



**Human Health and Ecological Risk Assessment
for the Use of Wildlife Damage Management Methods
by USDA-APHIS-Wildlife Services**

Chapter II

**The Use of Cage Traps in
Wildlife Damage Management**

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USE OF CAGE TRAPS IN WILDLIFE DAMAGE MANAGEMENT

EXECUTIVE SUMMARY

USDA-APHIS-Wildlife Services (WS) Program uses cage traps to capture a variety of vertebrate animals for specific wildlife management projects, mostly where a need exists to resolve a wildlife damage situation. Wildlife can cause damage to property, agriculture, and natural resources or cause human health and safety concerns; for example, cage traps may be used to capture a skunk that is under a house or a for disease surveillance. WS uses cage traps extensively for wildlife damage management operations. Cage traps are used in many settings including urban and rural areas. WS personnel use cage traps in accordance with WS Directive 2.450.

Potential human health and environmental risks from the proposed use of all types of cage traps including purse and box traps, and drive or herd style cage traps by WS has been evaluated by APHIS and determined that the risks to human health and the environment are negligible. Cage traps can capture nontarget species, but capture rates are low compared to overall take and nontarget species are often released from cage traps unharmed. Cage traps have minimal risks to people, pets, and nontarget species. WS will continue to support and conduct research and education that supports more humane and effective trapping methods and will implement these measures in programs, where appropriate, to further reduce risk to nontarget animals.

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1 INTRODUCTION

Cage traps are commonly used by the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) Program to capture animals in wildlife damage management (WDM) activities. Cage traps come in a wide variety of styles and generally are of a particular design to accommodate the size of the target animal. They are designed to take advantage of the behavior or physical characteristic of the target animal. For example, box traps (Powell and Proulx 2003) can be made to capture a shrew (8 inches long) up to a black bear¹ (up to 12 feet long) and may be baited with an attractant preferred by the target species, or set on target animal trails without bait. Standard cage traps such as box traps, corral traps, clover traps, culvert traps, flight cage traps (e.g., pigeon walk-in traps, modified Australian crow traps for starlings), funnel traps (minnow traps), and suitcase traps are a few of the many designs of cage traps available. The wide variety of cage traps come with different doors and triggering mechanisms to close the door or trap. Most of these traps are made of wire, Nylon mesh, or solid metal/plastic/wood walls, floors, ceilings and doors, but can be panels with no roof for animals that cannot climb, jump, or dig out quickly. Some of these traps are made on floats to live capture aquatic animals such as turtles and otters. Another type of cage trap *per se*, is the drive or herd trap (Couey 1949, Addy 1956), which will also be discussed. Cage traps have been used for decades, if not centuries in some form or another, and are an effective method for trapping a wide variety of species.

In 1996 the Association of Fish and Wildlife Agencies (AFWA), working cooperatively with federal and private partners, embarked on a goal to develop voluntary Best Management Practices (BMPs) for trapping furbearers in the United States (Batcheller et al. 2000). The stated purpose and intent of AFWA in developing the BMPs was to: “*Scientifically evaluate traps and trapping systems used for capturing furbearers in the United States.*” AFWA determined the best methods by species², but was primarily targeting harvest by private fur trappers and not take in WDM activities. Evaluations of trap performance were based on animal welfare, efficiency, capture rate, selectivity, practicality, safety, mechanical function, cost, quality, durability, weight, and maintenance requirements (Fall 2002). Science-based literature and research on the variety of traps and snares were used by AFWA to develop the BMPs. The evaluation of BMPs continues and BMPs are updated as research results warrant (AFWA 2017). BMPs were provided to state and federal wildlife agencies as well as trappers and the public in the form of a general overview for traps and trapping, and specifically the most efficient and humane methods for trapping 24 furbearer species in the United States (USA) (AFWA 2017). The goals were to promote regulated trapping as a modern wildlife management tool, identify practical traps and trapping techniques while continuing to improve efficiency, selectivity, and the welfare of trapped animals through research, to provide specifications for traps that meet BMP criteria for individual species in various regions of the USA, to provide wildlife management and trap industry professionals with information to evaluate trapping systems in the USA; and to instill public confidence in and maintain public support for wildlife management and trapping through distribution of science-based information. AFWA (2017) focused on private trappers and realized that trapping for depredation control was different. The BMP program utilizes international humane trapping standards consistent with the Agreement on International Humane Trapping Standards among Russia, Canada, and the European Union. WS has adopted these standards, where feasible, for trapping in the USA and conducts research on different trapping systems.

¹ See the Introduction to Risk Assessments – Chapter I for scientific names. These are only given if not used in that Section.

² Furbearers with AFWA (2017) trapping BMPs include Virginia opossum, beaver, muskrat, nutria, Canada lynx, bobcat, coyote in Eastern U.S., coyote in Western U.S. (both eastern and western United States populations have own BMPs since eastern coyotes are larger as a result of hybridizing with wolves), gray wolves, red fox, swift/kit fox, arctic fox, gray fox, river otter, fisher, American marten, weasel (least, long-tailed, and short-tailed), mink, American badger, ringtail, raccoon, and striped skunk.

WS Policy (WS Directive 2.450, 09/24/2014)³ states that the use of the BMP trapping guidelines developed and promulgated by AFWA (2017) for private fur harvest and other trapping activities are valuable and should be followed as practical. WS uses the BMP guidelines as the basis for policy formulation, but recognizes that some cage traps used in WDM are not commercially available and that not all devices recommended in the BMP guidelines for general public-use meet the more stringent performance requirements, particularly for efficiency and durability, for use in federal wildlife management activities. The Directive also discusses the fact that traps need to be set so that captured animals are not conspicuous to the public, particularly along public roads and trails; this reduces the possibility of a member of the public attempting to free an animal and getting injured and also to prevent trap theft. Cage traps are typically placed in areas where the public will not haphazardly stumble onto a trap or a trapped animal. The Directive also notes that agency cage trap replacements are to be selected from those commercially available or equivalents listed in BMP regional guidelines for each species (AFWA 2017), unless changes are authorized by the WS Regional Director.

1.1 Cage Traps

Cage traps (*e.g.*, Figure 1) allow a target animal(s)⁴ to enter inside an enclosure, but prevents the target animal from exiting once trapped. Cage traps are available in a variety of designs and sizes to live-capture different animals. The design and size of a cage trap are based on the size and behaviors of target animals. WS has used cage traps to successfully live-capture over 200 species of animals, including mammals (*e.g.*, raccoons, voles, monkeys, deer), birds (*e.g.*, waterfowl, pigeons, starlings, crows), reptiles (*e.g.*, snakes, turtles, iguanas, alligators), and fish (Table 3). Cage traps are placed in areas where activity by the target animal is high (*e.g.*, along travel corridors), with the entrance to the trap easily accessible and baited with an attractant to entice the target animal inside. Attractants used in cage traps could include familiar scents, non-live food items, live bait such as birds or mice (held in a bait station), or another target animal (decoy trap).



Figure 1. Standard box trap, often called a cage trap, set for a raccoon. The pan is in the rear and attached to the door by a metal rod. When the door closes, a hinge opens another flap that does not allow it to be opened from the inside.

Many cage traps are designed with a door⁵ that is held open by attaching the door to a pan, wire trigger, electronic beam, remote activating device, or other type of mechanism that can be activated once the animal is completely inside. When the target animal enters through a door to investigate the attractant, the pan, wire, or beam once tripped allows the opened door to quickly close with the animal trapped inside. Suitcase-style traps have a trigger or pan in the center of the trap and hinged panels that resemble an open suitcase when

³ All WS Policy Directives referenced in this document can be found @ <http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/wildlifedamage> under Wildlife Damage – WS Program Directives.

⁴ Depending on the trap-style, a trap may capture one or more animals. In the text, animal can refer to one or more.

⁵ Traps can have multiple entrances depending on the trap and the target species. Some bird traps have as many as four to six.

set. When a target animal steps on the pan or trips the wire or trigger in the center of the trap to investigate the attractant, the side panels snap shut around the animal, which resembles a closed suitcase with the target animal live-captured inside. Other traps, such as funnel traps, allow animals to enter the trap through an opening that is larger at the beginning and progressively gets smaller as the animal moves towards the entrance into the trap. Once the target animal enters the trap, the opening in the trap is too narrow to allow animals to exit easily, or the opening is positioned in such a way that prevents exiting but allows other target animals to enter into the trap. Traps can also be designed with one-way doors that allow target animals to lift open or push through (e.g., hanging wires or bobs) a door as they enter into the trap to investigate an attractant, but once inside, the door is closed behind them and the animal is unable to exit, these types of traps are often multiple-catch traps. Another type of entrance is similar to an elevator where the weight of the animal drops it to a lower level where it can enter the cage.

Schemnitz et al. (2012) discusses cage traps extensively, along with the diversity of traps available to live-capture animals. Some of the more common cage traps used by WS to live-capture target animals are discussed in this document, but is not an exhaustive list of available cage traps that WS has used in the past or could use in the future to live-capture target animals. However, the human and environmental risks and hazards associated with cage traps would be similar across the diversity of traps available since those traps operate under the same principle. The following are examples of specialized cage traps that are commonly used by WS to live-capture certain target animals. Their size and design are intended to target certain animal species and to exclude non-target animals.

➤ **Box traps**, often referred to generally as cage traps if they are made of wire mesh (Figures 1 and 2), are one of the more common types of traps available to live-capture animals and the trap with the most diversity in size and design. Box traps are generally rectangular, as the name implies. Box traps are enclosed on all sides, except for a door or doors that allow entrance into the enclosure. Box traps are generally constructed using wire mesh, but sometime are enclosed using sheet metal or hard plastic. They have a range of sizes, which is dependent on the size of the target animal. Attractants, particularly edible baits, are often used with box traps to entice target animals into the enclosure. The door or doors (some have doors at either end) to the enclosure are held open by a triggering mechanism, such as a pan or trip wire, or a remote control that closes the doors where the trap is viewed from a distance or with cameras. The attractant is normally placed on or beyond the triggering mechanism so the target animal has to step on or trip the mechanism to reach the attractant, which releases the door to close, and the animal is trapped inside the enclosure. However, where an operator is waiting to close the door from a remote area, feed may just be in the middle or away from the doors (these are commonly used for feral swine). Box traps are available to live-capture a variety of vertebrates from mammals to fish, but are most commonly used by WS to live-capture mammal and bird species that range in size from mice and voles to white-tailed deer and mountain lions. Box traps are generally portable and can be placed in areas frequently used by target animals, including in the water on floats for species such as waterfowl, otters and aquatic rodents. Traps with more than one door are usually used, especially, for animals that like to see the “other side” or the way through (e.g., rabbits). Box style cage traps generally allow for the capture of one individual at a time, so their use can be labor intensive and costly.

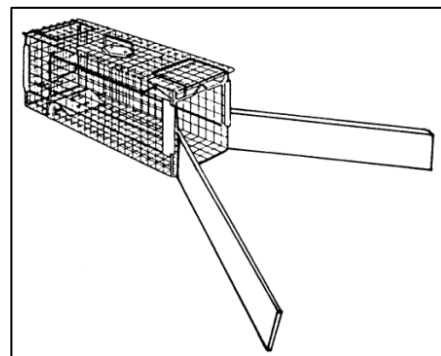


Figure 2. Box cage trap with wings to guide animals into traps such as armadillos and feral chickens.

- **Culvert traps** are used to live-capture bears. Culvert traps are a type of large cylindrical trap with differing trigger systems and gravity doors. These are constructed of solid tubular metal (a culvert) and are on a wheeled platform or trailer for transport. The door to culvert traps is held open by a triggering mechanism that is located at the opposite end of the trap from the door. Attractants are often used with culvert traps to entice bears into the enclosure (bears do not mind investigating enclosed areas for food whereas other animals typically would not). Baits similar to those attracting nuisance bears may be used. The attractant is normally placed on or beyond the triggering mechanism so the target animal has to step on or trip the mechanism to reach the attractant. Upon contact the door closes and the animal is trapped inside the enclosure. Due to the size and weight of most culvert traps, they are primarily restricted for use near roadways, although models exist that may be disassembled and reconstructed in remote areas. Culvert traps are checked daily to address any bears live-captured.

- **Clover traps** are the most common cage trap for deer (Clover 1954). The Clover trap, named for the originator and not the shape, has been modified since the original design was developed, but has the appearance of a large box trap. They restrain deer once captured. The trap is portable with sides that collapse and fold together for easy transport (Sparrowe and Springer 1970, Roper et al. 1971, McCullough 1975). Traps are placed in areas where activity by the target species is high and are baited with an attractant. When the target animal enters the cage trap to investigate the attractant, a pan or wire is triggered releasing the door and enclosing the animal inside the Clover trap. Clover traps are typically checked daily if not more often.

- **Corral traps** are generally used by WS to live-capture feral swine, and potentially other hoofed animals. As the name implies, these look like corrals when constructed because they have open tops, which allows birds and other nontargets to come and go. Corral traps for feral swine are generally large circular traps consisting of panels anchored to the ground using steel posts with a door allowing entrance. Side panels are typically woven metal fencing, referred to as hog panels or cow panels. The entrances into the traps generally consist of a door that allows entry into the trap but prevents exit, or a guillotine-type door that are triggered usually from remote access (camera monitor and some type of remote switch to close the doors). The doors are often designed to allow swine to enter the trap continually allowing for the possibility of capturing multiple swine. The top of traps is often open, which allows most nontarget species to escape, such as white-tailed deer. Some variation in design is expected based on the soil type, brush, and the number of swine expected to be captured. Corral traps are typically baited with food sources that are attractive to feral swine, such as corn. Corral traps for swine are semi-permanent traps that can be disassembled but are generally constructed and left in areas for extended periods. Doors, side panels, and steel posts are often heavy and bulky and may have to be carried long distances to areas where feral swine are active. If a remote control is used, swine can come and go as they please until the operator decides to close the doors when the desired number of animals are inside the trap.

➤ **Walk-in and swim-in traps** are similar to box traps with doors designed so that target animals can either push open the door to enter the trap, which promptly closes behind the animal or are made of funnels with open entrances that go into the trap which allow the target animal to enter, but once inside they go to the sides of the cage trap away from the funnel to try to get back out (Figure 3 and 4). Entrances are fitted with repeating or *revolving* doors made of wire bobs that hang down (tied together as a wire panel or free hanging) or solid panels such as glass or wire mesh. The doors open inward but return to the closed position after the target animal enters the trap. Funnels are also placed on the outside parallel to the walls and taper inward so that the entrance into the trap is smaller than the entrance parallel to the outside wall. Walk-in traps are typically baited with a food attractant inside the trap with some sprinkled outside, particularly at the doorway entrances. As animals consume the limited amount of food attractant around the doors or entryways, they are drawn into the trap by the presence of larger amounts of food inside the trap. Animals are unable to push open the door once inside the trap. The design of the door allows multiple target animals to enter the trap. WS generally uses walk-in traps for bird species, such as pigeons and chickens.

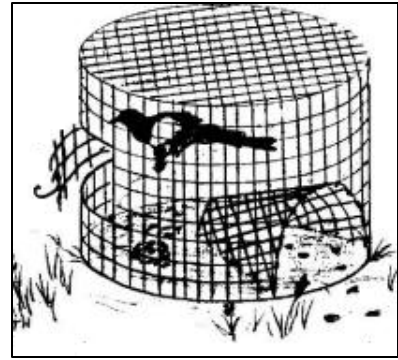


Figure 3. Walk-in trap with a funnel entrance.



Figure 4. A swim-in trap with 3 mallards and a northern pintail.

➤ **Decoy traps and bait station traps** are (Figure 5) mostly similar in size to walk-in traps, depending on the size of the target species. In both types of traps, live animals are maintained. Decoy traps are similar in design to the Australian Crow Trap as reported by McCracken (1972) and Johnson and Glahn (1994). Decoy traps are commonly rectangular and they are generally constructed of a wooden or metal frame and wire mesh or netting to form an enclosure, which can be constructed in a variety of sizes, depending on the target species and the number of birds likely to be captured. Sides go up above the middle panel with the funnels and have perches to encourage birds to stay above the funnels so they do not try to escape. Decoy traps are commonly used by WS to target social flocking bird species such as crows, starlings, house sparrows and blackbirds. Live decoy birds of the same species being targeted are usually placed in the trap with sufficient food and



Figure 5. A brown tree snake cage trap made from a modified minnow trap. A live mouse is in an inner compartment that attracts the snake. These are multiple catch traps and can catch up to 15 or 20 snakes.

water to assure their survival. Perches are configured in the trap to allow birds to roost above the ground and in a more natural position. The feeding behavior and calls of the decoy birds attract other target birds to the trap. In addition, the traps are often baited with food attractants. Openings in the enclosure allow target birds to enter the enclosure to feed on the bait. Openings are generally placed at the top of the enclosure and are generally about the length and width of target bird species with their wings folded so birds can enter but are unable to exit with their wings extended as they are flying upwards toward the openings. Active decoy traps are monitored daily, every other day, or as appropriate, to address captured birds and to replenish bait and water. Depending on design, decoy traps can be portable or permanent. Portable decoy traps generally consist of several parts and panels that require assembly once transported to a location where target animals are active.

Bait station traps are similar to decoy traps except that they have live bait rather than decoys and usually have funnels in the sides. Inside, live mice or chickens are kept in an inner cage which has an access door to feed and water them. The snakes, or other target animals, are attracted to the lure and scent, and enter, but are not able to get out because they typically go to the sides (Figure 5) and the entrance to the funnel is in the center of the trap. However, if a snake enters a trap with its tail still outside the trap, it will follow its tail back out (usually the cage that holds the prey is small enough to allow the snake to coil around it, thus pulling its tail inside).

- **Swedish goshawk traps** are used to live-capture hawks and owls. These traps can be portable or permanent and are baited similarly to a box trap that contains a live attractant, such as a pigeon or mouse. The trapping mechanism consists of an “A” frame made of wood or metal along with a trigger that is mounted atop the bait cage. The frame is generally made of mesh wire or netting. The sides of the “A” are hinged so that the sides are held open in a “H” shape by a trigger that stretches the length of the trap. The trigger mechanism is hinged in the middle. As a raptor enters into the trapping mechanism to investigate the lure in the bait trap, it lands on or brushes against the trigger, which collapses and allows the sides to close back into an “A” shape trapping the raptor inside (Meng 1971, Kenward and Marcstrom 1983). Traps are monitored by personnel to quickly respond to live-captured raptors. The pigeons are in a separate compartment below the raptor and generally do get predated.

- **Purse traps**, suitcase traps or basket-type cage traps are designed to live-capture animals, primarily birds and mammals and have the appearance of a purse or suitcase when closed. These types of traps are typically constructed of a metal frame covered in netting to heavy-gauged wire that is hinged with springs. When set, the trap is opened to allow an animal to enter and the pan that triggers the trap to close is in the center of the trap. The trap is baited with an attractant, or live animal, so when the animal investigates the attractant or preys on the animal, the pan is triggered and the sides snap closed around them. Popular traps used to catch beaver include the Bailey and Hancock beaver traps. These traps generally set in shallow water, are some of the largest traps, and weigh about 25 pounds. They are relatively bulky to carry and maneuver. Of all cage traps, the Bailey (Figure 6) and Hancock traps for beaver and otter are fairly bulky and have the most potential for causing injury to those setting them. A



Figure 6. Bailey trap, a purse trap, used primarily for trapping beaver. This purse trap has a size of 39" x 21" x ~12" and weighs about 30 pounds.

popular trap to capture birds, especially raptors, is the bow-net trap. Bow nets consist of two semi-circular bows as a frame with loose netting strung between the bows that are placed on the ground. Hinges and springs connect the two semi-circular bows at their bases with one bow fixed to the ground. The other semi-circular frame is folded and held together with the stake portion with a trigger or release mechanism (Bloom 1987, Hull and Bloom 2001).

- **Nest box traps** are used to capture breeding and post breeding European Starlings and other targeted secondary cavity-nesting⁶ birds (DeHaven and Guarino 1969, Knittle and Guarino 1976). With this trap, the door closes when the bird enters into the cavity. The cavity boxes are usually hung on the side of a building or on a tree, depending where the target species is located. WS has used these to capture Northern Flickers, European Starlings, House Sparrows, House Finches, Tree Swallows, and bluebirds. The birds are alive when captured⁷. Other nest box traps come in different designs. Some are open and placed directly on a nest with eggs to capture the adult (similar to a Swedish goshawk trap) and have been used by WS to capture gulls and blackbirds.
- **Colony traps** are multi-catch traps used to live-capture muskrats. There are various types of colony traps. One common type of colony trap consists of a cylindrical tube of wire mesh with a one-way door on each end (Novak 1987). Colony traps are set at entrances to muskrat burrows or placed in muskrat travel lanes. Colony traps are effective, relatively inexpensive, and easy to construct (Miller 1994). The stovepipe trap, a common type of colony trap, is usually made with sheet metal and may capture two to four muskrats on the first night (Miller 1994).

1.2 Drive/Herd Traps

Drive or herd traps are different from regular cage traps because animals have to actively be herded or driven to the pen or corral trap by people. People on foot and in boats, aircraft or other vehicles “drive” animals into an area that narrows down naturally or artificially (fencing guides or wings of an appropriate size) until they are directed into a small confined area, a corral, usually made of some type of panels or heavy-gauged wire fencing where a door can be closed to keep them in the pen or corral. These are normally used for geese when they are flightless during their primary molt. Other species that can be trapped in drive traps include hooved mammals, feral waterfowl because they typically cannot fly or fly well, and jackrabbits, small rodents, and snakes. Typically, people surround the animals opposite the pen and may use cage panels, ropes, or chains between them to keep animals headed in the direction of the enclosure (Figure 7). People normally walk slowly to allow time for animals to keep moving in front of them. Once to the pen or corral, it is closed and the animals are then processed.

1.3 Use Pattern

From FY11⁸ to FY15, WS used cage traps to capture 226,264 target animals of 45 species (Tables 1a, 1b, and 1c). WS caught target animals in decoy traps (64% of capture), a variety of box traps (29%), snake traps (4%), feral swine corral traps (1%), goshawk traps (1%), purse or suitcase traps (0.6%), and culvert traps

⁶ Secondary cavity-nesters do not excavate the cavity themselves, but use those created by another animal (e.g. woodpecker).

⁷ Another type of nest box trap uses a snap trap inside which kills the target bird, but will be discussed under quick kill traps.

⁸ FY11 equals the federal Fiscal Year 2011 which is October 1, 2010-September 30, 2011 (the year is denoted by FY11, FY12, and so on and is the federal Fiscal Year for 2011, 2012, and so on).

(0.3%). WS captured 2,939 nontarget species of 161 species, which was 1.3% of the total take of all animals in cage traps; nontarget species were taken in box traps (84% of nontarget captures), decoy traps (12%), culvert traps (2%), snake traps (1%), suitcase traps (0.4%), goshawk traps (0.3%), and feral swine corral traps (0.1%). Mammals accounted for 20% of the target take in cage traps (Table 1), birds 78% (Tables 2a and 2b), and reptiles, amphibians and fish (2%) (Table 3).

WS targets several mammalian species with cage traps, including federally listed threatened and endangered (T&E) species (Table 1). Mammals are captured in cage traps to protect a variety of resources including livestock, livestock health, feed, crops, property, natural resources, and human health and safety from wildlife strikes at airports and reducing potential for disease such as rabies. In fact, over 50% of the cage trap captures are for rabies surveillance following the distribution of oral rabies vaccine baits targeting mostly raccoons, skunks, other predators, and rabbits. The Virginia opossum is generally considered a nontarget in the oral rabies vaccination program because it is a mammal that rarely contracts the disease. Thus, opossums have a high nontarget capture rate. Opossums did account for the highest number of all vertebrates captured in cage traps or 51% of all nontarget vertebrates captured by WS between FY11 and FY15. Depending on the species, its abundance, whether it is invasive or not, and the damage situation, target mammals may be euthanized, relocated, or released after disease sampling/banding. However, most target species are euthanized. Of the mammals euthanized, 40% were invasive species (Table 1).

More birds are captured by WS with cage traps than the other vertebrates at 78% of all target species captured with cage traps (Tables 2a and b). Birds are captured in cage traps to protect a variety of resources including livestock, feed, crops, property including aircraft, natural resources including the federally endangered Kirtland's warbler (*Setophaga ruticilla*) from brown-headed cowbirds, human health and safety from wildlife strikes at airports, and reducing potential for disease. Depending on the species, its abundance, whether it is invasive or not, and the damage situation, target birds may be euthanized, relocated, or released after disease sampling/banding.

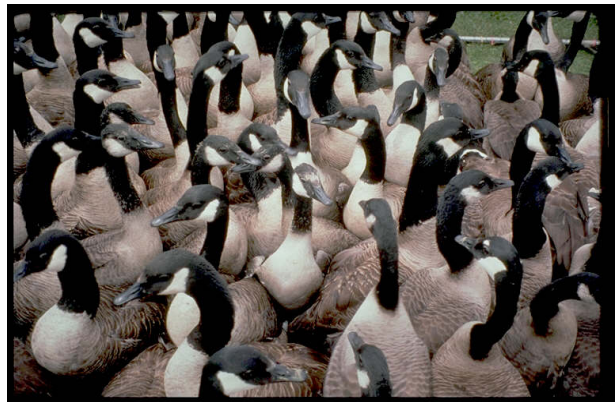


Figure 7. Standard goose drive where geese are herded with boats from water and people walking on land. Slowly the geese are herded to a pen which has wings coming away from it in a "V." The geese are enclosed in a pen and handled for their predetermined disposition (relocated, freed, or euthanized).

Table 1. The annual average number target and nontarget mammals captured by WS with cage traps in WDM from FY11 to FY15 throughout the United States (USA).

MAMMAL SPECIES CAPTURED WITH CAGE TRAPS				
SPECIES	TARGET		NONTARGET	
	Killed	Released	Killed	Released
Virginia Opossum [^]	1,761	336	9	1,501
Feral/Free-roaming Cat*	630	505	2	209
Bobcat	43	1	0.2	0.6
Mountain Lion	31	0	0	0.4
Small Asian Mongoose*	2,003	1	0	0
Coyote [^]	20	2	0	0.2
Feral/Free-Roaming Dog*	4	23	0.2	8
Red Fox [^]	42	11	0.2	3
Common Gray Fox	166	21	0.4	78
Black Bear	148	539	0.2	3
- Louisiana Black Bear ^{T&E}	0	4	0	0
Grizzly Bear ^{T&E}	0	2	0	0
River Otter	15	2	0	4
Fisher	0.4	10	0	5
Raccoon	7,482	8,144	9	101
Striped Skunk	4,460	291	5	11
Other Predator (11T, 9NT – 13 sp.) ¹	27	4	1	9
Feral Swine*	9,057	40	0.2	0.4
Collared Peccary	0	7	0.8	11
Mule Deer (incl. Black-tailed Deer)	0	10	0	0.4
White-tailed Deer (captive* and wild)	0.4	0	2	8
Feral Goat*	0	10	0	0
Other Hoofed Mammal (1T, 2NT – 3 sp.) ^{** 1}	0.4	0	0	2
Beaver [^]	759	121	0	1
Nutria*	156	3	0	0
Muskrat	107	0.2	0.6	32
Woodchuck	129	11	0	83
Yellow-bellied Marmot	5	6	0	0
California Ground Squirrel	1,632	1	0.4	20
Rock Squirrel	252	3	0	5
Meadow Vole	27	0.8	0	0
Prairie Vole	1	32	0	0
Western Gray Squirrel	4	5	0	2
Eastern Gray Squirrel [^]	34	10	2	44
Eastern Fox Squirrel [^]	24	17	0	19
Red Squirrel	0.6	2	0.2	11
Douglas' Squirrel	0.2	10	0	0
North American Deermouse	113	0.8	0	0
White-footed Deermouse	14	160	0	0
House Mouse*	231	21	0	0
Brown (Norway) Rat*	52	1	1	3
Black Rat*	1,189	4	0	0.2
North American Porcupine	10	1	0.8	14
Desert Cottontail	310	12	0.2	33
Eastern Cottontail [^]	83	10	0.8	69
Other Rodent & Rabbit (29T#, 15NT -33 sp.) ¹	44	6	0.6	20
Nine-banded Armadillo	68	2	1	5
Vagrant Shrew	14	0	0	0
Other Shrew/Bat (4T - 4 sp.) ¹	0.8	0	0	0
AVE. ANNUAL MAMMALS TAKEN (87T, 56NT – 97 sp.)	31,150	10,403	38	2,316
% TARGET AND NONTARGET MAMMALS TAKEN	70.9%	23.7%	0.1%	5.3%

* Invasive species ** Nontarget livestock [^]Invasive sp. in some areas – W USA # Three invasive sp. (9 killed)

¹Includes species with a total take, including Target (T) and Nontarget (NT) take, less than 10 for each species and not a T&E sp., or sensitive. Animals killed or released with an average annual take over a 5-year period less than 1 are given in decimals and those one or more rounded to whole numbers.

Most birds targeted with cage traps are euthanized. Of the euthanized target birds, 92% were invasive species (Table 2a and b). Comparatively, 5% of the nontarget birds were invasive species, but 24% of the nontarget birds killed were invasive. The birds captured in cage traps by WS are divided into Tables 2a (non-passerine birds) and 2b (passerine or songbirds).

Table 2a. The annual average number target and nontarget non-passerine (not songbirds) birds controlled by WS with cage traps in WDM from FY11 to FY15 throughout the USA.

NON-PASSERINE BIRD SPECIES CAPTURED WITH CAGE TRAPS				
SPECIES	TARGET		NONTARGET	
	Killed	Released	Killed	Released
Rock Pigeon*	26,299	66	0.6	0.2
Island Collared-Dove*	153	14	0	0
Eurasian Collared-Dove*	584	0.6	0.2	12
Spotted Dove*	1,563	9	0	0
Zebra Dove (<i>Barred Ground-Dove</i>)*	1,326	2	0	0
Mourning Dove [^]	968	398	4	83
White-winged Dove	0.4	2	3	28
Other Doves (2NT - 2sp.) ¹	0	0	0	2
Great Black-backed Gull	24	0	0	0
Herring Gull	147	0	0	0.2
Other Larids (5T, 1NT - 5 sp.) ¹	6	0.8	0	0.2
Black-bellied Whistling-Duck	0	0.2	2	8
Canada Goose	4	29	0.2	0
Mallard (incl. 0.2 lethal take of feral domestic mallard*)	25	170	0.2	1
Green-winged Teal	0.8	10	0	0
Other Waterfowl (8T, 2NT - 8 sp.) ¹	1	28	0.2	1.8
Turkey Vulture	113	1	1	4
Black Vulture	2,739	2	0	0
Sharp-shinned Hawk	0.8	11	0	2
Cooper's Hawk	7	162	1	5
Northern Harrier	0.2	27	0	0.2
Bald Eagle	0	1	0	0.4
Red-shouldered Hawk	0.2	14	0	0
Red-tailed Hawk	87	770	0	0.4
Rough-legged Hawk	0	16	0	0
Golden Eagle	0	0.4	0	0
Barn Owl	2	152	0	0
Snowy Owl	0	75	0	0
Great Horned Owl	2	140	0	0.4
American Kestrel	28	320	0.8	6
Other Raptor (10T, 3NT - 11 sp.) ¹	1	40	0.2	2
Waterbird/Wading Bird/Shorebird (1T, 4NT - 5 sp.) ¹	0.2	0	0	1
Wild Turkey	55	17	0	5
Black Francolin*	153	0	0	0
Gray Francolin*	227	0	0	0
Erckel's Francolin*	89	0	0	0
Red Junglefowl*	174	0	0	0
- Feral Domestic Chicken*	858	6	0	0.6
Ring-necked Pheasant*	11	19	0.2	0
Other Gallinaceous Bird (1T*, 2NT - 3 sp.) ¹	0.2	0.2	0	3
Woodpeckers/Parakeets (6T, 3NT - 7sp.) ¹	9	0	0	0.6
Ave. Annual Non-Passerine Birds Taken (64T, 36 NT - 74 sp.)¹	35,658	2,503	14	167
% of total take of Non-Passerine Species	93.0%	6.5%	<0.1%	0.4%

* Invasive species

[^]Invasive species in some areas

¹Include species with all take less than 10 and not a threatened, endangered, sensitive or highly invasive species are summarized with the total number of species targeted (T), taken as nontargets (NT), and included in the row (# species). The "Risk Assessment Introduction" Chapter has all of the species taken listed and their scientific names. Animals killed or released with an average annual take over a 5-year period less than 1 are given in decimals and those one or more rounded to whole numbers.

Table 2b. The annual average number target and nontarget passerine (songbirds) birds controlled by WS with cage traps in WDM from FY11 to FY15 throughout the USA.

PASSERINE BIRD SPECIES CAPTURED WITH CAGE TRAPS				
SPECIES	TARGET		NONTARGET	
	Killed	Released	Killed	Released
European Starling*	116,275	272	6	1
Red-winged Blackbird	2,085	8	3	3
Yellow-headed Blackbird	35	17	0	2
Brewer's Blackbird	803	0.2	0	0
Common Grackle	100	0.2	1	10
Great-tailed Grackle	10	0	0.4	0
Boat-tailed Grackle	0.4	0	0	0
Brown-headed Cowbird	7,598	13	0	0.4
Blue Jay	0.2	0.4	0.4	26
American Crow	126	0.8	2	1
Other Corvids (4T, 3NT - 5 sp.) ¹	13	2	0.2	11
Tree Swallow	2	0	3	12
Other Aerialists (1T, 1NT - 2 sp.) ¹	0.6	0	0	1
Western Kingbird	13	21	0.2	21
California Towhee	16	7	0.4	0.4
Savannah Sparrow	0.8	41	0.4	41
Song Sparrow	0	6	0	9
White-crowned Sparrow	179	1	0	0.6
Dark-eyed Junco	0	1	0	91
Northern Mockingbird [^]	14	19	2	26
Eastern Bluebird	0	0	1	20
Northern Cardinal [^]	85	76	0.2	2
House Finch [^]	337	0	0	10
Other Passerine (10T, 26NT - 29 sp.) ¹	5	18	1	25
Unidentified Bird	0	0	0	0.8
Common Myna*	481	0	0	0
Java Sparrow*	5,990	0	0	0
Red-crested Cardinal*	1,191	0	0	0
House Sparrow*	2,305	6	2	0.8
Eurasian Tree Sparrow*	253	10	0	0
Other Invasive Passerines (4T - 4 sp.) ^{* 1}	7	0	0	0
Ave. Annual Passerine Birds Taken (44 T, 50 NT – 66 sp.)	137,925	520	23	315
% of total take of Passerine Species	99.4%	0.4%	<0.1%	0.2%
Ave. Annual All Birds Taken (108T, 86NT-140 sp.)	173,583	3,023	37	482
% TARGET AND NONTARGET BIRDS TAKEN	98.0%	1.7%	<0.1%	0.3%

* Invasive species

[^]Invasive species in some areas

¹Species with a total take less than 10 and not a threatened, endangered, or sensitive species are summarized with the total number of species targeted (T), taken as nontargets (NT), and included in the row (some are both targets and nontargets). The "Risk Assessment Introduction" Chapter has all of the species taken listed and their scientific names. Animals killed or released with an average annual take over a 5-year period less than 1 are given in decimals and those one or more rounded to whole numbers.

WS also targets several reptilian species and few amphibians and fish (only the common carp) with cage traps, and these accounted for 4% of the target take between FY11 and FY15 (Table 3). Reptiles are captured in cage traps to protect a variety of resources, but primarily property, natural resources, and human health and safety. Depending on the species, its abundance, whether it is invasive or not, and the damage situation, target reptiles may be euthanized, relocated, or released. However, most are euthanized. Of the euthanized reptiles, almost 100% were invasive species with 95% of the reptiles targeted being the brown tree snake (Table 3). The brown tree snake is an invasive species on Guam where it has eliminated all but two of the native forest bird species. Most brown tree snakes are captured in modified minnow traps that have funnels on both ends with doors added at the end of the funnel so that they cannot get back out because they easily escape without them (figure 2). A live house mouse is the attractant inside the cage, but it is in a compartment where it is fed regularly. The scent that the live mice produce helps attract the snakes. Since the mouse is not eaten, these become multi-catch traps and several snakes can be caught in one trap.

Table 3. The annual average number target and nontarget reptiles, amphibians, and fish captured by WS with cage traps in WDM from FY11 to FY15 throughout the USA.

REPTILES, AMPHIBIANS, AND FISH CAPTURED WITH CAGE TRAPS				
SPECIES	TARGET		NONTARGET	
	Killed	Released	Killed	Released
Common Snapping Turtle [^]	0.4	36	0	5
Eastern Box Turtle	0	0.4	0	21
Northern Painted Turtle	0	66	0	5
Pond Slider [^]	9	58	0	2
Black Spinytail Iguana [*]	171	0	0	0
Green Iguana [*]	12	0	0	0
Mangrove Monitor [*]	0	0	0	15
Brown Tree Snake [*]	7,570	144	0	0
Other Reptiles (11T, 8NT – 15 sp.) ¹	7	11	2	3
American Bullfrog [^]	0	0	0.2	0.2
Common Carp [*]	21	0	0.2	0
Channel Catfish [^]	0	0	0	11
Other Fish (3NT - 3 sp.) ¹	0	0	0	2
AVE. ANNUAL OTHER SPECIES TAKEN (20T, 19NT, 29 sp.)	7,790	315	2	64
% TARGET AND NONTARGET OTHER SPECIES TAKEN	95.3%	3.9%	<0.1%	0.8%

* Invasive species

** One invasive (0.2 killed)

[^]Invasive species in some areas – western USA

+ Two invasive (3 killed)

One invasive sp. (6 killed)

¹Species with a total take less than 10 and not a threatened, endangered, sensitive or highly invasive species are summarized with the total number of species targeted (T), taken as nontargets (NT), and included in the row (# species). The “Risk Assessment Introduction” Chapter has all of the species taken listed and their scientific names. Animals killed or released with an average annual take over a 5-year period less than 1 are given in decimals and those one or more rounded to whole numbers.

Animal capture trap night is a standard comparison measurement of effectiveness or selectivity for all types of mammal traps that remain in place for one or more nights. The standard is to compare the number of animals captured with 1000 trap nights. Cage traps were used between FY11 to FY15 for a total of 6,856,538 trap nights annually, or 6,857 1000 trap nights. An annual average of 229,203 target and non-target animals were captured in cage traps between FY11 and FY15 for a total of 33.4/1000 trap nights. Target capture was 33.0/1000 trap nights at 98.7% of all take which is a highly effective method with minimal numbers of nontarget species capture (0.4/1000 trap nights) at 1.3%. These figures represent a high effectiveness rating for target animal capture with a very low take of nontarget animals. However, with that said, it should be noted that many traps for birds can catch several to a hundred in a day, not making this a great comparison to other methods.

Drive or herd traps are another type of cage trap, but requires the presence of people to make them work. Between FY11 and FY15, WS used drive traps to capture 18,268 target animals representing 12 species (Table 4). Of the 18,267 target captures, 13% were relocated; some States relocate Canada geese to waterfowl management areas, but fewer of these are available every year. Three nontarget species, an average of 2 annually, were taken during the 5 years because most can be excluded when herding animals towards the pen. The nontarget captures were released at the capture location. About 99% of the target captures were “resident” Canada Geese, which are introduced nesters throughout much of the USA when they are captured. They can cause extensive damage at parks (figure 3). In fact, most all operations were conducted for Canada geese and other waterfowl were caught during Canada goose roundups.

Table 4. The annual average number target and nontarget animals captured by WS with drive/herd traps in WDM from FY11 to FY15 throughout the USA.

ANIMALS CAPTURED WITH DRIVE/HERD TRAPS FROM FY11 TO FY15				
SPECIES	TARGET		NONTARGET	
	Killed	Released	Killed	Released
Gray Francolin*	0.8	0	0	0
Feral Domestic Goose*	47	18	0	0
Canada Goose	15,846	2,214	0	0
Mallard	23	57	0	0
- Feral Domestic Mallard*	33	9	0	0
Feral Domestic Muscovy*	9	3	0	0
Other Waterfowl (7T, 3 NT, 10 sp.) ¹	0.2	8	0	2
ANNUAL AVE. TOTAL ANIMALS TAKEN (12T, 3NT - 15 sp.)	15,959	2,309	0	2
% OF ALL TARGET AND NONTARGET SPECIES TAKEN	87.4%	12.6%	0	0.01%

¹Species with a total take less than 10 and not a threatened, endangered, or sensitive species are summarized with the total number of species targeted (T), taken as nontargets (NT), and included in the row (some are both targets and nontargets). Animals killed or released with an average annual take over a 5-year period less than 1 are given in decimals and those one or more rounded to whole numbers. The "Risk Assessment Introduction" Chapter has all of the species taken listed and their scientific names.

* Invasive species.

2 HAZARDS

2.1 Human Health and Safety

Human health and safety hazards associated with cage traps include potential cuts or abrasions from loose wires or snags, sharp edges on the equipment, or strains from moving cage traps, especially those that are heavier such as the beaver Hancock and Bailey traps. It is possible with some designs that the hand could be pinched by the door. However, most injuries occur while transporting, setting, or maintaining cage traps. Muscle strains could also occur during the construction or placement of corral traps for feral swine, since the wire mesh panels, door, and steel posts are heavy and cumbersome to handle. Corral traps used to live-capture waterfowl can also be cumbersome due to their size but are generally constructed of netting and a lightweight frame to reduce weight. The removal of animals from cage traps may lead to bites or scratches.

Hancock traps and Bailey traps are heavy, bulky traps that are constructed of metal frames and metal wire, which could cause muscle strain during transport and while setting the trap. Hancock traps and Bailey traps can weigh up to 30 or more pounds. Hancock traps and Bailey traps could pose additional hazards as employees set the trap if the trap inadvertently snaps shut during the setting process. During research projects conducted by Muller-Schwarze and Hoggart (2005) targeting beavers, they reported that Hancock traps inadvertently closed many times injuring their technicians; they gave examples of injuries including the hand of an experienced technician being pinched between the edges of the two halves of the trap and another bruised the face of a novice technician. The safety mechanism for Hancock traps is located next to the trigger mechanism, which requires people to reach inside the set trap to release the safety mechanism and fully activate the trap. Muller-Schwarze and Hoggart (2005) recommended modifying the trigger mechanism and the safety mechanism of Hancock traps by moving the safety mechanism to the edges of the trap, which allows the trap to be activated without reaching inside the set trap to release the safety mechanism. After retrofitting their Hancock traps with new trigger mechanisms, Muller-Schwarze and Hoggart (2005) used the modified Hancock trap in the field for six years without any accidents.

Live-captured animals may also bite or scratch people as they tend to the trap or encounter the trap. Handling of wildlife from cage traps could also result in hazards associated with disease and parasite transmission

from wildlife (Animal Care Use Committee 1998). The same injury hazards extend to the public who encounter and tamper with traps placed by WS.

2.2 Environmental

Cage traps are mechanical methods that are employed to live-capture animals and are not methods that would contaminate water or result in the bioaccumulation of chemicals or other hazardous materials. Lures and food attractants are sometimes used to encourage target animals to enter inside traps; however, relatively small quantities are used and those items are not considered hazardous. Food attractants consist of food items that are preferred by target animals. For example, whole kernel corn could be used outside and inside a trap set to capture feral swine, deer, or pigeons. Whole eggs could be used inside a box trap to attract striped skunks or marshmallows could be used to encourage a raccoon to enter a trap. Food attractants could also consist of animals that are placed inside of cage traps alive to attract target animals. For example, pigeons or mice are often used as attractants for traps that target raptors, since mice and pigeons are prey items for raptors. Lures could include liquid attractants that mimic another target animal's presence. For example, beaver castor is derived from glands within a beaver and used to attract other beaver. Lures could also consist of individual animals of the target species and often works for species of birds that are social and feed together. Target animals that are placed inside a live-trap to attract other target animals are often referred to as "*decoys*." For example, a pigeon is often placed inside a walk-in trap designed to live-capture other pigeons. Other pigeons are attracted by the presence of the pigeon and food in the trap. Blackbirds are often used in decoy traps to attract target bird species to the traps. Therefore, lures and attractants used to attract other target animals would not be substances that would bioaccumulate in the environment and those attractants would not cause environmental harm.

Hazards to animals captured in cage traps include stress, injury, and death. Injuries can occur to the captured animals (Beringer et al. 1996, Haulton et al. 2001, Peterson et al. 2003) and rarely to the user. Most cage traps are checked daily which reduces the time for injuries to occur. White et al. (1991) demonstrated that red fox held in cage traps of a box-style had elevated levels of the stress hormones, adrenocorticotropin and cortisol, as well as other physiological impacts when compared to fox not held in cages. Some animals may struggle to escape and they may become injured or break teeth. Blundell et al. (1999) reported swelling and abrasions to appendages of river otter live-captured in Hancock traps and serious damage to teeth, presumably from otters chewing on the metal to escape. Powell and Proulx (2003) reported abrasions to the muzzles of animals live-captured in cage traps. Mowat et al. (1994) noted injuries to lynx that were live-captured in box traps that ranged from broken or split claws to superficial cuts on the nose, and rarely on the face. Mowat et al. (1994) considered those injuries to lynx that occurred from capture in box traps to be minor. Of the nontargets live-captured in box traps during a study conducted by Mowat et al. (1994), only one fox suffered injury from a cut on the foot, which was considered minor. Finally, the death of captured animals could occur because of environmental conditions, such as extreme temperatures or exposure to rain. Euthanasia of animals could be necessary when the animal is unlikely to survive due to a trap related injury. Target and nontarget species captured by WS are listed in Tables 1, 2, 3 and 4.

As a result of concerns regarding injuries and death of animals from foothold traps, snares, and other traps including cage traps, the Association of Fish and Wildlife Agencies (AFWA), along with federal and private partners working cooperatively, embarked on a goal to develop voluntary Best Management Practices (BMP) for trapping furbearers in the United States (Batcheller et al. 2000, AFWA 2017). Results of their research (AFWA 2017) were provided to state and federal wildlife agencies as well as trappers and the public in the form of a general overview on BMPs for traps and trapping. AFWA (2017) focused on private trappers and

realized that trapping to control depredation was different. However, WS has adopted these standards, where possible, for trapping in the USA and conducts research on different trapping systems. Cage traps were included in much of the research.

WS Policy (WS Directive 2.450, 09/24/2014) states that the use of the BMP trapping guidelines developed and promulgated by AFWA (2017) for private fur harvest and other trapping activities are valuable and should be followed as practical. WS utilizes the BMP guidelines as the basis for policy formulation, but recognizes that some devices used in wildlife damage management are not commercially available and that not all devices recommended in the BMP guidelines for general public use meet the more stringent performance requirements, particularly for efficiency and durability, for use in Federal wildlife management activities.

3 RISKS

WS Policy (WS Directive 2.450, 09/24/2014) states that the use of the BMP trapping guidelines developed and promulgated by AFWA (2017) for private fur harvest and other trapping activities are valuable and should be followed as practical. WS follows the BMPs for cage traps, which primarily discuss the size of the door opening, and cage material specifications for cage traps.

3.1 Human Health and Safety

WS employees are knowledgeable in the use of methods available for WDM, the wildlife species responsible for causing damage or threats, and WS directives. WS employees whose duties involve animal capture participate in a trapper education course (see WS Directive 2.450). That knowledge is incorporated into the decision-making process inherent with the WS' Decision Model that would be applied when addressing requests for assistance (see WS Directive 2.201). When employing traps in WDM, WS employees consider risks to public safety based on location and method, especially those that could be hazardous to the public. For example, risks to human safety from the use of cage trap methods would likely be lower in rural areas that were less densely populated or on private property where the public has limited access. Consideration is also given to the location where WDM activities are conducted based on property ownership. If locations where methods are used is on private property in rural areas where access to the property could be controlled and monitored, the risks to human safety from the use of cage traps would likely be less. If damage management activities occurred at public parks or near other public use areas, then risks of the public encountering and subsequently tampering with cage traps and the corresponding risk to human safety would increase. Activities would generally be conducted early mornings or night when human activity was minimal or in areas closed to the public where human activities was minimal. (*e.g.*, in areas closed to the public).

Use and placement of cage traps by WS would comply with applicable laws, regulations, and authorizing permits (see WS Directive 2.210, WS Directive 2.450). Traps would not be used unless appropriate authorization was granted by the landowner (see WS Directive 2.450). Cage traps used by WS are labeled with an attached WS – U.S. Govt. tag or stamped directly on the trap.

Cage traps are mechanical methods that are activated by an animal entering into the trap; therefore, if left undisturbed by the public, cage traps would not pose a human safety concern. However, risks could occur if the public tampers with traps placed by WS. If the public tampers with traps, the risks and hazards of injury would be similar to those risks and hazards from the use of those methods by WS employees. Risks of injuries associated with cage traps and box traps could occur incidentally from transporting, placing, and checking traps.

WS field and office employees filed an annual average of 79 Office of Workmen's Compensation (OWCP) claims for strained backs, lacerations, animal bites, burns, and other injuries that occurred on the job from FY13 to FY15. Of these, an annual average of 2.0 (0.7 lacerations, 0.3 illness, and 0.3 sprain) were related to cage traps and 0.3 (0.3 compression/contusion to elbow from slip-fall) for herd traps. Additionally, WS employees had an average of 19 injuries from falls, slips, twists, and repetitive activities that resulted in lacerations, sprains, contusions, strains, compression bruises, and fractures that were associated with field activities, but the injury was not readily associated with any specific activity such as setting cage traps. Considering the number of employees (~1,900), these claims are relatively few for the number of hours spent afield (the OWCP claims from FY13 to FY15 also includes office employees and injuries such as carpal tunnel syndrome). Thus, risks of setting cage traps are relatively minor to employees.

The risk of injury from captured animals is also minimal. Typically, employees dispatch target animals captured in cage traps with a gunshot to the brain⁹. The highest risk is typically from animals that are trapped in cage or drive traps that are not staked, but are attached to drags; employees may accidentally come across a hidden animal that is trapped when approaching the location of the set. Few employees over many years have been injured by such captured animals. A more obvious risk is associated with the release of captured animals. WS employees usually carry a catch-pole (a pole with a cable loop that can hold an animal prior to release). Catch-poles are very effective in handling wildlife, but an animal's behavior following release, though mostly predictable, is a primary concern. If an animal is too large, is in an area where the use of firearms would cause a safety concern, or is being trapped for a research project, an animal may be immobilized or euthanized with drugs; though usually not a problem, drugged animals can also be a risk¹⁰ which will be discussed separately under the Immobilization and Euthanasia Risk Assessment.

From FY13 to FY15, WS operational field personnel averaged 3 bites or injuries annually from animals and some of these were from trapped animals. One, a feral cat, was captured in a cage trap and bit the WS employee while transferring custody to a local animal shelter. Another black bear in a culvert trap bit a WS employee on the hand before being released after relocation. Additionally, a coyote captured in a foothold trap bit an employee before it was euthanized. Another bite was from a feral cat that had been caught and released from a foothold trap; the cat bit the WS employee while it was in the process of being transferred to a local animal shelter. Two WS employees were bit by feral or free-roaming dogs being hand gathered, but one escaped capture. Finally, a bat that was caught by a person from another agency bit a WS employee while the bat was being sampled for a variety of diseases (primarily rabies).

To analyze the risk of animal bites, context is needed. WS operations annually killed 43,576 and released 11,432 predators with methods conducive to being bitten from FY13 to FY15. Thus, an average of 2.3 bite incidents were related to capturing them alive while hand gathering (0.7), transferring custody to another agency after capture (0.7), relocating an animal (0.3), in the process of euthanizing a live-captured animal (0.3), and while handling an animal for disease sampling (0.3). For bite incidents that occurred from released animals (2.0), WS had a ratio of one bite per 5,700 releases. For animals to be euthanized, the ratio was much less at 1 bite for 145,000 animals killed. Overall, the bite ratio was 1 bite for every 18,000 animals captured with live-capture methods. This is a low risk.

⁹ WS personnel are trained and certified to use firearms which results rapid euthanasia and this is discussed in the Firearms Risk Assessment.

¹⁰ WS personnel are trained and certified to use immobilization and euthanasia drugs and risks associated with their use are discussed in the Immobilization and Euthanasia Drug Risk Assessment.

Two other bites (0.7/year) occurred from dogs at private residences while WS personnel were making contact with people requesting WS assistance. It should be noted that 2 bites in three years occurred as dog attacks; this again is a minimal number as the Centers for Disease Control (2015) estimates 4.5 million dog bites alone occur annually throughout the USA. Thus again, we believe these risks are low and well within the norms.

In addition to field personnel, from FY13 to FY15, NWRC personnel received an annual average of 1.0 animal bites or injuries from research animals with bites from a skunk (0.3) and a rat (0.3), and a bone fracture from feral swine (0.3). Lab animal bites typically come from caged animals during routine maintenance or research. It is not known whether these particular animals were from trapped animals from research that was being carried out in the field.

WS personnel could be exposed to animals carrying diseases such as rabies. All recorded bites from FY13 to FY15 and an annual average of two lacerations/splashes were from potentially diseased animals (e.g., rabies). Only two bites in three years (0.7) were from animals in known cage traps. These bites had the potential for transmitting the rabies virus. None of the animals involved in the incidents was identified as subsequently rabid with the exception of fluids from tissue from a known rabid skunk that splashed into the eye of a researcher. Thus, a potential for 5 animals per year caused concern potentially for exposure to rabies from FY13 to FY15. Personnel that have the potential for exposure to rabid animals, have the option of obtaining the rabies prophylactic series with follow up boosters to reduce the potential for contracting the disease if exposed through a bite, laceration, or contact with animal fluids. General exposure to animals is common for many WS employees, but considering the number of animals captured or handled, the risk of contracting a wildlife-borne disease is minimal. As discussed, WS attempts to place cage traps in areas where exposure to the public is minimal.

Thus, considering the number of employees and the types of injuries, it is believed that the risk of injury to WS personnel is minimal. WS employees engaged in trapping receive trapper education training to reduce risk of injury. WS personnel use gloves¹¹ and job aids including stake pullers and trap setter devices to minimize injury risk. However, setting traps sometimes requires free hands and gloves may not be used.

3.2 Environmental

Both target and nontarget animals could be captured when using cage traps. Environmental risks are limited to the capture of nontarget animals. However, trap design, trap size, attractants, and trap placement can minimize the risk of non-target capture. Cage traps generally allow the safe release of nontarget species and result in a lower potential for stress and injury compared to other trapping methods such as foothold traps (Mowat et al. 1994, Powell and Proulx 2003, Kolbe et al. 2003, Schutz et al. 2006, Iossa et al. 2007, Munoz-Igualada et al. 2008). The total nontarget take from cage traps was 1.2%, a minimal number, with 97% of these being released. Of the 2,939 nontarget species captured and freed or killed (Tables 2, 3a, 3b, and 4), the most common nontarget species were opossums (51%), feral house cats (7%), raccoons (4%), dark-eyed juncos (3%), mourning doves (3%), woodchucks (3%), common gray foxes (3%), and eastern cottontails (2%). These were the only species with nontarget captures above 50 throughout the USA; all of these species are abundant within their range – most are found throughout the eastern USA and much of the West, if not all. Thus, this is a very low risk to nontarget species.

¹¹ Setting traps may sometimes require free hands and gloves may not be worn at all times.

Data from other studies have demonstrated similar rates of nontarget captures from cage traps while other studies have reported higher nontarget capture rates. However, mortality rates are low and population level nontarget impacts were not anticipated from cage trapping efforts (Gosling et al 1988, Baker et al. 2001, Way et al 2002, Short et al. 2002, Shivik et al., 2005, Iossa et al. 2007). Variability in non-target capture and mortality rates will be dependent on the target animal and ability to implement cage trapping measures that are species-specific that reduce nontarget captures. The risk to nontarget animals is minimized by WS implementing measures that increase selectivity and reduce capture time. For example, the adoption and advancement of electronic signaling devices have been shown to reduce the holding time for trapped animals reducing the potential for stress and other impacts to nontarget animals (Larkin et al. 2003, Benevides et al. 2008, Darrow and Shivik 2008, Will et al. 2010). Signals sent from traps to remote devices such as cell phones not only serve to reduce the holding time for captured animals but also allow personnel to collect more accurate data regarding trapping, ensure compliance with regulations regarding trap monitoring and address animal welfare concerns. The use of the appropriate cage trap size and design; trap placement; and the selection of bait or lure applicable to the target animal reduce the risk of the capture of non-target species (Baker and Clarke 1988, Andrzejewski and Owadowska 1994, Jojola et al. 2009, Phillips and Winchell 2011). Proper trap maintenance and minimizing trap check intervals allow for the safe release of non-target species. WS recognizes the Best Management Practices (BMP's) for trapping as developed by the Association of Fish and Wildlife Agencies that emphasizes animal welfare, efficiency, selectivity, practicality, and safety and as practical will utilize these guidelines when conducting trapping programs (AFWA 2017). WS also continues to support research and methods that are humane and selective towards the target animal by developing baits, lures and attractants specific to the target animal while also improving on trap design and facilitating the development of more efficient trap monitoring methods (Huot and Bergman 2007, Fagerstone and Keirn 2012).

The risk of capturing nontarget animals exists even with these mitigating factors in place, but the risk is reduced and will continue to be reduced as further regulatory and scientific information becomes available on trap selectivity. From FY11 to FY15, WS took an average annual total of 244,534 target animals (98.8%) with cage and drive/herd traps and 2,941 nontarget animals (1.2%). An average of 77 nontarget animals, taken in cage traps, was euthanized (0.03%) between FY11 and FY15. Finally, WS did not take any nontarget threatened and endangered species in cage traps, but did 2 bald eagles accidentally between FY11 and FY15 that were released. WS did target an average of 0.4 grizzly bears and 0.6 Louisiana black bears, 1 bald eagle, 0.4 golden eagles annually from FY11 to FY15; all of these were targeted and taken with the appropriate permit (all were released unharmed). Thus, the risk to nontarget species and in particular T&E species is negligible using cage traps.

Of concern is the potential for animals to succumb to environmental conditions, such as heat and cold, while held in cage traps. WS personnel consider placement (e.g., cage traps are placed in shaded areas where possible during warmer months to avoid heat exposure), the necessary food and water for decoy animals in decoy traps, and time between trap checks. A new development that will make cage traps more efficient, while minimizing the time an animal is in a cage trap, is a remote cage trap monitor that alerts the user that an animal is captured or the trap is closed. Few animals trapped in cage traps die of exposure.

4 UNCERTAINTIES AND CUMULATIVE IMPACTS

Uncertainty in this risk assessment is negligible as WS has over 100 years using cage traps for WDM activities and understands potential risks of using the variety of cage traps available. The knowledge gained from this experience has helped reduce uncertainties.

Cumulative impacts could occur to target and nontarget animals. However, cumulative impacts are addressed in National Environmental Policy Act documents (USDA 2017) such as WS (2017) and found not to be significant to any native species population. Additionally, the “Introduction to Risk Assessments for Methods Used in Wildlife Damage Management” looks at all take from all WDM activities by WS and none shows a significant level of take for any native species. From a human health perspective, the use of cage traps in WDM will not have any known cumulative impacts.

5 SUMMARY

WS uses cage traps as a component of an integrated approach to managing wildlife issues for several vertebrate pest species. APHIS WS works cooperatively with other natural resource agencies at the state, national and international level to develop effective and humane trapping measures while minimizing exposure to human health and nontarget animals. Cage traps offer a comparatively low risk to human health and the environment compared to other trapping methods, but their use is specific to those animals where aversion to entering a trap can be minimized. Advancements in the design of cage traps and the response time to handling caged animals have resulted in more effective and humane trapping of target animals while dramatically reducing the potential for nontarget captures. WS will continue to support and conduct research that supports more humane and effective trapping methods, and implement these measures in their programs, where appropriate, to further reduce risk to nontarget animals.

Overall, the evaluation of risks to human health and safety and the environment from the use of cage traps are very minimal. WS personnel are professional with their use of cage traps and work to minimize the identified potential risks.

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7 PREPARERS

7.1 APHIS WS Methods Risk Assessment Committee

Writers for “Use of Cage Traps in Wildlife Damage Management Risk Assessment”:

Writer: Thomas C. Hall

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Reviewer: Michael Green

Position: USDA-APHIS-Wildlife Services (WS), Environmental Coordinator, Fredrick, MD

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Data Contributor: Joey Millison

Position: USDA-APHIS-WS Information and Technology (IT), Junior Applications Developer

Education: Information and Technology coursework from various sources

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7.2 Internal Reviewers

USDA APHIS Wildlife Services

Reviewer: Gary Littauer

Position: USDA-APHIS-WS, Assistant Regional Director/Supervisory Wildlife Biologist, Fort Collins, CO

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7.3 Peer Review

The Office of Management and Budget requires agencies to have peer review guidelines for scientific documents. The APHIS guidelines were followed to have “The Use of Cage Traps in Wildlife Damage Management Risk Assessment” peer reviewed. WS worked with the Association of Fish and Wildlife Agencies to have experts review the documents.

7.3.1 Peer Review Agencies Selected by the Association of Fish and Wildlife Agencies

Reviewer: Association of Fish and Wildlife Agencies

Reviewer: California Department of Fish and Wildlife

Reviewer: Michigan Department of Natural Resources

7.3.2 Comments

Comments regarding concerns with the risk assessment and a response:

1. **Comment:** Why are some animals in fractions in the tables?

Response: Clarification was added below each table that “Animals killed or released with an average annual take over a 5-year period less than 1 are given in decimals and those one or more rounded to whole numbers.”.

Comments received not requiring a response.

1. **Comment:** Commenters provided general overall support for the contents of this Risk Assessment.
2. **Comment:** The document adequately outlines potential consequences of the use of cage traps, description of operating procedures and mitigations to negative consequences is sufficient to allow WS decision makers the

ability to make informed decisions about the continued use of cage traps, Assumptions and uncertainties are clearly stated, references selected are appropriate.

3. **Comment:** Commenter stated that “I liked seeing all the numbers documenting target vs non-target captures as well as success per trap nights and such. I don’t have anything more to add.”

Appendix 1. “Other Species” Included in Tables.

Table 1

Other predator = swift fox, kit fox, American marten, least weasel, long-tailed weasel, short-tailed weasel, mink, badger, ringtail, hog-nosed skunk, hooded skunk, eastern spotted skunk, and western spotted skunks.

Other hoofed mammal = American elk, Philippine deer* and feral cattle*

Other rodent and rabbit = mountain beaver, black-tailed prairie dog, white-tailed prairie dog, Richardson’s ground squirrel, Belding’s ground squirrel, Columbia ground squirrel, thirteen-lined ground squirrel, Mexican ground squirrel, round-tailed ground squirrel, golden-mantled ground squirrel, eastern chipmunk, least chipmunk, Botta’s pocket gopher, woodland vole, southern red-backed vole, Ord’s kangaroo rat, Abert’s squirrel, southern flying squirrel, Gambian rat*, desert woodrat, dusky-footed woodrat, eastern woodrat, Mexican woodrat, bushy-tailed woodrat, Mexican woodrat, Pacific rat*, Desmarest’s Hutia, mountain cottontail, New England cottontail, Appalachian cottontail, European rabbit*, snowshoe hare, European hare* and black-tailed jackrabbit

Other mammal = Asian house shrew*, northern short-tailed shrew, eastern mole and 1 sp. Unidentified bat (from 13 different species NM – 0.2 lethal take).

Table 2a

Other dove = Inca dove and common ground-dove

Other larid = laughing gull, ring-billed gull, California gull, glaucous-winged gull and western gull

Other waterfowl = wood duck, gadwall, American wigeon, American black duck, blue-winged teal, cinnamon teal, northern shoveler and northern pintail

Other raptor = broad-winged hawk, Swainson’s hawk, ferruginous hawk, eastern screech-owl, barred owl, burrowing owl, long-eared owl, short-eared owl, caracara, merlin, prairie falcon and peregrine falcon

Other wading bird/shorebird = American bittern, black-crowned night-heron, cattle egret*, great blue heron and Pacific golden-plover

Other gallinaceous bird = northern bobwhite, ruffed grouse and common peafowl*

Other forest bird = red-headed woodpecker, Gila woodpecker, red-bellied woodpecker, downy woodpecker, hairy woodpecker, northern flicker and monk parakeet

Table 2b

Other corvid = Steller’s jay, California scrub-jay, black-billed magpie, fish crow and common raven

Other aerialist = purple martin and barn swallow

Other passerine = Say’s phoebe, great crested flycatcher, loggerhead shrike, eastern towhee, chipping sparrow, field sparrow, grasshopper sparrow, white-throated sparrow, golden-crowned sparrow, eastern meadowlark, western meadowlark, Baltimore oriole, hooded oriole, Carolina chickadee, tufted titmouse, cactus wren, house wren, white-breasted nuthatch, gray catbird, brown thrasher, curve-billed thrasher, wood thrush, American robin, purple finch, American goldfinch, ovenbird, palm warbler, black-headed grosbeak and rose-breasted grosbeak

Other invasive passerine = red-vented bulbul*, red avadavat, nutmeg mannikin and saffron finch*

Table 3

Other reptiles = American alligator, gopher tortoise, Blanding’s turtle, Florida box turtle, northern map turtle, eastern mud turtle, common musk turtle, spiny softshell, common five-lined skink, Argentine black and white tegu*, eastern kingsnake, gophersnake, southern watersnake, cottonmouth and western diamond-backed rattlesnake

Other fish = northern pikeminnow, largemouth bass and bluegill

Table 4

Other waterfowl = snow goose, Ross’s goose, wood duck, gadwall, American wigeon, blue-winged teal, cinnamon teal, northern pintail, redhead and ruddy duck