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Modification of net configurations of the Coda Netlauncher® to enhance bird capture

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***Abstract*:** We modified and evaluated capture nets fired from the Coda Netlauncher® as a tool for capturing various avian species. We modified the netlauncher by using customized nets to maximize the area of the capture zone. We captured 137 birds, comprising 12 species, in 23 attempts between July 2008 and October 2009 using this method. Capture success rates varied from 25 to 69% were comparable to success rates reported for other capture methods for these species. However, individual capture success for different net configurations varied greatly from 3 to 65%. Minimal injuries and 2 bird fatalities were reported. The netlauncher, using modified nets, proved to be a cost-, labor-, and time-efficient tool compared to what has been reported for other avian capture techniques. The netlauncher provides managers with a lightweight, flexible method of capture that does not use combustive or explosive propellants, and, thereby minimizes associated training and regulatory oversight.

***Key words*:** birds, capture, Coda Netlauncher, human–wildlife conflicts, nets

BIRD SPECIES ARE CAPTURED for several reasons, including conservation, management, monitoring, and research. Two commonly used methods of capture are the cannon and rocket net traps (Schemnitz 1996). Both of these traps have been used with considerable success for many years (Wheeler and Lewis 1972, Urbanek et al. 1991, Grubb 1988). However, recent changes in regulatory oversight in obtaining, handling, and using classified combustive or explosive propellants have initiated research on alternative methods for launching net traps. In addition, the recent focus on collection of large numbers of diverse bird species for monitoring of zoonotic diseases, such as avian influenza and West Nile virus, necessitate new and effective means of sampling.

The netlauncher is a capture system developed by Coda Enterprises Inc. (Mesa, Ariz.) and was first produced in 1984. The netlauncher design has several advantages in that it is classified by the U.S. Department of Justice, Bureau of Alcohol, Tobacco, and Firearms as a tool rather than either a firearm, controlled propellant, or explosive. This classification minimizes many regulatory restrictions of the netlauncher's use. In addition, the system is lightweight, compact, can be launched remotely from up to 400 m away, and does not require special training or certifications to operate. The system is currently designed to launch a small net (5 × 5 m) ≤20 m from the netlauncher. We evaluated the effectiveness of the netlauncher system, using various net sizes and materials suitable for capturing a range of bird species.

Methods

The netlauncher system incorporates the use of a small, .308 caliber, blank as the energy source for propulsion through a manifold system and using 4 weights attached to a lightweight net. The weights drag and deploy the net from a fiberglass tray mounted to the forward base of the netlauncher. The netlauncher footprint is approximately 0.6 m × 0.9 m, and it weighs approximately 18 kg. The base of the unit is a metal frame to which the tray, barrel assembly, and firing mechanism are mounted (Figure 1).

Categories of target species included waterfowl, colonial waterbirds, wild turkeys (*Melagris gallapavo*), and vultures. We placed the netlauncher in areas where groups of birds were congregating or at pre-baited stations. We also constructed a dummy netlauncher to be placed at the capture site >2 days prior to capture attempts to habituate birds, and then replaced it with the actual netlauncher at the time of capture. The netlauncher was fired with either a hard-wired or a radio-controlled detonator, depending on capture circumstances. The transmitter and receiver communicate using digital signal coding that

is set by Coda Enterprises Inc. prior to shipping; 1 radio-controlled detonator can fire >1 netlauncher.

We developed 3 customized net configurations (made by Coda Enterprises Inc., Mesa, Ariz.) to maximize the capture area that could be covered by the netlauncher (Table 1). We did not evaluate the standard netlauncher capture net, as it was not suitable for bird capture. Modifications were designed to make the nets as light and as large as possible while still maintaining the strength necessary to withstand repeated launching and capture stresses. All nets were roughly rectangular and were made of #9 twine at 39-kg tensile strength. A selvage of 7.6 cm poly-cord with 340 kg test was placed around all nets. Each net was equipped with 4 weights that served as the projectiles. The projectiles were attached to the selvage using 12-cm spectra cord with 566-kg test lead lines. The lead lines were equally spaced on the forward end of the nets between each corner. Net 1 (9 × 15 m) was designed to be fired outside of the netlaunch-er's fiberglass tray. Because of its larger size, net 1 did not fit inside the tray. Instead, net 1 was spread out in front of the netlauncher and then gathered in an accordion type method to form a line parallel to the netlauncher tray (Figure 2). Net 1 was outfitted with 5 m of spectra cord attached from the 2 inner projectiles to the selvage. The 2 outer projectiles were attached with 18 m of spectra cord. Net 2 (8 × 12 m) was fired from inside the tray. The outer projectiles' line lengths for this net were 2 m, and the 2 inner line lengths were 1 m. Net 3 (6 × 9 m) also was fired from inside the tray. The inner projectiles were attached with 1 m of spectra cord, and the outer projectiles had 2 m of cord. We also purchased leather drawstring sacks and plastic containers for net storage. We used the sacks to put the lead lines, projectiles, and anchor lines in to prevent entanglement in the net during storage, thereby facilitating set-up.

Figure 1. The basic Coda Netlauncher® configuration with net loaded in the fiberglass tray.

Table 1. Net specifications.

Net	Dimensions (m)	Mesh size (cm)	Cost	Selvage[a] (cm)	Lead line lengths[b] (m)
Net 1	9.1 × 15.2	5	$622	7.6	17.6 outer
					4.6 inner
Net 2	7.6 × 11.6	5	$475	7.6	1.8 outer
					0.9 inner
Net 3	6.1 × 9.1	5	$469	7.6	1.5 outer
					0.8 inner

[a] Poly-cord, 340 kg test
[b] Spectra cord, 567 kg test

We visually adjusted the barrel configuration of the netlauncher to vary the path of the net upon firing. When the barrels were pointed in a more upwards direction, the nets would shoot higher, but had a tendency to remain airborne longer, allowing birds more time to escape. With the barrels pointed in a more downward or horizontal direction, the nets shot flatter and fell quicker over the target species. We visually examined the flight path of the net from the launcher placed on level ground prior to going into the field. In some cases, we placed a decoy a specific distance in front of the net to evaluate

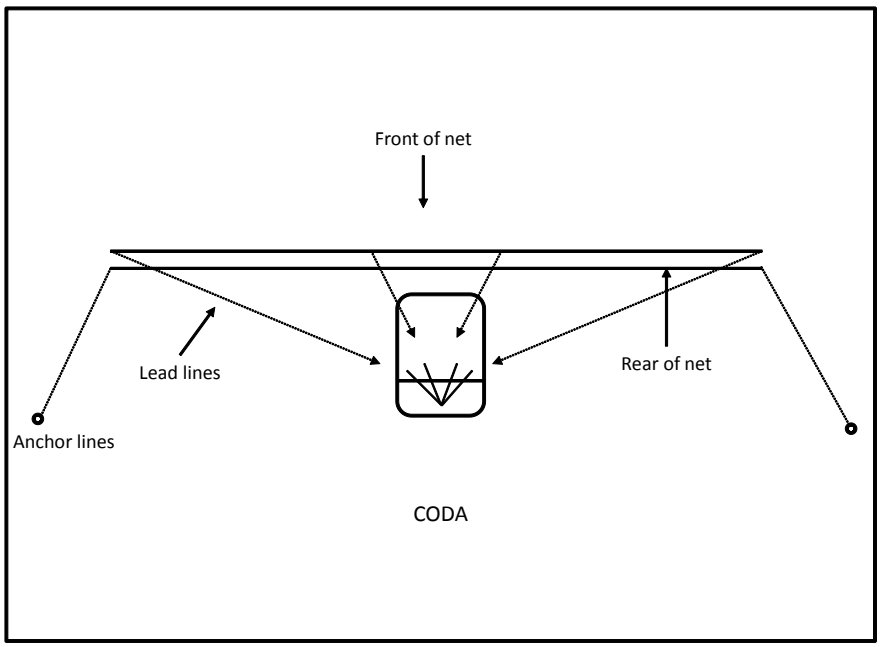

Figure 2. Diagram for basic set-up of the Coda Netlauncher® using the 9.1-m x 15.2-m net (Net 1).

clearance of the net. The barrels were then adjusted accordingly to prevent capture injury or fatality to the bird. Barrels and nets were adjusted depending on the net configuration and target species.

We qualitatively evaluated each net type based on 3 basic capture criteria: capture success rate, individuals per capture attempt, and capture efficiency. We measured capture success rate as the number of capture attempts in which ≥1 individuals of the target species were captured. We measured individuals per capture attempt as the number of individuals caught per capture attempt of the target species. Capture efficiency was measured as the number of individuals captured versus the number of individuals that escaped per capture attempt. The number of escapes was determined by visual estimation of the number of individuals present in the target area when the net was fired to the number of birds actually captured. In some cases, when firing the smaller nets into large flocks of birds, it was not possible to determine the exact number of individuals in the target area. This was due to the fact that wind and bird movements preclude a determination of the exact target location and number of individuals in a given location. In these cases, we reported only the number caught and the escapes only as individuals actually escaping from the net prior to their being recovered. We then qualitatively compared our measured values with those available from the literature for other avian capture methods, specifically, rocket nets, cannon nets, and leg-hold traps.

Results

The netlauncher was positioned for capture on 53 occasions, with a total of 23 captures attempted between August 2008 and October 2009. We evaluated the netlauncher on a variety of bird species in a variety of habitat types. Net 1 was used on 13 captures, net 2 on 5 captures, and net 3 on 5 captures (Table 2). Of these 23 capture attempts, two were unsuccessful due to equipment failure or misfire. One misfire was recorded using net 1 and the other using net 3. These misfires were not considered in calculating capture success rates. A total of 137 birds, compromising 116 target and 21 nontarget individuals representing 12 species were captured (Table 2).

The total cost of the netlauncher, including a remote detonator, 100 blank cartridges, tool kit, and instruction manual, was $4,050. Individual costs for nets 1, 2, and 3 were $621, $474, and $469, respectively. The total cost of the netlauncher with the 3 nets was $5,615

Table 2. Capture locations, date, and species captured. Species are listed according to the 4-letter alpha code of the American Ornithologist Union.[a]

Location	Date	Net	Target species	Number of species caught	Number and species escaped
Miss. catfish ponds	Jul 2, 2008	Net 1	GBHE[b] GREG[b]	1 CAEG[1]	2 CAEG
Miss. catfish ponds	Jul 2, 2008	Net 1	GBHE	0	1 GBHE
Miss. catfish ponds	Jul 2, 2008	Net 1	GBHE	0-Misfire	3 GBHE
Noxubee NWR	Jul 8, 2008	Net 1	WODU[b]	0	17 WODU
Noxubee NWR	Jul 10, 2008	Net 1	WODU	9 BRBL[b]	4 BRBL
Plaquemine Parish, La.	Aug 1, 2008	Net 1	WHIB[b]	0	1 WHIB
Plaquemine Parish, La.	Aug 1, 2008	Net 1	BBWD[b]	2 BBWD	0
Plaquemine Parish, La.	Aug 2, 2008	Net 1	WHIB	1 WHIB	0
Gretna, La.	Aug 5, 2008	Net 1	MALL[b]	2 MALL	1 MALL
Noxubee NWR	Aug 18, 2008	Net 1	WODU	23 WODU 7 COGR 1 BHCO 1 RWBL[b]	0
Sardis Lake WMA	Feb 20, 2009	Net 1	WITU[b]	1 WITU	6 WITU
Miss. Golf Course	Jun 4, 2009	Net 1	CANG[b]	8 CANG	5 CANG
Noxubee NWR	Aug 12, 2009	Net 1	WODU	73 WODU 1 MALL 1 MODO	25 WODU
Miss. catfish ponds	Mar 4, 2009	Net 2	GREG	0	1 GREG
Aliceville Lake, Ala.	Mar 17, 2009	Net 2	AWPE[b]	0	5 AWPE
Ag Field, Miss.	Aug 5, 2009	Net 2	CANG	0	3 CAEG
Miss. catfish ponds	Oct 21, 2009	Net 2	AWPE	0-Misfire	1500 AWPE
MS catfish ponds	Oct 21, 2009	Net 2	AWPE	5 AWPE	0
Plaquemine Parish, La.	Aug 3, 2008	Net 3	GREG	0	1 GREG
Plaquemine Parish, La.	Aug 6, 2008	Net 3	WHIB	0	6 WHIB
N. Carolina airport	Aug 28, 2008	Net 3	CANG	1 CANG	5 CANG
N. Carolina airport	Aug 28, 2008	Net 3	CANG	0	16 CANG
N. Carolina airport	Aug 28, 2008	Net 3	CANG	0	8 CANG

[a]Net 1 = 9.1 m 15.2 m; Net 2 = 7.6 m × 11.6 m; Net 3 = 6.1 m × 9.1 m
[b] GBHE = great blue heron (*Ardea herodias*); CAEG = cattle egret (*Bubulcus ibis*); GREG = great egret (*Ardea alba*); WODU = wood duck (*Aix sponsa*); BRBL = Brewer's blackbird (*Euphagus cyanocephalus*); WHIB = white ibis (*Eudocimus albus*); BBWD = black-bellied whistling duck (*Dendrocygna autumnalis*); MALL = mallard (*Anas platyrhynchos*); COGR = common grackle (*Quiscalus quiscula*); BHCO = brown-headed cowbird (*Molothrus ater*); RWBL = red-winged blackbird (*Agelaius phoeniceus*); WITU = wild turkey (*Meleagris gallopavo*); CANG = Canada goose (*Branta Canadensis*); MODO = mourning dove (*Zenaida macroura*); AWPE = American white pelican (*Pelecanus erythrorhynchos*).

Table 3. Qualitative comparison of the Coda Netlauncher® using 3 modified net configurations to literature values of other capture methods for capturing avian species.

Capture method	Initial cost of equipment	Capture success rate	Individuals/ capture attempt	Capture efficiency	Injuries	Fatalities	Set-up time (hours)
Net 1 (*n*=12)	$5,616	69.2%	10	64.9%	4	2	0.3
Net 2 (*n* = 5)		25.0%	1	36.0%	1	0	0.3
Net 3 (*n* = 4)		25.0%	0.3	2.7%	0	0	0.1
Modified portable rocket-net[a]	$955–$2,040 ($1,402–$2,856)[c]	10–90%	28	N/A	0	2	0.5
Modified leg-hold traps[b]	$840 ($1,233)[c]	10–70%	52	1	1	0	3

[a] King et al. (1998), Pooler et al. (1998), Engel and Young (1989), Cox et al. (1994).
[b] King et al. (1998), Engel and Young (1989).
[c] Estimated present-day cost using a 3% inflation adjustment.

(Table 3). These costs do not reflect expenses for travel to capture sites or labor. The average set up time for all nets was 16 min (n = 39, SE = 1.58; Table 3). Capture success rates were between 25 and 69% for all nets (Table 3). The average number of individuals captured per attempt ranged from 0.25 to 10 for all 3 nets (Table 3). Capture efficiency was highest with net 1 at 64% (Table 3). Five bird injuries and 2 fatalities were recorded. Four of the injuries occurred using net 1, and were minor wing bruises to target species. The fatalities occurred while using net 1 when a nontarget red-winged blackbird (*Agelaius phoeniceus*) was decapitated by deployment of the net and a nontarget grackle (*Quiscalus quiscula*) was euthanized after suffering a severed wing. The other injury was a wing abrasion to a target species that was reported using net 2.

Discussion

The netlauncher system provides a method of capturing avian species with relatively little effort and efficiently comparable to other capture methods. The 69% capture success rate for net 1 was well within the range reported for modified leg-hold or modified portable rocket nets (Table 3). We also noted an increase in capture success rate during the later part of the study, which may be due to our increased familiarity with the modified nets.

A study by King et al. (1998) described 2 capture techniques using modified soft-catch leg-hold traps and portable rocket nets. They reported capturing 52 wading and waterbirds, representing 6 species in varied habitats, using 60 modified leg-hold traps. Although we conducted multiple trapping sessions, the exact number was not reported (King et al. 1998). The modified leg-hold traps cost approximately $14/trap and required >1 individual 3 hours to set out 60 traps (Table 3). These modified leg-hold traps cost $20/trap today from Minnesota Trapline Products (Pennock, Minn.). The initial cost of the leg-hold traps is considerably lower than the netlauncher, and like the netlauncher, was effective on multiple species in varied habitats. However, the effort involved in setting up the leg-hold traps was considerably greater than that of the netlauncher. King et al. (1998) had 1 recorded injury of a bird using leg-hold traps and no fatalities, which was fewer than the netlauncher; yet, fewer birds were captured by King et al. (1998).

King et al. (1998) also reported capturing 142 American white pelicans (*Pelecanus erythrorhynchos*) in 5 attempts using their modified portable rocket-net. However, they provided no measurement of capture success for their method, so, a direct comparison is not possible. This method took King et al. (1998) approximately 0.5 man hours for set up, and cost $955 for the box, net, 3 rockets, and 3 charges (Table 3). However, Pooler et al. (1998) reported a cost of approximately $2,040 for a similar rocket-net system. At present-day

prices, adjusting for inflation at the standard rate of 3% per year, these 2 rocket-net systems would costs $1,402 and $2,856, respectively. The initial purchase of the netlauncher incurs high start-up cost, but it is subsequently more cost efficient compared to the rocket-net, which typically requires 3 rocket charges at $9 each for every capture attempt (D. T. King, USDA / Wildlife Services, personal communication). Coda Enterprises Inc. provided 100 blank .308 cartridges with the purchase of the netlauncher, and charged $79 for a box of 100, thereafter. The equipment cost of a single capture attempt using the netlauncher was $0.79, whereas, the cost of operating the rocket net will be at least $27 for each capture attempt. There are also higher costs associated with storing the rocket-net charges in an approved explosives bunker. Although the netlauncher's initial cost was greater than the rocket net, this may no longer be the case given inflation and increased costs since the King et al. (1998) and Pooler et al. (1997) studies. Two bird fatalities were reported by King et al. (1998) during the capture attempts using the modified portable rocket-net system, which is similar to what we report for the netlauncher.

We were most successful using net 1, but it was not as quick to set up or as portable as nets 2 and 3. Net 1 also was more difficult to hide in some situations and could not be used in brushy areas or shallow water. Nets 2 and 3 had the advantage of being pre-set and were simply dropped off at the capture site with minimal disturbance. Net 2, being slightly larger than net 3, did not shoot as high, and was faster, making it more effective at capturing avian species. Nets 2 and 3 have the advantage of launching from the tray, which enables them to be utilized on a boat, truck, all-terrain vehicle (ATV), or in shallow water. However, net 3 was small and lightweight, which caused it to launch too high and too far, and it was, therefore, too slow in dropping over the capture zone. Of the 3 net configurations evaluated, we can recommend only configurations 1 and 2 for use in capturing.

The netlauncher does have some deficiencies relative to other capture methods. Although more injuries were recorded with the netlauncher than with modified leg-hold traps, they were primarily minimal wing bruises from net 1 and net 2. Weather and environmental conditions can create a disadvantage when using the netlauncher, due to the lightweight nets used and limited propellent when compared to rocket nets. The nets may not deploy properly and have too much hang-time or be shifted from the target area under high winds. Net 1 may not deploy properly when the ground layer consists of many sticks, twigs, or stubble on which the net can catch. Before launcher set-up, the capture site should be cleared of any materials that may cause interference with the net. A dummy netlauncher should be used to habituate birds to the presence of a netlauncher whenever possible. In the 23 capture attempts using the netlauncher, we encountered 2 misfires, in which the net failed to launch. One of the misfires was caused by using the remote detonator, which lost its battery charge. Grubb (1988) reported 1 misfire out of 61 firings of the rocket-netlauncher, resulting in the system being detonated when the arming switch was activated.

Ease and rapidity of set-up and transportation of the netlauncher is perhaps its greatest advantage over other capture methods. The versatility of the netlauncher allows us to use it in urban settings, including a park in New Orleans, Louisianna, a catfish pond levee in the Mississippi Delta, and an airfield runway in Raleigh, North Carolina. The main concern with firing the netlauncher is clearance of any objects that may be hit by the weights fired from the manifold. The netlauncher also can be mounted on a platform, vehicle, ATV, or boat. The netlauncher system can be carried by 1 person and set up in 15 minutes. Leg-hold traps have to be set individually and require a high number of traps to capture an adequate number of birds for sampling.

Another advantage of the netlauncher over rocket nets is its classification as a tool rather than a firearm. Therefore, no special permits or regulations are required for transporting, firing, or storing the netlauncher, unlike the rocket net which has strict regulations placed upon the use and storage of rocket net charges.

The netlauncher with modified nets proved to be a useful tool for capturing many avian species. Its flexibility of use and reduced regulatory requirements create a system that wildlife professionals can utilize to capture a diversity of avian species in different habitats.

The netlauncher can also be used for capturing other species of animals, such as deer (Pooler et al. 1998), but we evaluated its success only in capturing birds. Similar trapping methods have proven successful, but because of strict regulations, time of set-up, trap-shy animals, and cost associated with use, the netlauncher may be a viable alternative. Future research should be conducted to determine ways in which the netlauncher could be improved. Further modifications to the net sizes, shapes, and net material could prove effective in increasing deployment cover area and net durability. Larger nets that are capable of fully deploying from the canister could help reduce set-up time and improve future capture success rates. Incorporating a higher caliber energy source for propelling larger nets also should be investigated further. Overall, the netlauncher is a mobile unit that is easy to transport, set-up, operate, has few restrictions on use, and is effective, making it a valuable tool for wildlife professionals to employ for capturing and sampling avian species.

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