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Mitred Conure Control on Maui

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ABSTRACT: Hawai'i has no native parrots (Psittacidae), but at least two species of this family have naturalized on the island of Maui, the result of accidental or deliberate releases of pet birds. A breeding pair of mitred conures was illegally released in approximately 1986 on the north shore of Maui. At its peak, a population of over 150 birds was documented, demonstrating that conures in Hawai'i can be highly productive in the wild. These non-native birds pose a threat to Hawaiian ecosystems, agricultural productivity, and quality of life. They are highly adaptable, reproduce rapidly, eat a variety of fruits and seeds, are extremely loud, can carry viral and bacterial diseases, and may compete with native seabirds for cliffside burrows. Of particular concern is the conures' ability to pass viable seed of highly invasive species, including *Miconia calvescens*, a tree which is found near the conures' roosting/breeding areas. Information from the conures' native range in South America suggests these birds can become established at elevations in excess of 3,000 meters, underscoring the potential for spreading invasive weeds into intact, native forests, and high value watersheds at upper elevations. In response to threats posed by mitred conures, a variety of strategies had been explored to reduce or eliminate the Maui population, including bait stations, live bird lures, mist nets, rappelling to locate roosts, and audio playbacks of conure vocalizations. None of these approaches proved successful. Shooting individual birds was deemed the most appropriate alternative and has been highly effective: approximately 20 birds remain in the wild. This paper highlights historic efforts, lessons learned, and the value of a cooperative interagency and community-based approach for removal of a non-native flock of mitred conures.

KEY WORDS: bird control, Hawai'i, invasive species, mitred conure, parrots, *Psittacara mitratus*, shooting

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INTRODUCTION

The State of Hawai'i lacks any native parrots; however, at least 28 species have been sighted in the wild (Runde and Pitt 2008a). Two species, the mitred conure (*Psittacara mitratus*) (formerly *Aratinga mitrata*) and the peach-faced lovebird (*Agapornis roseicollis*), have established reproductive populations on Maui Island, Hawai'i. Both are common in the pet trade (BirdLife International 2014). Draft rules by the Hawai'i Department of Land and Natural Resources would classify all members of the Psittacidae family as "injurious species," which would make illegal the release of any parrot to the wild (DLNR 2011). The mitred conure is the focus of an eradication campaign on Maui, while no efforts are underway to control lovebirds.

Conures are of the order Psittaciformes and have large hooked bills and zygodactylous feet. They are native to South America where they prefer semi-arid montane slopes and valleys between 1,000 and 2,500 m but up to 3,400 m (BirdLife International 2014). These mostly green parrots are 38 cm long when fully grown and weigh 250 g (Silva 1993). One brood is typically raised per year and clutch size is 1-4 eggs incubated 23-26 days; chicks fledge at about 50 days of age (Arndt 1982, Hoppe 1982). They are long-lived with an average lifespan in captivity of 20-30 years. Conures vocalize regularly during flight, are relatively quiet when perched, and are raucous just before they start flying or when disturbed (Waring 1997). Mitred conures are one of the most abundant and widespread parrots in southern California and Florida. In Hawai'i, they are present on Hawai'i Island, Maui, and O'ahu (Gassman-Duvall 2002, Runde and Pitt 2006).

The Flock

The flock originated from an intentional and/or accidental release of captive birds on the north shore of Maui around 1986. The birds nest and roost in cliffside cavities which are located approximately 30 m below the cliff edge and 30 m above the ocean (Gassman-Duvall 2002). The cliffs are 50-60 m high and the cavities are spread out across the cliff face. The habitat is characterized as low-elevation, alien wet forest (Wagner et al. 1999), dominated by non-native plants, including guava (*Psidium* spp.) and Christmas berry (*Schinus terebinthifolia*) trees. Mean annual precipitation is approximately 2,300 mm (Giambelluca et al. 2013).

The population had reached an estimated 150-200 birds by 2002 (Carter and Gassman-Duvall 2001, Runde and Pitt 2008a) but fragmented into two separate groups by around 2001 (Gassmann-Duvall 2002). Both groups have remained close to the original point of release, separated by less than 2 km. No other mitred conure colonies are known to exist on Maui. The two groups intermingle, complicating accurate population estimates.

During Waring's observations in 1996, flock sizes ranged from 2-23 birds. Gassman-Duvall reported flock sizes up to 120 birds in 2002. From August through March, the birds typically depart the cliffs just after sunrise, forage in upper elevation forests (>1,300 m), and return at dusk. From April through July, the presumed breeding season, the conures stay closer to the cliffs (Gassman-Duvall 2002, Runde and Pitt 2006). The birds typically fly in pairs no higher than 100 m off the ground, in a straight-forward pattern at 25-30 km per hour (Gassman-Duvall 2002). Daily flight patterns take the

conures back and forth through the local community (Runde and Pitt 2006). The birds often stop to forage along the way, making them highly visible to area residents.

Potential Threats

Alien parrots pose a variety of threats, including: competition with native birds; negative impacts on natural plant communities; damages to crops and human facilities; and transmission of diseases and zoonoses (Menchetti and Mori 2014). Mitred conures can fly 8-16 km/day and tolerate low temperatures, allowing them to reach and potentially alter remaining pristine forests found on the upper elevation slopes of Maui (American Bird Conservancy 2013).

Conures are fruit and seed eaters. In Hawai'i, the birds are known to eat a wide range of wild and cultivated fruit (Runde and Pitt 2008a); on Maui, the conures have been observed feeding on at least 10 different non-native plants (Runde and Pitt 2008a, Waring 1997). Large fruiting trees of miconia (*Miconia calvescens*), one of Hawai'i's most damaging invasive species (Medeiros et al. 1997), were found in close proximity to the conures' breeding site (Maui Invasive Species Committee MISC, unpubl.). Miconia has been a control target for nearly two decades on Maui, with total expenditures in excess of \$10,000,000 (MISC, unpubl.). The conures will consume the fruit and can pass viable seeds of miconia (Gassman-Duvall 2002) and Koster's Curse (*Clidemia hirta*) and *Ficus* spp. (Fern Duvall, Hawai'i DLNR-DOFAW, pers. comm.).

In 2006, during aerial surveys for invasive plants, MISC discovered miconia in a state forest reserve, far from any known seeding plants but in line with the conures' observed flight paths and approximately 5 km from the conures' breeding site (Runde and Pitt 2008a). Undetected satellite populations of miconia present a huge challenge for the ultimate control of this invasive plant. Other potential threats associated with an increasing population of conures include seed predation on rare and endangered plants, seabird nest displacement, and reduced agricultural productivity.

By 2000, the growing population of conures had raised the concern of state, federal, and local resource managers (Loope et al. 2001) and they began to explore options for removing the conures from the wild.

Eradication Requirements and Challenges

Eradication campaigns can be logistically complex, expensive, and controversial (Morrison et al. 2011). Favorable conditions for an eradication outcome include early detection and rapid response to isolated, small populations with low reproductive rates and no dormant life stages (Clout and Veitch 2002). After an invasion has become too widely established, it can become biologically or economically infeasible to eradicate or contain. Introduced parrot populations may have a lag period of several decades and then rapidly irrupt in range and population numbers (Runde et al. 2007, Menchetti and Mori 2014), highlighting the importance of early action.

An aggressive effort to remove the population

appeared to be the most cost-effective and humane approach; however, successful eradication programs must consider the social and political context as well as biological and logistical factors (Morrison et al. 2011). In addition to the controversial aspects of wildlife removal, the two conure groups were located on private property, with reluctant landowners. It became apparent that different options would need to be explored in order to address community concerns and gain support.

Community Outreach and Capture Efforts

As early as 1992, some residents living close to the birds had expressed concerns about increasing numbers and the birds' loud calls (Gassman-Duvall 2002); others stated they enjoyed the birds' presence. The owner of the founding pair of birds was still living in the community and made attempts to recapture them with help from state biologists. The community was divided and the issue drew both local and national attention (King 2001). In 2002, resource managers from state, federal, and nonprofit agencies organized a community meeting to address concerns and discuss potential methods of removal. An animal rescue group asked to have the opportunity to capture the birds with the intent of keeping them in captivity. The group entered into a Memorandum of Agreement with MISC, received a permit from the state Department of Land and Natural Resources (DLNR), and agreed to provide public education and information and exchange pertinent information. The group reported using bait stations, live birds, and taped vocalizations to attract the conures. No reported captures occurred and the permit lapsed.

Researchers from the USDA National Wildlife Research Center (NWRC) worked to develop alternative options for removal (Runde and Pitt 2008a,b). Activities included bait stations with a seed-fruit mix, placement of live conures in cages, and audio playbacks of conure vocalizations. Direct capture efforts included deployment of mist nets and rappelling on the cliff face to locate roosts. No birds were ever removed from the wild using these approaches, and shooting was ultimately determined to be the most feasible remaining option (Runde and Pitt 2008b).

We present information on efforts to date and status of the current population, and discuss the challenges and importance of working with the local community to remove conures from the wild.

METHODS

Community Outreach

The conures roost and nest on properties owned by two different landowners, but also fly over and/or rest and forage on at least 20 properties in the area. Starting in 2004, MISC contacted local property owners and residents by phone, email, and in person to discuss the potential for using the sites for control operations. Key talking points included the threat posed by the conures, previous unsuccessful non-lethal efforts, and liability concerns. In anticipation of initial control operations, MISC and DLNR developed a draft press release to address any potential public response. Supportive landowners were encouraged to report sightings directly

to MISC. MISC contacted landowners in advance of any control operation to secure permission and address concerns.

Although not directly related to the conure project, MISC also conducted field operations in the same area to survey for and control miconia. Thus, MISC had existing and ongoing contacts and relationships with many of the local landowners. Additionally, MISC has a very active outreach and education program in the broader community. The conures have been part of the outreach message since at least 2002.

Population Estimates

Population estimates were derived from the literature (Waring 1997, Carter and Gassman-Duvall 2001, Runde et al. 2007) and from direct counts by MISC and DLNR (Figure 1). In 2004, MISC conducted surveys uphill from the nesting area along the H na Highway in East Maui to estimate the number of birds in the flock and determine general flight patterns. Each counter used a radio to convey information about bird movement to reduce the potential for double-counting the same birds. Counts also occurred before and during control operations. To reduce double counting, only the high count observed during a site visit was used. In addition to information collected by agency staff, several local residents tracked bird movement and flock size, which helped increase the confidence of population estimates.

Control Methods

In late 2005, MISC and DLNR conducted site surveys to identify suitable properties based on accessibility, safety, proximity to the flocks, and landowner support.

Two properties with access to the two different conure groups were identified as suitable.

Regular control operations began in 2006. Two to 6 shooters from DLNR, MISC, and initially, USDA-Wildlife Services were stationed along the cliff edge during early morning or evening hours. Each agency had and followed its own protocols for certifying qualified shooters. A safe shooting lane for each person defined the shooting space and if an opportunity occurred, the shooter fired, always towards the ocean to avoid shooting in the direction of any residence. Shooters used 12 gauge shotguns with 2¾ game loads. High brass game loads, heavy shot (typically #6), and full choke were used because the area is typically windy (15 - 20 knots) and the birds are very fast. Operations near one of the two roosting areas were scheduled about every 4 to 6 weeks to reduce impacts to the local community. Increased efforts occurred during the breeding season (April to July) to capitalize on more consistent and frequent flights during the chick-rearing season and to help minimize potential site abandonment (Waring 1997, Runde and Pitt 2006).

There was a gap in control effort from 2010 to 2011. In 2010, the economic recession affected funding for DLNR. MISC was not able to use firearms until 2011, at which time control operations resumed. In addition to agency control operations, one local resident obtained a wildlife damage control permit from DLNR to remove the birds.

Data recorded included time of day, number of shooters, and number of birds shot. Any direct hit was considered a mortality regardless of whether the carcass was recovered. All carcasses were provided to DLNR for eventual stomach analysis.

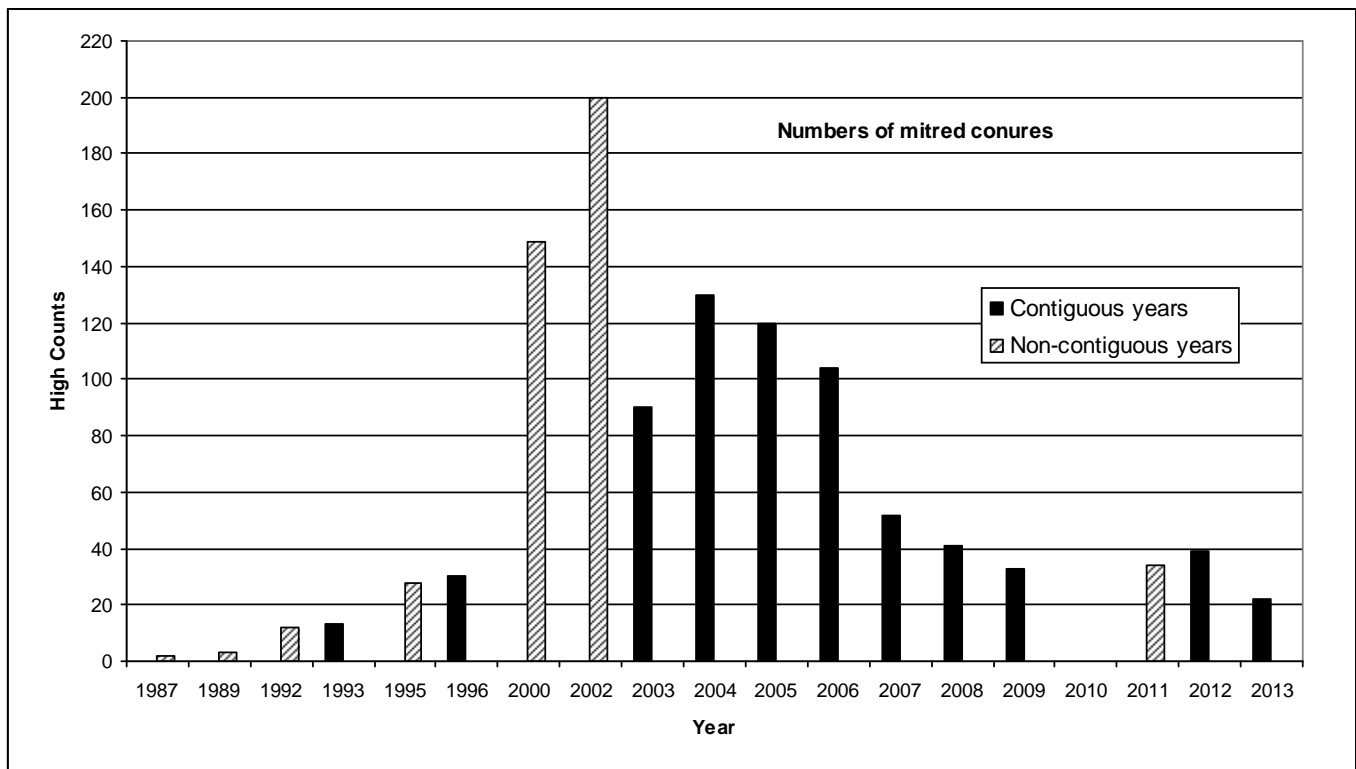


Figure 1. Numbers of mitred conures reported or observed from 1987 through 2013.

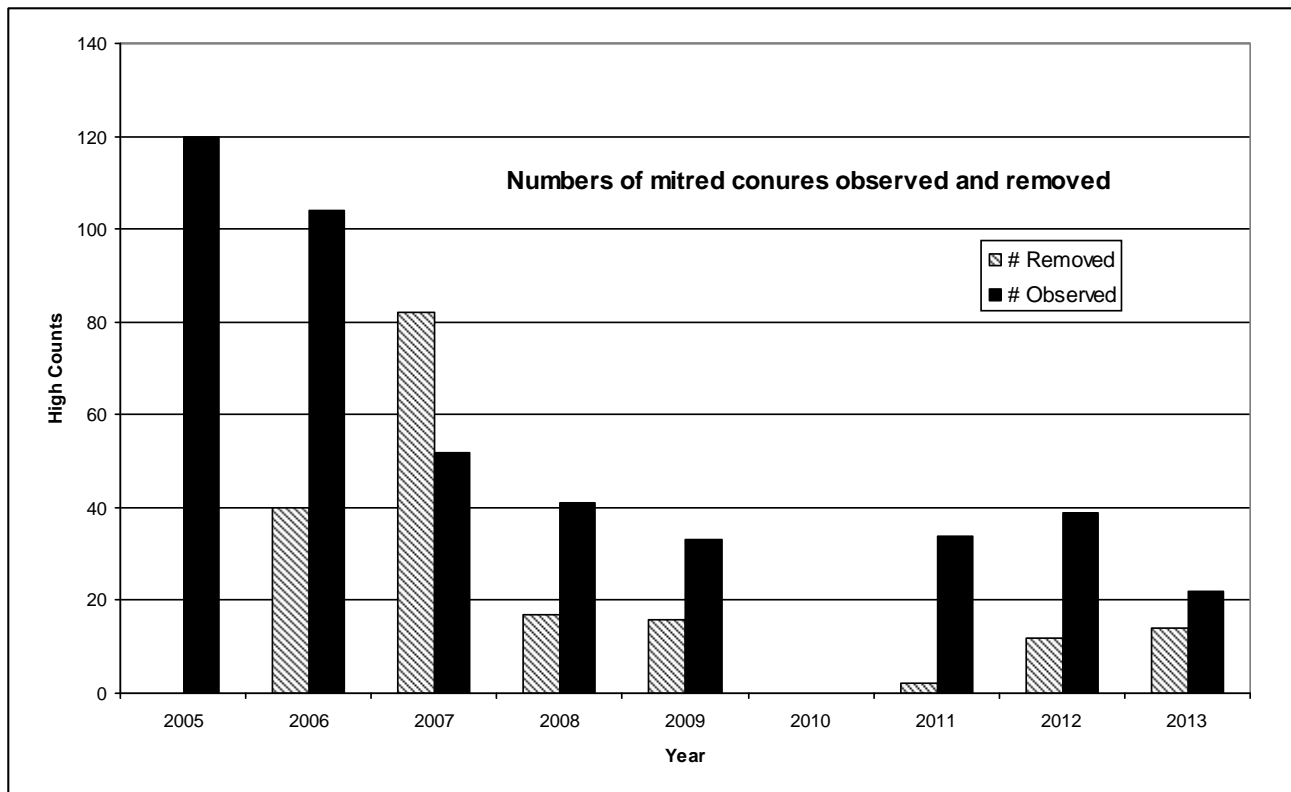


Figure 2. Numbers of mitred conures observed and removed from 2005 through 2013.

RESULTS

Control Operations

Control operations occurred on 90 days (average 11.25 days per year, not including years where no operations occurred). MISC and DLNR staff time totaled 955 hours in active control operations.

The mitred conure flock decreased from an estimated high of 150-200 birds in 2002 to 20 birds by 2014. A total of 187 birds were removed by 9 trained shooters during 89 control operations from 2006 through 2013 (Figure 2). At least 12 additional birds were shot by area residents; minimal data exists for effort related to these removals. Due to the hiatus in operations during 2010, the population rebounded slightly. The observed numbers of birds in 2011 was nearly the same as 2009, and increased in 2012.

On average, it took 5 hours to remove one bird. Depending on the location, weather, and number of birds present, the average ranged from 3 to 13 hours per bird. The amount of time per bird removal increased as the flock decreased, presumably because shooting opportunities declined and the birds appeared to adjust flight patterns to avoid shooters.

Community Support

No numerical measures were collected to gauge shifts in community perspective; however, the anecdotal results of community engagement should be considered as part of project evaluation. While some residents undoubtedly remain opposed to the removal of the birds, MISC has received no objections since 2008. A 2007 communication involved a South Maui resident (located 27 miles

from the affected community) who was affiliated with a national animal rights group known to cause physical property damage in Hawai'i. Staff from MISC, the Maui County mayor's office, and the Federal Bureau of Investigation met with the individual to address concerns; no further objections were received.

Positive community support has evolved into a "citizen science" approach for some residents, who actively track flock behavior and log information about time of day, habitat use, and movement patterns. Having eyes and ears on the ground has provided invaluable information for control operations. At least one resident removes birds from his own property as they fly over.

DISCUSSION

Mitred conures had become established and were reproducing in the wild on Maui. The conures posed threats to the native environment, agriculture, and human quality of life. The population rose rapidly from a founder pair of 2 birds in 1986 to at least 150 birds by 2003, demonstrating the species' high fecundity and raising alarms about feasibility of control if no action were taken.

The conure population presented numerous challenges for a successful removal campaign. Located in a rural residential location on private property, landowner permission was required for control operations. Cliffside nesting made access difficult. Some community members actively opposed lethal control, an unsurprising result since the flock originated from the release of live birds by a local resident.

Simberloff (2003) argued that the science required for

a decision on a fast course of action is often minimal, while waiting to do more can make control more difficult or impossible. However, moving quickly is not always an option if access or public opposition is an issue. Failure to eradicate the monk parakeet (*Myiopsitta monachus*) when still feasible was related to the controversy associated with killing a charismatic species (Simberloff 2003). Control of Maui's wild lovebirds would be challenging, as the population is located in a densely populated urban area. In the case of Maui's mitred conures, the science required included demonstrating that non-lethal methods weren't working in order to address community concerns. The control efforts described here were preceded by a suite of unsuccessful live capture strategies over several years, which established that the only viable option was direct removal by shooting (Runde and Pitt 2008b).

While cliffside access was difficult, the location was ideal for shooting in an area with human habitation because shots could be directed toward the ocean, away from any houses. The involvement of multiple agencies with trained shooters helped address gaps in effort caused by funding or scheduling challenges.

Any eradication program should address the possibility that the population has fragmented and in this case that another flock might exist on Maui. The high population estimate in 2002 of approximately 200 birds does not match estimates closer to 120 in 2005. No formal control program was underway until 2006, which raises the question: Where did 30-80 conures go?

The high estimate was reported by Gassman-Duvall as a range of 150-200 conures, so the initial estimate could have been high. Alternatively, some birds could have moved to the warm, dry regions of west and south Maui, areas that are more similar to the birds' preferred habitat in their native range. Mitigating against that possibility is the likelihood that residents would report sightings of a parrot flock to MISC, as they have with the recently expanding population of lovebirds in south Maui. Additionally, before starting the direct control program, resource managers were concerned about potential site abandonment after shooting began. Although bird flight becomes erratic after a firearm is discharged, evidence to date does not suggest site abandonment. Numbers observed have been consistent over time and no alternate nesting, feeding, or roosting sites have ever been found or reported. However, repopulation from other Hawaiian Islands remains a remote possibility, as well as releases of caged birds. Ongoing surveillance and vigilance for new arrivals or new releases remains important.

This project could not have been successful without the cooperation of multiple partners and local residents. The importance of dialogue with the community and development of positive relationships cannot be overstated. Residents now report the most opportune times for control and the choice of the least disruptive, most effective location incorporates their recommendations. Determining the most appropriate removal techniques and building community support has taken time, but each component has been critical to the projected eventual outcome: eradication of mitred conures from the island of Maui.

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