## Title
Barn owls and industry: problems and solutions



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# BARN OWLS AND INDUSTRY: PROBLEMS AND SOLUTIONS

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ABSTRACT: Three methods were explored to eliminate damage caused by owl pellets and fecal droppings: exclusion; trapping; and sound deterrents including abstract sound, biosonic sound, and high frequency sound.

Initial successful results of various types of sound diminished with time to the point that owls adapted and ignored all sound repellents within a short period. Exclusion techniques were ineffective as owls would find ways around, through or between any non-permanent structure blocking entry through warehouse openings. Live-trapping and relocating owls was the only effective technique tested in this experimental program. Three trap methods were found effective, but trap success diminished with use of each method. Thirteen owls were trapped in one warehouse during this study using bal-chatri, goshawk and drop-net techniques. The details of each method are discussed.

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## INTRODUCTION

Barn owls, *Tyto alba*, occasionally create a costly problem for industry and government agencies when they take up residence in unlikely and unwelcome places. High, dark corners of warehouses or aircraft hangers are regularly used as nesting sites in areas where there are high barn owl populations or where the loss of natural nesting sites has caused barn owls to look for man-made structures. The relationship of some barn owl population and man-made structures is reported by Marti et al. (1979). Although modern structures provide excellent nesting sites for barn owls, they frequently must be removed because of the extensive damage they can cause to the building and/or its contents.

Accumulation of fecal waste and pellets (the indigestible parts of prey that are regurgitated each 24 hours) cause three significant problems:

1. Contents of the fecal waste or "whitewash" is sufficient to damage beyond use the delicate surface of certain parts. Damaged supplies amount to a very large and unnecessary expense in the aerospace industry.

2. Owls often tear ceiling insulation to obtain access to the area between the insulation and the roof. This space provides an excellent nesting site. The insulation debris contaminates high-tech equipment. Replacement of ceiling insulation is a major task in structures where thermal regulation is critical.

3. Pellets and feces may cover large areas in some of the more remote sections of a structure and require a major clean-up and decontamination effort by maintenance personnel.

In one recent case, owls had nine nest sites in the ceiling where they tore down the insulation and its supporting wire mesh to gain access to the ceiling space. Some of the insulation was used as nesting material. However, most of it was dropped on the floor or stored parts. The ceiling space provides a nest that is well insulated from wide temperature variation and is undisturbed by predators.

In this particular case, the storage building (500,000 sq ft) had large doors (20 ft x 20 ft) that remained open in the summer for constant 24-hour vehicle traffic enabling the owls unrestricted access to the building. During the colder winter months all of the doors were closed, except when delivery trucks needed access in the building. Owls flew in and out-of-doors that were opened for delivery trucks and could even squeeze through small spaces between the door and door frame. There was no way to seal these spaces.

The first step towards solving this problem required close observation of behavioral habits and patterns. Ten days and nights were devoted to observing and documenting the owls' diurnal and nocturnal movements in the building. These data included the owls' roosting and loafing areas, the time they left to feed and the time they returned, their nesting habits and locations in the building, pre- and post-nesting activities, diet, and how close they could be approached before they flew. After this information was documented and reviewed (much of this information was confirmed by Peter Bloom (pers. comm. 1982) and Otteni et al. 1972), an experimental program was initiated to develop, test and recommend the most cost-effective techniques to eliminate the damage caused by the owls without jeopardizing or injuring them.

The goal was to develop effective, practical, and economical methods of deterring or removing the owls. The specific objective was to refine at least one technique that an individual could operate by himself which was 100% effective.

## LIVE TRAPPING

The trapping methods tested and an analysis of each method is described below:

Bal-Chatri Trap

A bal-chatri trap measuring 12"x12"x2" was used in the beginning of the study. A similar trap is described by Berger and Hamerstrom (1962). Brown or cinnamon-colored mice were used as bait in the bal-chatri and a small weight was attached to the bottom of the trap with a 3-ft elastic cord. The purpose of the weight was to keep the owl from flying off with the trap after its talons were entangled in the slip-knot nooses. The function of the elastic cord was to diminish the force of impact when an owl attempted to jerk the cage into the air. The trap was used at night prior to the time that the owls departed the warehouse to search for prey. The trap was placed on the floor about 30 ft from an owl and remained in place until the owl either struck at the mouse or flew away. Generally an owl made a strike within 30 minutes after placing the trap. Occasionally an owl only studied the trap for 5 or 10 minutes before striking. There were also times that an owl watched and listened to the mouse, but did not strike. The color of a mouse and the sounds it made determined the degree of response by an owl. Active, brown-colored mice produced the best results when placed in the bal-chatri trap with dry leaves and the plastic liner from cigarette packages.

Two owls were trapped the first night the bal-chatri trap was used. Both owls struck at the mouse within several minutes after the trap was placed. One owl made two attempts at the mouse before it was trapped. A third owl made a series of unsuccessful attempts at the trap and then hesitantly flew away.

The bal-chatri met most of the criteria established for a successful trap. It was practical and economical. However, it required that someone constantly observe and be ready to run and grab the owl before it slipped its talons out of the noose structure. It was most effective at the first of the study, but not as the study progressed, suggesting that trap-shyness develops quickly. Several owls escaped before an observer could get to the trap. This technique appeared to be only partially effective due to human error and/or owls that were not well entangled in the noose apparatus and escaped.

A variation of the bal-chatri trap is the carpet-noose trap. The slip-knot noose arrangement used on a bal-chatri is assembled on a piece of carpet or 1/2-inch welded wire. The carpet or welded wire with the noose arrangement is placed in some of the most frequent perching sites that the owls use through the course of the day. This type of trap is not baited. If properly placed, the owl's talons will slip into the nooses as the owl is landing at the perch site. The carpet or welded wire is attached to an elastic anchor in the same manner as described for the bal-chatri trap. When the owl leaves the perch site, the slip knots will tighten around his talons and will allow the owl to move no further than the length of the elastic cord. The problem with this type of trap device is that the owl normally is jerked back by the elastic cord, the end result being that the owl is left hanging upside down. This is no problem if the owl can be quickly freed and placed in a holding container. This trap method was abandoned after one attempt because of the difficulty in making a quick recovery of the trapped owl.

Swedish Goshawk Trap

The Swedish goshawk trap was one of the best trapping methods employed during the study. This trap did not require constant attention, was very effective and is not expensive to construct.

The Swedish goshawk trap used in this study was similar to those designed by Meng (1971). It was 3 ft square, 3 ft high and sat 18 in off the floor. Several modifications were made to increase its effectiveness. A double-hinged trigger mechanism was used rather than the single hinge used by Meng. The double hinge was extremely sensitive and fast-acting. Later in the study an infrared (invisible) sensor trigger mechanism replaced the mechanical double-hinge trigger. A micro-switch was attached to one of the hinged doors in a manner that triggered a blinking orange light when the doors automatically closed after an owl entered the trap. The light was attached to the micro-switch with 30 ft of wire allowing the light to be positioned for maximum visibility from anywhere within the building.

The trap was designed to be collapsible for ease in transporting. This feature made the trap design more practical and cost effective than the bal-chatri because it allowed the observer freedom to trap somewhere else in the building at the same time. The second modification included the installation of a metal ring measuring 5 in high and about 2-1/2 ft in diameter inside the trap. The ring was placed in the bottom of the trap and served to keep the mice that were used as bait in the center of the trap where they were more visible to the owls. Also, the bottom of the trap was lined with a special plastic material that increased the noise level made by the mice. Leaves were also put in the bottom of the cage to enhance and incorporate a sound familiar to owls hunting in outdoor conditions. As mice moved around in the cage, the leaves and the Saran-wrap material increased the noise level making it easier for the owls to pinpoint the position of a mouse. It was observed, however, that even in good light conditions, an active mouse making an abundance of noise was needed to elicit a strike response from an owl (Knudsen 1981).

Typically, the goshawk trap was set out early in the evening and left all night. An owl was usually trapped by 1 or 2 a.m. The trap was checked periodically throughout the night by looking for the blinking light. Trapped owls were removed, placed in a ventilated cardboard box and later released about 200 miles from the site. Trap success diminished with time. During the first several months of operating the goshawk trap, an owl was captured each time the trap was set. During the last few months, the owls would sit and watch the mice in the trap without striking. Even if the trap was left all night in a remote area of the building, the owls would not strike. The owls were obviously trap-shy. The trap was 100% successful in trapping an owl when a strike was attempted. There were no escapes.

Two specific locations in the building yielded the best results with the goshawk trap. These areas had little human activity and were usually dark. One area was in a corner of the building where several owls roosted. The other location was also near a flyway used by the owls when entering or exiting the building. Both locations had owl activity every night so the traps were continually visible to the owls. Several different areas were tested to determine if the owls could be caught anywhere in the building or only in selected locations. No owls were trapped in any other area. It's not clear why no owls were trapped at these other locations. Perhaps the close proximity of the building wall, parts bins, and equipment caused the owls to avoid the traps. Most successful trap sites had 10 to 15 ft of open space on at least three sides of the trap. This suggests that the auditory and visual cues needed to stimulate an owl's reaction are blocked unless there is sufficient open space around the trap.

The goshawk trap was practical and economical. It was effective in the first several months of use, but its effectiveness declined later in the study. As was the case with the bal-chatri trap, the owls appeared to avoid the goshawk trap the longer it was used.

## Nest Boxes

Nest boxes were originally intended for installation at locations outside the building in an attempt to lure the owls to nest in the boxes rather than in the building. The plan was to mount them on the fence that surrounded the building. While implementing this phase of the program it was determined that the chain link fence may be too close to the ground for suitable nest sites. An alternate test was conducted when it was discovered that the nest boxes made an excellent trap.

Six nest boxes were placed in strategic locations in the building and two boxes were placed on the top of the roof. Five of the boxes inside the building were installed as close as possible to known nesting areas. The sixth nest box was installed in a flyway zone. The two boxes installed on the roof were located over the two doors that the owls used most frequently to enter and exit the building. The boxes were modified by installing a sliding door on the front side that could be manually closed by someone located approximately 100 ft away. With this modification an owl could be trapped when it was in the box. The boxes were installed about 20 ft above the floor so they were safe from disturbance. The nest boxes were installed in January so that the owls could adapt to them before the nesting season began. The owls nested in three of the eight nest boxes and used two others as roosting sites. The other three boxes were not used.

Unfortunately none of the owls were ever trapped in the nest boxes. Within 10 days after the first visible evidence of an owl using a nest box they began to lay eggs. All trapping activity was stopped during the nesting period.

Several owls were raised in two of the existing nests that were located in the ceiling. In one of those nests four owls survived and fledged the nest. There was a second nest that had young owls but was inaccessible. It is not known how many owls were in that nest. Acceptance of the nest boxes by the owls was encouraging even though none were trapped. There was no question that the owls could have been trapped in the nest boxes, if their unusually early nesting cycle had been known prior to installation of the boxes. Timing in this instance would be required so the owls could be trapped before they laid eggs. The nest boxes are practical, economical, and have potential effectiveness. The nest boxes were made out of 1/4-in plywood (U.C. Davis Raptor Center Plans).

## Nets

The large doors that the owls used to enter and depart the building provided excellent netting sites. The netting operation required that all doors be shut early in the day and kept closed except to allow delivery vehicles in and out of the building. One hour before sunset a net was hung over the door opening on the inside of the building while the door was shut. Since the doors are about 20 ft high, it was necessary to install a pulley system with ropes at the top of the door. After this net was secured around all of the sides and at the bottom, a second net was also hung from the top of the door by the same pulleys. The bottom of the second net was pulled up to the ceiling by another pulley which was attached to the ceiling. This pulley was located about 20 ft away from the door so that the second net was stretched out and hung from the ceiling. Several small sand bags were attached to the bottom of the net that hung from the ceiling. After dark, the door was opened and the nets were positioned. As an owl approached the door the second net was dropped, trapping the owl between it and the first net.

The net over the door opening was difficult for the owls to see because the net material was black in color. When the owls attempted to leave the building they flew into the net over the door. Just before an owl hit the stationary net, the drop net was released.

Several modifications to the netting system were tested. When the owls left the building, most of them flew out at a point that was located in the middle of the door opening and approximately 2 ft below the top of the door, or 18 ft from the floor. A black piece of plastic was secured over the door opening from the top of the door down to about 10 ft above the floor. This forced the owls to fly about 8 ft above the floor. When the owls were trapped, it was much easier to get them out of the nets since they were close to the floor. To accustomize the owls to fly below the plastic, it was installed a week before trapping.

The owls developed a cautious behavior as they became aware that there was an obstruction at the door. They also became suspicious of our presence in the building. Towards the end of the study the owls would sit on a metal beam over the door, look at the net and if there was any gap at the top of the net, the owls would jump down on the net, spread the opening and slip out. It was very important to keep the net secured to the top of the door frame as much as possible. It was surprising how well the owls adapted to the conditions and took advantage of any situation that allowed them to get out of the building.

Occasionally an owl would fly into the net and bounce out before becoming trapped. The owl normally made several additional attempts to get out of the building before it was trapped. Most owls were trapped after two attempts, but there were two owls that continued to escape. These two owls learned to get out of the building through small gaps in the net. During the last few weeks of the netting program, the two owls that remained in the building made no attempt to fly out if the net was in place. They sat and looked at the net or flew along side of it.

Although very effective, drop nets were not as efficient to use compared to other trap methods because it took two people for the operation. Various sizes of mist netting was also used but the owls never became entangled in any type of net.

EXCLUSION

Several methods to keep owls from entering the building were tested during the early stages of the study. After a couple of trials it was evident that it was not going to solve the problem.

The first method consisted of securing a large sheet of black plastic over the door opening and leaving about an 8-ft opening between the bottom of the plastic and the floor. This opening allowed delivery vehicles access to enter and leave the building. The plastic was installed in the evening after the owls left the building. When the owls returned, they would fly up to the plastic and then fly away after they discovered that they could not enter the building. After several attempts the owls realized that they could fly underneath the plastic to enter the building. The obvious solution was to cover the entire door opening with plastic, but this created problems for the delivery vehicles to get in and out of the building and also the wind would eventually tear the plastic from its tie-downs.

The second exclusion method included hanging the black polypropylene netting over the door. The netting would withstand the wind, but again it would not allow delivery vehicles easy access because it would continually get caught on parts of the vehicles as they drove through the net. If the net was shortened to allow the delivery vehicles access, the owls would fly underneath. Sealing off the ceiling nest sites was also attempted but proved to be impractical and very costly.

SOUND DETERRENTS

Biosonic sound is a term that refers to the recorded distress or alarm calls of individual bird species. The call, which is amplified and played back through a loudspeaker, is normally species-specific. Birds that hear their own recorded alarm call may respond by departing the area. In some cases the message may be understood by other species that associate with the original species, but usually the reactions of other species of birds are weak or absent. It is obvious from field work that some bird species do not respond well to recorded alarm or distress calls but rely more upon visual or auditory cues. Some of the most successful examples of the effective use of alarm and distress calls have been with starlings. Recorded alarm calls of the barn owls had no deterring effect when played back over portable sound-testing equipment.

ABSTRACT SOUNDS

Abstract or acoustical sounds are artificially produced. Sound generators produce a multitude of electronically synthesized sounds from screeches to warbles to the sound of a shotgun blast. These sounds frighten birds, or for an undefined reason elicit a flight response. Most species can be repelled initially by some form of acoustical sound.

Even the most sensitive species will adapt and become nonresponsive to any sound if the sound generator is left unattended. The key to overcoming adaptation is to add a visual stimulus and to integrate several sound types. The visual stimulus is accomplished by using a sound generator that moves as the sound is emitted. Integrating several sound types requires the use of more than one type of sound generator. Successful use of sound requires two or more sound systems which will not only produce unusual sound but also that exploit the visual cues of the birds at the same time (Larkin 1976). A complex system of abstract sound patterns integrating three and four sound types at the same time was tested on owls. The sound systems were tested from stationary mounts and in a portable backpack module. It was determined that a person walking near a perched owl had a greater effect on owls than abstract sound. The use of these sound devices was ineffective.

HIGH INTENSITY SOUND

High-intensity sound probably would produce pain or distress to some degree in owls and they may consequently avoid an area. Sound produced from air raid sirens or other similar devices have been used against birds. However, results are not well documented. Sounds at an intensity of 100 decibels may cause some birds to depart an area; but at the level or for use against owls it would also be hazardous to personnel.

Producing sound levels in the range of 100 db or higher could be done near the source of the sound-generating unit. The farther away the birds were from the source the lower the decibel range.

Consequently the effect of repelling birds over any distance is very unlikely. Ultra-high-frequency sound was tested over a period of 1 year. After 4 to 6 weeks, owls were observed perching on the generating units.

## CONCLUSION

Live-trapping barn owls as described above was the most effective technique for removing barn owls from the structures. These trapping techniques have been tested on many occasions since this initial work was completed. Trap-shy behavior develops quickly and it has generally been necessary to utilize all three trap methods to trap out four or more barn owls in any one structure.

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