

Doctoral thesis

For the degree of Doctor of Philosophy

**Predation and Shorebirds:
Predation Management, Habitat Effects,
and Public Opinions**

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AKADEMISK AVHANDLING

för avläggande av filosofie doktorsexamen i ekologisk zoologi, som enligt naturvetenskapliga fakultetens beslut, kommer att offentligen försvaras fredagen den 30 januari 2009, kl. 10.00 i föreläsningssalen, Zoologiska institutionen, Medicinaregatan 18, 413 90 Göteborg.



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Abstract Many shorebird populations are rapidly declining and a high nest predation rate is one of the threats facing these populations. Thus, factors that affect predation and how to manage it in an effective way are receiving increased attention. This thesis deals with nest predation in two ground-nesting shorebirds (waders): the Northern lapwing *Vanellus vanellus*, and the redshank *Tringa totanus* nesting in coastal pastures. I study how habitat structures affect nest predation and distribution. I also test the effectiveness of two non-lethal methods for managing predation, and survey public attitudes towards predator control and animal conservation.

Predators that hunt by sight often search for prey from elevated perches, such as trees, stone walls and fences. Theory suggests that prey visibility depends strongly on predator perch height and distance. I estimated how prey (a mounted bird) visibility depends on predator perch height, distance and vegetation height in coastal pastures. Visibility increases strongly with observer perch height and proximity. For example, from the lowest perch (0.2 m), visibility of the target bird declines to < 5% beyond 20 m distance, but 40% of it remains visible from the highest perch (8 m), even as far as 120 m. The strong increase of prey visibility with predator search height suggests that the removal of predator perches can improve the survival of endangered prey populations in open habitats.

Predators such as the hooded crow *Corvus cornix* use raised structures for perching and to elude lapwing attacks. I find that crows spent more time at or near raised structures than expected and that wader nests were placed farther away from these structures than expected in two out of three years. Waders thus tend to avoid breeding close to raised structures, which therefore reduces the suitable breeding area and probably also the local wader population size.

Habitat management is just one technique for reducing nest predation, and apart from lethal predator control, there are several non-lethal methods. I tested the effect of nest enclosures to protect individual wader nests from predation. Protected nests had a higher hatching success than unprotected nests. Protected redshanks suffered increased predation on incubating adults, which often sit on the nest until a predator is close by. These results emphasize the need for caution in the use of nest enclosures, particularly in redshanks and other species with similar incubation behaviours. Enclosures can, however, be a useful management tool in shorebirds that leave their nests early, when an approaching predator is still far away. I also tested predator avoidance of wader eggs by placing mimic eggs injected with an illness-producing substance in artificial nests. Compared to control areas, the daily survival rate was higher for wader nests during the first three weeks in areas with aversive eggs, but there was no difference for the nesting season as a whole. Egg predation by foxes and other nocturnal mammals may have masked a greater aversion effect in avian predators. I suggest that the dose of the illness-producing substance should be increased and the aversion-learning period prolonged in future tests of this potentially useful technique.

Predation management sometimes includes lethal predator control, which can be controversial, and knowledge of public attitudes is essential for successful conservation measures. Using a mail survey sent to a representative sample of the Swedish public (1 751 replies) I found that there is support for protecting threatened animals. Although the support for a general control of animals was low, a majority supported several specific reasons for control, including control of animals that pose a risk to threatened species or to traffic. The support for control varied depending on species, being the lowest for raptors and the highest for mice and rats. A majority did not support the use of more costly non-lethal control in place of lethal methods, but urban residents and animal rights supporters were more positive than the others.

I conclude that available perches can have significant effects on prey detection and distribution of wader nests. It is possible to reduce nest predation in some shorebird species using non-lethal techniques such as nest enclosures. When using lethal predator control, I suggest that information about the reasons for control as well as the species involved is highly important, especially as in regard lethal control in urban regions.

Keywords: Conservation, waders, predation, coastal pastures, redshank, lapwing, attitudes, human dimensions.

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