 | 1 | 22.9 | 21.2 | 23.2 | 1 BS |
| 5 | 1 | 15.7 | 11.5, 12.0 | 15.7, 14.0 | 2 S |
| **Grey-shanked douc langur** | | | | | |
| 10 | 1 | 18.3 | 20.3, 19.4, 21.0 | 32.2, 30.0, 32.4 | 3 BS |
| 10 | 1 | 18.3 | 20.6 | 26.1 | 1 S |
| 10 | 1 | 18.3 | 21.2 | 29.2 | 1 S |
| 10 | 2 | 18.3 | 15.6 | 18.8 | 1 S |
| 10 | 2 | 18.3 | 16.0 | 21.6 | 1 S |
| 11 | 1 | 18.9 | 22.9 | 28.0 | 1 BS |
| 11 | 1 | 18.9 | 20.2 | 26.1 | 1 S |
| 11 | 2 | 18.9 | 17.5 | 19.3 | 1 S |
| 11 | 2 | 18.9 | 16.2 | 19.8 | 1 S |
| 12 | 1 | 20.9 | 23.5 | 28.7 | 1 BS |
| 12 | 1 | 20.9 | 23.6 | 29.1 | 1 BS |
| 12 | 2 | 20.9 | 23.0 | 29.9 | 1 BS |
| 12 | 2 | 20.9 | 23.3 | 30.6 | 1 BS |
| 12 | 2 | 20.9 | 22.8 | 31.2 | 1 S |
| 12 | 2 | 20.9 | 22.7, 22.4 | 24, 28.3 | 3 S |
| 12 | 2 | 20.9 | 22.5, 22.9 | 27.6, 24.8 | 3 S |
| 12 | 2 | 20.9 | 23.5, 23.0, 23.1 | 26.8, 28.6, 24.4 | 2 BS, 1 S |
| 12 | 2 | 20.9 | 23.0, 23.0, 22.9 | 26.2, 25.3, 24.6 | 3 S |
| 13 | 2 | 21.2 | 23.1 | 25.8 | 1 S |
| 13 | 2 | 21.2 | 22.4 | 26.0 | 1 S |
| 13 | 2 | 21.2 | 22.3 | 26.0 | 1 BS |
| 13 | 2 | 21.2 | 22.2 | 25.6 | 1 BS |
| 13 | 2 | 21.2 | 24.8 | 28.8 | 1 BS |
| **Hatinh langur** | | | | | |
| 12 | 1 | 20.9 | 23 | 26.1 | 1 S |
| 12 | 1 | 20.9 | 23.3, 23.1, 22.9 | 24.5, 26.9, 26.2 | 2 BS |
| 13 | 1 | 21.2 | 24.5 | 26.8 | 2 S |

**Online Resource 4.**

Thermal Video montage of Delacour’s langurs playing in the semi-wild enclosure in the Endangered Primate Rescue Center in Northern Vietnam.