Catching Crows

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ABSTRACT

American Crows (*Corvus brachyrhynchos*) are notoriously difficult to capture. I have spent 17 years attempting to capture unmarked members of two study populations and summarize here methods tried and those found to be the most successful. At best, I have achieved only moderate success; crows are captured, on average, in one of approximately three attempts. Trickery is a large component of successful techniques. I discuss the Australian Crow Trap, drop-door traps, cannon and rocket nets, the Netlauncher, and the Netgun. Other trapping considerations, including strategy, bait, choice of location, and weather are also discussed.

INTRODUCTION

American Crows (*Corvus brachyrhynchos*) are difficult to catch. They are intelligent, extremely wary, and very quick. I began trying to catch crows 17 years ago when, as an incipient graduate student, my interest in them was piqued by an opportunity to observe some regularly. I asked Thomas R. Howell, the ornithologist at UCLA, about the dearth of literature on crows in the wild. His response: "They're too smart; no one can catch them." I have been trying ever since.

The ability to identify individual animals underlies any detailed study of population demographics, social organization, or fitness correlates. Thus, as part of field studies on cooperatively breeding populations of American Crows in Encino, CA, and Stillwater, OK, I have attempted to capture and mark as many individuals as possible in families under observation. My study population in California was unusual in that it was colonial (Caffrey 1992) and, therefore, crows from many families would gather together at bait. Inveterate cachers, individuals would constantly depart the area with bait to cache elsewhere, making it difficult to keep track of particular unmarked individuals. Trapping attempts were thus almost always geared toward maximizing the number of individuals caught per attempt. Most crows can probably be caught once, when unfamiliar with trapping protocol. It was, therefore, possible to use the same trapping apparatus more than once in the same general area, because of the temporary absence of cachers when traps were sprung or nets detonated. I used large trapping devices (drop- and walk-in traps and a cannon net), with which I was able to capture some crows while a subset of the local population remained naive. As more and more crows became experienced with the potential downside to approaching the trapping apparatus, fewer and fewer ventured into target range. In addition, because of the difficulty of identifying particular unmarked individuals, I had little control over who got caught. Critical study animals thus remained unmarked for the duration of my thesis research, constraining the collection of some kinds of data (e.g., contributions to nestling feeding; Caffrey 1999). For some kinds of work, however, the "randomness" of who gets caught might not impede trapping objectives, e.g , capturing crows in the effort to monitor the spread of West Nile Virus.

Crows in Stillwater, OK, are more classically territorial. Although there is a surprising amount of movement of individuals among groups, families generally occupy non-overlapping areas (Caffrey (unpubl. data). The differences in social organization between the two populations have rendered different trapping strategies necessary Crow family size in Stillwater ranges from two to 12 individuals. My students and I have sometimes been able to catch all members of small families simultaneously, but for most families, additional

capturing events have been required. We have been able to catch the unmarked members of otherwise marked families only by switching to a smaller, more cryptic trapping device, changing the device's camouflage, changing baits, and waiting for intervals of up to one year before a second or third trapping attempt. We determine the readiness of particular unmarked individuals to approach particular combinations of camouflage and bait type by intermittently offering them different set ups. Because first-year crows tend to be less wary than older individuals, we preferentially leave them for subsequent attempts if we are unlikely to get a shot at all of the unmarked members of a family.

I have tried many methods in over 600 capture attempts in California and Oklahoma, resulting in zero to moderate success. The discoveries borne from my ability to identify individual crows have been well worth the immense amount of time and effort put into the capture process. Individual crows modify and use objects to accomplish particular goals (Caffrey 2000a, 2001), and both populations are highly unusual among cooperative breeders (Caffrey 1992, 2000b, unpubl. data). I caught 205 free-flying crows in California over seven years and have caught over 185 in five years in Oklahoma. No crows have ever been injured during the capture process. Here, I summarize some of my trapping experiences and provide details for methods of capture that have been the most successful.

METHODS, RESULTS AND DISCUSSION

In almost all such situations, habituation of crows to the trapping apparatus is necessary; they almost never approach threatening novel situations in such a way as to allow many of them to be caught. An important consideration, too, is that crows present when trap doors drop or nets are launched, whether they are captured or not, will generally not approach a similar situation for many months. Thus, many trapping attempts end unsuccessfully because the "best shot" on a given day is not worth precluding the capturing of other local crows in the near future. Also, crows may avoid trapping locations for weeks to months subsequent to capture events. Trapping locations should therefore be chosen so as not to interfere with observation opportunities or crow nest site selection.

Not Worth the Effort - A few methods tried early on did not work at all, including a "noose carpet " Crows are very reluctant to walk on unfamiliar substrate; it took more than a week of baiting to get crows to walk onto a 1 m^2 piece of astroturf. I then anchored several monofilament nooses to it and watched as, within minutes, a squirrel became miserably entangled. Even if the chance of capturing a non-target species was zero, I would not try this again; catching crows one at a time is tedious business. In addition, the "one" to approach from within a group will be random and catching an already-marked individual would only increase the wariness of unmarked onlookers Similar considerations apply to the use of leg-hold traps; the substrate factor and the randomness of who gets captured undermines their effectiveness (John Marzluff, pers. com.). Glue traps, used for mice and rats, did not work either; crow feet did not stick.

Drop-in and Walk-in Traps - In California, my study population bred colonially on a golf course (Caffrey 1992). I began trying to trap crows with an Australian Crow Trap (Kalmbach and Aldous 1940 [Wildlife Research and Management Leaflet B5-27, "A cage trap useful in the control of White-necked Ravens"]; modifications in Rowley 1968) The trap is designed such that crows attracted to the bait inside land on the rungs of the ladder-like structure across the top, then drop in; the spaces between the rungs are too small for crows to fly out At first I tried erecting it on the day I was to attempt trapping, with no prior baiting of the area. Crows were interested in the food inside, and possibly the novelty of the thing, but rarely approached and never landed on it. Following a suggestion, I placed inside the trap a crow undergoing rehabilitation, but the crow was spooked by the situation, behaved erratically, and frightened resident crows away. A stuffed Great Horned Owl (*Bubo virginianus*) did not attract crows in either

I had made the trap collapsible so that it would be transportable; thus, gradual habituation of crows to the apparatus was possible. Getting crows to feed near and in the trap in preparation for trapping

required baiting, starting 4 - 5 m away from the apparatus and gradually moving closer, over 4 - 7 weeks. With the netting on all sides rolled up, crows would eventually step over the wood along the bottom and feed inside. Their wariness was never so clear as at this stage – they would nervously inch toward the wood and then JUMP BACK, over and over, before nervously venturing in (this pattern of behavior came to be known as "the trap dance"). Once they would enter and feed, I would (under cover of darkness) roll down the netting on one side, and start over. Eventually, when crows would enter with three sides rolled down, I would attempt to trap them.

On trapping days, capture success was too dependent on uncontrollable factors (in this habitat) for this to be a practical means of capturing study animals. Crows needed a long time, once on the rungs, to decide to drop in. I caught a few crows this way (a total of 28 in eight successful attempts; up to eight at a time) but spent many days not catching any, as golfers and grounds crew personnel disturbed contemplating crows, or undetectable phenomena spooked crows from the area. Fox squirrels (*Sciurus niger*) did not fear the trap and ran all over it, prohibiting crows not only from dropping in, but from landing in the first place. For days prior to crow trapping days I would trap squirrels and release them elsewhere, but I was never able to stem the tide enough to reduce their impact.

Under appropriate conditions, the Australian Crow Trap can be used very successfully to capture crows. Placed in habitats that crows are frequenting already, with little disturbance from humans and squirrels, and baited with food more enticing than that available in the surrounding area, many crows may enter over periods of hours. At the extreme, S. E. Aldous (of Kalmbach and Aldous 1940), in attempts to reduce local crow populations, captured a total of 177 in three traps in one day. Lisa Reed of Rutgers University, in association with monitoring West Nile Virus seroprevalence in wild crows in East Brunswick, NJ, has caught a maximum of 54 in 24 hours in one trap (*www.rci.rutgers.edu/~lreed/crowtrap.htm* and *www.rci.rutgers.edu/~lreed/dimensions.htm* for trap details). The trap is located at a large compost pile/ landfill area, heavily foraged by crows and is baited with dog chow, eggs, bread, peanuts, and corn on the cob. From 100 - 200 crows/week have been caught "when cold"; no crows at all have been caught during summer. Jeff Levengood of the Illinois Natural History Survey, also trapping with regard to monitoring the spread of West Nile Virus, has caught up to 25 crows/day by placing traps baited with bread near harvested crop fields where aggregations of crows were feeding. In both situations, zero crows were caught on many days and captures were biased toward young of the year.

Because crows would enter the Australian Crow Trap and feed inside with three sides rolled down, I modified the trap by changing one end to function as a drop-door trap. The door was held open with a piece of wood (a "2 x 2"), with a long string attached to the bottom. This provided a bit more control over the situation, although crows were afraid of the door and its support, and on two occasions golfers tripped over the string and sprung the trap, wasting weeks of preparation time by alerting nearby crows to the danger of the apparatus. Because the door was heavy and had to be at least 1.8 m off the ground in order for crows to walk underneath, its dropping took long enough for some crows to escape. I caught a total of 18 crows in six successful attempts using this trap, up to eight at a time. I subsequently built a larger yet structurally more simple drop-door trap. It was a rectangular box, 3.05 x 2.44 x 1.83 m (length x width x height), made of 2 x 2s and covered with lightweight netting that could be rolled down a side at a time as the trap dance played out. The door was supported by pins connected to radio-controlled servo arms. With a remote transmitter, I could pull the pins and drop the door. I caught several crows this way as well (a total of 24 in four successful attempts; up to 13 at a time), yet their reluctance to walk underneath and into an enclosed structure rendered this an inefficient crow-trapping method.

Bernd Heinrich of the University of Vermont has used a large drop-door trap (approximately 2.1 x 3.1 x 4.6 m) to capture successfully Common Ravens (*C. corax*). Built into the surrounding woods and camouflaged with branches, ravens finally entered in numbers of up to 43 at a time after two months of baiting.

Cannon and Rocket Nets - To get crows comfortable enough to approach and feed in front of the cannon net I used in California, I had to lay out the net and eventually also the wire and cannon apparatus each day for 3 - 5 weeks. I did not try to disguise it. Again, I placed the bait some distance away and gradually moved it closer over those 3 - 5 weeks. The golf course management allowed me to leave everything in place for the day preceding a trapping day. On trapping day I arrived, armed the cannons, and laid out the wire (to a 12 volt battery 30 - 60 m away) right in front of waiting crows (foolish, in retrospect). In spite of this, and the fact that a person had to stand at the battery to detonate, I managed to catch quite a few crows, at first, using this approach (a total of 135; up to nine at a time). However, as my trapping attempts continued, crows became more and more wary, especially on trapping days, and would not land. Having the person at the battery pretend to be golfing enabled me to catch a few more crows in a few more attempts, but their wariness became more and more difficult to overcome.

I thus tried to eliminate cues to which crows were likely responding on trapping days. I bought a mannequin and sat it in my passenger seat to compensate for the fact that on trapping days I often had someone in the car with me as I baited and prepared the apparatus for crow capture. I rented golf carts in which to hide the battery and the person prepared to detonate. Tricks such as these worked to some extent, but the wire remained an obvious sign. I therefore modified the remote apparatus (from the drop-door trap) so that the servo arms could complete the electrical connection between the 12V battery and the wire (now shortened to the length of the net) coming out of the back of the three cannons. I packaged the receiver/servo device into a handmade lucite box and placed both it and the battery into a plastic box. Placed alongside the net with antenna exposed, it enabled remote detonation of the cannons. This significantly improved trapping success; yet, I was still only catching crows, on average, one out of every 3 - 4 tries.

I had been relatively successful using a rocket net in Stillwater, Oklahoma, where crows occur in family groups of 2 - 12 and occupy somewhat exclusive territories. Cannon and rocket nets both function via projectiles connected to the leading edge of a folded up net (17.4 x 13.1 m) carrying it out and over the area in front of the apparatus. The ammunition is packed into the back of the projectiles–the rockets–of a rocket net; the projectiles of a cannon net are propelled from the ammunition/cannon apparatus, which is bulkier than the projectile support structures (angle irons) of a rocket net. The rockets are thus easier to disguise than would be the cannon apparatus, and the rocket net ammunition is easier to procure (Winn-Star, Inc., Marion, IL; cannon net ammunition appears to be no longer commercially available in the United States). But the rockets leak sparks, which has started several fires; these were frighteningly dangerous in that crows were trapped under the net, and I was 60 - 90 m away. Under dry environmental conditions, wetting down the net and the area in front of the apparatus ahead of time should prevent fires from starting.

The enhanced success achieved at first in Oklahoma was due, in large part, to a change in approach. For 1 - 14 days prior to a trapping attempt, my students and I gradually built up a row of leaves that came to mimic the appearance of the rockets and folded net hidden under leaves. The leaves had to mimic the appearance of the whole set up, including where the camouflaged wire would be. We baited the area every night so that the food was there first thing in the morning. When all the leaves were in place and the bait was being taken, and a morning-before watch confirmed that the crows in which we were interested were coming to the setup, we arrived after sunset to set up the net and the angle irons for the rockets. We used a Waterfowl-Pigeon-Dove Net, and Weight-forward Recoilless Net-trap Rockets, both from Wildlife Materials, Inc (Carbondale, IL). We positioned the center rocket so that it would rise to approximately 1.8 m at its peak by adjusting the trajectory path of the supporting angle iron. We used angle irons that were 3 x 3 x 44 cm, and drove them approximately 18 - 20 cm into the ground with a rubber mallet. The end rockets should angle slightly out to the sides of the forward path of the net (at an angle of approximately 10°) and rise to no more than 0.5 m at their peak to reduce the chance that crows will escape out the sides of the unfolding net. On trapping morning, in the dark, we put in place and wired the rockets, and covered everything with

everything with leaves. We spread the bait 1 - 2 m from the net, approximately 1.5 m away from the path of the center rocket on both sides, and at least 3 m in from the side edges of the net. Then we would wait, detonator at hand, in a car or blind.

To catch crows with either cannon or rocket nets, the birds must be within approximately 2.5 m of the folded net and 3 m inside of the sides as it unfolds. They must also be relaxed; preferably eating. We caught members of some families on our first tries, but other families took two to several attempts before they would approach a readied net in numbers that made it worthwhile. On average, for families not "on to us" yet, we were successful one out of approximately three attempts.

Attempts can be unsuccessful because crows do not land at all, or because the way in which they feed makes the shot not worth it, e.g., only one or two of a family of six come in at a time. Again, once even only a couple of members of a family have been caught, they and most others will not approach food near a row of leaves for many months, if ever. Yet, because what crows do on one day is often not the same as what they do on another, unsuccessful trapping days have often been followed by a day with a better shot. We left the net in place if we were coming back the next day. For families that come to the bait early in the morning, it is often the first group of them to approach that will end up having been the best shot. Once everyone begins eating, caching, foraging elsewhere, and returning on their own schedules, the simultaneous arrival of a group becomes less likely, although it can happen. We never detonated, even with an otherwise desirable shot, if a crow was standing on the net or in the path of one of the rockets.

Crows quickly picked up on the setup and then avoided anything that looked similarly threatening. We were sometimes able to trick them into taking different bait (see below), but as soon as the leaves went down, wary crows would not land. Other types of vegetative camouflage might fool them, but anything that can get caught up in the net upon launching cannot be used. Grass clippings sometimes worked as an alternative, but the 17.4 m row is tough to blend into the surrounding habitat. Because crows generally prefer to forage in open habitats (pers. observ.), "hiding" the leaves/grass and net amidst thick brush often does not work well. With their guard already up, most crows do not feed comfortably in such a situation I eventually modified the rocket net electronics so that J could detonate remotely, thus obviating the wire, but the wariness of individuals familiar with the setup could not be overcome.

Also in the effort to monitor the spread of West Nile Virus, Kevin J. McGowan of the Cornell Laboratory of Ornithology caught approximately 80 crows in eight successful attempts over one month with a cannon net at a large compost area outside of town. Crows required several days of habituation before they would approach the mock setup and left its area at the slightest disturbance. Yet with a huge population of visiting crows, up to 15 were caught at a time. Most of the crows caught were young of the year, and zero crows were caught on several days.

Netlauncher - We are currently using a Coda Enterprises Inc. (Mesa, AZ) Netlauncher (Fig. 1). It uses a smaller (7.6 x 7.6 m), lighter net; as such, it launches quickly, but the target range is small Both manual (via a wire) and remote detonation options are available. The net is pulled up and out of the pan by four "bullets" connected to the leading edge and shot out of the barrels upon detonation We attached camouflage material to a piece of chicken wire to cover the back end of the Netlauncher, leaving the tips of the barrels and the net pan exposed (these cannot be covered with anything that can possibly hang up the net). We drape 4 - 8 cm-wide camouflage strips from the chicken-wire cover to the ground to cover the front end of the apparatus. We then put a light layer of leaves over everything. We habituate crows to the presence of a pile of leaves near the bait for several days prior to a trapping attempt.

When used as directed, the net is launched some distance away from the apparatus; the trajectory can be altered by changing the position of the barrels. We tried actually launching the net at crows, but even with all four barrels in their lowest possible positions, the net went too high and was subject to wind effects; most crows escaped out from underneath. Sitting the back end of the Netlauncher on a 2 x 4 brought the sides of the

launched net down to only approximately 60 - 70 cm off the ground, which was still too high to keep crows from getting out. We just barely caught all three crows standing right at the bait (a tight circle of food directly in front and 7.6 - 8.1 m away from the leading edge of the net pan) in our best shot using this method, but the number of escapees now aware of the setup is daunting. Dampening the net beforehand apparently shortens the distance it is launched, and thus increases control over its trajectory, yet crows still escape (John Marzluff, pers. comm.).

Fig. 1 Netlauncher

Using the Netlauncher as a miniature cannon net (we stake down the back end of the net) has increased our capture success. On the trailing end of the net, 1 m to each side of the center, we added two ropes of length equal to that of the ropes already connected to the outer corners. Subsequently, we have lengthened all four ropes to 3 m, so that the bait can be further from the apparatus. Getting the back end of the net to open adequately under these conditions requires having the peripheral ropes extended out from the pan on both sides. We stake down the ends of the center two ropes at the sides of the pan, and the ends of the two outer ones approximately 3 m out. This sacrifices some of the Netlauncher's potential crypticity; we have to disguise it sitting in the center of a (thin) 6 m row of leaves/debris.

Once crows are taking bait in a particular area, build up to the final façade takes only a couple of days. Thus, preparation time for naïve groups is short. In addition, groups that were rocket-net wary were apparently cuing in on the length of baiting time and the size of the leaf row; members of many groups behaved as if they thought they were safe for the first few days. That the launcher setup looked like an incipient rocket net event no doubt contributed to some wary crows taking greater risks "early" in the baiting process.

If possible, we place the Netlauncher near some type of vegetation (to help disguise the setup) in an otherwise open area. We have the back end taped to two 2 x 4s so as to lower the net trajectory. Directly behind the back end, we drive two 3 x 3 x 44 cm angle irons half way down into the ground to eliminate any chance that recoil of the device will alter the trajectory of the net. We secure the top two barrels (carrying the center two "bullets") in their lowest positions (aiming ap- proximately 1.5 m high, at peak). The bottom two barrels (housing the outer two "bullets") should be just high enough to permit loading (just above the lip of the pan). It appears as if the bullets will strike the ground in this position, but they are dragged aloft by the center bullets. We put the bait 4 - 4.5 m from the leading edge of the launcher pan. I advise experimenting with all these variables before employing the Netlauncher in the field. We have missed shots at important birds because of not paying close enough attention initially to the path of the net. One particularly attractive characteristic of the Netlauncher is the ease with which it sets up and breaks down (15 - 20 min.); a bonus on an unsuccessful morning.

It took only one experience with the firing of the net for individual crows to begin avoiding bait near a pile of leaves. Our last resort, for the remaining unmarked individuals in otherwise marked families, is to hide the apparatus under a tipped-over plastic outdoor garbage can (an idea I must enviably attribute to John Marzluff). We cut off one whole side and lay the can over the back end of the launcher. At first we used an outdoor trash bag to cover the ends of the barrels and the net pan, but even a single layer of a flimsy trash bag loosely taped in place got caught up in the leading edge of the net upon detonation on several occasions, interfering with its opening and allowing crows to escape. We now cut trash bags into 20 cm wide strips and loosely tape them from the top of the can to the pan. We place the remote receiving unit in another trash bag and position it next to the

garbage can. Litter and leaves disguise the ropes pulled out of the back of the pan on both sides. Strategic placement of various types of litter enhance the disguise; we place the bait in a circle of approximately 30 cm diameter 4 - 4.5 m away. In my experience, only crows standing within approximately 60 cm of the bait are likely to get caught.

Netgun - The Netgun (Coda Enterprises Inc., Mesa, AZ) looks like a modified rifle with four barrels, which house the "bullets" attached to the four corners of a 3.7 x 3.7 m net. When fired, the net is shot out perpendicular to the ground. We attempted to capture crows with the Netgun but were thwarted in all attempts; crows would not remain on the ground as we drove slowly past baited spots with our gunner in the back of a pickup truck. Our failure to capture crows with the Netgun was likely due, at least in part, to the heightened awareness of previously targeted members of our study population. The Netgun has been used successfully for crows and ravens by wildlife officials in Alaska and New York State (C. Gray, Coda Enterprises Inc., pers. comm.).

Bait - I have tried many different kinds of bait and report here only on what works best under various conditions. When first trying to attract crows to an area, big pieces of bread work well: whole slices, hamburger rolls, etc. We break open rolls and rip into whole loaves, or not, so as to maximize the contrast with the substrate. Piles of cracked corn (in areas without geese) and noticeable aggregations of peanuts, cereal, popcorn, cooked pasta, and puffed cheese snacks also work well. Raw peanuts (in the shell) are one of the staples of our arsenal; not many other animals eat them, and they are also one of the best indicators that crows are taking the bait: crows remove and cache many of them, but, with experience, the opened shells of those eaten on the spot are very distinctive. On trapping days, however, the bait should not include large food items that can be picked up and carried away easily. Crows generally need to be standing in place, picking at food, in order to be caught. Chopped hard-boiled and scrambled eggs work well, as do cooked spaghetti, water-logged bread, dry cat food, and stepped-on puffed cheese snacks. The gradual introduction of trapping-day bait a few days ahead of time reduces the number of things crows detect as different on trapping day. Once individual crows have been caught, their families begin to avoid our bait. It is thus a good idea to leave some items in reserve, so that changing baits is possible when targeting a group for the second or third time. We have been somewhat successful with fast food offerings, including wrappers and napkins; we soak, or step on and smash, the bread items (which crows generally take first). We have also been moderately successful with large pizzas in take-out boxes, but surprisingly not so with road-killed squirrels.

Additional Considerations - Trapping locations must be chosen carefully. Except for perhaps the first time a particular group is targeted, the apparatus has to somehow blend into the background. We try to choose places where humans are unlikely to be; people can be frightened badly (all launching devices are LOUD), disturb crows, or inhibit shots. Crows must be able to find and feel comfortable coming to the bait; grass longer than 8 - 10 cm prohibits the former, e.g., and longer than 10 - 12 cm the latter. Grass longer than approximately 10 cm also makes it difficult to know where crows are relative to the net or Netlauncher. An unobstructed view is required, preferably facing directly into the oncoming path of the net (so as to be able to gauge the relative position of crows accurately), and away from the rising sun. When using a wire, we have at least 60 m available, and we try hard to disguise it. A snaking, broken-up line of leaves is not disguise enough. Picking a location with the need to hide the wire in mind helps a bit, but the availability of suitable habitat configurations is not high. The wire is an important variable to eliminate as soon as possible. I have avoided putting the wire across a road, but a few cars and a bicycle have ridden over it with no unfortunate results.

We have used one half of the rocket net successfully when trapping in cramped locations (the other half must launch as well, right next to the "center" rocket). In an effort to increase the number of trapping attempts we could make, we have tried setting up the Netlauncher in the daylight, unbeknownst to crows being targeted. They have either discovered the setup process and left the area, or have arrived even more wary than they are in the morning. We have caught zero crows in at

least 15 daytime attempts. We have trapped year-round and noticed no blatant seasonal patterns of wariness, although some breeders are particularly reluctant to take bait during the breeding season. We have set off the rocket net and the Netlauncher relatively close to four nest trees (up to only 50 m away), with stages of the nesting cycle ranging from recent hatchlings to five-week old nestlings. We did so only in cases of injured crows requiring rescue (see following article) and were very careful regarding the timing of detonation relative to the presence of other family members, but we were probably just plain lucky that no abandonments occurred.

Weather needs to be taken into consideration as well. The opening and trajectory of the Netlauncher net is affected by wind, and wind fuels fires started by the falling sparks of rocket net rockets. Wind also makes the pan-covering trash bag strips flap about, which makes crows reluctant to land nearby. Rain water collects in the pan of the Netlauncher; the net will launch properly if damp, but not if soaked. Crows avoid foraging in the rain, if possible, but can sometimes be caught when a lengthy rain finally lets up. Accumulated snow and ice (from the previous night) slow down the rocket net. Sitting in the car for hours on really cold or really hot days is really unpleasant. Earthquakes and tornadic storms are usually bad news.

To the extent possible, we try to reduce the obviousness of our car on trapping days, and we have tried hiding ourselves within the car behind perforated windshield sunshades. I try not to use my car when trapping; crows recognize and respond negatively to vehicles associated with capture. Because they do the same to people associated with capture, I don a disguise once crows are caught and wear it during their processing.

What to Expect - Expect everything that can to go wrong. We have missed intended shots because of pushing the wrong buttons on the detonator, holding the detonator upside down, and leaving the receiver turned off. We have crossed wires, wired in parallel instead of in series, and unknowingly unplugged the wire. We left the safety engaged on the Netlauncher. A friend in California got so involved in practicing his golf swing that he failed to see me signaling to detonate the cannon net. A hook that had been dropped into the folded up rocket net, failure to screw rocket pieces together tightly enough, and loose angle irons have all caused rockets to go awry, allowing crows to escape.

Cats, dogs, red foxes, geese, starlings, grackles, and blackbirds have all had to be shooed from the bait. Stillwater Parks and Recreation Department employees have disturbed crows and run over bait on trapping days. Oklahoma State University Grounds personnel have mowed over or removed our leaf rows repeatedly, and once even removed a set up rocket net. One of the rocket net fires burned a football-field sized piece of a city park and critically damaged our net.

Crows themselves are the biggest problem. They do not show up, they show up and leave immediately, they show up and hang around but do not land. They land and they forage all around the general area, but will not approach the setup. They appear indifferent toward the bait. When crows do approach, they continually move in and out of range; individuals generally do not spend much time at the bait. Detonation decisions sometimes have to be made in split seconds as crows arrive, wander into but mostly out of the target area, and depart without warning. It can be nerve-wracking We usually have a plan ahead of time with regard to which individuals we are hoping for and which ones we will take if we do not get a better shot. We often end up modifying the latter after waiting 3 - 4 hours.

They seem to know the number of them we are after and approach simultaneously only in numbers of at least one fewer. They inadvertently move bait out of range, thereby providing forage for and prohibiting subsequent arrivers from being caught. Juveniles sometimes play by chasing family members away from the net. Interactions with cats, hawks, owls, kites, geese, turkeys, mockingbirds, and neighboring crow families have thwarted our catching of crows. Yet the sharpness and cunning of crows present the biggest challenge; fooling them is not easy. One two-year old male, upon his family's arrival to the rocket net, flew directly over the path of the "hidden" wire to our car, where he appeared to look right through the windshield at us before alarm-calling loudly; his

family left and never came back. The breeding female of another group, after a lot of calling overhead, landed and walked right past the bait to the brand new Netlauncher (disguised with leaves), cocked her head as she looked over the setup, and took off alarm-calling; her family followed. In California, of the total of 205 individuals caught, only 10 were caught a second time. In Oklahoma, only 11 of 188 untargeted individuals have been recaught. We have been purposely trying to recapture particular individuals (individuals that do not want to be caught again; see following article) and have managed to catch only 34 in hundreds of attempts. My students and I have spent hundreds of hours planning and preparing trapping attempts, and thousands of hours waiting in cars, yet we remain the undeniable runners-up in this battle of wits.

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LITERATURE CITED

Caffrey, C. 1992. Female-biased delayed dispersal and helping in American Crows. *Auk* 109: 609-619.

Caffrey, C. 1999. Feeding rates and individual contributions to feeding at nests of cooperatively breeding Western American Crows. *Auk* 116: 836-841.

Caffrey, C. 2000a. Tool modification and use by an American Crow. *Wilson Bull.* 112: 283-284.

Caffrey, C. 2000b. Correlates of reproductive success in cooperatively breeding Western American Crows: If helpers help, it's not by much. *Condor* 102: 333-341.

Caffrey, C. 2001. Goal-directed use of objects by American Crows. *Wilson Bull.*, in press.

Kalmbach, E. R. and S. E. Aldous. 1940. Winter banding of Oklahoma crows. *Wilson Bull.* 52: 198-206.

Rowley, I. 1968. The ABC of crow catching. *Australian Bird Bander*, Sep:47-55.