

## RESULTS

A total of ten native and 14 non-native bird species was detected during VCP surveys within the five Kahuku study areas (Table 2). The native species included: Hawaiian Hawk (ʻIo) (*Buteo solitarius*), Pacific Golden-Plover (Kōlea) (*Pluvialis fulva*), Hawaiʻi ʻElepaio (*Chasiempis sandwichensis*), ʻŌmaʻo (*Myadestes obscurus*), Hawaiʻi ʻAmakihi (*Hemignathus virens virens*), ʻAkiapōlāʻau (*Hemignathus munroi*), Hawaiʻi Creeper (*Oreomystis mana*), Hawaiʻi ʻĀkepa (*Loxops coccineus coccineus*), ʻIwi (*Vestiaria coccinea*), and ʻApapane (*Himatione sanguinea sanguinea*).

The non-native species included: Erckel's Francolin (*Francolinus erckelii*), Kalij Pheasant (*Lophura leucomelanos*), Wild Turkey (*Meleagris gallopavo*), Spotted Dove (*Streptopelia chinensis*), Zebra Dove (*Geopelia striata*), (Eurasian) Sky Lark (*Alauda arvensis*), Hwamei (*Garrulax canorus*), Red-billed Leiothrix (*Leiothrix lutea*), Japanese White-eye (*Zosterops japonicus*), Common Myna (*Acridotheres tristis*), Saffron Finch (*Sicalis flaveola*), Northern Cardinal (*Cardinalis cardinalis*), House Finch (*Carpodacus mexicanus*), and Yellow-fronted Canary (*Serinus mozambicus*).

In addition, we recorded five bird species while traveling through or near the study areas that were not detected during the VCP surveys: Hawaiian Goose (Nēnē; *Branta sandvicensis*), Chukar (*Alectoris chukar*), Common Peafowl (*Pavo cristatus*), Rock Dove (*Columba livia*), and Yellow-billed Cardinal (*Paroria capitata*). All species described are included in the species list for the Kahuku Unit of HAVO (Appendix B).

Several species are notable for not having been detected during the Kahuku survey but whose occurrences were established during the 1976 and 1978 Hawaiʻi Forest Bird Surveys (Scott *et al.* 1986). These species include: Black Francolin (*Francolinus francolinus*) in the dry open upland habitats of the leeward study areas; Japanese Quail (*Coturnix japonica*) in the dry open upland habitats at the southern portion of the Kaʻū study area; Ring-necked Pheasant (*Phasianus colchicus*) in all vegetated habitats throughout Kahuku; and California Quail (*Callipepla californica*) and Nutmeg Mannikin (*Lonchura punctulata*) in the dry open upland habitats of the South Flank and leeward study areas. Another absent species, the Japanese Bush-Warbler (*Cettia diaphone*), is now established in the lower elevations of the Kaʻū Forest Reserve (Jeffrey Foster, pers. comm.). Bush-Warblers are rapidly expanding their range on the Big Island and are expected to be a common species at Kahuku in future years.

Total counts of each species across all five study areas ranged from a single detection of a Saffron Finch to over 4,000 detections of ʻApapane (Table 2). In general, the least common native species were the Hawaiian Hawk and Pacific Golden-Plover in open habitats and the ʻAkiapōlāʻau and Hawaiʻi Creeper in forested habitats. Hawaiʻi ʻAmakihi and ʻApapane were the most abundant native species detected. As in many areas throughout the state, the Japanese White-eye and Northern Cardinal were the most abundant non-native species in Kahuku.

The minimum number of detections for adequate estimation of density was met for eight native and ten non-native species (Table 3). Density values ranged three across orders of

magnitude from the very rare ( $<0.001$  birds/ha for Sky Lark) to very abundant (about eight birds/ha for `Apapane).

Table 2. Abundance and occurrence of species detected during the 2005 Kahuku Forest Bird Inventory. Symbols “#”, “occ” and “%” indicate the number of birds detected, and the number and percent of stations (stns) surveyed at which the species occurred within each study area. Native bird species are highlighted in bold. Empty cells indicate that no detections were recorded during VCP surveys.

| Species                      | Ka`ū (474 stns) |     |     | South Flank (121 stns) |     |    | Honomalino (166 stns) |     |     | Papa (18 stns) |     |     | Northwest (55 stns) |     |     |
|------------------------------|-----------------|-----|-----|------------------------|-----|----|-----------------------|-----|-----|----------------|-----|-----|---------------------|-----|-----|
|                              | #               | occ | %   | #                      | occ | %  | #                     | occ | %   | #              | occ | %   | #                   | occ | %   |
| <b>Hawaiian Hawk (ʻIo)</b>   | 8               | 7   | 2   | 1                      | 1   | <1 |                       |     |     |                |     |     | 1                   | 1   | 2   |
| Erckel's Francolin           | 10              | 8   | 2   | 48                     | 36  | 30 | 64                    | 52  | 31  | 4              | 4   | 22  | 44                  | 31  | 56  |
| Kalij Pheasant               | 21              | 10  | 2   |                        |     |    |                       |     |     |                |     |     | 1                   | 1   | 2   |
| Wild Turkey                  | 10              | 8   | 2   | 10                     | 6   | 5  | 13                    | 10  | 6   | 3              | 2   | 11  | 1                   | 1   | 2   |
| <b>Pacific Golden-Plover</b> | 6               | 6   | 1   | 6                      | 3   | 3  |                       |     |     |                |     |     | 5                   | 2   | 4   |
| Spotted Dove                 |                 |     |     | 22                     | 14  | 14 |                       |     |     |                |     |     | 3                   | 3   | 6   |
| Zebra Dove                   |                 |     |     | 12                     | 8   | 7  |                       |     |     |                |     |     |                     |     |     |
| <b>Hawai`i `Elepaio</b>      | 38              | 29  | 6   |                        |     |    | 29                    | 21  | 13  |                |     |     | 3                   | 2   | 4   |
| (Eurasian) Sky Lark          | 1               | 1   | <1  |                        |     |    | 5                     | 5   | 3   |                |     |     | 25                  | 16  | 29  |
| <b>ʻŌma`o</b>                | 733             | 335 | 71  | 47                     | 29  | 24 |                       |     |     |                |     |     |                     |     |     |
| Hwamei                       |                 |     |     | 3                      | 3   | 3  |                       |     |     |                |     |     |                     |     |     |
| Red-billed Leiothrix         | 154             | 83  | 18  |                        |     |    |                       |     |     |                |     |     |                     |     |     |
| Japanese White-eye           | 550             | 301 | 64  | 309                    | 118 | 98 | 193                   | 106 | 64  | 24             | 13  | 72  | 67                  | 26  | 47  |
| Common Myna                  |                 |     |     | 14                     | 9   | 7  |                       |     |     |                |     |     |                     |     |     |
| Saffron Finch                |                 |     |     | 1                      | 1   | <1 |                       |     |     |                |     |     |                     |     |     |
| Northern Cardinal            | 31              | 24  | 5   | 152                    | 79  | 65 | 383                   | 150 | 90  | 30             | 11  | 61  | 14                  | 10  | 18  |
| House Finch                  |                 |     |     | 84                     | 51  | 42 | 143                   | 74  | 45  | 9              | 4   | 22  | 45                  | 17  | 31  |
| Yellow-fronted Canary        |                 |     |     | 18                     | 13  | 11 |                       |     |     |                |     |     |                     |     |     |
| <b>Hawai`i `Amakihi</b>      | 732             | 361 | 76  | 135                    | 68  | 56 | 800                   | 165 | 99  | 76             | 18  | 100 | 358                 | 55  | 100 |
| <b>ʻAkiapōlā`au</b>          | 23              | 17  | 4   |                        |     |    |                       |     |     |                |     |     |                     |     |     |
| <b>Hawai`i Creeper</b>       | 33              | 23  | 5   |                        |     |    |                       |     |     |                |     |     |                     |     |     |
| <b>Hawai`i `Ākepa</b>        | 90              | 53  | 11  |                        |     |    |                       |     |     |                |     |     |                     |     |     |
| <b>ʻI`iwi</b>                | 374             | 209 | 44  |                        |     |    | 58                    | 44  | 27  |                |     |     | 51                  | 28  | 51  |
| <b>ʻApapane</b>              | 3061            | 474 | 100 | 151                    | 54  | 45 | 601                   | 166 | 100 | 56             | 18  | 100 | 231                 | 55  | 100 |

Table 3. Density of bird species detected during the 2005 Kahuku Forest Bird Inventory. Density is reported as mean number of birds per hectare (#/ha) with lower and upper 95% confidence interval values. Native bird species are highlighted in bold. Empty cells indicate the species was not detected in the study area (see Table 2). Bird species that were omitted (see Table 2) did not have a sufficient number of detections to develop detection functions used for density estimation.

| Species                 | Ka`ū (474 stns) |        |       | South Flank (121 stns) |       |       | Honomalino (166 stns) |       |       | Papa (18 stns) |       |       | Northwest (55 stns) |        |       |
|-------------------------|-----------------|--------|-------|------------------------|-------|-------|-----------------------|-------|-------|----------------|-------|-------|---------------------|--------|-------|
|                         | #/ha            | lower  | upper | #/ha                   | lower | upper | #/ha                  | lower | upper | #/ha           | lower | upper | #/ha                | lower  | upper |
| Erckel's Francolin      | 0.006           | 0.003  | 0.013 | 0.108                  | 0.076 | 0.154 | 0.097                 | 0.069 | 0.136 | 0.064          | 0.026 | 0.161 | 0.168               | 0.112  | 0.251 |
| Kalij Pheasant          | 0.091           | 0.035  | 0.241 |                        |       |       |                       |       |       |                |       |       | 0.012               | 0.004  | 0.036 |
| Wild Turkey             | 0.006           | 0.003  | 0.013 | 0.023                  | 0.008 | 0.072 | 0.230                 | 0.010 | 0.053 | 0.038          | 0.013 | 0.109 | 0.002               | <0.001 | 0.019 |
| Spotted Dove            |                 |        |       | 0.040                  | 0.023 | 0.070 |                       |       |       |                |       |       | 0.040               | <0.001 | 0.179 |
| <b>Hawai`i `Elepaio</b> | 0.144           | 0.075  | 0.276 |                        |       |       | 0.320                 | 0.076 | 1.349 |                |       |       | 0.097               | 0.013  | 0.700 |
| (Eurasian) Sky Lark     | <0.001          | <0.001 | 0.021 |                        |       |       | 0.009                 | 0.002 | 0.036 |                |       |       | 0.115               | 0.051  | 0.259 |
| <b>`Ōma`o</b>           | 1.025           | 0.904  | 1.162 | 0.330                  | 0.260 | 0.461 |                       |       |       |                |       |       |                     |        |       |
| Red-billed Leiothrix    | 0.330           | 0.241  | 0.453 |                        |       |       |                       |       |       |                |       |       |                     |        |       |
| Japanese White-eye      | 2.358           | 2.019  | 2.755 | 3.253                  | 2.849 | 3.714 | 1.911                 | 1.599 | 2.284 | 2.857          | 1.963 | 4.158 | 1.881               | 1.268  | 2.789 |
| Northern Cardinal       | 0.026           | 0.014  | 0.050 | 0.485                  | 0.392 | 0.559 | 0.829                 | 0.613 | 1.122 | 0.576          | 0.334 | 0.994 | 0.095               | 0.039  | 0.230 |
| House Finch             |                 |        |       | 0.597                  | 0.402 | 0.887 | 0.735                 | 0.541 | 0.998 | 0.557          | 0.145 | 2.141 | 0.530               | 0.247  | 1.136 |
| Yellow-fronted Canary   |                 |        |       | 0.168                  | 0.020 | 1.402 |                       |       |       |                |       |       |                     |        |       |
| <b>Hawai`i `Amakihi</b> | 1.647           | 1.401  | 1.936 | 0.832                  | 0.650 | 1.065 | 4.528                 | 4.069 | 5.038 | 4.714          | 3.278 | 6.778 | 4.723               | 3.984  | 5.599 |
| <b>`Akiapōlā`au</b>     | 0.193           | 0.111  | 0.336 |                        |       |       |                       |       |       |                |       |       |                     |        |       |
| <b>Hawai`i Creeper</b>  | 0.353           | 0.181  | 0.692 |                        |       |       |                       |       |       |                |       |       |                     |        |       |
| <b>Hawai`i `Ākepa</b>   | 0.321           | 0.168  | 0.613 |                        |       |       |                       |       |       |                |       |       |                     |        |       |
| <b>`Iiwi</b>            | 0.885           | 0.729  | 1.075 |                        |       |       | 0.393                 | 0.288 | 0.537 |                |       |       | 0.605               | 0.368  | 0.995 |
| <b>`Apapane</b>         | 7.982           | 6.982  | 9.125 | 0.924                  | 0.663 | 1.286 | 3.481                 | 3.044 | 3.982 | 3.635          | 2.174 | 4.867 | 2.800               | 2.148  | 3.650 |