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Predation by Ermine and Long-tailed Weasels on Duck Eggs[1]

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Ermine (*Mustela erminea*) and long-tailed weasel (*M. frenata*) predation on duck eggs was studied at Union Slough National Wildlife Refuge, Kossuth County, Iowa, 1984-85. Captive individuals of both species ate 2-4 duck eggs at a rate of 0.5-2 eggs per trial day. All eggs were moved but some were not opened. One hole, ringed with small fragments and "bite-outs", was made in all eggs opened by captive weasels. In the field, the appearance of opened eggs, the pattern of egg loss and the amount of nest bowl disturbance were used to determine the number of nests depredated by weasels. Egg loss at nests depredated by weasels generally occurred over several days; nest bowl disturbance was minimal and most hens did not abandon their nests until over half their eggs were taken. Of 263 upland duck nests that failed due to predation, 38 had eggs taken by weasels and 27 of the 38 failed solely because of weasels. Weasels also took eggs from at least 5 of 20 nests that lost 1-7 eggs before ≥1 remaining egg hatched. Because 12 of 13 weasels captured were ermine, most depredation of nests by weasels during the study probably was by ermine.

INDEX DESCRIPTORS: Duck eggs, ermine, Iowa, *Mustela frenata, M. erminea,* nesting, nest predation, weasel.

Duck production in the midcontinental prairie pothole region is severely limited by predator-caused nest failure (Cowardin and Johnson 1979). Many investigators attempt to identify predator species responsible for duck nest failures by examining destroyed eggs (Rearden 1951, Oetting and Dixon 1975, Higgins 1977, Livezey 1981). Although long-tailed weasels have been occasionally implicated in duck nest failure (Hansen 1947, Glover 1956, Keith 1961:63, Teer 1964), predation by the smaller ermine (Hall 1951) has not been reported. Few data are available that describe predation by weasels on duck nests or the appearance of duck eggs eaten by weasels. This paper documents ermine predation on duck eggs, describes characteristics of ermine and long-tailed weasel predation on duck eggs and reports on the losses of duck nests due to weasels at one area in northern Iowa.

STUDY AREA AND METHODS

Observations of predation by weasels on duck eggs were made during a duck nesting study at Union Slough National Wildlife Refuge in north-central Iowa, 1984-85. Refuge physiography, vegetation and land use are described by Burgess et al. (1965).

Presence and relative abundance of ermine and long-tailed weasels were determined by March-August field observations and July live-trapping. A sighting index value was calculated each year by dividing the total number of places (150 m diameter) where ≥1 weasel was seen by the total number of hours investigators were in the field. Repeated sightings at the same place, on the same day, by the same person, were not included. Weasels sighted could not be identified to species so trapping was used to determine the relative abundance of each species. Tomahawk cage traps (15 × 15 × 61 cm, 2.5 × 2.5 cm mesh), baited with sardines and cat food, were used in 1984 and Tomahawk cage traps (13 × 13 × 45 cm, 1.3 × 1.3 cm mesh), baited with fried bacon, were used in 1985. Captured weasels were identified according to Hall (1951). Relative abundance of other potential duck egg predators are described by Fleskes (1986).

Feeding trials were used to determine characteristics of weasel predation on duck eggs. Two adult ermine and 1 adult long-tailed weasel captured in July 1985 were immediately placed in individual 2 × 2 × 3 m cages (wooden except for 1 side of 1.3 × 1.3 cm mesh wire) containing a watering dish, vegetation for bedding and 2 duck eggs. Addled mallard (*Anas platyrhynchos*), addled blue-winged teal (*A. discors*) and fresh wood duck (*Aix sponsa*) eggs were used during 1-8-day trials (Table 1). Activities of the weasels were monitored for 1-60 minutes every 1-10 hours by sitting quietly off to one side of the wire mesh. Each egg eaten by the long-tailed weasel and 1 ermine were replaced with ≥1 fresh wood duck egg so that 1-4 unopened eggs were present throughout their trials. Eggshells were not removed until feeding ceased, except in 1 instance where feeding was stopped to record egg appearance (a, Fig. 1) before the hole was completely enlarged.

Duck nests were found by flushing hens, eggs were candled to determine their development stage (Weller 1956), and nests were checked every 3-10 days until their fate was known. Weasels were judged to have preyed upon a nest if opened eggs found at the nest were like eggs opened by captive weasels. If no eggshells were found, depredation was also attributed to weasels if, like at nests depredated by weasels where eggshells were found, eggs were lost repeatedly with little nest bowl disturbance.

Table 1. Summary of feeding trials used to determine characteristics of ermine (*Mustela erminea*) and long-tailed weasel (*M. frenata*) predation on duck eggs.

Weasel ID	Times (hrs. since trial start) monitoring started[1] and opened eggs first noted (underlined)	Type and number of eggs in cage	Type and number of eggs eaten
Ermine A	1, $\underline{4}$, 6, $\underline{9}$, 16, 24	2 mallard[2]	2 mallard[2]
Ermine B	1, $\underline{2}$, 12, $\underline{18}$, $\underline{28}$ 38, 48, 58, 60	2 teal[2] 4 wood duck[3]	2 teal[2] 1 wood duck[3]
Long-tailed weasel	1, $\underline{10}$, 20, $\underline{30}$, 40, 50, 60, $\underline{66}$, 76, 86, 96, 106, 116, 126, 136, 146, $\underline{156}$, 160, 170, 180, 188, 192	7 wood duck[3]	4 wood duck[3]

[1]Monitoring lasted 1-60 minutes.
[2]Addled eggs.
[3]Fresh eggs.

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RESULTS

Weasel abundance

Sighting index values for weasels in 1984 (0.006, 1029 investigator hours) and 1985 (0.005, 885 investigator hours) did not differ ($X^2 = 0.16$, 1 df). No weasels were captured during 470 trap-nights in 1984 but 12 ermine and 1 long-tailed weasel were captured during 242 trap-nights in 1985.

Feeding trials

Captive weasels ate 2-4 duck eggs at mean rates of 0.5-2 eggs per trial day (Table 1). The rate generally decreased with trial time even though weasels rolled eggs around and attempted to open them throughout their trials. However, the effect of time may have been confounded by the effect of egg size because only wood duck eggs were present during the later hours of the 2 longest trials. Weasels attempted to open all eggs, but they failed to open 6 of 11 wood duck eggs (Table 1).

The method used by each weasel to open eggs was similar to that described for Franklin's ground squirrels (*Spermophilus franklinii*) (Sowls 1948). Although the shape and size of the hole weasels made in eggs varied, all were ringed with numerous small shell fragments and "bite-outs" (Fig. 1). The hole in each fresh egg was enlarged until about 30 mm in diameter, and contents were eaten as they flowed out of the tipped egg. Some yolk (2-10%) remained in 4 of 5 eggshells from fresh eggs. Addled eggs were chewed further until a third or less of each remained intact. Weasels seemed to consume eggshell only from addled eggs. Feeding was completed 15-25 minutes after fresh eggs were first pierced but eggshells from addled eggs were chewed upon intermittently for 2-9 hours. Paired canine marks were found on 1 eggshell and were spaced 4 mm apart.

Nesting study

Fates of 392 upland duck nests (228 blue-winged teal, 154 mallard, and 10 of other species) were determined; 67% failed because of predation, 8% failed because of other causes, 20% hatched with no egg loss, and 5% lost 1-7 eggs before ≥ 1 of the remaining eggs hatched. Of 263 nests that failed due to predation, 38 had eggs taken by weasels; 27 failed solely because of weasels and 11 that failed because of another predator had eggs eaten by weasels earlier.

Evidence at nests preyed upon by weasels reflected traits observed during feeding trials (Table 2). Weasels were seen near 9 nests that they preyed upon; eggshells were found at 6 of these. Most (24/27) hens whose nests failed solely because of predation by weasels continued incubation or laying until most of their eggs were outside the nest bowl either opened, intact or in an unknown condition (Table 3). A similar pattern of repeated egg loss was observed at 5 of the 13 nests that lost ≥ 2 eggs before ≥ 1 of the remaining eggs hatched. Repeated egg loss at other nests may have been missed because nests were not checked daily. When found, eggshells and displaced intact eggs were often in narrow trails under dense vegetation, sometimes in groups of 2-4.

The daily probability (DP) of a nest being depredated at least once by weasels did not differ ($z = 1.58$, $P = 0.11$) for mallards ($DP = 0.0053$) and teal ($DP = 0.0091$). Likewise, the DP of any duck nest having an egg taken by weasels for the first time during laying ($DP = 0.0057$) and incubation ($DP = 0.0055$) was not different ($z = 0.10$, $P = 0.92$).

Table 2. Feeding traits of weasels (*Mustela erminea* and *M. frenata*) on duck eggs observed during feeding trials, and evidence found at nests depredated by weasels reflecting each trait. Percent of nests where evidence was found at least once, before any were destroyed by another predator, in parentheses.

Feeding trial trait	Corresponding evidence at nests
1. Biting used to enlarge single hole in eggshell.	1. Eggshells have 1 hole with fragmented edges ([1]100%) and paired canine marks ([1]17%).
2. Egg contents eaten by tipping egg.	2. Some yolk left in ≥ 1 eggshell ([1]42%).
3. Whole eggs moved.	3. ≥ 1 egg out of nest ([2]19%). 3. ≥ 1 egg missing ([2]84%).
4. 0.5-2 eggs eaten per day.	4. Some eggs untouched ([2]100%). 4. Repeated egg loss ([2]95%). 4. No nest disturbance ([2]100%). 4. Nest remains viable ([3]89%).

[1]Based on 24 nests where eggshells were found.
[2]Based on all 38 nests depredated by weasels.
[3]Based on 27 nests that failed solely due to weasels.

Table 3. Status of eggs, when egg loss was first detected, from 27 duck nests that failed solely because of weasel (*Mustela erminea* or *M. frenata*) depredation, and from 24 of the nests when they were abandoned by the hen after remaining active for an additional 4-18 days.

	Percent of all eggs known to have been present				
Nest Status	Opened	Missing	Intact out of nest bowl	Intact in nest bowl	Total
Loss 1st detected	12	30	4	54	100
Abandoned by hen	20	51	6	23	100

DISCUSSION

Both long-tailed weasels and ermine prey upon duck eggs. Predation during feeding trials began almost immediately; thus, both species seemed familiar with duck eggs. Because 12 of 13 weasels captured were ermine, most weasel depredation of nests found during this study probably was by ermine.

Predation by ermine may have been previously underestimated. Hansen (1947), Glover (1956) and Teer (1964) reported that 12.0%, 4.0% and 11.1%, respectively, of predator-caused duck nest failures on their study areas were due to long-tailed weasels. However, none of them used extensive trapping to determine if ermine populations were present.

Predation by weasels may be a common cause of nest failure on an area even when weasels are rarely seen or captured. Keith (1961) observed only 1 weasel during the 5 years of his study of duck nesting yet reported loss of several nesting hens and nests to weasels. Cairns (1985) attributed greatly reduced breeding success of black guillemots (*Cepphus grylle*), a species with mallard-sized eggs (Harrison 1984), to ermine, but sighted ermine on only half of the islands where reduced breeding success occurred. I failed to capture any weasels in July 1984 even though 13 (all ermine) were captured on the same area 2 weeks later by R. Lampe using different bait and different size traps (unpubl. rep., Buena Vista College, Storm Lake, Iowa, 1984).

Although previous descriptions of weasel predation on eggs from duck (Hansen 1947, Teer 1964) and other ground-nesting bird nests (Stoddard 1931, Middleton 1935, Darrow 1938, Cairns 1985) have usually not been extensive, most characteristics reported by each researcher are similar to those I observed. However, Teer (1964)

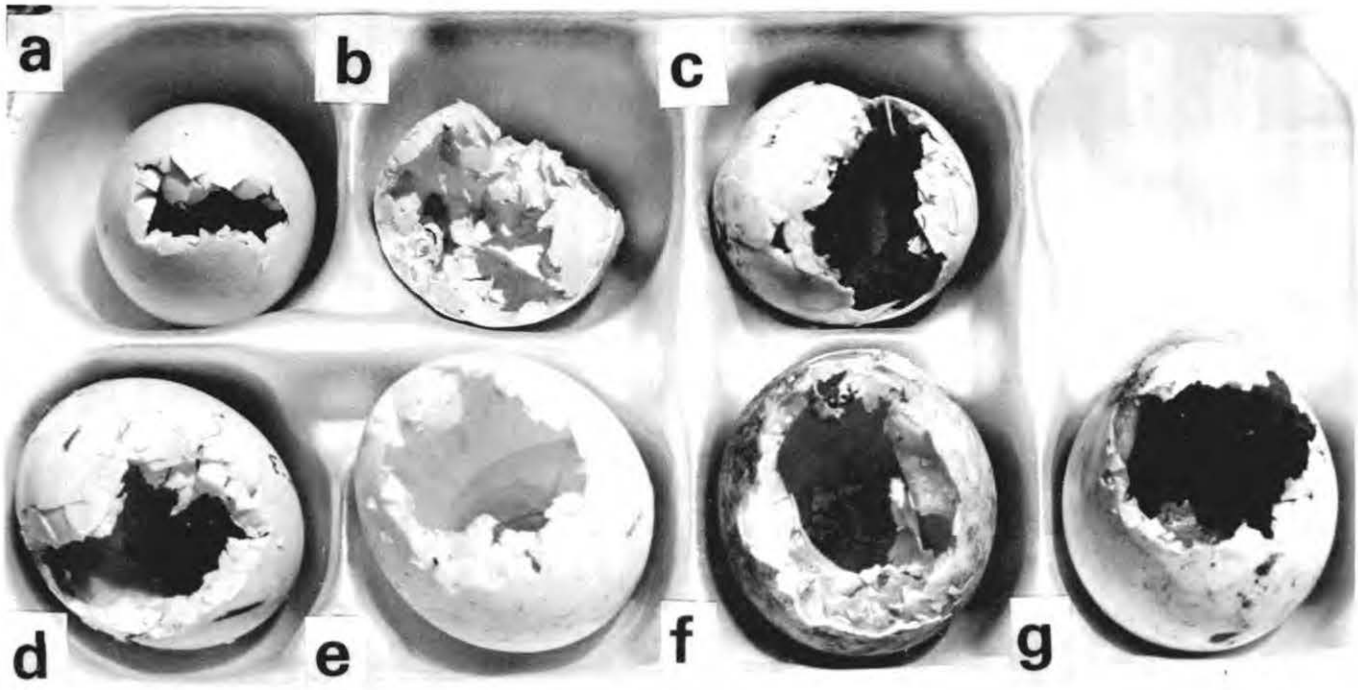

Fig. 1. Eggshells of duck eggs eaten by a captive ermine (*Mustela erminea*) (a,b,d) and a captive long-tailed weasel (*M. frenata*) (c,e,f,g). Note the fragmented hole edges. Eggshells "a" and "b" are from addled eggs, all others are from fresh eggs. Eggshell "a" was collected while the weasel was still enlarging the hole, all others were collected after feeding was completed. Two other eggshells from addled eggs were chewed further by an ermine until only fragments remained (not shown).

reported that paired tooth punctures on eggshells were characteristic of long-tailed weasels and that predation by weasels could be distinguished from predation by Franklin's ground squirrels. Hansen (1947) reported that measuring the distance between tooth punctures on eggshells was rarely a reliable identifier of the predator species. I rarely found paired tooth punctures.

Although predation by weasels usually can be differentiated from predation by most other species by examining patterns of egg loss and evidence at pillaged nests, the description of predation on nests by Franklin's ground squirrels (Sowls 1948) is nearly identical to that by weasels which I observed. The tendency of weasels (Stoddard 1931, Middleton 1935, Darrow 1938, Anonymous 1966) and Franklin's ground squirrels (Sowls 1948) to carry eggs away from the nest and of hens to remove eggshells from the vicinity of their nests (Sowls 1955:103-108) further complicates efforts to identify predation by these nest predators. Where weasels and Franklin's ground squirrels both occur, methods other than examining patterns of egg loss and evidence at pillaged nests may be needed to estimate the importance of each as nest predators.

Teer (1964) theorized that, because weasels are primarily carnivorous, incubated eggs would more likely be taken than newly laid eggs. I found no such difference. Incubating hens may attract weasels, but unlike some researchers (Middleton 1935, Darrow 1938, Keith 1961, Cairns 1985), I found no evidence of weasels killing hens.

Large (mallard-sized) eggs may be more difficult to open and less attractive to weasels than small (teal-sized) eggs. Captive weasels failed to open some wood duck eggs, and there was some indication that the probability of a mallard nest being depredated by weasels was less than that for teal nests.

Efforts to increase duck nest success are affected by the makeup of the predator community (Greenwood 1986). Ermine and long-tailed weasels, when present, can be important nest predators. Their impact on nesting ducks should be assessed before a management practice aimed at increasing nesting success is selected.

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