

MANAGING AVIAN DAMAGE IN AQUATIC HABITATS

Mikayla Killam¹, T.J. Muir², Linda Tschirhart-Hejl³, and John M. Tomeček, Ph.D.⁴

INTRODUCTION

Across the state of Texas, birds rely on a variety of aquatic habitats to meet needs ranging from foraging habitat and water access to shelter from their own predators and everything in between. Conflicts can develop when birds concentrate on aquatic habitats economically or recreationally important to humans. Many times, these issues are related to artificial bodies of water (lakes, tanks, ponds, etc.) that have been stocked with fish for recreational purposes. In these situations, a bird—or flock of birds—can negatively impact a valuable resource while exhibiting very normal wildlife behavior. Other issues can arise when birds are drawn to an aquatic resource and then use surrounding structures to perch. The buildup of droppings or nesting material can become unsightly and even lead to health concerns when near recreational structures (docks, pavilions, etc.). When managing these issues, it is important to remember that the bird in question is a native animal that plays an important role in the environment.



Figure 1. Double-crested cormorant eating a fish.

Photo by Phil Hauck

GENERAL ECOLOGY AND IDENTIFICATION

When managing issues with birds in an aquatic setting, identification is a very important first step. Not all birds see fish as an ideal part of their diet, so identification can help determine if the birds most often observed have any potential impact on the resource. Additionally, many species that do consume fish as part of their diet do so in a way that has very limited impacts on their surroundings. Identifying the birds observed near a body of water can help determine if there is a need for management action.

Another factor to consider is that most bird species have some level of legal protection, and that the level of protection can vary from one species to the next. Proper identification can inform which management strategies are legal options. Some of the species often associated with issues in aquatic habitats are discussed in the following pages.

¹ Wildlife Damage Management Program Specialist, Texas A&M AgriLife Extension Service

² Wildlife Damage Management Biologist, Texas Wildlife Services

³ District Supervisor, Texas A&M AgriLife Extension-Texas Wildlife Services

⁴ Associate Professor and Extension Wildlife Specialist, Texas A&M AgriLife Extension Service

Double-crested cormorants

The double-crested cormorant is the most abundant cormorant species found in the United States (U.S.) (Dorr et al., 2021). In Texas, double-crested cormorants may be confused with neotropical cormorants or anhinga, but the double-crested cormorant is the species most often documented causing conflicts. All three species are large, black aquatic birds, but the anhinga has a pointed bill, while cormorants have hooked bills. The neotropical cormorant also has a longer tail and a pale-yellow throat pouch as opposed to the double-crested cormorant's brightly colored neck pouch. Double-crested cormorants are migratory birds that specialize in feeding by diving underwater. These birds spend their winters in southern portions of the U.S., which can seasonally lead to very high concentrations of cormorants at available resources.

In many cases, diet studies have found that cormorants do not typically consume large quantities of commercial or sport fish species and instead focus their diet on small fish and shrimp (Dorr et al., 2021; Dorr et al., 2016). However, as a colonial bird, cormorants sometimes feed in groups large enough to negatively impact natural fisheries in lakes, stocked ponds, and aquaculture facilities (Dorr & Fielder, 2017). Many of the issues seen with cormorants involve areas where fish are artificially concentrated, providing easier hunting for these birds, such as stocking release sites, spawning sites, fish farms, and stocked fishponds (Dorr et al., 2016). In natural settings such as lakes and ponds, issues can also occur when cormorants concentrate on a specific fish size, which can reduce populations and recruitment long term, or when they feed primarily on smaller fish that are important food sources for popular sport fish (Dorr & Fielder, 2017).



Figure 2. Double-crested cormorant swimming. Photo by Phil Hauck

Gulls

The term "gulls" refers to a group of birds found in the Laridae family. While this family of birds encompasses 99 unique bird species, 22 gulls are commonly found in Texas, and only eight species of gull are typically associated with human-wildlife conflict (Winkler et al., 2020a; Lowney et al., 2018). The following species are the most common when it comes to gull-related damage: herring gull, laughing gull, ring-billed gull, great black-backed gull, California gull, Franklin's gull, Bonaparte's gull, and glaucous-winged gull (Lowney et al., 2018). Gulls are often associated with oceans and seashores, but as a migratory



Figure 3. Flock of ring-billed gulls. Photo by Rick Nirschl

bird, they can also be found near inland bodies of water across North America. The diet of a gull varies greatly across species and ranges but can include insects, shrimp, crabs, fish, eggs, and birds (Winkler et al., 2020a). Gulls will also feed on fish and mammal carcasses, pet food, or human garbage where available. Gulls often travel in large flocks, which can cause damage when feeding on captive or restricted fish populations or when they steal pelleted food intended for fish. Additionally, health and property damage concerns may exist where gulls congregate in large quantities due to the buildup of nesting material and fecal matter (Lowney et al., 2018).

American white pelicans

Two species of pelican can be found in Texas: the brown pelican, which is only in coastal habitats, and the American white pelican, which can be found throughout much of central and western North America (Knopf & Evans, 2020). The diet of American white pelicans consists primarily of schooling fish that are smaller than half of the pelican's bill length (Knopf & Evans, 2020). White pelicans are opportunistic feeders and will also consume crayfish, larger fish, salamanders, and tadpoles when available (Knopf & Evans, 2020). American white pelicans prefer to feed in shallow water and may forage for their food individually, in small groups, or in large, coordinated groups of over 25 individuals (Knopf & Evans, 2020; King, 2019). When pelicans concentrate their foraging efforts on fish that are in captive environments, such as an aquaculture facility or a stocked pond, it can cause damage to fish populations (King, 2019). The severity of losses from consumption depends on the number of pelicans present, the size of the fish consumed, and how long the pelicans remain at one location. Another concern related to American white pelicans feeding in stocked fishponds or aquaculture facilities is that they are the primary host for the parasite



Figure 4. A flock of foraging pelicans. Photo by Rick Nirschl

Bolbophorus damnificus and can spread viable eggs of the parasite through defecation (Fox, 1965; Weis et al., 2018). Catfish are an intermediate host for this parasite and, when infected, can experience a variety of symptoms, including death from the infection, subsequent bacterial infections, or inability to evade predators while sick (Weis et al., 2018).

Herons and egrets

Like gulls, the terms “heron” and “egret” actually encompass a number of species. When grouped together, herons and egrets are described as long-legged, long-necked birds often associated with aquatic habitats and curving their necks while in flight (Hoy, 2017). In aquatic environments, these birds can forage in a solitary manner or as a group. As wading birds, their foraging is typically limited to shallow water, where they can walk to search for food. Their diet varies from one species to the next but is largely made up of fish, with crustaceans, insects, amphibians, and even small birds and mammals when available (Winkler et al., 2020b). Conflicts with these birds typically involve small captive populations of fish or areas with sport fish that are frequented by large numbers of herons and egrets (Hoy, 2017).



Figure 5. Great blue heron scanning the water for prey. Photo © Frode Jacobsen

Ospreys

Ospreys are piscivorous raptors whose diet is made up almost entirely of fish (Bierregaard et al., 2020). Ospreys specialize in capturing fish by diving feet first out of the air and grabbing their prey out of the surface of a body of water (Bierregaard et al., 2020). Although ospreys dive from great heights to capture their prey, they typically capture prey in only the top 3 feet of water (Bierregaard et al., 2020). This means that their diet is limited to fish found in shallow waters or fish that school near the surface of a body of water (Bierregaard et al., 2020).

Like other raptor species, ospreys experienced dramatic population declines in the 1900s, likely due to pesticide use weakening their eggshells. Thanks to new regulations and conservation efforts, ospreys can be found throughout their historic ranges around the world. In Texas, ospreys have been documented statewide during migration but are most often seen in the year-round populations found in coastal regions. Even though they exclusively eat fish, ospreys rarely impact healthy fish populations. If you believe you have an osprey issue that requires action, please reach out to a local Wildlife Services office for more information.

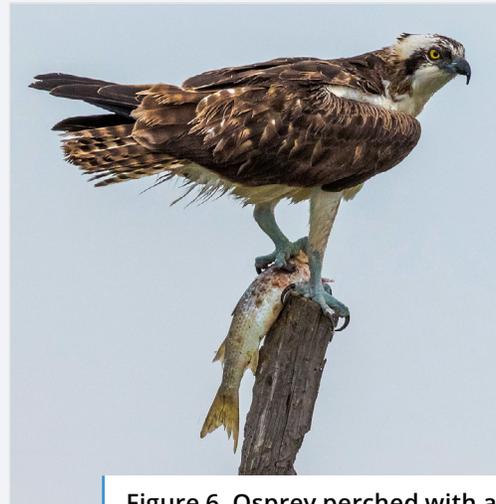


Figure 6. Osprey perched with a captured fish. Photo by Nancy Norman

LEGAL CONSIDERATIONS

At a minimum, all of the birds discussed thus far are protected under the Migratory Bird Treaty Act of 1918 (MBTA). The MBTA was created in response to an international treaty between the U.S., Canada, Mexico, Japan, and the USSR (now Russia) to end the commercial trade of migratory birds that travel across international boundaries (Tomeček & Frank, 2019). The MBTA protects migratory birds from all forms of “take” and defines take as any action that can be considered an attempt to pursue, capture, hunt, kill, or sell a protected bird or the parts, nests, or eggs of such bird (Tomeček & Frank, 2019). It is important to note that the definition of take does not include harassment. When implemented correctly, harassment can be an effective tool for managing protected birds that are causing damage. Part of correctly implementing harassment is ensuring that it begins prior to nesting so that eggs or chicks are not abandoned. If harassment causes active nests with eggs or chicks to be abandoned, then it is legally considered a form of take. In some cases, lethal action may be deemed necessary as part of a management plan concerning a bird protected by the MBTA, but a federal Migratory Bird Depredation Permit must be granted before any action can be taken.

WHEN TO ACT?

None of the birds discussed thus far pose a direct threat to humans, but in certain situations, they may threaten resources that humans value. Some of these species congregate in large enough numbers that their nesting habits may damage trees and artificial structures. Additionally, large quantities of fecal matter around nesting birds may present a health hazard (Lowney et al., 2018; Hoy, 2017). Issues are also observed when birds forage heavily on local fisheries, stocked fish, and even backyard ponds (Dorr et al., 2016; King, 2019). It is important to remember that other factors related to pond management and stocking practices can contribute to declines in fish populations as well. The best way to identify that an avian predator is causing fish populations to decline is through direct observation (King, 2019). If excessive fish consumption is not seen, other pond management strategies should be reviewed. For additional information on best practices for pond management, check out the [Pond and Sport Fish Management page](https://fisheries.tamu.edu/pond-management/)¹ from the Texas A&M AgriLife Extension Service.

¹ Web address for Pond and Sport Fish Management page: <https://fisheries.tamu.edu/pond-management/>

When managing migratory birds, timing can be a very important factor in a successful management plan. Some of these species may have local, non-migratory populations, but the majority will have seasons where conflict is greater due to an increased number of birds based on migratory patterns. If a species and its migratory patterns can be identified, then the timing of management can be better focused.

The decision to take management action against birds in an aquatic environment will depend on how much conflict a landowner can tolerate. In some cases, preventative management can resolve issues enough for coexistence, whereas in other situations, more targeted management is required. When making management decisions regarding these species, it is important to remember that they are all native species that serve an important role in our ecosystem. Functional coexistence is the goal of the following management options, not complete eradication.

MANAGEMENT TOOLS

An Integrated Wildlife Damage Management (IWDM) approach is recommended when developing a management strategy for coexisting with wildlife that may be causing damage issues. This simply means that a variety of management tools are used to improve the overall success of management efforts. There are a variety of tools available for legally managing birds in various situations. Conflicts between humans and birds can take on a variety of forms, and not all of these tools will be applicable in each scenario. In an IWDM approach, the manager must select the combination of tools that make the most sense for their specific situation.

In some situations, permits can be acquired to allow lethal action as a component of an IWDM plan. Before any lethal action can be taken, other management practices must be attempted, and the permits must be approved prior to action. The permit will only be granted if it is part of an existing management plan with other non-lethal management efforts. Additionally, local laws and city ordinances must also be considered. Lethal action is rarely a viable option for a private citizen in an urban setting.

Cultural management

Depending on the levels of damage encountered, there are adjustments managers can make to minimize the potential for conflict with these bird species. These practices are most effective when implemented prior to the birds establishing in an area, but they can also be an important part of managing an issue once it is established.

Stocking practices

In areas where fish are regularly stocked, new fish should be released at night to give them time to disperse and find cover before avian predators start foraging (Dorr et al., 2016). If possible, fish should also be released in areas with deep water, as many avian predators forage most successfully at more shallow depths. If predation issues are specifically related to cormorants, stock fish prior to migratory arrival in the winter or after the cormorants leave in the spring (Dorr et al., 2016). While non-migratory populations of cormorants, pelicans, herons, and gulls may exist in Texas, total numbers are typically lower after migratory populations travel to their northern breeding grounds. During spring migration, foraging issues may increase as birds prepare for their migratory journeys (King, 2019).

Food removal

With many of the species discussed in this article, removing food sources is not a viable option because the food attracting the birds is a resource that humans also rely on and utilize. In the case of gulls, there are a myriad of alternative food sources that can also attract flocks of birds. These food sources include fish food, dog or cat food, human garbage, and even food that was intended for human consumption (Lowney et al., 2018). To avoid attracting gulls to an area, efforts should be made to ensure that all of these potential food sources are inaccessible to gulls, and intentional feeding should be strictly prohibited. Additionally, insecticides and mowing can be used to prevent large hatches of bugs that may cause gulls to concentrate in an area (Lowney et al., 2018).

Habitat modification

Management options for habitat surrounding a body of water will vary and even be contradictory, depending on the species causing issues. In many

cases, planning pond construction to allow for deep water where fish can take refuge is an excellent preventative measure. Depending on the species causing damage, the following modifications can also be pursued.

- ▶ American white pelicans prefer to forage in open water. Allowing woody vegetation to grow in shallow areas of water may reduce accessibility for foraging pelicans (King, 2019).
- ▶ In the case of cormorants, trees may be providing locations for potential nest sites. Trees with active nests may not be destroyed without proper permitting, but during non-nesting seasons, tree removal may encourage birds to choose a different location the following year (Dorr et al., 2016).
- ▶ Gulls are attracted to fresh water, especially in marine environments where fresh water is limited (Lowney et al., 2018). In marine locations, efforts should be made to ensure that rainwater does not pool on the landscape and provide a resource that would attract gulls (Lowney et al., 2018).

Exclusions

Netting

Nets, wires, or ropes may be useful for excluding many bird species from aquaculture facilities or hatcheries (Hoy, 2017; Dorr et al., 2016; Lowney et al., 2018; King, 2019). As with other exclusion options, netting and wiring can become expensive and impractical at larger scales and should only be implemented selectively in high-risk locations (Hoy, 2017; Dorr et al., 2016). On private property, these enclosures can be helpful for protecting decorative ponds with ornamental fish or small stocked tanks attempting to maintain a high density of fish.

Netting is typically a total enclosure approach where nets should extend all the way to the ground to ensure birds cannot walk into an area (Hoy, 2017; Dorr et al., 2016). Additionally, nets should be carefully observed to ensure that other protected wildlife (migratory songbirds) are not being harmed or killed by their presence. Overhead wire systems are a slightly more cost-effective partial enclosure option. These systems are made up of wire grids suspended above a body of water that make landing and taking off difficult

for large birds (King, 2019). To be effective, the wires must be tight enough that they do not sag down to the water when large birds land on them (Hoy, 2017; King, 2019). This setup can be effective for deterring flocks of large birds, but individuals may learn how to navigate the barrier and continue feeding (King, 2019; Dorr et al., 2016).

Perch deterrents

With smaller birds such as gulls, issues can also arise from birds perching or nesting on the ledges of buildings, on top of signs, on railings, and on a variety of other structures (Lowney et al., 2018). Perch deterrents such as spikes or electrified tape can be effective tools for preventing nesting and perching on these structures (Lowney et al., 2018). There are a variety of prefabricated spikes that can be purchased to deter perching, so for maximum effectiveness, select an option that is specifically rated for the species causing damage (Seamans & Gosser, 2016). Spikes should be sharp and tightly placed so that birds cannot land between them (Avery & Lowney, 2016). They should also be short and resistant to bending, or larger birds will be able to adjust the spikes so that the area is useable as a perch (Avery & Lowney, 2016).

There are also prefabricated systems that allow a manager to run an electrified tape or track on a narrow perching surface that will briefly and safely shock any bird attempting to perch (Wildlife Services Florida, 2017). This option is only recommended in areas where potential perches are inaccessible to people who could accidentally come in contact with the device.

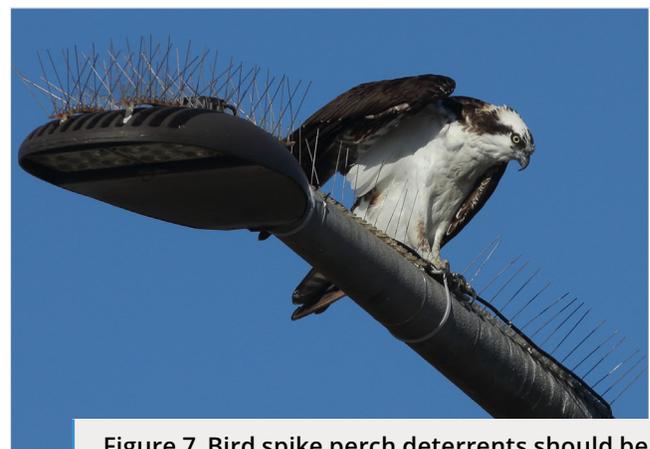


Figure 7. Bird spike perch deterrents should be resistant to bending so that larger birds cannot manipulate them into a perch. *Photo by R.J. Adams*

Non-lethal harassment

Harassment is most effective when used as soon as an issue arises and before birds have become accustomed to a specific area or resource (Dorr et al., 2016). Many of these bird species will quickly adapt to scare tactics, so it is important to use a variety of tools to be most effective. Additionally, scare tactics should appear to be random. If loud noises, bright lights, or other tactics follow a predictable pattern, they may become less effective over time as birds learn the pattern and anticipate the disturbance (King, 2019).

Vehicles

In some situations, frequent human activity in an area can be enough to disturb newly arrived birds or exclude foraging birds from a small area of interest (Dorr et al., 2016). Around smaller bodies of water, trucks, all-terrain vehicles (ATVs), or utility task vehicles (UTVs) can be driven to increase levels of human activity and disperse foraging or resting flocks (Lowney et al., 2018). In larger bodies of water, boats can be used to disperse flocks on the water (Dorr et al., 2016). Using vehicles for harassment is an easy first step to disrupting foraging patterns.

Pyrotechnics

Pyrotechnic noisemakers are specialized explosive devices that can be effective tools for avian harassment (Seamans & Gosser, 2016). The most commonly used pyrotechnics are cartridges launched from a hand-held launcher (Fig. 8) or specially designed shells discharged from a 12-gauge single-barrel, single-shot, break-action shotgun. Once fired, they either make a screaming sound as they travel or explode with a loud bang, depending on the type used (Lowney et al., 2018). Bear in mind that municipal sound ordinances and firearm laws must be considered when planning their use. Additionally, basic firearm safety should be used when handling these devices, as even non-lethal loads propelled by gunpowder can cause injury or death by accident. Never point these at any living thing or flammable/explosive substance. In most areas, a permit is required to use these devices within city limits. Depending on the type of pyrotechnics, additional permits from the U.S. Bureau of Alcohol, Tobacco, and

Firearms may also be required (Lowney et al., 2018). Regardless of permit requirements, proper authorities should always be notified in advance to avoid any misunderstandings related to the sound or appearance of the pyrotechnics. When using pyrotechnics, managers should ensure the harassment effort is not used on a regular interval that birds can learn and predict. Successful use of sound deterrents relies on startling the birds, and therefore, randomized timing and deployment locations should be used.



Figure 8. Unloaded pyrotechnic launcher.

Photo by Mikayla Killam

Propane cannons

Propane or air-powered cannons (Fig. 9) can be effective avian harassment devices. Rather than firing a projectile, they use a compressed charge of ignited propane or air to make a loud noise when ignited (propane) or released (air). Bear in mind that municipal sound ordinances must be considered when planning their use. There are a variety of avian deterrent cannons available for purchase, but managers should ensure that whatever system they use does not operate on a regular interval that the birds can learn and predict. Successful use of sound deterrents relies on startling the birds, and therefore, managers should incorporate changes in timing, cannon position, and cannon direction as appropriate for their application (Seamans & Gosser, 2016).



Figure 9. Propane air cannon. Photo by Mikayla Killam

Lasers

Lasers are an excellent option for avian roost harassment because they do not harm the birds, the potential for disturbing neighbors is minimal, and they are most effective in low light when birds are typically roosting (Fig. 10; Seamans & Gosser, 2016). The use of lasers has proven most effective in the low light of dawn and dusk because some species are less likely to be dispersed by a laser during full darkness (Dorr et al., 2018; Avery & Lowney, 2016). It is important to follow all safety recommendations associated with your selected laser model, including but not limited to the following points.



Figure 10. An example of a hand-held laser.

Photo by Mikayla Killam

- ▶ Always point the laser in a safe direction and not at people, homes, or vehicles.
- ▶ When pointing the laser, know your target and what is behind your target.
- ▶ Do not aim the laser at a reflective surface, including mirrors, mirrored surfaces, or windows.
- ▶ Do not use lasers near airports or point them at aircraft.

When used to disperse roosts, harassment with lasers must be diligent and constant, and the effort will likely take several consecutive nights. If you select an automated laser or light system, ensure that the laser uses a random pattern so that birds do not become accustomed to it.

Spotlight

When necessary, American white pelicans will forage for fish at night. Typically, this behavior is limited to the breeding season (summer) and rarely occurs during the winter (Knopf et al., 2020). When this issue occurs, spotlights can be a useful tool for dispersing actively foraging flocks (King, 2019).

Visual deterrents

Artificial devices used to make an area look like humans or predators are present have come a long way from historic scarecrows. Today, there are a variety of tools that can be used to visually startle birds, including modern scarecrows, reflective tape, bird effigies, specially painted balloons, and even inflatable options that sway back and forth with no discernable pattern (Seamans & Gosser, 2016). These tools have varying levels of success depending on the birds they are intended for. Cormorant numbers have been successfully reduced in areas where stakes with reflective tape are placed around roosting sites, with the tape tied in a way that it can randomly move with the wind (Dorr et al., 2016). Gulls have been scared from an area where an effigy was hung near a resting area (Lowney et al., 2018). An effigy consists of an artificial, deceased, or taxidermized bird that is hung in an easily visible location in a way that makes it look dead or dying (Dorr et al., 2018). Gulls will see the effigy and avoid the area, assuming there is some kind of lethal risk there. It is important to note that since gulls are protected, a Migratory Bird Depredation Permit is required to use dead or taxidermically prepared gulls as effigies (Dorr et al., 2016). Additionally, many bird species can eventually become desensitized to effigies and other forms of visual harassment, so these methods should only be used for a limited period and then removed until needed again.

LETHAL ACTION

In some cases, lethal removal under a Migratory Bird Depredation Permit may be a necessary addition to an IWDM plan. Select removal of a few individuals can help to reinforce management efforts, improve their success, or eliminate the individuals specifically causing damage (Dorr et al., 2016; Avery & Lowney, 2016). In some cases, these species may become acclimated to non-lethal harassment over time and no longer perceive it as a threat. In other cases, large colonies of nesting birds may need their population to be regulated through various nest management strategies. In these situations, occasional lethal action paired with other management techniques can improve the overall success of management efforts. As all of these species are protected by the MBTA, it is important to remember that lethal action can only

be taken if a permit has been granted by the U.S. Fish and Wildlife Service (USFWS).

In Texas, a landowner looking to implement lethal management practices on these species will have to apply for their own permit with USFWS each year they want to include lethal removal in their management plan. To apply for a permit, there is a fee and a waiting period prior to approval. Additionally, the holder of the permit will be responsible for reporting birds taken and applying for permit renewal if needed. If approved, the permit will include a specific number of birds authorized for lethal removal. For more information on incorporating lethal control into a management plan, interested individuals can reach out to their regional Texas Wildlife Services office for advice, as they will be involved in the permit application process.

The following steps can be taken for an individual to apply for a Migratory Bird Depredation Permit directly from USFWS.

1. Harassment actions must already have been taken for a permit to be reviewed.
2. Reach out to the U.S. Department of Agriculture Wildlife Services Program to request a Form 37 Migratory Bird Damage Project Report. Regional contact information can be found on the [Texas Wildlife Services contact page](#)² or by contacting the state office at (210) 561-3800. A Wildlife Services professional will conduct an investigation and document current harassment efforts, the results of those efforts, and total nuisance bird numbers, then determine if they recommend a USFWS permit be issued or not. If Wildlife Services recommends a permit be issued, they will suggest a maximum quantity of birds to be taken, and they may recommend additional actions to be used in conjunction with lethal removal.
3. An applicant must then submit Form 37 with a Migratory Bird Depredation Permit application to USFWS and pay the associated fee.
4. If a permit is issued, yearly reports will be required. If the problem persists and harassment efforts are still in place, managers can apply for permit renewals.

² Web address for Texas Wildlife Services contact page: <https://agrillife.org/txwildlifeservices/who-to-contact/>

Depredation permits are designed to reinforce the negative connotation of existing aversive conditioning. They are not the sole answer to conflict issues and will not be granted if they are not used in conjunction with other practices.

CONCLUSION

The overlap between resources humans value and resources that wildlife rely on can lead to conflict in a variety of scenarios. It is important for managers dealing with avian nuisance issues to remember that all of the species discussed in this article play a vital role in the environment, and coexistence with these birds is the ultimate goal. The tools outlined in this publication should provide managers with a variety of options for addressing issues with avian predators around bodies of water. To be successful, it is important that multiple tools are used and their timing is varied enough that the birds do not become accustomed to them.

If additional information is required, a qualified professional can provide situation-specific recommendations for management efforts. Contact the Texas Wildlife Services or the Texas A&M AgriLife Extension Service for more information.



Figure 11. Great blue heron checking a fishing cart for any potential food. Photo by Christopher Sanders

Texas Wildlife Services Program

Canyon

Rick Gilliland, DS
WTAMU Box 60277
Canyon, Texas 79016
(806) 651-2880

Fort Worth

Randy M. Smith, DS
501 W. 10th St., Room B-10
Fort Worth, Texas 76102
(817) 978-3146

San Angelo

Doug Steen, DS
33 East Twohig, Room 317
San Angelo, Texas 76903
(325) 655-6101

Fort Stockton

Richard Dickerson, DS
P.O. Box 1521
Fort Stockton, Texas 79735
(432) 360-1122

Uvalde

Cory Wilson, DS
122 North East St.
Uvalde, Texas 78801
(830) 278-4464

Kerrville

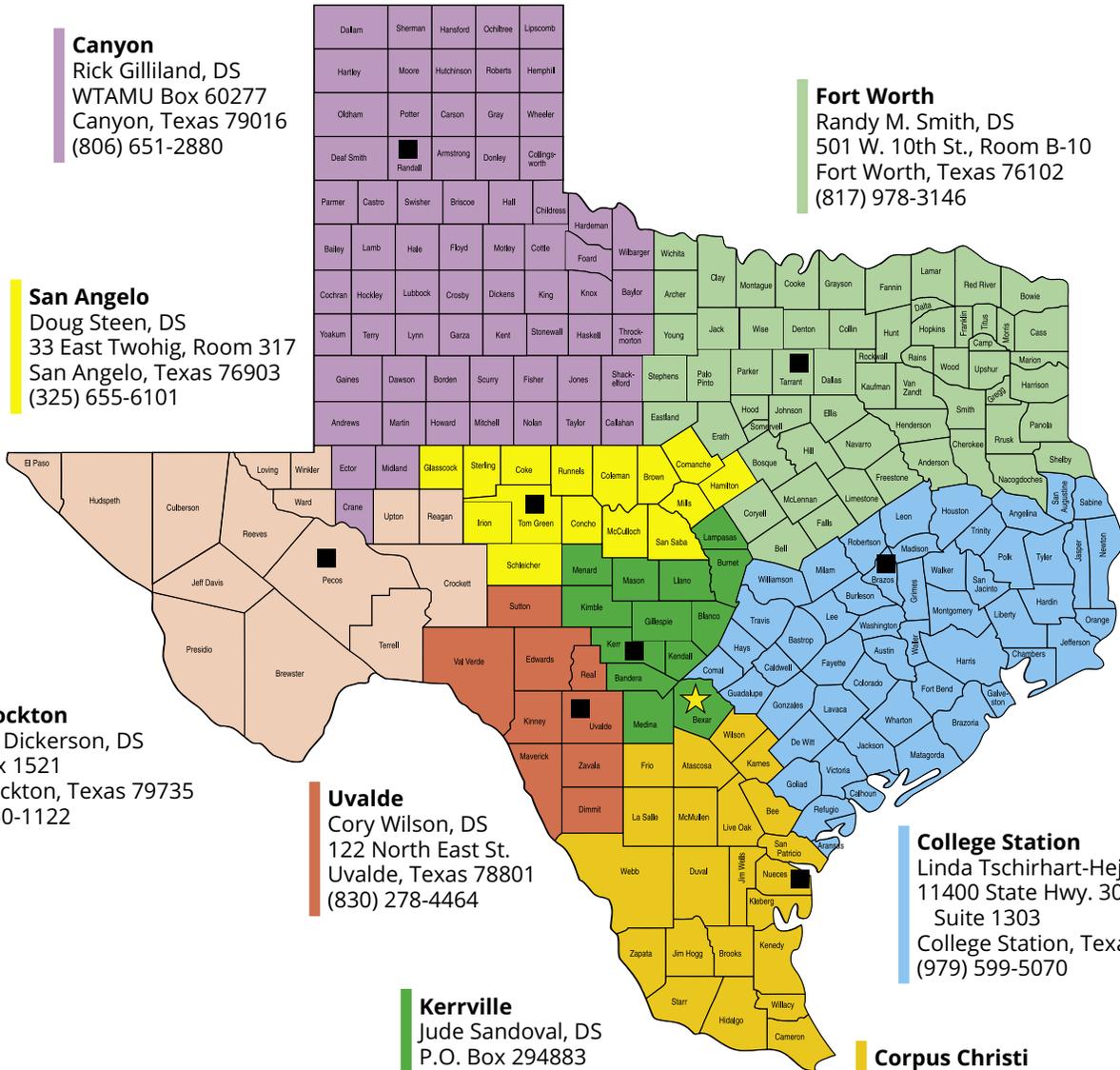
Jude Sandoval, DS
P.O. Box 294883
Kerrville, Texas 78029
(830) 896-6535

College Station

Linda Tschirhart-Hejl, DS
11400 State Hwy. 30,
Suite 1303
College Station, Texas 77845
(979) 599-5070

Corpus Christi

Rick Sramek, DS
P.O. Box 9259
Corpus Christi, Texas 78469
(361) 299-1176



State Office

Michael J. Bodenchuk, SD
Bruce R. Leland, ASD
P.O. Box 690170
San Antonio, Texas 78269-0170
(210) 472-5451

SD	State Director
ASD	Assistant State Director
DS	District Supervisor
ADS	Assistant District Supervisor

District Offices

REFERENCES

- Avery, L. M., & Lowney, M. (2016). *Vultures*. Wildlife Damage Management Technical Series. USDA, APHIS, WS National Wildlife Research Center.
- Bierregaard, R. O., Poole, A. F., Martell, M. S., Pyle, P., & Patten, M. A. (2020). Osprey (*Pandion haliaetus*), version 1.0. In P. G. Rodewald (Ed.), *Birds of the World*. Cornell Lab of Ornithology. <https://doi.org/10.2173/bow.osprey.01>
- Dorr, B. S., & Fielder, D. G. (2017). Double-crested cormorants: Too much of a good thing? *Fisheries*, 42(9), 468–477. <https://doi.org/10.1080/03632415.2017.1356121>
- Dorr, B. S., Hatch, J. J., & Weseloh, D. V. (2021). Double-crested cormorant (*Nannopterum auritum*), version 1.1. In A. F. Poole (Ed.), *Birds of the World*. Cornell Lab of Ornithology. <https://doi.org/10.2173/bow.doccor.01.1>
- Dorr, B. S., Sullivan, K. L., Curtis, P. D., Chipman, R. B., & McCullough, R. D. (2016). *Double-crested cormorants*. Wildlife Damage Management Technical Series. USDA, APHIS, WS National Wildlife Research Center.
- Fox, A. C. (1965). *The life cycle of Bolbophorus confusus (Krause, 1914) Dubois, 1935 (Trematoda: Strigeoidea) and the effects of the metacercariae on fish hosts* [Unpublished doctoral dissertation]. Montana State University.
- Hoy, M. D. (2017). *Hérons and egrets*. Wildlife Damage Management Technical Series. USDA, APHIS, WS National Wildlife Research Center.
- King, T. (2019). *American white pelicans*. Wildlife Damage Management Technical Series. USDA, APHIS, WS National Wildlife Research Center.
- Knopf, F. L., & Evans, R. M. (2020). American white pelican (*Pelecanus erythrorhynchos*), version 1.0. In A. F. Poole (Ed.), *Birds of the World*. Cornell Lab of Ornithology. <https://doi.org/10.2173/bow.amwpel.01>
- Lowney, M. S., Beckerman, S. F., Barras, S. C., & Seamans, T. W. (2018). *Gulls*. Wildlife Damage Management Technical Series. USDA, APHIS, WS National Wildlife Research Center.
- Seamans, T. W., & Gosser, A. (2016). *Bird dispersal techniques*. Wildlife Damage Management Technical Series. USDA, APHIS, WS National Wildlife Research Center.
- Tomeček, J. M., & Frank, M. G. (2019). *A guide to the Migratory Bird Treaty Act: What everyone needs to know about migratory birds* [RWFm-PU-173]. Texas A&M AgriLife Extension Service.
- Wildlife Services Florida. (2017). *Vulture deterrent sources and costs*. USDA, APHIS, WS National Wildlife Research Center.
- Winkler, D. W., Billerman, S. M., & Lovette, I. J. (2020a). Gulls, terns, and skimmers (*Laridae*), version 1.0. In S. M. Billerman, B. K. Keeney, P. G. Rodewald, & T. S. Schulenberg (Eds.), *Birds of the World*. Cornell Lab of Ornithology. <https://doi.org/10.2173/bow.larida1.01>
- Winkler, D. W., Billerman, S. M., & Lovette, I. J. (2020b). Herons, egrets, and bitterns (*Ardeidae*), version 1.0. In S. M. Billerman, B. K. Keeney, P. G. Rodewald, & T. S. Schulenberg (Eds.), *Birds of the World*. Cornell Lab of Ornithology. <https://doi.org/10.2173/bow.ardeid1.01>
- Wise, D. J., Hanson, T. R., & Tucker, C. S. (2008) Farm-Level Economic Impacts of Bolbophorus Infections of Channel Catfish. *North American Journal of Aquaculture*, 70, 382–387.



Funded by Southern Sustainable Agriculture Research and Education (SARE), U.S. Department of Agriculture under award number 2020-38640-31521.

Front banner image by [wirestock on Freepik](#).