

## Focal Species: O’ahu ‘Elepaio (*Chasiempis ibidis*)

**Synopsis:** The O’ahu ‘Elepaio is an adaptable species that has persisted in low elevation, disease-plagued forests dominated by alien plants on the most developed of the Hawaiian Islands. The most serious threat to the species is predation on nests by alien rats, which take eggs, chicks, and even incubating females. Rat control has been the primary conservation tool and can be effective at reducing predation, but it must be implemented on a larger scale to reverse declines of more ‘elepaio populations. O’ahu ‘Elepaio in some areas are evolving to nest higher off the ground in response to rat predation. Forest restoration with native trees that are less attractive to rats might help decrease the need for rat control.



Female O’ahu ‘Elepaio feeding nestlings.  
Photo Eric VanderWerf



O’ahu ‘Elepaio habitat, Wailupe Valley. Photo E. VanderWerf

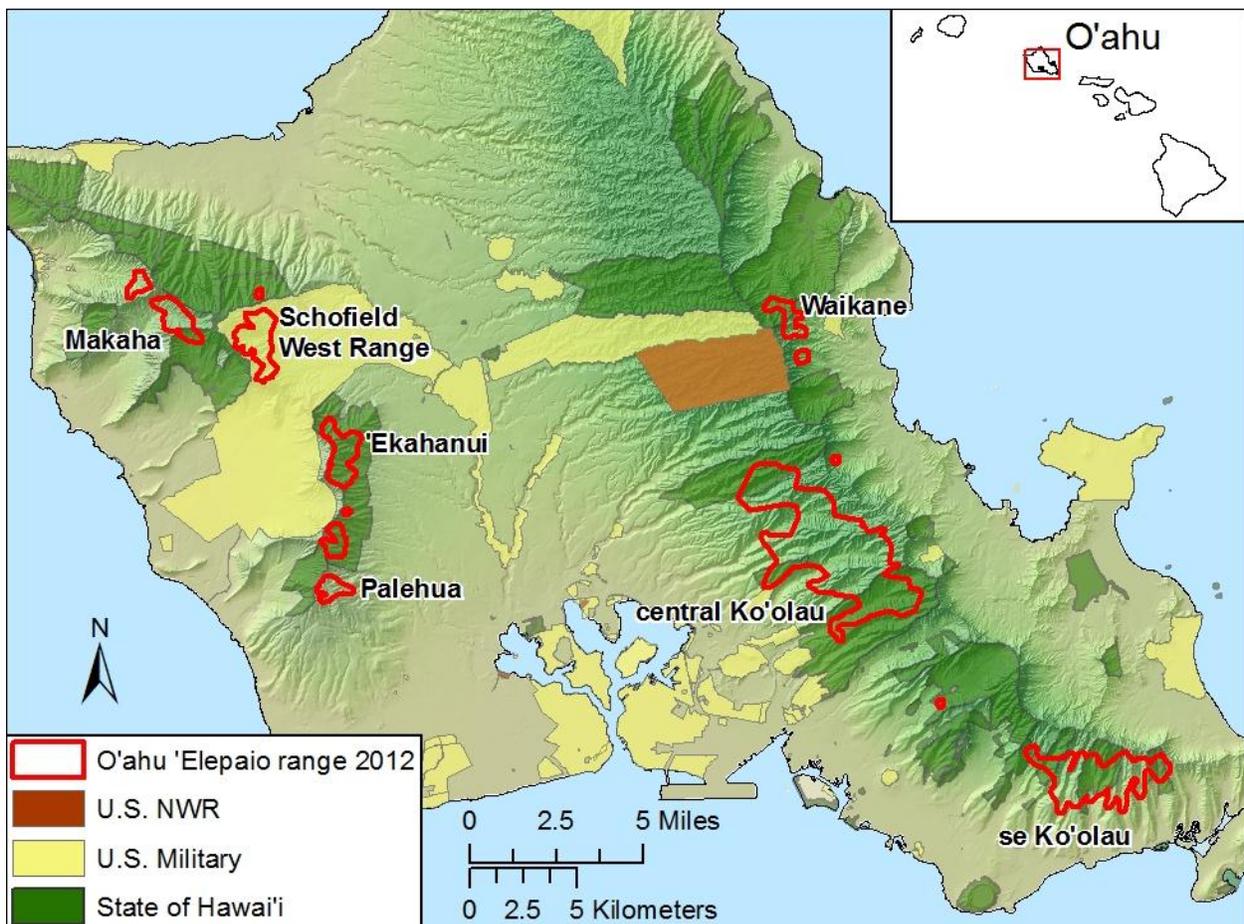
**Status:** The O’ahu ‘Elepaio was formerly considered a subspecies (*Chasiempis sandwichensis ibidis*), but in 2010 it was split into a separate species based on morphological, genetic, and behavioral evidence (VanderWerf 2007, VanderWerf et al. 2009). It is listed as endangered under the U.S. Endangered Species Act and by the State of Hawai’i using its previous taxonomy. The Kaua’i ‘Elepaio (*C. sclateri*) and Hawai’i ‘Elepaio (*C. sandwichensis*) are relatively common and widespread on their respective islands.

**Geographic region:** Hawaiian Islands  
**Taxonomic Group:** Forest Birds  
**Federal Status:** Endangered  
**State status:** Endangered  
**IUCN status:** Endangered  
**Conservation score:** 20/20, At-risk  
**Watch List 2007 Score:** Red  
**Climate Change Vulnerability:** High

**Population Size and Trend:** The current population estimate is 1,261 birds (95% CI=1,181-1,343), based on surveys conducted in the Wai’anae Mountains from 2006-2009 (VanderWerf et al. 2011a) and in the Ko’olau Mountains from 2011-2012 (E. VanderWerf unpubl. data). Of this total, 300 were located in the Wai’anae Mountains and 961 (95% CI=881-1,043) were located in the Ko’olau Mountains. The sex-ratio is male-biased in almost all areas, and the population consists of about 477 breeding pairs and 307 single males. In the 1990s, the population was estimated to be 1,974 birds, with roughly half the total in each mountain range (VanderWerf et al. 2001). The number of ‘elepaio in the Wai’anae Mountains has declined drastically in the past 20 years, but the number in the Ko’olau Mountains has remained more stable.

**Range:** The current range of the O’ahu ‘Elepaio is estimated to be 5,187 ha (12,812 acres), of which 3,947 ha are located in the Ko’olau Mountains and 1,240 ha are located in the Wai’anae

Mountains (VanderWerf et al. 2011a, E. VanderWerf unpubl. data). The range is highly fragmented, and because ‘elepaio do not disperse far, these fragments are isolated from each other. The largest subpopulations are in the central Ko’olau (523 birds) and southeastern Ko’olau (403 birds) Mountains, with smaller subpopulations in ‘Ekahanui (100 birds), Schofield Barracks West Range (104 birds), Palehua (41 birds), Waikane and Kahana Valleys (24 birds), and several tiny fragments containing 1-5 birds each. Size of the range was estimated to be 5,486 ha (13,550 ac) in the 1990s, which is only 4% of the presumed prehistoric range and 25% of the range occupied in 1975 (VanderWerf et al. 2001). The range has declined further in the Wai’anae Mountains (VanderWerf et al. 2011a), but it has remained relatively stable in the Ko’olau Mountains.



**Essential Biology:** The O’ahu ‘Elepaio is a small (11-13 g) monarch flycatcher (Monarchidae) endemic to O’ahu. Adults are brown above, white below with dark streaks, and have white wings bars and white tail tips. ‘Elepaio have a two-year delay in plumage maturation in both sexes; first and second-year birds are reddish brown and lack the white markings of adults (VanderWerf 1998, 2001). The song is a squeaky whistle from which the Hawaiian name is derived.

O’ahu ‘Elepaio prefer areas with a tall forest canopy and a dense understory and are most abundant in riparian habitat in valleys (VanderWerf et al. 1997, 2001). They occur in a variety of forest types ranging from wet to dry. Elepaio have adapted to forests dominated by alien plants, but nests in fruit-bearing alien trees suffer high rates of predation (VanderWerf

2009). The nesting season is primarily from January-June. Both sexes build the nest, incubate the eggs, and feed the nestlings. Only the female incubates at night, leading to higher predation on females by nocturnal rats (VanderWerf 2009). The clutch size is usually two eggs, occasionally one or three. Eggs hatch after 18 days, and chicks fledge 16 days after hatching. Without rat control nest predation is common, but rat control has resulted in increases in nest success (33% vs. 62%), fecundity ( $0.69 \pm 0.05$  vs.  $0.33 \pm 0.06$  fledglings per pair), and female survival (10-25% increase; VanderWerf 2009, VanderWerf et al. 2011b).

Elepaios are non-migratory, sedentary, and defend all-purpose territories year-round (VanderWerf 1998, 2004). Territory size varies with habitat structure and population density, and averages 0.6-2.0 ha (1.5-5.0 ac). Dispersal is driven by interspecific competition, and 'Elepaio disperse far enough to find a vacant territory, often only 300-500 meters (VanderWerf 2008). 'Elepaio are long-lived for a small Passerine (up to 20 years). Mate fidelity and site fidelity are high, and a pair may occupy the same territory together for their entire lives.

### Primary Threats:

- **Introduced Predators.** Predation on nests by alien black rats (*Rattus rattus*) is the most serious threat to the O'ahu 'Elepaio (VanderWerf and Smith 2002, VanderWerf 2009). Rats take eggs, nestlings, and even adult females from the nest. Rat control programs can result in substantial increases in nest success and survival of females, if properly implemented (VanderWerf 2009, VanderWerf et al. 2011b). Young elepaios sometimes leave the nest before they can fly well and may spend 1-2 days on or near the ground, where they are vulnerable to a range of alien predators, including feral cats (*Felis domesticus*), small Indian mongooses (*Herpestes auro-punctatus*), and feral pigs (*Sus scrofa*). O'ahu Elepaios in some areas are evolving to place nests higher in trees in response to predation by rats, where they are safer (VanderWerf 2012).
- **Disease.** Elepaios have greater immunity to alien diseases than some of the Hawaiian honeycreepers, but avian pox (*Poxvirus avium*) and avian malaria (*Plasmodium relictum*) cause some mortality and may weaken or disable birds and reduce reproductive ability (VanderWerf 2009, VanderWerf et al. 2011a). All areas of O'ahu are subject to mosquito-borne diseases; there are no high-elevation refugia from disease like on other islands because the mountains on O'ahu are lower (VanderWerf et al. 2006). O'ahu 'Elepaios have persisted despite high disease prevalence and may be evolving resistance to avian poxvirus and avian malaria.
- **Invasive Alien Plants.** 'Elepaio are able to forage and nest in forest dominated by alien plants, but nest predation is high in such areas because many alien trees bear fruit or nuts that are attractive to rats and support high rat abundance, increasing nest predation risk (VanderWerf 2009). Preventing the spread of alien trees such as strawberry guava (*Psidium cattleianum*), christmasberry (*Schinus terebinthifolius*), mango (*Mangifera indica*), and Java plum (*Syzygium cumini*) into native forest and restoring native trees would help to reduce the threat from nest predation.
- **Feral pigs.** Feral pigs are an indirect threat to O'ahu 'Elepaio by facilitating the spread of invasive alien plants that support high rat populations. The presence of feral pigs also may limit the use of poison bait for controlling rats (USFWS 2006).
- **Wildfires.** Wildfires are a threat to O'ahu 'Elepaio by accelerating habitat degradation and spread of alien plant species not used by 'Elepaio, such as *Eucalyptus* spp. Wildfires

are a threat primarily in drier areas of O‘ahu, such as Schofield Barracks West Range and Makua Military Reservation (USFWS 2006).

- **Social.** Rat control to protect O‘ahu ‘Elepaio nests from predation has been conducted using traps and poison bait stations. In some areas there has been concern about possible consumption of bait by feral pigs and subsequent human consumption of pig meat. Temporary hunting closures or exclusion of feral pigs from areas with bait using fences could alleviate this concern. Outreach programs aimed at increasing public awareness of the threat posed by rats to native species and the need for rat control might help provide the political will-power to undertake large-scale rat control.

**Conservation Actions to Date:** The O‘ahu ‘Elepaio was listed as endangered by the U.S. Fish and Wildlife Service and the State of Hawai‘i in 2000 (USFWS 2006). Critical habitat also was designated in 2000. Most areas where O‘ahu ‘Elepaio still occur are zoned for conservation and are protected from development, but habitat degradation remains a problem. In 2008, 3,716 acres of land in Moanalua Valley, which forms the core of the largest remaining O‘ahu ‘Elepaio population, were purchased from a private landowner by the Trust for Public Land with funding from the U.S. Army Compatible Use Buffer Program, the U.S. Fish and Wildlife Service, and the State of Hawai‘i, and then transferred to the state of Hawai‘i for management as a forest reserve. Another important area was protected in 2010, when 3,592 acres of land encompassing the Nature Conservancy’s former Honouliuli Preserve, including the ‘Ekahanui area, were purchased from a private landowner by the Trust for Public Land with funding from the U.S. Army Compatible Use Buffer Program, the U.S. Fish and Wildlife Service, and the Hawai‘i Legacy Land Conservation Fund, and then transferred to the state of Hawai‘i for management as a forest reserve.

Rat control has proven to be an effective method of increasing nest success and survival of breeding females, if properly implemented, and has become the cornerstone of conservation efforts for the O‘ahu Elepaio (VanderWerf and Smith 2002, VanderWerf 2009, VanderWerf et al. 2011b). Ground-based rodent control using snap traps and diphacinone bait stations has been conducted in several areas and by several agencies, including: the Honolulu Watershed Forest Reserve since 1997 by Pacific Rim Conservation in collaboration with the Hawai‘i Division of Forestry and Wildlife; at Schofield Barracks West Range and Makua Military Reservation since 1998 by the U.S. Army Environmental Division; in Ekahanui since 2000 by The Nature Conservancy of Hawai‘i and the U.S. Army; in Lualualei Naval Magazine from 2002-2004 by the U.S. Navy; in Makaha Valley from 2004 to 2009 by the U.S. Army and the City and County of Honolulu Board of Water Supply; in Moanalua Valley since 2005 by the U. S. Army; at Palehua since 2007 by The Nature Conservancy of Hawai‘i and the U.S. Army, and in Waikane Valley from 2007-2009 by the U.S. Army. The efficacy of these rat control efforts has varied, however, and rat control programs in Makaha and Waikane were discontinued because they were not effective and the number of ‘elepaio had declined (VanderWerf et al. 2011b).

Research has focused on surveys to determine the distribution and abundance of the species and to locate areas where management is needed (VanderWerf et al. 2001, 2011), monitoring response of ‘elepaio populations to rat control (VanderWerf and Smith 2002, VanderWerf 2009, VanderWerf et al. 2011b), mist-netting and banding to facilitate demographic monitoring and measuring of disease prevalence (VanderWerf et al. 2006). Examination of a 17-year data set from the southeastern Ko‘olaus revealed that O‘ahu ‘Elepaio are evolving to nest higher off the ground as a result of selection by rats against low nests (Vanderwerf 2012). Nest

success also has increased over the same period, providing some hope that this natural population response will aid in recovery.

**Planning/Research Needs:**

- Explore other methods of rat control and compare their cost-efficiency, including large grids of snap traps and self-resetting rat traps.
- Investigate whether ‘elepaio nest height is increasing in other parts of O‘ahu.
- Investigate whether O‘ahu ‘Elepaio are evolving resistance or tolerance to avian poxvirus and avian malaria.
- Conduct public outreach about the threat posed by rats to native species and the need for larger scale rat control.
- Determine accuracy of estimates for survival of juvenile O‘ahu ‘Elepaio to improve demographic models.

**5-Year Conservation Goals:**

- Increase the scale of rat control.
- Improve the cost-effectiveness of rat control methods.
- Begin restoration of native forest habitat to reduce predation by rats on ‘elepaio nests.

**Conservation Actions:**

- Predator Control
  - Continue rat control in the following O‘ahu ‘Elepaio populations: 1. southeastern Ko‘olau, 2. Schofield Barracks West Range, 3. Moanalua Valley, 4. ‘Ekahanui, and 5. Palehua.
  - Investigate self-resetting rat traps as a means of decreasing cost of rat control.
  - Support efforts by the ‘Ōhulehule Forest Conservancy and a private landowner to resume rat control in Waikane Valley.
- Habitat Restoration and Ungulate Control
  - Complete ungulate fence in Schofield Barracks West Range and remove all feral pigs.
  - Support efforts by the ‘Ōhulehule Forest Conservancy and a private landowner to begin native forest restoration in Waikane Valley.
  - Begin restoring native forest inside a demonstration ungulate fence in Wailupe Valley as a test of reducing the need for rat control.
- Social.
  - Support public education and outreach about need for rat control.
  - Continue meetings of the Hawai‘i Toxicant Working Group, encourage broader input and participation by conservation practitioners.

**Summary of 5-year Actions, 2012-2016:**

Conservation Action	Year(s)	Annual cost	Total Cost
Continue rat control in Wailupe Valley	1-5	\$30,000	\$150,000
Continue rat control in Moanalua Valley, Ekahanui, Schofield Barracks, and Palehua	1-5	\$120,000	\$600,000
Resume rat control and ‘Elepaio monitoring in Waikane Valley	1-5	\$13,000	\$65,000

Purchase 50 self-resetting rat traps, measure and compare cost-efficiency to other control methods	1-2	\$15,000	\$30,000
Restore native forest habitat in fenced demonstration area in Wailupe Valley	1-5	\$10,000	\$50,000
Eradicate feral pigs from fenced area of Schofield Barracks West Range	1-3	\$100,000	\$300,000

**Potential Partners:** Hawai'i Division of Forestry and Wildlife, U.S. Fish and Wildlife Service, U.S. Army, Pacific Rim Conservation, Ko'olau Mountains Watershed Partnership, Wai'anae Mountains Watershed Partnership, 'Ōhulehule Forest Conservancy.

**Ancillary Species:** Control of alien rats would benefit other native bird species that use forest habitat on O'ahu, including 'Apapane (*Himatione sanguinea*) and O'ahu 'Amakihi (*Hemignathus chloris*).

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