# Gray-headed Chickadee Captive Flock and Propagation

## A Scoping Report


Dr. Rebecca McGuire
Wildlife Conservation Society, Arctic Beringia Program
3550 Airport Way, Suite 5
Fairbanks, AK 99709
rmcguire@wcs.org

*A report to the Alaska Department of Fish and Game (ADF&G) in fulfillment of cooperative agreement 19-054 under State Wildlife Grant T-33 Project 10.0, April, 2020. ADF&G and the Wildlife Conservation Society have co-ownership of all content.*

Recommended Citation:
*McGuire, R. 2020. Gray-headed Chickadee captive flock and propagation: A scoping report. A report by the Wildlife Conservation Society to the Alaska Department of Fish and Game, in fulfillment of cooperative agreement 19-054, Fairbanks.*

# Table of Contents

## 1.0 Introduction

The North American subspecies of Gray-headed Chickadee (*Poecile cinctus lathami*) is a small, rare, and enigmatic songbird with a historical distribution covering portions of the boreal forests and Arctic shrublands of Alaska, the Yukon Territory, and Northwest Territories. Based on local observations of potential declines in abundance in northeastern Alaska and a lack of knowledge on the current distribution, population size, population trend, and habitat associations, the Alaska Department of Fish and Game, in cooperation with the US Fish and Wildlife Service, began conducting surveys to gain knowledge on this species. After seven years of survey efforts, they have not found a population upon which research or conservation efforts could be focused. This has raised concerns about the status and population trends for this species.

Globally, four subspecies of Gray-headed Chickadees are recognized (following Dickinson and Remsen 2013). Three occur in Eurasia (*P. c. lapponicus*, *P. c. sayanus*, and *P. c. cinctus*) and one occurs in North America; *P. c. lathami*, which is endemic to Alaska and northwestern Canada. Like other chickadee species, Gray-headed Chickadees are presumably non-migratory or perhaps short-distance migrants, making gene flow between the Old and New World subspecies since the last glacial maximum (approximately 20,000 years ago) highly unlikely. DeCicco et al. (2017) found that *P. c. lathami* differed significantly from its nearest Old World subspecies, *P. c. cinctus,* in 7 of 14 morphological variables, with *P. c. lathami* having generally darker plumage and a larger bill. Their results support the current distinction between the Old and New World subspecies although a phylogenetic assessment of the two subspecies is needed.

Exceedingly little information has been gathered on *P. c. lathami* since it was first discovered and named (previously considered *P. c. alascensis*) in North America in 1817 (Booms et al. 2020). Numerous historical records suggest the species might have been locally common from the Noatak and Kobuk River drainages, the upper Colleen River in northeastern Alaska, and the Old Crow Flats in the Yukon Territory, Canada (Booms et al. 2020). The species likely currently occurs from the lower Yukon River near the Nulato Hills north to the southern side of the Brooks Range near Kotzebue, and east across both the north and south slopes of the Brooks Range into the northern portions of the Yukon and western-most Northwest Territories, Canada. It is found in areas of lowland conifer forest, which is mostly old-growth spruce (*Picea*), especially in areas with dead or decaying trees. North of the tree-line and tundra edge it also occurs in dwarf and mature willows along rivers and creeks, and in montane areas on alpine heath. In the non-breeding season, it is found in similar habitat as well as in alders (*Alnus*) and aspens (*Populus tremula*) and may also be found in dwarf scrub including Labrador tea (*Ledum palustre*). The species breeds from May to July and is monogamous. The nest is a platform of decaying wood, moss, grass stems and animal hair or fur, in a hole in a rotting tree trunk or stump; however, it will use nest boxes as well. Clutches can be from four to eleven eggs. The diet is made up mainly of small invertebrates, but it will also consume seeds and scraps from bird feeders or refuse scraps, and cache food items. The species is thought to be resident, remaining within territories all year; juveniles may be more nomadic (Gosler and Clement 2007).

The species' global population estimate is 2,000,000 (Partners in Flight 2013) though accuracy of this estimate is unknown. In Fennoscandia, the species has declined

substantially since the 1960's (Hailman and Haftorn 1995) and in Southern Norway, by an estimated 90% (Dale and Andreassen 2016). Most likely causes of the decline include a combination of climate change and competition with increasing populations of other chickadee species (Dale and Andreassen 2016). We know of no population estimates for North America (Hailman and Haftorn 1995) though Rosenberg et al. (2016) considered there are fewer than 5,000 based on Partners in Flight Science Committee (2013) "expert knowledge." Historically, the species was considered rare or uncommon throughout most of its distribution, though it was commonly observed in some areas (Booms et al. 2020).

Given their perceived population trajectory, it is likely that management steps may need to be taken in the near future to prevent Gray-headed Chickadees from becoming threatened or endangered. In the event that a captive flock of Gray-headed Chickadees is determined to be necessary to guard against extinction and serve as a potential source for future conservation measures, this plan provides detailed guidance and directions on how to create and manage a captive flock and propagation program.

## 2.0 Triggers for Moving Forward

Prior to the plans presented in this report for the establishment of a captive flock, care must be taken that captive propagation is appropriate and the best conservation tool for recovery of the species. We briefly summarize captive propagation, pros and cons, here, but this report is primarily for use after such a decision has been made.

Captive propagation and reintroduction is a widely used conservation tool, having been recommended in 64% of 314 recovery plans for endangered species within the United States (see Ostermann et al. 2001). It is typically thought of as an emergency strategy, after less invasive options have been exhausted, as a last ditch attempt to keep the species extant while reasons for decline are addressed. Typically, the plan is to capture all or some of the existing wild population, propagate them in captivity, determine factors influencing the population decline in the wild, attempt to mitigate those factors, and reintroduce individuals produced in captivity back into the wild. There are success stories and failures in the literature, and the World Conservation Union (IUCN) has a Conservation Breeding Specialist Group that tracks captive rearing programs for plants and animals worldwide (www.cbsg.org) The goals of the captive flocks are to protect the genetic material of the species in times of high risk and support reintroduction programs that establish additional flocks in the wild. Captive propagation also allows for the comprehensive investigation of key physiological or behavioral traits that can provide clues for the better management of wild populations and can contribute to education by enabling the public to view and become knowledgeable about those species in greatest jeopardy (Carpenter and Derrickson 1982).

Prior to captive propagation and translocation a number of questions must be considered: (1) is there an existing genetically distinct population; (2) does the wild population need to increase; (3) is there an appropriate source population; (4) have the original causes of the population decline been identified and addressed; (5) is there adequate habitat to support the species; (6) do necessary collaborators support propagation and translocation; and (7) is there a clear scientific protocol with quantifiable benchmarks for evaluating

success? Typically, captive propagation has been deemed appropriate when a species is near extinction in the wild and in situ management is not possible, and a wild population does not have sufficient size for translocations. The goal is typically to establish a self-sustaining population capable of becoming a source population for translocations while avoiding inbreeding depression, minimizing accumulation of deleterious mutations, maintaining genetic fitness of individuals released into the wild, and minimizing threats of demographic stochasticity (See Dein et al. 1995).

Individuals from captive breeding programs may differ genetically from the target population which can result in outbreeding depression following hybridization. Selection pressures in captivity may differ from those in natural environments giving rise to genotypes that are maladapted to natural habitats, and individuals from captive breeding programs may have low genetic diversity and inbreeding depression due to small population sizes and the use of a small number of individuals for breeding; hybridization with maladapted or inbred individuals may lower the average fitness of populations which will threaten wild populations (Todesco et al. 2016).

There are two risks of hybridization for species with very small population sizes: genetic swamping and demographic swamping. Genetic swamping is where the rare form is replaced by hybrids and demographic swamping is where population growth rates are reduced due to many maladaptive hybrids being produced. Todesco et al. (2016) found in a review of literature that genetic swamping is more frequent than demographic swamping and that human involvement is associated with increased risk.

Collectively, these risks must be considered prior to the formation of a captive Gray-headed Chickadee flock given the lack of information about the current status of the species, genetic information about the species, and the causes of the population declines. Gray-headed Chickadees in Europe are known to interbreed with willow tits (*P. montanus*; Järvinen 1989). Hybridization with other chickadee species in North America has not been documented, however, Gray-headed Chickadees are closely related to Boreal Chickadees and it is likely that they could inter-breed. Lait et al. (2012) documented the more distantly related Black-capped Chickadee (*P. atricapillus*) hybridizing with Boreal Chickadees, suggesting that hybridization between the closely related brown-capped species is very possible. Therefore, care must be taken not to increase the likelihood of hybridization between Gray-headed Chickadees and Boreal Chickadees.

## 3.0 Review of Select (Primary) Locations of Captive Chickadees or Similar Species

**Akron Zoo**
500 Edgewood Ave.
Akron, OH 44307-2199

Shane Good, Director of Collections Management, Akron Zoo
Phone: 330-375-2550 ext. 7268
Cell: 330-802-0164
s.good@akronzoo.org

Kim Cook, Senior Director of Life Sciences Akron Zoo
k.cook@akronzoo.org

The Akron Zoo has a long-term captive flock of Black Capped Chickadees. They have successfully bred in captivity and are housed in a large out-door aviary in a multi-species flock (Figures 1 and 2). The chickadees have access to warmed indoor housing (Figure 3). Their protocols for feeding can be seen in Appendix A. Additionally, they have indoor cages for quarantined birds (Figure 4). The indoor cages were made and installed by Corners Limited in Kalamazoo Michigan (https://cornerslimited.com). They have offered to help with fund raising and possibly send up one of their keepers to help with facility set-up if needed.

Figure 1. Large out-door multi-species aviary at the Akron Zoo, Ohio, in winter.

Figure 2. Large out-door multi-species aviary at the Akron Zoo, Ohio, in summer.

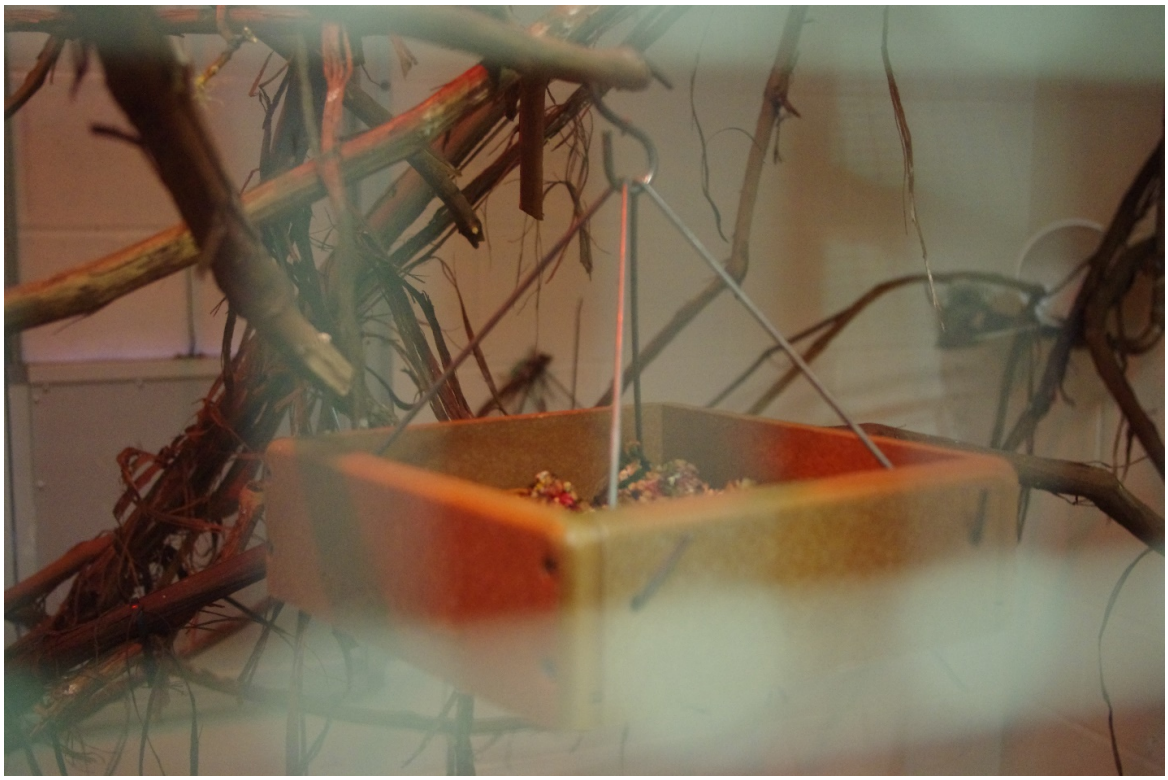


Figure 3. Heated, indoor portion of small passerine aviary, Akron Zoo, Ohio. Perches and feeder can be seen through the mesh.

Figure 4. Indoor holding cages for small passerines, Akron Zoo, Ohio.

**U.S. Geological Survey**
4210 University Drive
Anchorage, AK 99508

Dr. Colleen Handel, Research Wildlife Biologist, Alaska Science Center
Ph: 907-786-7181
Email: cmhandel@usgs.gov

Housed a short-term flock of black-capped chickadees for research into avian keratin disorder. This facility was for short-term housing only and was removed after the research was completed. No pictures or description available at this time.

**University of Alaska, Fairbanks**
Biological Research and Diagnostic Facility
1003 Sheenjek Drive
Fairbanks, AK 99709

Drs. John Blake and Caroline Van Hemert
Ph: 907-474-7020

Email: jeblake@alaska.edu

Housed a short-term flock of black-capped chickadees for research into avian keratin disorder. Birds were individually housed in 76 x 46 x 46 cm, stainless steel cages and maintained at 10 C under full-spectrum lights set to the photoperiod of Anchorage, Alaska, adjusted weekly to match natural seasonal changes in daylight period. Diet consisted of chipped sunflower seeds, suet, mealworms (*Tenebrio molitor*), and ground hard-boiled eggs provided *ad libitum* in low-rimmed petri dishes. Avian Calcium for Birds (Zoo Med Laboratories, Inc., San Luis Obispo, California, USA) and Avi-Con avian multivitamin (Vet-A-Mix, Lloyd, Inc., Shenandoah, Iowa, USA) were provided according to manufacturer guidelines (see Van Hemert et al. 2012). Chickadees reportedly did well in this facility but this set-up is not appropriate for a long-term captive breeding flock.

## 4.0 General Requirements of a Captive Flock Facility, Including Captive Propagation

### Housing

Recommendations for captive *Parus* and *Poecile* spp. are provided as follows by Hawkins et al. (2001: Section 24). Chickadees can be housed in either cages or aviaries. Outdoor aviaries are likely to be better for the birds' well-being than indoor cages. Birds may be group housed in large aviaries but need to be kept individually if housed in small cages to avoid aggression. Close observation should be kept over the first two days if

birds are to be kept in aviaries with conspecifics, especially if there is more than one male in the group. The upper group size depends on the size of the aviary and the cover provided in it by plants or artificial structures, but groups of more than 12 birds are not recommended (Table 1). Hawkins et al. (2001) recommends that species not be mixed. Indoor aviaries should also have the floor covered with absorbent paper, changed twice a week. If birds are group housed, a food and a water bowl should be provided for each bird and placed at least 10 cm apart in order to prevent dominant birds restricting access to these by subordinates. If housed in outdoor aviaries, birds must be provided with shade, windbreaks and appropriately positioned perches. An alternative would be to link the outdoor aviary to an indoor cage to provide shelter and for ease of capture. Hawkins et al. (2001) recommended that temperatures not be allowed to get too low (<10 C) or too high (>20 C) for extended periods of time (more than a few hours). However, this is likely not reasonable for chickadees which should retain the ability to survive in northern Alaska. The Akron Zoo provided outdoor heaters (Figure 5). It is important to maintain the appropriate environmental conditions and day lengths. Hawkins et al. (2001) recommended the use of daylight lightbulbs in any holding area needing additional light. Shade must be provided in the summer, and the predicted increase in smoke from forest fires may need to be considered (Lisa Pajot, personal communication). If possible, they should be housed in the appropriate ecotype, as much as possible. E.g. northern coniferous and deciduous forests (Booms et al. 2020). They should have natural ground and if possible should have snow within the aviary as there is some suggestion that they may snow roost (H. Korth personal communication).

Figure 5. Outdoor heater in the aviary at the Akron Zoo, Ohio.

Table 1. Space allowances for chickadees (from Hawkins et al. (2001) Table 8).

| Number of birds | Cage dimensions (m) | Minimum height (m) | Minimum number of feeders |
|---|---|---|---|
| 1 | 0.4 x 0.7 | 0.4 | 1 |
| Breeding pair | 2 x 2 | 2 | 2 |
| Up to 6 | 3 x 3 | 2 | 1 per bird |
| Up to 12 | 4 x 4 | 2 | 1 per bird |
| Over 12 | Not advised | | |

The enclosure needs to have a solid wall or 1"x1/2" wire mesh. Chickadees can tear apart and put holes in fiberglass screen (Lisa Pajot, personal communication). Chickadees are escape artists and can squeeze through small spaces (Shaun Good, personal communication). All facilities must have appropriate safe-guards against bird escape. Doors to the aviaries should never open directly to the outside, but rather open into an enclosed area with a second door. Nets should be kept handy in the event that a bird does escape from their enclosure into the secondary area. If a bird has escaped into a room, a technique to recapture it, is to note where the bird is, turn the lights off, and retrieve the bird. This is less stressful than swinging a net around trying to catch it in flight, or cornering it (Lisa Pajot, personal communication).

Aviary design must ensure that the chickadees are not accessible to avian or mammalian predators and have adequate security against break-ins, vandalism, etc. To deter mammalian predators, the enclosure walls should be set at least 20 cm into the ground with the wire mesh extending 60 – 90 cm out from the cage in order to prevent tunneling into the enclosure. Alternatively, a mesh 'predator skirting' can still extend a meter out from the enclosure either above the ground or slightly buried. Some aviaries have an electric wire around the outside of the enclosure. Enclosures, especially those with outdoor flights, must be checked frequently to ensure that there are no holes. The bottom of every panel on the enclosure must be flush with the ground to ensure that there are not any small areas where birds could escape or become trapped. All doors and windows remain locked at all times.

To help facilitate breeding, two bluebird style nest boxes (2 boxes per pair of birds) should be provided. Examples of a nest boxes used by the Akron Zoo can be seen in Figures 6 and 7. Provide nesting materials in the spring. The Akron Zoo filled nest boxes very full with material such as shredded alder (Shane Good, personal communication). Colleen Handel's team used shredded spruce and birch and filled nest boxes up to just below the nest entrance (Lisa Pajot, personal communication). The chickadees will push it out and organize it to their liking (Shane Good, personal communication). Some captive birds do better if they are allowed mate choice (Shane Good, personal communication) and an option for an open aviary and some caging for pairs would be optimal. In the wild, grey-headed chickadee' nests always contained moss and lagomorph fur and usually a layer of decayed wood (see Hailman and Haftorn 1995), and these components should be provided.

Figure 6. Small passerine nest box at the Akron Zoo, Akron, Ohio.

Figure 7. Interior of small passerine next box at the Akron Zoo, Akron, Ohio.

Incubation is variable in Fennoscandia, ranging from 14-17 days. Fledglings depart the nest 19 d post hatch in Finland, and up to 20 d in Murmansk region. Fledglings remain on parents' territory about two weeks (see Hailman and Haftorn 1995).

## Food

Hawkins (et al. 2001) suggests providing a bowl of food (a commercial insectivorous food mixture, plus 2 to 6 of the following: peanuts, sunflower seeds, pine nuts, hemp seeds and at least one live/fresh food item e.g. mealworm or wax moth larvae, dried egg, fresh grated carrot) daily in the morning. The smaller birds invariably refuse to eat mealworms, and avoidance of some types of nut or seed may also develop. A daily bowl of fresh water must be provided to allow the birds to drink and to bathe. As with other species, careful diet analysis should be undertaken to ensure an appropriately balanced nutrient profile and any deficiencies or imbalances should be corrected; blue tits, in particular, are susceptible to vitamin A deficiency. Consider providing 'puzzle feeders' to extend foraging time. The Akron Zoo diet plan is very similar and can be seen in Appendix A. An example of a feeder used at the Akron Zoo can be seen in Figure 8.

Figure 8. Small passerine feeder at the Akron Zoo, Akron, Ohio.

## Habitat Enrichment

There are no current data on whether or not chickadees would make use of 'toys' or whether the provision of such toys would enhance the birds' living conditions. However, cage or aviary additions should be provided that will encourage the birds to spend time exercising and foraging for their food. Provide small trees and undergrowth, shade and windbreaks (Shane Good, personal communication). The Akron Zoo placed used Christmas trees in the aviary each winter. Chickadees spend most of their resting time sitting on a perch. Perches can be branches or pieces of dowel varying in thickness from 1 to 2 cm and at least two per cage should be provided. Roosting boxes can be provided for birds in cages, but birds will roost on a perch, often in preference to using a roosting box. Suspended balls of straw could also be provided. (Hawkins et al. 2001).

## Health and Welfare

The chickadees should be visually accounted for daily and at least once a year they should have a full health check (Shane Good, personal communication).

Potential health and welfare problems (from Hawkins et al. 2001)

- Claws growing too long. Claws should be shortened by clipping, not sandpaper.
- Vitamin A deficiency. Correct this with carefully calculated and measured supplements of vitamin A.
- Molting problems. House birds outside or inside with daylight light bulbs. Use appropriate day lengths, if birds are housed indoors.
- Stereotypies. Some flight stereotypies may develop, e.g. somersaulting backwards off the perch. These can be prevented by providing larger caging, environmental stimulation and the opportunity for flight, e.g. at least access to a larger area for restricted periods.
- Abraded feathers. Decrease human activity around cages or aviaries. Provide more perches and larger caging.
- Poor condition. Monitor diet content and provide vitamin supplements if necessary

## Daily Routine

It is important that the staff be careful to both complete the necessary husbandry and minimize disturbance. All birds must be checked daily through visual inspection, the flock must be fed according to protocol and water should be replenished daily. Frozen vertebrate diet items to be fed the following day must be removed from the freezer and placed in the fridge to thaw overnight. Food and water dishes should be cleaned and disinfected using the facility approved disinfectant and daily logbook entry and other records should be filled out as required. If the flock is about 12 birds, it will take several hours a day to clean, feed, and watch the birds (Shane Good, personal communication).

## Facility Cleaning and Maintenance

Along with daily cleaning of food and water dishes, a regular cleaning routine for perches, ledges and flooring should be established. For indoor housing, any floor substrate (newspaper or shavings) must be changed weekly, or as needed. Build-up of feces and other debris should be removed (scraped, swept, mopped, or vacuumed) weekly from inside facilities and monthly in outdoor aviaries. Holding pens can be hosed down and scrubbed with a cleaning solution (e.g. Peroxigard or Virkon), and rinsed before being left to dry. Alternatively, heavily soiled surfaces can be spot cleaned every week to 10 days. Perches should be replaced once or twice a year. The enclosures must be regularly examined to ensure there are no holes or sharp edges. Outdoor panels should be checked to make sure they are flush to ground and predator skirting or buried fencing is undamaged. All locks and door hinges should be oiled regularly so that staff can enter quickly and quietly. All doors must be secure at all times. Hands must be washed well with a disinfectant or veterinarian hand soap (e.g. SpectraStat) and thoroughly dried before handling food or the birds. Surgical gloves can be worn if desired. Stepping in and out of a bleach foot bath each time a bird area is entered is recommended (Lisa Pajot, personal communication). Soiled towels and other laundry should be stored in covered containers. Towels must be washed and dried after use. All trash should be sealed and stored in covered containers outside of the aviary and garbage is to be removed from the area daily. Pests, such as rodents, wild birds, or insects, may play a significant role in disease transmission as they can introduce disease organisms into an aviary by mechanical transmission or by being directly infected with and shedding the organisms. For example, if rodents have access to the feed bins, they may defecate in the feed, contaminating it with many potential pathogens such as *Salmonella* or *E. coli* (see Eastern Loggerhead Shrike Husbandry Manuel). Therefore, every effort must be made to control pests in and around the diet preparation area and prey item holdings.

## Health

The health of the birds should be evaluated regularly by close monitoring of the following indicators (see Eastern Loggerhead Shrike Husbandry Manuel). Any changes in these indicators may signify a problem.

- Appearance of feces (color, consistency, quantity)
- Amount of food or water consumed
- Behavior (e.g. ability to fly, activity level)
- Appearance or posture (e.g. sleepy, fluffed-up)
- Body weight
- Rate and depth of respiration
- Particular signs that indicate a health problem include:
- Discharge from nostrils, eyes or bill
- Excess loss of, or soiled or misshapen feathers

- Loss of appetite and weight loss
- Soiled vents
- Enlargements or swellings
- Vomiting or regurgitation
- Injury or bleeding
- Dull or closed eyes
- Lameness, wounded or swollen feet
- Lumps or wounds on the body
- Overgrown bill or nails
- Stains or scabs around eyes or nostrils

Once a bird has shown signs of distress, a designated veterinarian should be notified immediately. Sick or injured birds must be immediately isolated for observation and treatment to prevent further injury and to restrict the spread of infections. Document all unusual behavior or incidents that might indicate poor health and any ensuing medical intervention.

## 5.0 Options for Location of Captive Housing

We reviewed a number of options for housing the captive flock in Alaska. There are existing facilities at zoos, such as Akron, outside of Alaska, where a captive flock could be housed. However, it is really far to transport birds, the warmer environment may not produce birds capable of surviving in northern Alaska, birds may be exposed to more diseases, and photo length differences would be difficult to control in an outside aviary. Potential options within Alaska which we explored included The Seward Sealife Center, the Alaska Wildlife Conservation Center, the Bird Treatment and Learning Center, the Alaska Zoo, the University of Alaska Fairbanks Animal Resource Center (UAF ARC) and building new facility specifically for this flock in Fairbanks. However, the Seward Sealife Center does not have facilities that can be used for terrestrial birds, and the Bird Treatment and Learning Center does not house captive-flocks. The Alaska Wildlife Conservation Center and the Alaska Zoo did not respond to multiple phone messages. Therefore, there are two main Alaskan-based options; building a new facility and UAF ARC.

### New Facility

Following the recommendations described in this report, I designed a free-standing facility (Figure 9), including an aviary with a natural floor, three small holding pens, and an attached, insulated building for storing food and supplies, food preparation, and other activities. The aviary is long and narrow to strengthen the roof to lower the risk of snow building up on it and crushing it. Straight Ahead Construction provided a quote for building the facility (Appendix B). Akron Zoo recommended Corners Limited build the

aviary components of the facility, as they have extensive experience and have built similar aviaries for zoos around the country. Corners Limited provided a quote for aviary construction and shipping (Appendix C). The Corners Limited quote (Appendix C) is based on the Figure 9 design. However, Lisa Pajot (pers comm) recommends that the smaller, attached pens be 4'x4' in size to facilitate humans accessing the enclosure while birds are in it. The budget for construction of a new facility is in Table 2. The budget is missing some large costs but at a bare minimum is appears that construction of a new facility will cost over $67,300 and maintaining the flock will cost over $20,948 per year. I did not break down the personnel costs by chickadee because you have to have a technician ordering and preparing food, and cleaning the facility whether you have two chickadees or 12.

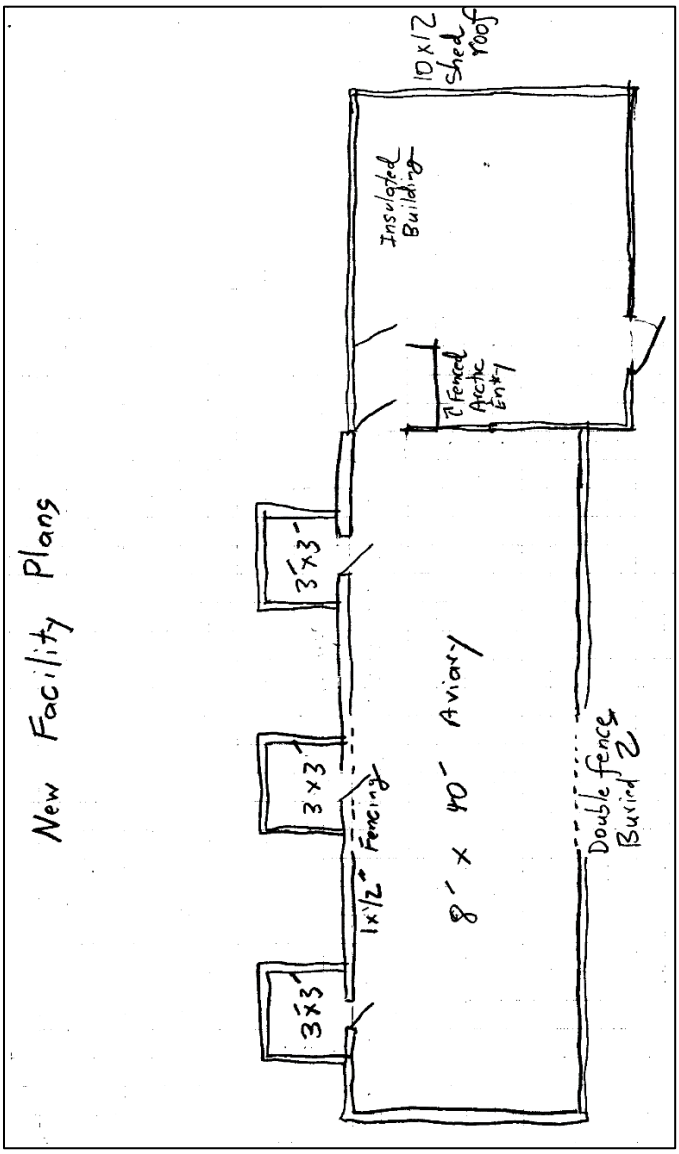



Figure 9. New facility design.

Table 2. Cost of building new facility and maintaining a captive flock for one year.

| Description | Costs ($) |
|---|---|
| Land lease | *Depends on location* |
| Straight Ahead Construction Estimate facility construction | $58,700 |
| Dirtwork | *Depends on location* |
| Corners Limited Estimate Aviary Fencing | $8,600 |
| Electrical Hook-up | *Depends on location* |
| One-year personnel costs to maintain flock, 2 hours/day* | $20,468 |
| Electric/year | $480 |

**Technician costs are based on a part-time Wildlife Conservation Society technician.*

## University of Alaska Fairbanks Animal Resource Center

UAF (ARC) has an existing structure and with some modifications it could be used to house a captive long-term flock. They have experience with passerines, including chickadees. John Blake and his team were very open to the idea of housing a captive, outdoor, long-term flock there. They provided a plan for an aviary on west ridge, a picture of the existing structure, and a quote (Appendix D). The cost of modifying the existing structure is $14,667.53 and the cost per chickadee for one year of colony maintenance is $374.44 (Table 3), at current costs. These were predicted to increase 2%/fiscal year; however, it is unclear what the university funding will look like in the future under the current state administration.

Table 3. Cost of housing a captive chickadee flock at UAF Biological Reserve Aviary and one year of maintenance. This information can also be seen in Appendix D.

| Description | Costs ($) |
|---|---|
| Modification of existing UAF Biological Reserve Aviary | 14,667.53 |
| Fourteen quarantine days, one breeding pair | 38.64 |
| Colony maintenance, per chickadee/year | 335.80 |

## 6.0 Initial Stocking

An appropriate source population may be difficult to locate in North America. Since 2010, the Alaska Department of Fish and Game, in collaboration with the USFWS, surveyed 5 locations where the species was previously documented to occur regularly based on museum collections or reliable field notes from biologists, as well as an additional location on the North Slope that contained substantial potential nesting habitat. Over 7 years, they conducted surveys on 56 days including 245 hrs. of active and 617 hrs. of passive respectively, covering approximately 400 km of survey routes, all in presumably good chickadee habitat. During these efforts, they detected Gray-headed Chickadees on two occasions. There are an additional handful of sightings reported in recent years (Booms et al. 2020).

This plan does not cover the option of using source populations in Europe as that would be an order of magnitude more complicated both logistically, genetically, and in regards to permits.

While there are challenges finding a wild source, stocking the captive flock with wild-caught adults would be preferable. Birds should be transported in dark, quiet, and confined conditions (e.g. small enough that movement is restricted). Food and water should be provided and birds should be confined singly (Laboratory Animals 2001). Observe the bird and record the attitude, respiration, and plumage condition. A physical examination is required to ascertain body weight, general condition, and possible trauma. Conduct the examination and provide suitable medical treatment as quickly as possible to reduce the stress to the bird. The first few days after capture are the most crucial for the birds' long-term survival. During this time, they should be oversupplied with a range of food items including several live invertebrates. If a bird is seen to be puffed up as if roosting but during the day, monitor closely. If in this position for more than 30 minutes, remove bird to a small heated hospital cage, provide lots of live food and consult a veterinarian (Laboratory Animals 2001). Acclimation of passerines has been successfully accomplished by placing birds in a solid wall enclosure that provides suitable plantings for security and perching, along with access to a variety of food items in multiple feeding stations (David Oehler personal communication). Leave the lights on for the full 24-hour period, for up to one week. This allows the birds to become familiar with the enclosure and find food, particularly during the periods when human activities (working staff) are not present and disturbance is minimal (David Oehler, personal communication).

Young *Parus* spp. chicks can be taken from the wild and hand reared in the laboratory, but this requires nearly constant feeding and hand-raised birds cannot be released into the wild. In the wild, chicks are raised largely on caterpillars. (Laboratory Animals 2001). Eggs can also be used for the initial stocking but with the same problems.

All bird transportation carriers should be clearly labelled with a bird's ID and the temperature of the transportation vehicle should remain close to 21ºC during translocation. The noise level will be kept as low as possible. Chickadees can be transported in individual pet carriers (e.g. cardboard or plastic cat carriers) with newspaper strips, grass or wood shavings placed in the bottom during transport. Carriers should be equipped with a secure wooden perch. Staff must ensure that feathers cannot

get caught in the cracks of the boxes by taping them over, or covering the bottom with folded paper. Cardboard carriers should be taped shut.

The following is a checklist for the transport of chickadees:

- Extra transport containers (cardboard pet carrier)
- Extra newspaper
- Cell phone
- Emergency pack (containing cotton, alcohol, and cloth)
- Hand towel
- Small flashlight
- Styptic pen for abrasions
- Water and extra mealworms (not to be placed in the carrier during transport, but staff should have these handy in case they are needed in the event of a delay)

## 7.0 Record Keeping

Facility staff are responsible for: 1) files for each individual bird, 2) a daily log, and 3) documenting temperature/humidity and weather. Records must be kept on each bird housed at a facility, including individual health records. Food consumption and leftovers should be tracked daily for each bird, as well as any unusual behaviors, occurrences and veterinary interventions noted. Records must also be kept on movements and transfers of birds between facilities. When breeding occurs, all attempted pairings, including those unsuccessful, should be recorded in the bird's history. Each chickadee should have an ID card that lists information such as the bird's hatch year and location, metal band number, and color band combination, who its parents are, breeding records, and any other relevant information relating to that bird. A daily record should be kept of the minimum and maximum temperature and humidity both inside and outside the building using digital thermometers which display min/max. The log can then be referred to in case of any ensuing health problems.

The importance of maintaining detailed records for each bird cannot be emphasized enough. General background information is needed for reporting requirements, such as species, age, the locale of rescue, reason brought into captivity, medical information, final disposition, and/or release location. Monitoring each individual bird requires a systematic and consistent means of evaluation to ensure its health, and to provide data for future use. Recording environmental conditions, exposure to infectious agents or toxins, diet, feed intake, physical condition, and body mass are essential in the care of birds in a captive situation (David Oehler 2001).

## 8.0 Release Phase

Once the captive flock is established, reproducing, and growing in size, the release phase where captive bred chickadees are reintroduced into the wild population would likely

begin. This obviously must be managed to balance impact between the captive breeding population and the translocated population; i.e., we need to maximize the effective population size to minimize the rate of loss of genetic variation. The literature suggests that larger release groups may be more successful than smaller release groups and that groups may vary between 20 individuals to more than 100. It is very unlikely that the captive Gray-headed Chickadee flock will be able to produce >20 individuals for release while maintaining a reasonable breeding flock size for many years.

It is important to consider the release group's demographics as familiarity of individuals within a release group may affect success. The sex ratios for translocated individuals should match the ratio for the wild population. Little is known about the sex ratio of wild Gray-headed Chickadees in North America, but it is thought to be 50:50 in Fennoscandia (see Hailman and Haftorn 1995). Familiarity of individuals in the release group may affect success since chickadees have strong social bonds and mate for life.

The release site should be one that most closely resembles the one from which the source population originated. Release into the core historical range is preferred. The presence of conspecifics, competitors and predators may affect translocation success. The site should be evaluated for predator-prey presence and relationships, food, water and shelter availability. The timing of release may be important, but there is no information on prior release of chickadees. Given that chickadees may rely on food caches to survive the winter, it is a good idea to release them in early summer when food is likely to be more abundant and birds have time to become familiar with the surroundings and form caches (Jim Johnson, personal communication). Weather should be considered. Local communities should be notified of the plans and encouraged to participate in the release where appropriate.

There are two types of releases, soft release, where animals are acclimated to the release site, and water food and/or shelter is provided initially, and hard release where no water, food or shelter is provided and translocated animals are released immediately upon arrival at release site. In addition, prior to either release type pre-release conditioning may be helpful. Chickadees need to be able to find food in the wild and have appropriate reactions to predators. We did not find any past documented releases for chickadees. However, a somewhat similar species, the Eastern Loggerhead Shrike has been successfully released using a soft release technique (Hacking Protocol for Loggerhead Shrike in Ontario 2018). In this instance, all birds in the captive population were ranked annually to help determine which should be released and which should remain as part of the captive breeding program using the following ranking system.

1. High Priority: Individuals whose lineage is under-represented within the captive population are considered "High Priority". Some of the offspring from these pairs will be kept back to enhance the captive flock, and any excess can be released.
2. Medium Priority: This group includes many good, experienced breeders whose offspring are generally not needed for the captive flock, and thus are good candidates for the release program. Offspring may be retained from regular priority pairs that include an older bird who may not have an opportunity to breed again.

3. Low Priority: Individuals whose genes are well represented within the captive population are considered genetically "Low Priority", thus are good candidates for the release program. These birds often represent our best breeders, and can produce large quantities of young for the release effort. (Hacking Protocol for Loggerhead Shrike in Ontario).

Additionally, shrikes were only released if they were healthy, able to forage independently, and exhibit normal behavior (Hacking Protocol for Loggerhead Shrike in Ontario). The Shrike team used release enclosures which had two or three separate units, each measuring 8 feet wide by 10 feet high by either 12 or 16 ft. long. Each basic unit was constructed of ½" x 1" galvanized welded wire mesh, cedar 2x4s (red cedar in 2001-2 and white cedar in 2003), and marine plywood. Adjacent units had a shared wall, with a window that can be opened to allow access between units. Each unit had a large 4' x 4' release door that extends to the roof of the enclosure, and a predator skirt of 1" square chicken wire that had been stapled to 1x2" strapping, and nailed to the bottom of the enclosures. The skirt extended 24" along the ground outside of the enclosures and discouraged predators from digging under and into the enclosure (Hacking Protocol for Loggerhead Shrike in Ontario 2018). Release pens for chickadees would need to follow the same requirements as the permanent breeding flock aviary (mesh size, predator skirting, etc.). The Hacking Protocol for Loggerhead Shrike in Ontario (2018) indicated that release cages should have adequate cover outside of, and proximate to, the release door, preferably in the form of bushes/trees within 20 m of the release door side of the enclosure. Ideally, a release cage should have a tree/bush within 10 m or less of the release door, although this is not always possible. This is likely a good idea for chickadees as well.

The release enclosures should be cleaned between each release group and no remnants of feces or food should remain. All soiled areas should be washed with a disinfectant solution (e.g. Virkon) and then rinsed. Any heavily soiled branches should be replaced. Release cages should have sufficient perches and cover. Birds may feel more secure and less stressed if they are able to get away from view during regular husbandry routines or if there are aggressive interactions with others in the cage.

The Loggerhead team (Hacking Protocol for Loggerhead Shrike in Ontario 2018) preconditioned birds prior to release by installing shelves below the release door both inside and outside the cage. Food was placed on the inside shelf throughout the training and release process to encourage young to leave the cage. Loggerhead shrikes were transferred to the release cages when they were 3-5 weeks post-fledging to encourage independent feeding and development of flight skills, and spent 7-14 days in the release cage, prior to release. (Hacking Protocol for Loggerhead Shrike in Ontario 2018). They recommend transporting birds in carriers as quietly and gently as possible and that only one person should be present in the enclosure unit when opening the carrier. When releasing a bird into the unit, staff would place the carrier on the ground facing away from both the person and the unit door but facing an area where the bird can immediately perch under cover. Staff would slowly open the carrier and remain quiet and still until the bird left the carrier. Staff would take a few seconds to inspect the bird for any physical injuries (e.g. lame leg/wing, inability to fly, blood). Only once the bird has settled down in the unit and is safely perching would staff move on to the next bird in the group. Once

all birds in the group had been released and are settled, staff would exit the unit. The process was then repeated in the adjacent unit with the next group. Alternatively, their staff released birds in adjoining units at the same time. They recommend that birds be observed for injuries for 2-5 minutes from >30 m away in a concealed location, and again after 30-60 minutes. (Hacking Protocol for Loggerhead Shrike in Ontario 2018).

The Shrike team (Hacking Protocol for Loggerhead Shrike in Ontario 2018) released groups of 2-12 young, with birds from 1-3 different broods (i.e. different parents), and found that larger groups did better. Their numbers and composition depended on breeding activity in that particular season, but groups usually consisted of broods that have developed along similar time lines (i.e. hatched and fledged around the same dates). Sometimes they would transfer different broods composing one release group on different days. They recommend observing fledglings for at least 20 minutes daily to monitor their health and development and account for all fledglings twice daily. Any birds that appear ill should not be released until cleared by a veterinarian. Consideration of the health of the wild population is of utmost importance. If there is evidence of an infectious disease, recovered birds or birds housed with sick siblings or parents for any length of time may not be releasable.

The Shrike team (Hacking Protocol for Loggerhead Shrike in Ontario 2018) considered groups ready for release when:

1) All birds in in the group are a minimum of 44 days old (4 weeks post-fledging, **at least** one week in the release cage). This provides enough time for these younger birds to gain their independence and refine their hunting skills.
2) All birds demonstrate strong flight skills and the release group has demonstrated an ability to take live vertebrate prey (i.e. hopper mice).

This is not completely comparable to chickadees but can help inform the decision that young are old enough, experienced enough, and pre-conditioned adequately for release. The release date will need to be flexible to some extent, depending on weather conditions and other factors (e.g. staffing, VIP visitors, etc.). Releases should be postponed if there are heavy rains forecasted for the afternoon/evening of the planned release day. Releases may also need to be postponed if known avian predators have been observed hunting in the release area. Staff should be aware of potential avian predators and monitor their frequency of occurrence throughout the breeding season.

The Shrike team (Hacking Protocol for Loggerhead Shrike in Ontario 2018) released birds in the morning during the routine feeding. They fed the birds as usual the evening before and placed the morning food 5-15m outside the release door. They allowed release groups to have access to the entire enclosure and did not flush or confine birds in any way. They observed the release from about 60m away in a hidden location that allowed a clear view and they recorded all bird activity and behavior and whether any predators were in the area. They observed the release enclosure for at least an hour. After an hour the observer left the area leaving the release door open. They rechecked the release cage after two and four hours and did not approach the cage while there were still birds inside or nearby. They began supplementary feeding the afternoon of the release day. Once all birds departed the release cage, they closed the door. They continued supplemental feeding outside the cage for at least one-week post-release. Birds should be closely

observed for signs of illness and injury and all observations on behavior, illness, injury, feeding rates, and predators should be recorded. Supplemental feeding should be slowly decreased to once a day, and then every other day to wean birds.

An assessment phase is recommended for reintroductions (Griffith et al. 1989; Stanley Price 1989; Kleiman et al. 1994; World Conservation Union/Species Survival Commission Re-Introduction Specialist Group 1995). However, captive breeding and reintroduction programs are rarely evaluated, and assessment criteria vary widely. One commonly used system is to monitor (1) survival and recruitment rates in the captive population, (2) survival of released animals, (3) recruitment of released animals, (4) growth rate of the reintroduced or augmented population, and (5) establishment of a viable wild population (Ostermann et al. 2001).

## 9.0 Permits/Legalities

- Institutional Animal Care and Use Committee Permit covering capture, transportation, long-term housing, propagation and release. This can be done through the University of Alaska, Alaska Department of Fish and Game, or Wildlife Conservation Society.
- Alaska Department of Fish and Game Permit
- U.S. Fish and Wildlife Service, Migratory Birds Management Permit
- USGS Bird Banding Permit
- Land Use Permits will depend on the capture locations.
- Others as needed, depending on implementation strategy

## 10.0 Recommended Implementation Strategy – Location and Approach

Prior to establishment of a captive flock, pilot work evaluating whether wild Gray-headed Chickadees have already been hybridizing with Boreal Chickadees needs to be done; this effort is underway (Jim Johnson personal communication). Black-capped Chickadees and Boreal Chickadees have been documented hybridizing (Tait et al. 2012). Dr. Sandra Talbot has investigated hybridizations of high latitude mammal species, and coupled with work by other researchers, suggested that the consequences of hybridization should be assessed on a case-by case basis (Sandra Talbot personal communication).

Housing the captive chickadee flock within Alaska will limit travel stress, provide a more natural habitat, and likely be cheaper. Of the two in-state options, UAF-ARC is cheaper, easier, and already has technicians and experience housing passerines (see section 5.0). An option is to house a small flock of captive Gray-headed Chickadees at UAF-ARC prior to making a final decision on facility construction and management of a larger and more permanent facility.

## 11.0 Literature Cited


Booms, T.L., L.H. DeCicco, C.P. Barger, and J.A. Johnson. *2020.* Current Knowledge and Needs of Gray-headed Chickadees in North America. Journal of Fish and Wildlife Management, *in press*.

Carpenter, J.W., and S.R. Derrickson. 1982. Whooping crane mortality at the Patuxent Wildlife Research Center, 1966-1981. Pages 175-179 in J. C. Lewis, editor. Proceedings of the 1981 crane workshop. National Audubon Society, Tavernier, Florida, USA.

Dale, S., and E.T. Andreassen. 2016. Population decline of the Siberian Tit (Poecile cinctus) in southern Norway and an assessment of possible causes. Ornis Fennica 93:77–87.

DeCicco, L.H., D. Shutler, and S.W. Mockford. 2017. Morphological differences between Nearctic and Eastern Palearctic Gray-headed Chickadees. Wilson Journal of Ornithology 129:171-175.

Dein, F.J., K.A. Converse, and C. Wolf. 1995. Captive propagation, introduction, and translocation programs for wildlife vertebrates. Pages 405-407 in LaRoe, E.T., G.S. Farris, C.E. Puckett, P.D. Doran, and M. J. Mac, editors. Our living resources: A report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. National Biological Service, Washington D.C.

Dickinson, E.C. and J.V. Jr., Remsen (Editors) 2013. *The Howard and Moore Complete Checklist of the Birds of the World.* 4th Edition, Vol.1

Eastern Loggerhead Shrike Husbandry Manuel. 2018. Husbandry manual for the care, breeding, and maintenance of captive loggerhead shrikes (*Lanius ludovicianus alvarensis*). Prepared by Wildilfe Preservation Canada.

Gosler, A., and P. Clement. 2007. Family Paridae (Tits and Chickadees). Pages 662-744 in K. Del Hoyo,, A. Elliott, D. Christie, editors. Handbook of the Birds of the World. Lynx Edicions, Barcelona.

Griffith, B.J., J.M. Scott, J.W. Carpenter, and C. Reed. 1989. Translocation as a species conservation tool: status and strategy. Science 245:477-480.

Hacking Protocol for Loggerhead Shrike in Ontario. 2018. Prepared for: Ontario Eastern Loggerhead Shrike Recovery Program.

Hailman, J.P. and S. Haftorn. 1995. Gray-headed Chickadee (*Poecile cinctus),* version 2.0 In The Birds of North America (A.F. Poole and F.B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA

Hawkins, P., D.B. Morton, D. Cameron, I. Cuthill, R. Francis, R. Freire, A. Gosler, S. Healy, A. Hudson, I. Inglis, A. Jones, J. Kirkwood, M. Lawton, P. Monaghan, C. Sherwin, P. Townsend. 2001. Members of the Joint Working Group of Refinement. Laboratory Animals **35** (Suppl. 1). Section 24: Tits and chickadees, Parus and Poecile spp.

Järvinen, A. 1989. More mixed breedings between *Parus cinctus* and *P. montanus* in Finnish Lapland. Ornis Fenn. 66:123.

Kleiman, D.G., M.R. Stanley Price, and B.B. Beck. 1994. Criteria for reintroductions. Pages 287-303 in P. J. S. Olney, G. M. Mace, and A. T. C. Feistner, editors. Creative conservation: interactive management of wild and captive animals. Chapman and Hall, London.

Lait, L, R. Lauff, and T. Burg. 2012. Genetic evidence supports Boreal Chickadee x Black-capped Chickadee hybridization in Atlantic Canada. Canadian Field Naturalist 126.

Ostermann, S.D., Deforge, J.R., and Edge, W.D. 2001. Captive breeding and reintroduction evaluation criteria: a case study of peninsular bighorn sheep. Conservation Biology 15:749-760.

Partners in Flight Science Committee. 2013. Population Estimates Database, version 2013. Available at http://pif.birdconservancy.org/PopEstimates. Accessed on 12 December, 2018.

Rosenberg, K.V., J.A. Kennedy, R. Dettmers, R.P. Ford, D. Reynolds, J.D. Alexander, C.J. Beardmore, P.J. Blancher, R.E. Bogart, G.S. Butcher, A.F. Camfield, A. Couturier, D. W. Demarest, W.E. Easton, J.J. Giocomo, R.H. Keller, A.E. Mini, A.O. Panjabi, D.N. Pashley, T.D. Rich, J.M. Ruth, H. Stabins, J. Stanton, T. Will. 2016. Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States. Partners in Flight Science Committee. 119 pp.

Stanley Price, M. 1989. Animal re-introductions: The Arabian oryx in Oman. Cambridge University Press, Cambridge, United Kingdom.

Lait, L.A., R.F. Lauff, and T.M. Burg. 2012. Genetic evidence supports Boreal Chickadee (Poecile hudsonicus) × Black-capped Chickadee (Poecile atricapillus) hybridization in Atlantic Canada. Canadian Field-Naturalist 126:143–147.

Todesco, M., M.A. Pascual, G.L. Owens, K.L. Ostevik, B.T. Moyers, S. Hubner S.M. Heredia, M.A. Hahn, C. Casyes, D.G. Bock and L.H. Rieseberg. 2016. Hybridization and extinction. Evolutionary Applications 9:892-908.

Van Hemert, C, C.M. Handel, and T.M. O'Hara. 2012. Evidence of accelerated beak growth associated with avian keratin disorder in black-capped chickadees (*Poecile atricapillus*). Journal of Wildlife Diseases 48:686-694.

World Conservation Union/Species Survival Commission Re-introduction Specialist Group. 1995. Guidelines for re-introductions. Gland, Switzerland.

## 12.0 Summary of Organizations/Experts Contacted for Input

**Shane Good**, Director of Collections Management, Akron Zoo
Phone: 330-375-2550 ext. 7268
Cell: 330-802-0164
sgood@akronzoo.org

**Hazel Wheeler,** Wildlife Preservation Canada
Lead Biologist - Eastern Loggerhead Shrike Recovery Team
hazel@wildlifepreservation.ca

**Dr. John Blake** DVM MVetSc
Director Animal Resources Center & UAF Attending Veterinarian
PO Box 756980
University of Alaska Fairbanks
Fairbanks, AK 99775-6980
907-474-7020

**Dr. C. Lisa Mahon**
Wildlife Biologist, Canadian Wildlife Service, Northern Region
Environment and Climate Change Canada / Government of Canada
And; Adjunct Professor, Department of Biological Sciences, University of Alberta, Edmonton,
Tel: 867-393-7935, Cell: 780-499-7349
Lisa.Mahon@canada.ca

**Lisa Pajot**
Wildlife Biologist, U.S. Geological Survey, Alaska Science Center
Anchorage, AK 99508
907 786-7179

**Dr. Jim Johnson**
Wildlife Biologist, Landbird Section Coordinator
U.S. Fish and Wildlife Service, Migratory Bird Management
907.786.3423
jim_a_johnson@fws.gov

**Dr. David Oehler (Previously Wildlife Conservation Society)**
Vice President, Nashville Zoo
615-833-1534 x193
doehler@nashvillezoo.org

**Dr. Kenneth J. Conley**, DVM, Diplomate ACVP
Senior Pathologist, Wildlife Conservation Society Zoological Health Program
718-220-7105
kconley@wcs.org

**Dr. Sandra Talbot**
Research Geneticist, Alaska Science Center, U.S. Geological Survey
907.786.7188
sandy_talbot@usgs.gov

***This does not include people and organizations contacted that didn't respond, or did respond but had no input or experience.***

# Akron Zoological Park Diet Sheet

**Common Name:** Small Insect Omnivore Birds
**Species:** *Tufted titmouse, black capped chickadee*
**Special Notes:** Aviary birds

**Daily Maintenance Diet:**

| | Fruit | Veg | Grain | Insect | Total |
|---|---|---|---|---|---|
| | 2 | 2 | 3 | 8 | 15 |
| grams | 13% | 13% | 20% | 53% | |
| 0 Harrison's fine | | | | | |
| 2 Dr. Harvey's Finch Seed | | | | | |
| 1 finely chopped nuts | **Add NUTS to diet Nov 1- Mar 31** | | | | |
| 1 finely chopped veggie mix | | | | | |
| 1 finely chopped fruit mix | | | | | |
| 1 finely chopped berries | | | | | |
| 1 finely chopped greens | | | | | |
| 6 mealworms or waxworms | | | | | |
| 2 other insects | | | | | |

| | Approx Measure |
|---|---|
| **Tuesday and Friday:** 0.25g calcium powder | 1/8 tsp |
| **Wednesday and Saturday**: 0.75 avian Missing Link | 1/4 tsp |
| **Monday and Thursday**: 0.4g tsp avian Nekton | 1/8 tsp |

**Mix Info:**

**Veggie mix may contain**: beans (green), broccoli, carrots, cauliflower, celery, corn, cucumber, parsnips, pea pods, peas, peppers, squash (summer, zucchini), turnips

**Fruit mix may contain**: apples, apricot, banana, canataloupe, dates, figs, grapes, honeydew melon, kiwi, mango, nectarine, papaya, peach, pear, plum, watermelon, pomegranate

**Berries may contain:** blackberries, blueberries, cherries (no pits), raspberry, strawberry (fresh or frozen)
**Greens may include**: beet greens, cabbage, collards, dandelion, kale, mustard, romaine, spinach, turnip
**"Other Insects" may include**: canned or frozen crickets (large and small), canned pillars and earthworms
**Nuts may include:** peanuts, pinenuts, almond, pecan, walnut

**Product Info:**

Harrison's Fine = Harrison's Bird Foods Adult Lifetime Fine
Dr. Harvey's Cockatiel = Dr. Harvey's Colossal Cockatiel Seed Mix
Dr. Harvey's What's Cookin' = Dr. Harvey's What's Cookin' Grain/veg/fruit mix
Calcium Powder = Aspery farms calcium powder
Avian Missing Link = DHI Missing Link Avian
Avian Nekton = Nekton S avian multivitamin

**Comments or Special Instructions:**
Can subsitute maintenance fruits with the following when available:
berries, peach, plum, mango, papaya, pomegranate, apricot

**Diet Approval Date:** _____ **Veterinarian Approval:** _____

## APPENDIX B: Straight Ahead Construction Aviary Quote

STRAIGHT AHEAD CONSTRUCTION

FAIRBANKS, ALASKA

Straight Ahead Construction LLC
2600 Horsetail Trail
Fairbanks AK 99709
(907) 978-3344
Alaska License #34800
Residential Endorsement #2517

May 6, 2019

**Client:**

Rebecca McGuire

**Scope of work:** build enclosed aviary

| | |
|---|---|
| 1. 32 driven posts 20' high | $16,000 |
| 2. Structure materials | $12,000 |
| - framing, insulation, vapor barrier, 2 exterior doors, roof | |
| 3. Labor | $15,000 |
| 4. Mesh | $8,200 |

- does not include shipping

| | |
|---|---|
| 5. Mesh install | TBD |
| 6. Electrical wiring | $7,500 |
| Total project cost | $58,700 |

**Payment schedule:**

50% of the total (less “TBD”) estimated cost plus 100% of mesh cost to be deposited prior to ordering the mesh. The remainder of the balance will be due at the termination of the project.

## APPENDIX C: Corners Limited Aviary Quote and Design

Hi Rebecca,

I apologize for the delay in getting this quote done for you!

Listed below is our cost for this unit:

Panel form construction
8' x 40' x 8' high
Three attached enclosures - 3' x 3' x 8' high
Flat wire roof
Open bottom
Silver finish
1" sq. Anodized aluminum tubing
1/2" x 1" - 16 ga. GAW wire mesh
Stainless steel hardware
4 hinged doors - 2' x 6'

$8,600.00
Plus shipping

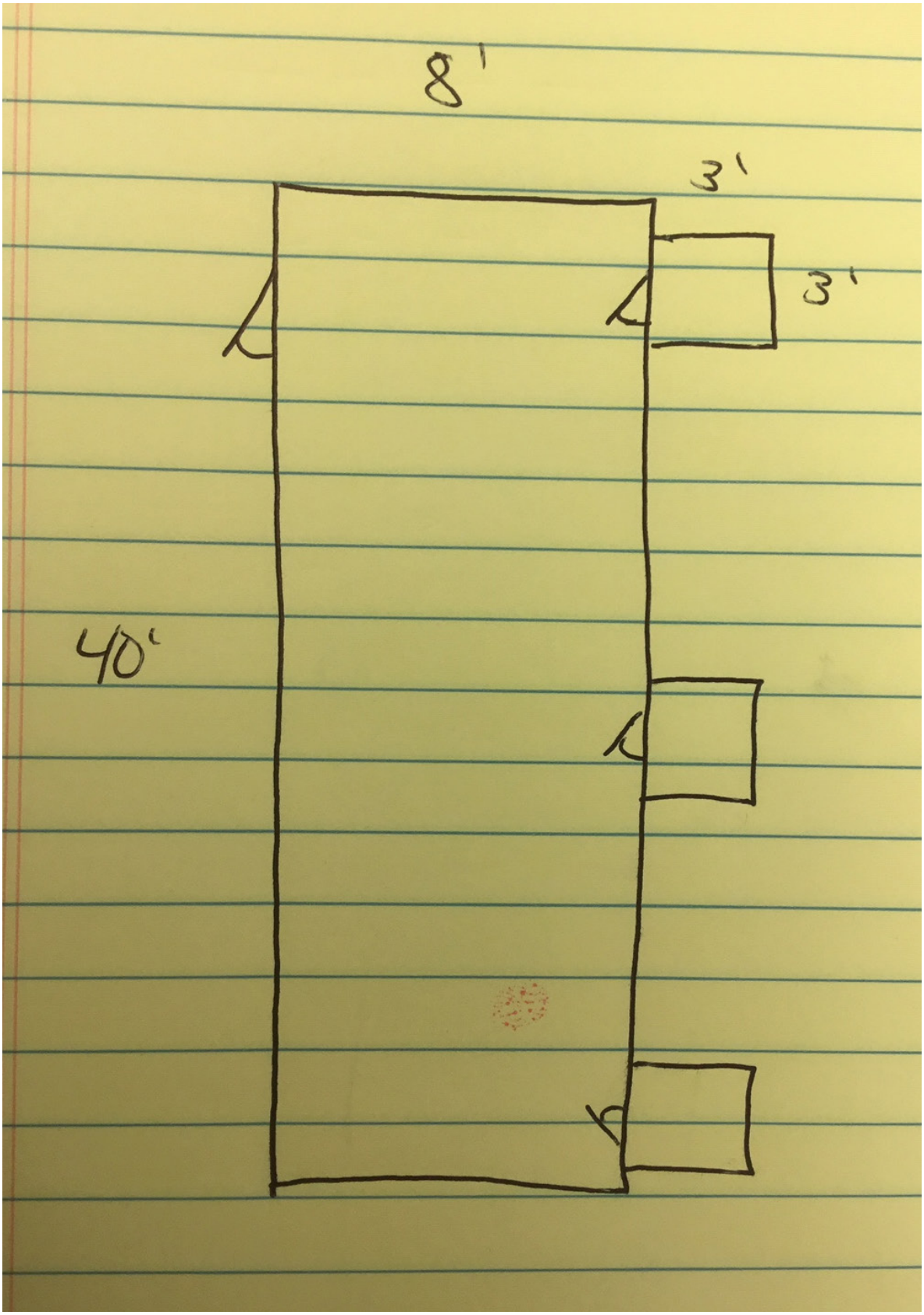
Due to the distance of shipping, we might suggest crating this order to reduce the risk of damage, the additional cost of the crate would be $500.00.

Here is a quick sketch of the layout:

Please let me know if you have any questions.

Thanks, and have a blessed day!

Jeff Smith
Operations Manager
Corners Limited
Cell: 269-207-0088


8'
3'
3'
40'

## APPENDIX D: UAF Aviary Quote and Design

**UAF Animal Resources Center**

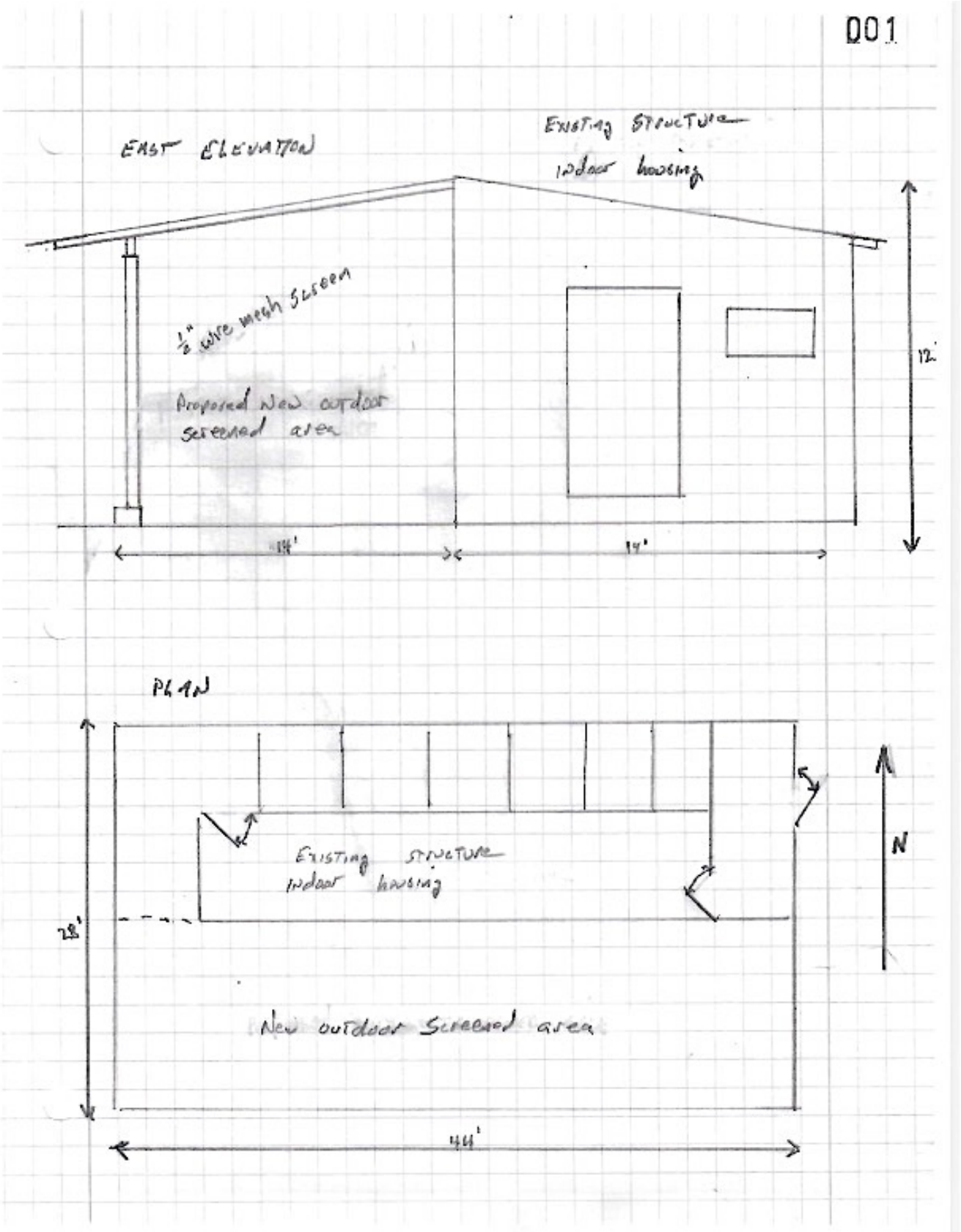
# Quote

**Date:** 04/15/19
**Quote #:** ARC 19-001

TO: Rebecca McGuire
Travis Booms (ADF&G)

Requested by:
Rebecca McGuire
rmcGuire@wcs.org

| QTY | QTY 2 | DESCRIPTION | UNIT PRICE | LINE TOTAL |
|---|---|---|---|---|
| | | Quote request for outdoor housing & per diem for captive Gray-headed Chickadee flock. | | |
| | | | | |
| 1 | | Supplies & labor to construct outdoor aviary off existing sturcture in UAF Biologial Reserve. This estimate is based on March 2019 labor & supply costs. | | $ 14,667.53 |
| | | | | |
| | | * The following is an estimate of daily care based on FY16 rates. The estimate is subject to change based on exact diet chosen, labor rates & other unforeseen care expenses. | | |
| 2 | 14 | Fourteen quarantine days, 1 breeding pair | $ 1.38 | $ 38.64 |
| 1 | 365 | Colony maintenance, per chickadee for one year | $ 0.92 | $ 335.80 |
| | | | | |
| | | | | $ - |
| | | *for per diems estimate 2% cost increase per fiscal year | | $ - |
| | | FY 2020 estimate per chickadee = $403 | | $ - |
| | | FY 2021 estimate per chickadee = $484 | | $ - |
| | | | | |
| | | *The estimate is subject to change based on exact diet chosen, labor rates & other unforeseen care expenses. | | |
| | | | | |
| | | Estimate subject to change. | TOTAL | |


001
EAST ELEVATION
EXISTING STRUCTURE
indoor housing
1/2" wire mesh screen
Proposed New outdoor
screened area
12'
14'
PLAN
EXISTING STRUCTURE
indoor housing
N
28'
New outdoor Screened area
44'