

A comparative study of the efficacy of red and green lasers as avian deterrents

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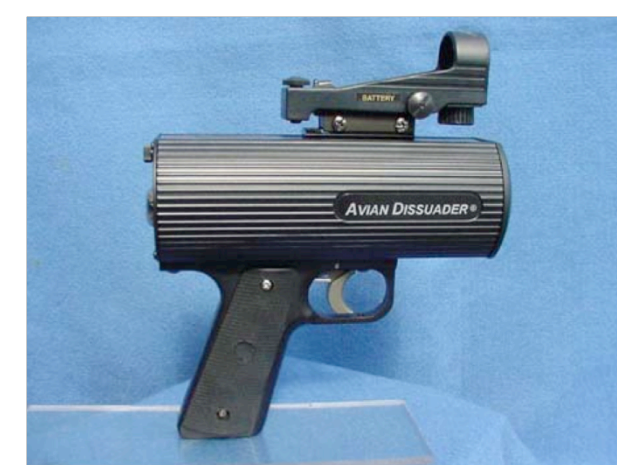
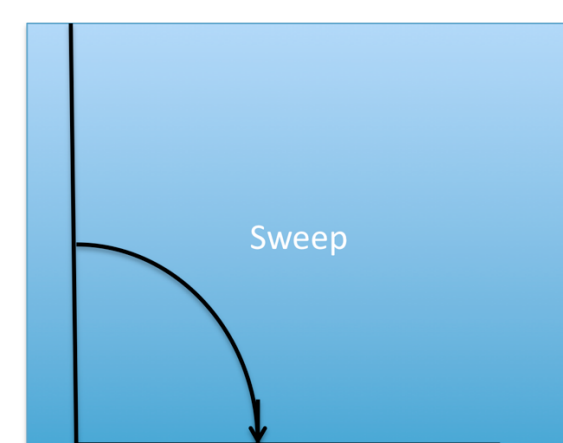
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ABSTRACT Mining and manufacturing operations produce wastewater ponds that can be hazardous or lethal to birds that land on or drink the water. Birds can also present hazards to human health and safety: coliform contamination of swimming or drinking water, droppings in parks, and aviation safety. Various deterrent technologies are available and potentially useful, alone or in combination. One technology is laser deterrents; red and green lasers have been demonstrated to disperse some species of birds from water surfaces. To determine which wavelength was more suitable in our environment we compared the efficacy of red and green lasers at dispersing waterfowl from small freshwater ponds in northern Alberta, Canada. The green laser ($\lambda = 532$ nm) was effective at dispersing sandhill cranes (*Grus canadensis*) and Canada geese (*Branta canadensis*), but not ducks. The red laser ($\lambda = 650$ nm) was less effective than green at dispersing the larger birds and ineffective at dispersing ducks. Although they did not disperse from the ponds, some species of ducks moved to shelter in emergent vegetation along the shore in response to the lasers. Other ducks, including lesser scaup (*Aythya affinis*), appeared to ignore the laser beams and continued feeding. Although the spectral sensitivities of the retinal cones of the species we tested are not available, retinal cones of other waterfowl species contain visual pigments that are sensitive to the wavelengths of the lasers we used. Although lasers are effective only with some species when the birds were sitting on the water, they can be used to augment other deterrent technologies. Radar activation of deterrents as the birds approach a pond, as opposed to continuous activation, is recommended to minimize habituation. We propose that the most effective bird deterrent system will be radar-activated and include acoustic, visual, and optical (laser) deterrent methods.

METHODS

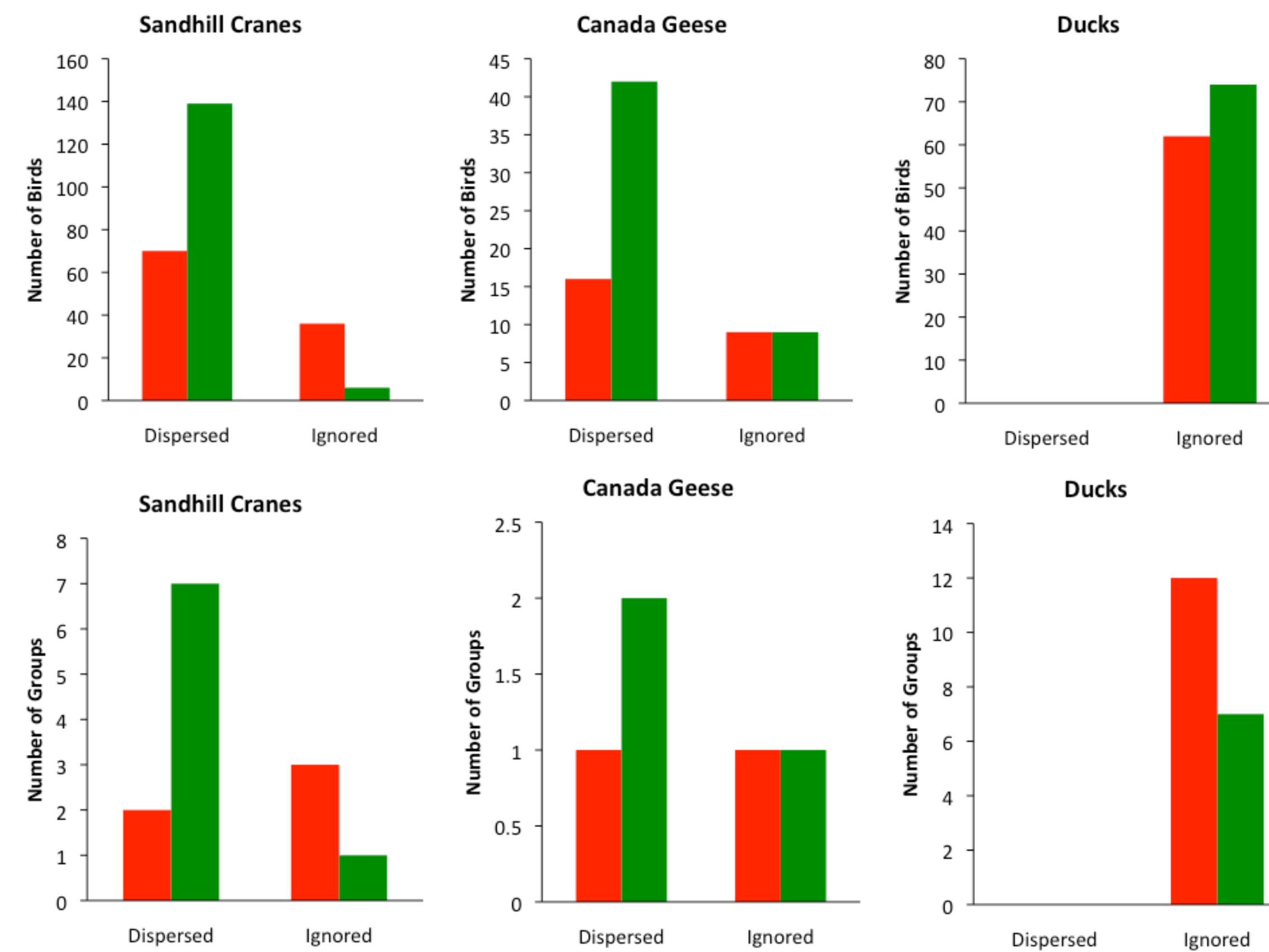
Nine ponds were monitored 16 August – 21 October 2011. Each pond was visited 4-5 times per night at 1-2 hour intervals from approximately 1 hour after sunset until before dawn. After counting and identifying the waterfowl on the pond, the beam of a red or green laser (selected before hand) was swept horizontally across the pond 1 m above the water. The reactions of the birds (if any) were recorded. If birds remained on the pond, the process was repeated 1 minute later.

Two hand-held Avian Dissuader units were used for the study. One produced a red beam (Feather-Light model BDL 650) with a peak wavelength of 650 nm and power of 50 mW. The second laser produced a green beam (Feather-Light model BDL 532) with a peak wavelength of 532 nm and power of 30 mW.



RESULTS

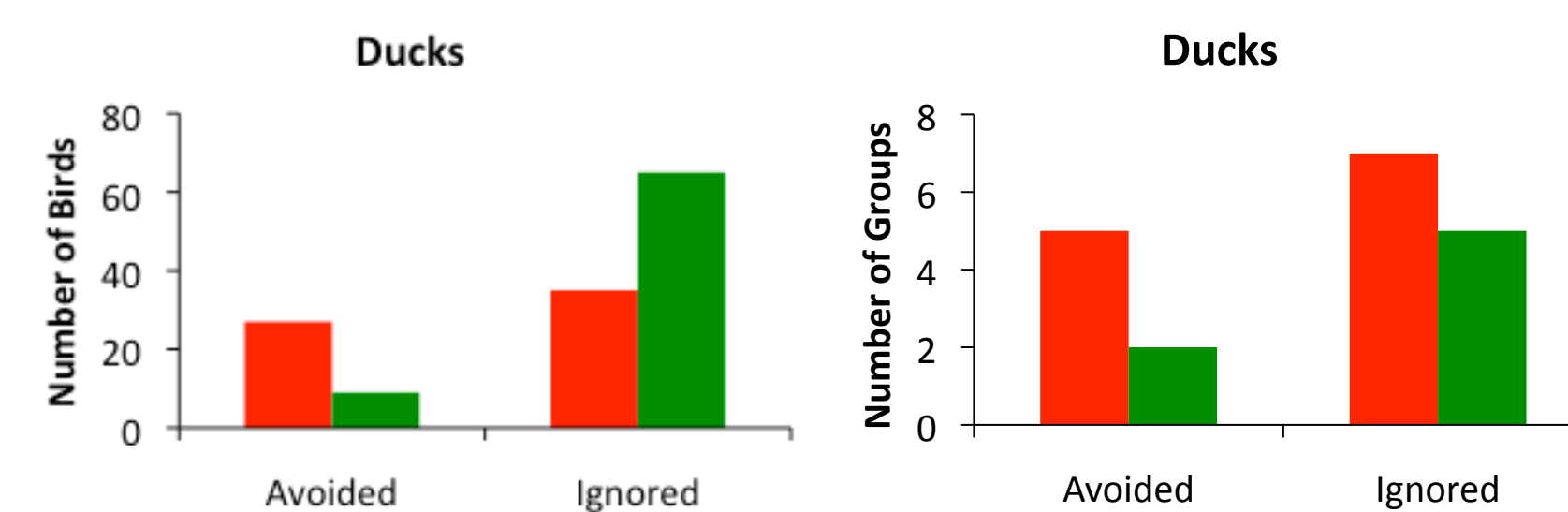
Waterfowl that responded to the moving laser beams did so by flying away (sandhill cranes [*Grus canadensis*] and Canada geese [*Branta canadensis*]) or escaping into emergent vegetation (ducks). Birds that did not respond to the moving laser beams are said to ignore them.



Sandhill Cranes almost always dispersed in response to the green laser but only about half the time to the red laser.

Canada Geese dispersed more often in response to the green laser than the red and larger flocks dispersed in response to both colors.

Ducks did not disperse to either laser but some ducks moved closer together to form a denser flock, dove under the water, and swam or flew into emergent vegetation along the opposite shore in response to the laser. Lesser scaup (*Aythya affinis*) appeared to ignore the laser and continued foraging.



DISCUSSION

	Sandhill crane		Canada goose		Duck	
	Dispersed	Avoided	Dispersed	Avoided	Dispersed	Avoided
Red laser						
Groups	2/5	0/5	1/2	0/2	0/12	5/12
Individuals	70/106	0/106	16/25	0/25	0/62	27/62
Green laser						
Groups	7/8	0/8	2/3	0/3	0/7	2/7
Individuals	139/145	0/145	42/51	0/51	0/74	9/74

We observed some taxonomically-specific differences in response to the laser deterrents: sandhill cranes almost always dispersed, Canada geese sometimes dispersed, and ducks never dispersed but instead sometimes exhibited escape behaviors.

Neither laser was totally effective against all the waterfowl we tested. Overall, the green laser was more effective at dispersing the target species than the red laser. The green laser dispersed more of individuals (67%, 181 of 270 total) and groups (50%, 9 of 18 total) against which it was tested than the red laser (individuals: 45%, 86 of 193 total; groups: 16%, 3 of 19 total). Birds that dispersed seemed to do so more quickly and with more vocalizations when exposed to the green laser. With one exception, the green laser dispersed all the individuals of a group when any of the individuals responded. The red laser dispersed all of the individuals in one case and only some of the individuals in the other two cases.

Ducks responded to the lasers with what could be interpreted as anti-predator behaviors: they moved closer together, dove under the water, and flew or swam into the emergent vegetation. They exhibited these behaviors more often to the red laser (individuals: 44%, 27 of 62 birds; groups: 42%, 5 of 12 groups) than the green (individuals: 12%, 9 of 72 birds; groups: 29%, 2 of 7 groups). We speculate that if the ducks that escaped into the pond vegetation had been flying when exposed to the lasers they might have dispersed.

The red laser showed limited effectiveness against ducks (none dispersed but some exhibited avoidance), geese (partly dispersing one group of 22 birds), and sandhill cranes (dispersing groups of 25 and 45 birds).

The green laser was almost totally effective in dispersing sandhill cranes (dispersing 7 of 8 groups) and partly effective against Canada geese (dispersing 2 of 3 groups). Except for one case, when any of the birds of either species left the pond, the entire group left. The exception was a group of 3 Canada geese that remained from a flock of 30. On two nights ducks swam towards, then flew into the emergent vegetation on the opposite side of the pond when the green laser beam swept past them. In no case did the green laser disperse ducks from the ponds.

CONCLUSIONS

Waterfowl responded to both types of laser but there was intraspecific and interspecific variation in whether and how individual birds responded. Larger birds (e.g., cranes and geese) and larger flocks were more likely to respond by flying away. If they responded, ducks moved into the pond vegetation.

The green laser appeared to be slightly more effective than the red laser at dispersing the larger birds but more ducks responded to the red laser than the green, although they did not disperse.