CANADIAN
WILDLIFE HEALTH
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STRATEGIES TO PREVENT AND CONTROL BIRD-FEEDER ASSOCIATED DISEASES AND THREATS

CREATING A WORLD
THAT IS SAFE AND SUSTAINABLE
FOR WILDLIFE AND SOCIETY

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1. Main Messages

- As the popularity of supplemental bird feeding increases, so too have the extent and frequency of infectious bird diseases that are suggested to result from increased contact between birds at feeders and contamination of the feed or feeders with infectious organisms.
- Surveillance alerts the public to the need for action, helps management agencies assess the species affected by and geographical extent of outbreaks and can fill information gaps needed to understand the ecological impact of diseases.
- Control measures center on reducing contact between infected birds and range from avoiding supplemental feeding through creation of bird friendly habitats to proper bird feeding techniques including appropriate choice of food combined with proper feeder selection, placement, cleaning and disinfection.
- Proper feeder placement can also reduce risk of unintended consequences of bird feeding, specifically predation and traumatic accidents.

2. Background

The impetus for this report was the widespread trichomonosis outbreak in the summer and fall of 2017 that extended through every province from Ontario east to Newfoundland and Labrador (CWHC, unpublished data). This and other bird feeder associated diseases generate a large amount of public interest and concern. The bird feeding public is passionate about bird protection on their properties, and many are avid conservationists. This document summarizes actions that can be taken by the public and resource managers to reduce disease risk.

Are bird feeders a risk? Supplemental feeding of wildlife is generally discouraged for mammals, primarily to prevent disease transmission, but also to avoid risks to maintaining biodiversity, ecosystem functioning, human health and livestock production (Sorenson et al., 2014). However, this activity is considered by many as an acceptable practice for birds. Over the last few decades, bird feeding has expanded from its primary intention to reduce starvation and nutritional stress in birds over-wintering in more northern latitudes to become an enormously popular year-round activity with millions of households providing huge quantities of supplementary food to wild birds (Jones and Reynolds, 2008; Robb et al., 2008). Food availability is a major factor in avian population dynamics, and altering the natural processes of food supply through supplemental feeding is a major ecological intervention. Despite the impressive scale of bird feeding, we lack a clear understanding of its positive and/or negative ecological effects (Robb et al., 2008). This hampers constructive debate among proponents and opponents of this activity, and as a result, many publications suggest the need for focused research on the effects of public bird feeding on ecosystems and bird ecology, especially in relation to environmental and climate change (Murray et al., 2016; Becker et al., 2015; Jones, 2011; Jones and Reynolds, 2008; Robb et al., 2008).

It is generally accepted that bird feeding increases survival and reproduction rates which leads to higher densities of the fed populations but these effects are not clearly understood and do not necessarily apply to all urban species (Ruffino et al., 2014; Harrison et al., 2010). It also results in an elevated risk of pathogen transmission due to the close contact with infected individuals (direct transmission) or by the fecal-oral route associated with environmental contamination around feeding sites (indirect transmission) (Murray et al., 2016; Becker et al., 2015; Bradley and Altizer, 2006). A suspected relationship between bird feeding and three significant diseases has been documented, including trichomonosis (Lawson et al., 2012; Neimanis et al., 2010), mycoplasmosis (Hartup et al., 1998; Dhondt et al., 2007) and salmonellosis (Pennycott et al., 1998); all three have been identified at public bird feeding sites in Canada in recent years (McBurney et al., 2015; Forzán et al., 2010; Mikaelian et al., 2001; Daoust et al., 2000; Dhondt et al., 1998; Prescott et al., 1998).

3. Management Cornerstones – The ABC's of Healthy Bird Feeding

- **a.** **A**void the unintended consequences of feeding that result from predation or trauma.
- **b.** **B**e vigilant with surveillance - be able to recognize the diseases to ensure that the bird feeding public is alert in time to act to implement disease control strategies and wildlife managers can assess the effects of controls and better understand the impacts of these diseases.
- **c.** **C**ontact reduction - create circumstances that decrease contact between uninfected and infected birds and/or with contaminated environments by:
  - i. Promoting management for bird friendly habitat to avoid the need for supplemental feed to attract or nourish birds.
  - ii. Ensuring proper feeding techniques and hygienic feeding practices.

These strategies are covered in more detail in the following sections.

a. Avoid Unintended Consequences - Predators and Trauma

Birds at feeding stations are anecdotally reported to be at an increased risk of predation from domestic cats and raptors, but this relationship between bird feeding and predation is not supported by the scientific literature (Lepczyk et.al., 2003; Robb et al., 2008; Roth and Lima, 2007; Dunn and Tessaglia, 1994). However, domestic cat predation on wildlife is well recognized (Loss and Marra, 2017; Blancher, 2013), and while its impact is debated, the precautionary principle should be used to guide actions to mitigate the potential negative effects of pet cats on wildlife populations (Calver et.al., 2011). Therefore, it remains prudent to reduce the risk of predation by a few simple techniques. Bird feeders should not be further than 3.5 metres from cover that provides a route of escape and protection to avoid predation. There should be an unobstructed view around bird feeders so that foraging birds can detect any predators in the area. Cover that could conceal predators attempting to mount an attack should not be near feeders. Feeders at lower levels should be surrounded by brush or fencing to preclude predator access. Predation

by free-ranging cats can be reduced significantly by the use of anti-predation collars (Hall et al., 2015; Willson et al., 2015; Gordon et al., 2010; Calver et al., 2007; Nelson et al., 2005; Ruxton et al., 2002), but none of these devices are completely effective at preventing successful predation. Therefore, preferably domestic cats should either be kept indoors or be leashed or kenneled without access to bird feeders when they are outdoors. Lastly, feeding birds during the breeding season may increase the risk of local depredation of the nests of these birds by squirrels and/or avian nest predators such as corvid species (Hanmer et al., 2016). Therefore, as mentioned below, it is important to select or guard feeders so that only target species can feed and other non-target wildlife species, especially nest and avian predators, cannot. It is also imperative to regularly clean spilled bird feed, seed hulls and waste from beneath bird feeders so that it does not attract unwanted wildlife species.

Blunt trauma associated with flying into windows, the sides of buildings and vehicles is a common occurrence when birds are startled at bird feeders. Therefore, bird feeders should be placed only one metre away from vehicles and buildings because at this distance frightened individuals cannot build up the momentum to cause a significant trauma that could result in their death. Otherwise, bird feeders should be greater than 10 metres away from vehicles and buildings because at this distance, birds appear capable of identifying images in the windows as reflections and avoid flying towards, preventing fatal traumatic incidents. Altering the appearance of windows by the application of bird strike prevention decals or by hanging streamers outside them is also a good avoidance strategy.

b. Be Vigilant with Surveillance

i. Why encourage surveillance? Despite the best intentions of the bird feeding public and the application of preventative measures, the possibility of disease outbreaks remains as a constant threat. Therefore, disease surveillance should be a priority activity for those engaging in responsible bird feeding (Sorenson et al., 2014).

Surveillance is essential for disease management decision making. It alerts the public to the need for action, allows management agencies to assess the extent of outbreaks and can fill information gaps needed to understand the ecological impact of diseases. Surveillance helps management agencies maintain public trust by demonstrating stewardship and responsiveness to wildlife events literally happening in their backyards.

ii. General surveillance principles. If sick or dead birds are found, the species, number affected, sex, age and clinical signs should be reported to a local federal, provincial or territorial wildlife agency and to the Canadian Wildlife Health Cooperative (CWHC) Regional Centre in your area (see **http://www.cwhc-rcsf.ca/report_submit.php** for contact information). If sick or dead birds are collected for disposal or submission for examination, do not handle them with bare hands, either wear disposable gloves and place individual specimens in a plastic bag or place a plastic bag over your hand, pick up the specimen and invert the bag over it. Seal the specimens in the bag by knotting the bag or closing it with a tie or the bag's closure mechanism. Write the date when and location where the specimen was collected on the bag with a permanent marker. The general public should not collect specimens for submission unless directed and approved to do so by staff at a local federal, provincial or territorial wildlife agency or staff at their CWHC

Regional Centre. Once sick or dead birds are identified on a property where birds are being fed, as a precaution and mitigation measure, all of the feeders should be taken down for cleaning and disinfection as noted below until feeder-associated diseases can be ruled out.

iii. What to look for. Citizen science is an important tool in detecting and understanding these diseases. Management agencies can support public surveillance efforts by helping members of the public to recognize the most common bird feeder associated diseases and by working with staff or partners to validate the observations through independent surveys or surveillance. The following summarizes the common signs of three important diseases observed at bird feeders. These signs are not definitive and confirmatory diagnoses require additional ancillary laboratory testing.

Trichomonosis

At bird feeders, trichomonosis occurs mainly in the summer and early fall and primarily affects purple finch (*Haemorhous purpureus*), American goldfinch (*Spinus tristis*) and pine siskin (*Spinus pinus*) but can also cause illness in other species of birds, most notably raptors, doves and pigeons. It is caused by a microscopic protozoan parasite known as *Trichomonas gallinae*. Trichomonosis causes severe damage to the tissues of the mouth, throat and crop. Affected birds may have difficulty swallowing, drool saliva, regurgitate food and water, demonstrate laboured breathing and/or have a swollen neck or throat. In addition to showing signs of general illness (i.e., lethargy, poor flight ability and fluffed up feathers), affected finches are frequently observed to have matted wet plumage around the face and beak, presumably due to regurgitation. Birds with trichomonosis are commonly very thin as the damage to the tissues of the throat and esophagus makes eating and drinking painful and difficult which results in starvation and dehydration. For further information visit:
http://www.cwhc-rcsf.ca/docs/fact_sheets/Trich_Factsheet.pdf (Accessed 23/11/2017)

Mycoplasmosis

At bird feeders, mycoplasmosis occurs most often in the colder months of the year, but it can occur at any time of the year. It affects multiple passerine species including house finch (*Haemorhous mexicanus*), American goldfinch, purple finch, evening grosbeak (*Coccothraustes vespertinus*) and pine grosbeak (*Pinicola enucleator*). This disease is caused in wild birds by the bacterium *Mycoplasma gallisepticum*. In wild bird species, mycoplasmosis causes inflammation of the tissues of the inner eyelid and outer surface of the eye (i.e., conjunctivitis) and the lining of the nasal cavity (i.e., rhinitis). Clinical signs include red and puffy or extremely swollen eyelids including the tissue covering the corners of the eyes. This may occur with or without a clear to cloudy fluid draining from the eyes. A crust may form along the eyelid margins potentially resulting in damage to the cornea, further eye discharge and loss of sight. Inflammation of the nasal cavity results in a flowing nasal discharge. Birds may have wet, matted feathers around the face and fluffed up body feathers. Infected birds may also exhibit a lack of activity, reduced feeding and weight loss. They may rub their eyes on branches or surfaces of bird feeders and can collide with stationary objects due to their impaired vision. Death usually results from starvation, exposure to inclement conditions, or predation. For further information visit:
http://www.cwhc-rcsf.ca/docs/fact_sheets/Avian_Mycoplasmosis_Fact_Sheet.pdf
(Accessed 23/11/2017)

Salmonellosis

Salmonellosis is a widespread disease affecting many species. In passerine birds, it causes outbreaks primarily in the winter and spring, some of which have been documented to occur simultaneously over extensive geographical areas of North America. It is caused by a group of bacteria in the genus Salmonella. Wild passerine birds are primarily infected with *Salmonella typhimurium* (also knowns as *S. enterica* subspecies *enterica* serovar Typhimurium). *S. typhimurium* causes disease in several species of passerine birds frequenting bird feeders including common redpoll (*Acanthis flammea*), pine siskin, purple finch, American goldfinch and evening grosbeak. Similar to trichomonosis, salmonellosis often causes severe inflammation and death of tissues of the esophagus and crop which affects the ability of the sick birds to eat and drink, resulting in starvation and death due to a combination of emaciation and dehydration. *S. typhimurium* can invade blood vessels and gain access to the bloodstream (i.e., sepsis), causing lesions in many tissues throughout the body. Death in such cases can be very rapid. Other commonly reported signs include rapid, laboured breathing, shivering, incoordination, lethargy, fluffed up feathers, droopiness, diarrhea and convulsions. Birds with salmonellosis may also regurgitate food and water and/or drool saliva. For further information visit:
https://www.nwhc.usgs.gov/publications/field_manual/chapter_9.pdf (Accessed 23/11/2017)

c. Contact Reduction

The primary strategy to prevent the emergence of these diseases at bird feeding and watering sites is to reduce the rate of contact between unaffected and infected birds and/or with environments contaminated with infectious organisms. Many of the options for prevention are under the control of the general public or organizations feeding birds on public or private properties and include:

i. Create "Bird-Friendly" Habitat for Natural Foraging. Appropriate management of private properties and gardens can create considerable wildlife habitat which can help maintain biodiversity (Lindemann-Matthies and Marty, 2013; Goddard et al., 2009). Sustainable "wildlife-friendly" gardening has become a focus of public education, outreach and engagement for many nongovernmental wildlife organizations. "Bird-friendly" gardens that attract birds to yards and parks while reducing disease transmission rates should provide natural sources of food, water and shelter in a sustainable manner.

Food: Native plants, bushes and trees can provide excellent sources of nutrition that replace the need for supplemental feeding. For example, the ratio of evergreen to deciduous trees in yards and the percentage of trees and plants with fruits or berries have been positively associated with native and migratory bird species richness, but in contrast, the number of bird feeders has not been an important predictor of native species richness (Belaire et al., 2014). A mixture of natural vegetation can provide a variety of seeds, nuts, berries, fruit, nectar and insects used by various bird species. If safe, dead trees can be left standing which allows them to decompose naturally and become a great source of insects for foraging birds. Local ornithologists, gardeners, naturalists and wildlife professionals can advise on how best to select the appropriate native vegetation for a given region.

Water: Birds need clean water for bathing to maintain the integrity of their feathers and for drinking. Larger properties could have natural water sources such as lakes, streams, ponds, marshes or seasonal water sources (i.e., vernal pools) to provide this habitat requirement. However, if they are not already present on larger properties, ponds, marshes and seasonal water sources can also be created as habitat. In small areas, water can most often be provided by properly placed birdbaths or small shallow dishes of water. However, water provided in this manner can quickly become contaminated with fecal infectious organisms, and *Trichomonas gallinae* has been demonstrated to survive for variable periods of time up to at least an hour in water containing organic material, including chlorinated municipal water, but not in clean chlorinated municipal water without organic debris (Purple et al., 2015; Gerhold et al., 2013). Therefore, birdbaths and water dishes should be emptied bi-monthly, washed, disinfected and refilled with fresh, clean water (see cleaning and disinfection instructions below).

Shelter: A varied garden, yard or park with a complex and diverse plant community provides shelter and security required for courtship, mating, nesting, egg incubation, raising young and protection from predators and cold. This can include areas of meadow or uncut grass, dense shrubs, hedge rows or thickets, mature stands of trees and dead trees. Local ornithologists, naturalists and wildlife professionals can advise on the best native vegetation for a given region as well as the optimal plants for attracting various species of birds. If providing suitable plants is not an option, nest and roosting boxes or bird houses can be an alternative for some species of birds, but they should be able to be cleaned and disinfected on a seasonal basis.

Sustainability: "Wildlife-friendly" gardens should be managed in a sustainable and environmentally sound manner to ensure the ongoing, natural, self-perpetuating processes that are needed to maintain high quality, clean soil, air and water which in turn promote the well-being of birds and vegetation. This is best accomplished on a given property through soil and water conservation techniques, control and removal of exotic species, and using organic and integrated pest management practices that lead to the elimination of chemical pesticides. There are many websites and other resources that can help guide property owners to develop "wildlife-friendly" gardens, but two helpful examples are:
http://cwf-fcf.org/en/explore-our-work/connecting-with-nature/in-the-garden/how-to-garden-for-wildlife/wildlife-friendly-gardening-provide-food.html
(Accessed 23/11/2017)

https://www.nwf.org/Garden-for-Wildlife
(Accessed 23/11/2017)

ii. Bird Feeding Practices to Promote and Protect Bird Health.
Why target bird feeders? Bird feeders can act as a fomite for various pathogens and lead to transmission of disease from infected to uninfected individuals (Murray et al., 2016; Becker et al., 2015; Bradley and Altizer, 2006). For example, *Mycoplasma gallisepticum* is able to persist and remain infectious for 12 hours on bird feeder portals (Dhondt et al., 2007, Fischer et al., 2015). *Trichomonas gallinae* can survive and replicate in moist bird seed for up to 24 - 48 hours depending on seed type (McBurney et al., 2017). Bird feeders lead to increased congregations of birds which is associated with increased contact rates

within and between species that can result in direct transmission of diseases between infected and uninfected individuals, exacerbating and prolonging disease outbreaks (Murray et al., 2016; Becker et al., 2015; Bradley and Altizer, 2006). Mitigation measures targeting feeders and water sources are generally quite reasonable to accomplish (i.e., simple removal and cleaning of all available bird feeders and artificial water sources).

Remove feeders once an outbreak is detected. Once a disease outbreak is identified on a property, the bird feeders and artificial water sources should remain out of use until the end of the known transmission period for that disease. In the case of a summer or fall outbreak of trichomonosis, that would be after the first prolonged cold weather and frost of the winter. In the case of a winter or spring outbreak of salmonellosis or mycoplasmosis, that would be until the first warm weather and emergence of insects in the summer. In the case of other circumstances and conditions or different diseases, consulting staff at your CWHC Regional Centre can provide you with the most up to date information with respect to management and/or mitigation in that particular situation.

Using the right feeders the right way. Select bird feeders that are manufactured from plastic, steel or glass because they are easier to clean and disinfect than those with porous surfaces (e.g., those made from wood or clay). Small feeders are best because they do not allow large numbers of birds to congregate and feed at one time which greatly reduces contact rates that could permit disease transmission. Additionally, small feeders empty quickly which prevents seeds from getting wet or spoiled. Feeders should have holes to permit any water that gains access to the feed to drain. They should be covered to prevent the seed from becoming damp or wet. Feeders should not have sharp edges or points that could cause injuries. They should allow birds to perch away from the food to prevent fecal contamination. Avoid table feeders or any feeder that permits birds to sit in or on the food while eating, risking fecal contamination of the food and feeder. Use specialized types of feeders that have modifications that only allow select species to feed in order to reduce contact rates between different species which prevents spillover of infectious organisms. Additionally, decrease the risk of predation by non-target mammalian and wildlife species by using guarded feeders as discussed above. The Audubon Guide to Bird Feeders describes six of the best bird feeders. It can be found at: **https://www.sfvaudubon.org/wp-content/uploads/2016/06/Audubon_Guide_Bird_Feeders_printPDF.pdf** (Accessed 23/11/2017)

To preclude large aggregations of birds at a single location which leads to high contact rates and increased potential for disease transmission, feeders should be placed at widely separated locations around a property where they can be readily observed for enjoyment as well as to look for potential hazards to the birds using them. Most birds will feed at multiple levels, but some species have preferences. Therefore, feeders should be placed at various heights including near the ground (but do not feed birds directly on the ground where fecal contamination can become a problem), at table level, suspended by hanging and attached to tree trunks. Feeders should only be a short distance (i.e., 3.5 metres) from safe cover such as evergreen trees, shrubs, hedgerows or brush piles to provide birds with the ability to perch and seek protection from inclement weather and predators.

Feeder hygiene is the key to disease prevention and control. Prevention of disease is primarily focused on proper application of hygienic practices. Galbraith et al. (2014) reviewed the hygienic practices used by the bird feeding public and found that 75% of those engaged in this activity simply placed the food on the ground where it could be contaminated by soil pathogens and bird feces, and of the small subset of people that used a container or a bird table to hold bird food, 20% never cleaned them and 17% only cleaned them two to three times per year. Additionally, for those that did clean their bird feed containers and tables, 36% used only cold water and while 20% used soap and water for cleaning, only 1% used a disinfectant (Galbraith et al., 2014). These substandard hygienic practices for bird feeding will not protect the health of birds. Bird feeders should be cleaned and disinfected twice a month while in use. This involves using a scrub brush and hot soapy water to clean debris and bird feces off of the feeders. These cleaning methods are supported by Feliciano et al. (2018) whose results suggest that scrubbing bird feeders with soap and water followed by a soak in a bleach solution is more effective in reducing persistence of pathogens than either method individually. Special attention should be given to the perches and openings where the birds have to place their heads inside to get access to the bird feed. After the feeders are washed and clean, they should be disinfected by immersion for two to three minutes in a solution of one part of liquid chlorine bleach and nine parts of warm water. Subsequently, they should be rinsed with clean water and allowed to air dry. A similar hygienic approach should be applied to any artificial water sources provided on a property. The areas around the feeders should also be regularly kept clean by raking and removal of waste food and bird droppings for disposal in the garbage. Since birds carry infectious organisms such as *Salmonella*, *Escherichia coli*, *Campylobacter* and *Histoplasma* that can cause disease in people, rubber gloves should be worn while performing these cleaning activities and hands should be washed well with soap, hot water and a disinfectant when finished. In the intervening periods bird feeders should be monitored regularly for uneaten seed that has become soggy or moldy so that it can be disposed of immediately. To prevent unused bird seed from becoming wet, moldy or contaminated by rodents, it should be kept in clean plastic or metal containers with secure lids in cool dry locations. Avoid excessive heat because it can destroy the nutrition and ruin the taste of certain seeds (e.g., sunflower seeds).

Feed the right food. Provide only high-quality bird seed by reading the ingredients on the packages because bargain brands often contain "filler" seeds such as milo, red millet, flax, oats, rice and wheat that are generally not eaten by birds and will readily absorb moisture promoting spoilage and fungal growth. Additionally, these "filler" seeds are often discarded by birds beneath the feeders, attracting rodents and other non-target wildlife species. Different bird species prefer different seed types so take this into consideration when selecting bird food and provide a variety. Sunflower seeds are the top choice among most birds. Cracked corn is preferred for ground-feeding birds, but it should not be too fine because the particulate matter and interior of the kernel readily soak up moisture which turns into mush promoting fungal and bacterial growth. Therefore, cracked corn should only be fed in small amounts in water-tight hopper feeders to prevent spoilage. Safflower seeds, nyjer seeds and peanuts are other good choices that will attract a variety of species. Home recipes using fruit, berries, nuts and peanut butter can provide high quality food for certain bird species. During cold temperatures, suet can be fed to insect eating bird species such as woodpeckers, chickadees, wrens and nuthatches but do not offer it during warm weather because the fat melts and becomes rancid too quickly. Nectar feeders are excellent sources of nutrition

for hummingbird species. Baked and crushed egg shells are an excellent calcium supplement for breeding birds. Foods that have no nutritional value for birds or should not be fed to them include bread (especially if it is moldy because the bread mold fungus Aspergillus fumigatus is infectious for birds) and chocolate which is toxic to birds. The Audubon Guide to Bird Seed describes the various types of available bird seed and it can be found at:
https://www.sfvaudubon.org/wp-content/uploads/2016/06/Audubon_Guide_Bird_Seed_printPDF.pdf
(Accessed 23/11/2017)

4. Summary

Similar to mammalian wildlife species, there is mounting evidence based on the risks described above that suggests that the activity of recreational supplemental bird feeding should be discouraged. However, until there is more clarity on the issue it remains a reality that bird feeding on public and private properties will continue to be a popular pursuit enjoyed by many members of the general public. Therefore, these individuals should be made aware of bird-safe methods of feeding. Additionally, a specific focus on the creation of "bird-friendly" habitat on private properties should be encouraged because it would have a significant impact on increasing biodiversity and conservation in urban landscapes while decreasing disease risk. Following the management ABC's discussed above will lead to the detection, prevention, mitigation, or management of the common wild bird health problems associated with supplemental bird feeding.

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