

VARIABLES INFLUENCING PREDATION OF ARTIFICIAL DUCK NESTS IN NORTHWEST COASTAL CALIFORNIA

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Abstract: Nest predation can greatly affect reproductive success of waterfowl. We studied factors influencing duck-nest predation near Humboldt Bay in northern California by testing the prediction that measurements of nest concealment and nest location should differ between successful and depredated artificial nests. We ran *a priori* hypothesized logistic regression models to evaluate the effects of nest concealment and nest location variables on the fate of all nests, and, for depredated nests, on the type of egg loss. The best-fit model for nest fate included lateral cover and study site variables. Among depredated nests, the best-fit model for the type of egg loss (broken or removed) included vertical cover, study site, and broad habitat. Best-fit models for nest fate and type of egg loss did not include local vegetation, distance to trail, or distance to water. Our results suggest that nest concealment influenced both the likelihood of nest predation and the type of predator to which a nest is vulnerable. We recommend that managers work to maximize opportunities for nest concealment and researchers determine locally important predators in future study designs.

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Key words: artificial nest, concealment, Humboldt Bay, mallard, nest predation, waterfowl.

Nest predation can greatly affect nesting success of waterfowl and can be a limiting factor in recruitment (Greenwood et al. 1987, Martin 1987, Esler and Grand 1993, Butler and Rotella 1998). Risk of nest predation can also be a strong selection agent influencing population and community patterns, life history traits, and habitat use (Martin 1987). A variety of factors potentially influencing duck-nest predation have been studied previously, including habitat edge,

proximity to trails (Olson and Rohwer 1998), distance to water (Esler and Grand 1993), nest density and concealment (Sugden and Beyersbergen 1986, Guyn and Clark 1997), and frequency of human visitation to nests (Esler and Grand 1993, Olson and Rohwer 1998). Many of these studies were conducted in areas well known for duck productivity, such as the prairie pothole region (Hammond and Forward 1956, Sugden and Beyersbergen 1986, Mankin and Warner 1992, Sovada et al. 1995, Butler and Rotella 1998). Little is known about the variables influencing predation of waterfowl

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nests in coastal areas of the Pacific Northwest. We studied factors influencing duck-nest predation near Humboldt Bay in northern California.

We focused on 2 ecological variables hypothesized to affect the likelihood of nest predation: nest concealment and nest location. Specifically, we tested the prediction that measurements of these factors should differ between successful and depredated artificial nests. We examined nest concealment by measuring vertical and lateral cover, and examined the effects of nest location using the following variables: vegetation type surrounding the nest, distance to the nest from established trails, and distance from water.

Nest predation is often assessed using artificial nests, although their accuracy and realism in measuring natural depredation rates and influencing wildlife management practices have been questioned (Esler and Grand 1993, Major and Kendal 1996, Butler and Rotella 1998). There is often a difference in predation rates between artificial and real nests and, in some cases, a difference in ecological factors that affect them (see Faaborg 2004 and other papers in Conservation Biology. 2004. 18[2]). Several studies, however, have suggested that artificial nests can reveal the relevant ecological variables affecting nest predation, especially when predation rates of real and artificial nests are similar (Major and Kendal 1996, Butler and Rotella 1998, Villard and Part 2004). Moreover, artificial nests are easily manipulated and provide an efficient, practical method by which researchers can better control experimental parameters such as sample size and location (Martin 1987, Esler and Grand 1993, Major and Kendal 1996, Guyn and Clark 1997, Butler and Rotella 1998). Although our results should be considered with caution, little work has been conducted on duck nesting ecology in our study area. Our work illuminates factors potentially affecting duck-nest predation and can assist land managers with future management or planning options for waterfowl. We are careful to not conclude that results from this study necessarily match those using real nests, but reasonable inferences can be made about habitat factors affecting nest predation in our study area.

STUDY AREA

We conducted this study in 3 fresh and brackish water sites near Humboldt Bay in northern California (Fig. 1). The Arcata Marsh and Wildlife Sanctuary is a 62-ha preserve located on the north side of Humboldt Bay; it functions as a city park, wastewater treatment facility, and wildlife sanctuary (Harris 1996). The Arcata Marsh contains a variety of vegetation, 6 bodies of water, and several commonly used trails. McDaniel and Fay Sloughs are predominantly grasslands, with patches of thorny shrubs and willows (*Salix* spp.) interspersed with tidal sloughs and a few moderately used trails (U.S. Geological Survey 2000).

We simulated the nests of mallards (*Anas platyrhynchos*), which commonly breed in marshes, ponds, and sloughs around Humboldt Bay (Wheeler 1966, Harris 1996). Track-plate stations and surveys indicated the following duck-nest predators in the area: striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), domestic cat (*Felis catus*), American opossum (*Didelphis virginiana*), river otter (*Lontra canadensis*), common raven (*Corvus corax*), and American crow (*Corvus brachyrhynchos*) (Humboldt State University [HSU], Wildlife Department, unpublished data 2003).

METHODS

Sampling Scheme

Following a stratified random design, 86 artificial nests were distributed among 3 study sites (Fig. 1). Using a recent aerial photograph (U.S. Geological Survey 2000), the study sites were stratified by 3 broad habitats—levee, grassland, willow/marsh—corresponding to general nesting locations for ducks in the area (Wheeler 1966). Previous work indicated that >70% of all duck nests are positioned within 15 m of water (Wheeler 1966). Therefore, we constrained our random locations to within 15 m of a permanent waterway identifiable in the aerial photo, and nests were >50 m apart. This

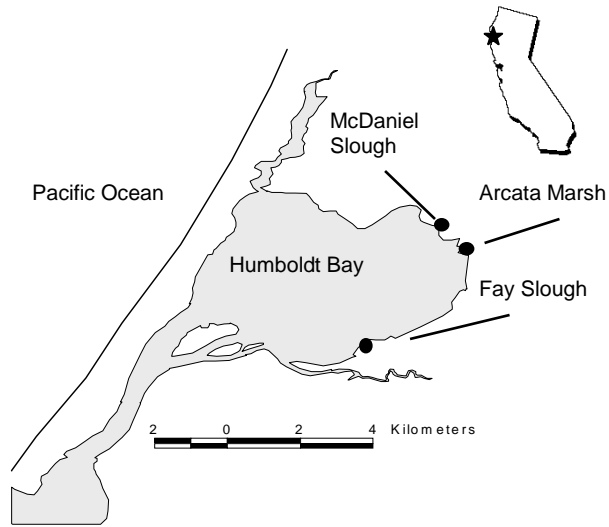


Fig. 1. Arrangement of study sites near Humboldt Bay, California, USA.

yielded inter-nest distances and nest densities that roughly matched that previously recorded for real nests in the only documented study of nesting ducks we could find for this location (Wheeler 1966). Random Universal Transverse Mercator (UTM) coordinates were generated using ArcView®. Nests were placed within 10 m of these coordinates in habitat patches ≥ 5 m in radius and comprising $\geq 50\%$ of 1 of the 3 local vegetation types (willow/cattail, grass, or thorny shrub). We distributed nests as evenly as possible among the local vegetation types, broad habitat categories, and study sites (Table 1). The Arcata Marsh, however, lacked open grassland within 15 m of water, and McDaniel and Fay Soughs lacked cattail/willow vegetation types along levees. Therefore, it was impossible to balance the experimental design, and some loss of statistical power to discern effects of vegetation type was unavoidable.

Nest Setup

Preliminary work suggested an unnaturally high predation rate unless care was taken to minimize visual and olfactory cues that predators use to locate nests. To reduce these cues, field workers wore plastic gloves in the field, washed the eggs in a nearby natural water source, and avoided trampling vegetation and

creating new trails (Major and Kendal 1996). To partially compensate for the absence of a hen, a handful of vegetation was placed over the nest as camouflage (Guyn and Clark 1997). All artificial nests were placed on the ground and vegetation was matted to simulate a mallard nest (Olson and Rohwer 1998). Each nest contained 6 brown chicken eggs arranged in a tight clump (Olson and Rohwer 1998). Tongue depressors placed in the center of the nest were labeled with the nest location and number to allow nest relocation in the case of egg loss. Although the tongue depressors could have elevated nest predation by making the nest more conspicuous, this factor should have had similar results among sites.

Data Collection Techniques

Following a practiced and standardized protocol, 18 pairs of field workers set up the nests; all data were collected in March 2003. Nests were checked 2, 7, and 21 d after initial placement (± 1 d). Nest checks were made at a distance of ≥ 8 m to avoid trampling vegetation. To minimize human disturbance at each nest site during setup, location and concealment variables were not recorded until the final check.

Proximity (m) to trail and water was measured with a measuring tape from the center of the nest to the closest edge of the nearest trail and water source. Vertical cover was assessed with a densiometer held approximately 0.5 m directly over the nest (Lemmon 1957). Two researchers made independent estimates at each nest and results were averaged for analysis. Lateral nest concealment was measured with a Robel pole (Robel *et al.* 1970) that was placed at the center of the nest and observed 4 m from each of the 4 cardinal directions. The highest 10-cm band that was $\geq 75\%$ obscured was recorded, and the 4 values for each nest were averaged for analysis. The fate of each nest at d 21 (i.e., depredated or undisturbed) and the type of egg loss (broken or removed) was recorded.

Statistical Analyses

We ran *a priori* hypothesized logistic regression models to evaluate the effects of nest

Table 1. Distribution of 86 artificial duck nests among 3 study sites, 3 broad habitats, and 3 local vegetation types near Humboldt Bay, California, USA, spring 2003.

Study Site	Broad habitats								
	Levee ($n = 35$) local vegetation types			Grassland ($n = 20$) local vegetation types			Willow Marsh ($n = 31$) local vegetation types		
	Grasses	Thorny shrub	Cattail/willow	Grasses	Thorny shrub	Cattail/willow	Grasses	Thorny shrub	Cattail/willow
Arcata Marsh ($n = 27$)	5	4	6	0	0	0	2	5	5
McDaniel Slough ($n = 29$)	6	4	0	7	1	2	3	3	3
Fay Slough ($n = 30$)	8	2	0	5	3	2	2	1	7

concealment and nest location variables on the fate of all nests and, for depredated nests, on the type of egg loss. We selected models based on Akaike's information criterion corrected for small sample sizes (AIC_c ; Burnham and Anderson 2002, Johnson and Omland 2004) to provide the best fit to the data balanced with penalties for over-parameterization. Candidate models were first ranked by AIC_c differences (Δ_i). Relative likelihood of each model in a candidate set was then estimated with AIC_c weights (w_i). The sum of all w_i values in a candidate set is 1.0 (Burnham and Anderson 2002). Therefore, each model's weight is the proportion of its likelihood to the sum likelihood of all candidate models.

To keep the number of candidate models relatively low, we first ran candidate models in a set containing only combinations of the 3 categorical strata variables (study site, broad habitat, and local vegetation types). We selected the best fit of these models and then ran models containing all possible combinations of the continuous variables (lateral cover, vertical cover, distance to trail, and distance to water) subject to the constraint that they also include the best-fit strata variable(s). To guard against inappropriately including strata variables in the final model when some combination of continuous variables alone might provide the best fit, we finally ran a model containing only the best-fit continuous variable(s). Statistical support for variable-related differences in nest fate or type of egg loss were assessed by summing the w_i for all models in which a

parameter of interest occurred, which avoids the limitation of basing conclusions on a single best-fit model (Anderson et al. 2000, Burnham and Anderson 2002, Johnson and Omland 2004). For illustrative purposes, we assessed differences in cover among nest fates and types of egg losses with Student's t -tests.

To assess the models' predictive efficiency, we calculated the area under the Receiver Operating Characteristic (ROC) curve for the top models. As a metric of model evaluation, ROC curves have the advantage of being independent of threshold cut points and therefore outperform conventional classification tables. A model with no predictive power yields an area under the ROC curve of 0.5, while a perfect model yields a value of 1.0 (Boyce et al. 2002, Fielding 2002).

RESULTS

Of 86 total nests in the experiment, 59 were depredated (68.6%). The best-fit model for nest fate included lateral cover and study site variables (Table 2). Successful nests had higher estimates of lateral cover than did depredated nests (Fig. 2). Depredation was more than twice as likely to vary with lateral cover as to be independent of lateral cover ($\sum w_i$ for models with lateral cover = 0.685, $\sum w_i$ for models without lateral cover = 0.315). Nest depredation rate was higher at McDaniel Slough (86%) than at Fay Slough and the Arcata Marsh (60% and 59%, respectively). Site-dependent depredation was 3.9 times as likely to provide the best fit to

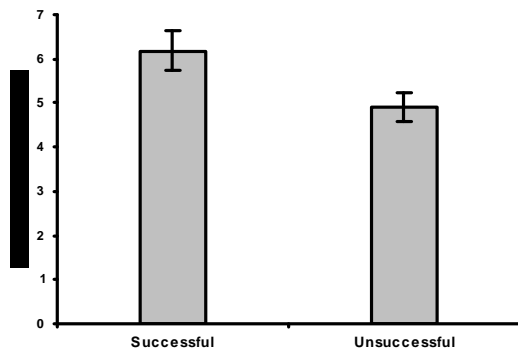


Fig. 2. The mean lateral cover (± 1 SE), as measured with a Robel pole, at successful nests was significantly higher than that at unsuccessful nests ($t = 2.24$, $df = 84$, $P = 0.03$).

our data as was site-independent depredation ($\sum w_i = 0.795$ and 0.205 , respectively). Once we accounted for the effects of lateral cover, however, site contributed only modestly to the fit of the model because lateral cover varied among sites and was lowest at McDaniel Slough (Table 3). Models without broad habitat, local vegetation, distance to trail, distance to water, and vertical cover provided better fits to our data than models including these variables, suggesting depredation did not vary consistently as a result of these factors. The top model included site and lateral cover as factors and yielded an area under the ROC curve of 0.70 (Table 2).

Among depredated nests, the best-fit model for the type of egg loss (broken or removed) included vertical cover, study site, and broad habitat (Table 4). Depredated nests containing broken eggs had higher estimates of vertical cover than did nests in which eggs were missing (Fig. 3). The type of egg loss was 2.4 times as likely to be dependent than independent on vertical cover ($\sum w_i = 0.709$ and 0.291 , respectively). Of depredated nests, proportionately fewer eggs were removed from those at Arcata Marsh (13%) than from those at Fay and McDaniel Sloughs (both 44%), and this effect was in addition to the influence of vertical cover, which was low at McDaniel Slough (Table 3). Site-dependent egg loss was 3.2 times as likely to provide the best fit to our

data as was site-independent egg loss ($\sum w_i = 0.762$ and 0.237 , respectively). Proportionately fewer depredated nests had their eggs removed (rather than broken) in willow/marsh habitat (45%) than those in grassland (64%) or levee habitats (80%). The type of egg loss was 3.4 times as likely to vary among models in broad habitats as those independent of broad habitats ($\sum w_i = 0.774$ and 0.226 , respectively). Models without local vegetation, distance to trail, distance to water, and lateral cover provided better fits to our data than models with these variables, suggesting the type of egg loss in depredated nests did not consistently vary as a result of these factors. The factors in the top model included site, broad habitat, and vertical cover and yielded an area under the ROC curve of 0.83 (Table 4).

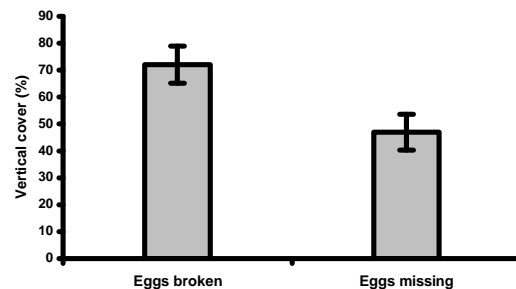


Fig. 3. Among unsuccessful nests, the mean vertical cover (± 1 SE), as measured with a densiometer, for nests with broken eggs was significantly higher than those with missing eggs ($t = 2.44$, $df = 56$, $P = 0.02$).

DISCUSSION

The overall nest success of 31.4% documented in our study was nearly identical to the nest success of 32.3% reported for mallards in California from 1985 to 1989 (Drilling et al. 2002). Although it is wise to cautiously interpret the results of studies using artificial nests, this similarity lends support to the relevance of using artificial nests to identify factors influencing duck-nest predation in this system. Lateral cover was >20% higher at successful nests than at depredated nests (Fig. 2), and depredated nests in which eggs were

Table 2. Models for the fate (depredated or not) of 86 artificial duck nests placed in 3 study sites near Humboldt Bay, California, USA, spring 2003; number of estimable parameters (K), second-order Akaike's information criterion (AIC_c), AIC_c differences (Δ_i), and AIC_c weights (w_i). Subscripts give parameterization for fate: no subscript = constant over nest location and nest concealment variables; 'site' = 3 study sites; 'br_hab' = 3 broad habitats; 'loc_veg' = 3 local vegetation types; 'lat_cover' = lateral cover; 'vert_cover' = vertical cover; 'dist_trail' = distance to nearest trail or road; 'dist_water' = distance to nearest water source. Coefficients for best-fit model are shown; the global model fit the data ($\chi^2 = 4.25$, $df = 7$, $P > 0.70$).

Model	K	AIC_c	Δ_i	w_i
Strata model selection				
Fate _(site)	3	106.44	0.00	0.628
Fate _(.)	1	109.26	2.82	0.153
Fate _(site+br_veg)	5	110.32	3.88	0.090
Fate _(site+loc_veg)	5	110.88	4.44	0.068
Fate _(br_veg)	3	112.93	6.49	0.024
Fate _(loc_veg)	3	112.96	6.52	0.024
Fate _(site+br_veg+loc_veg)	7	114.98	8.54	0.009
Fate _(br_veg+loc_veg)	5	117.22	10.78	0.003
Final model selection				
Fate _{(site+lat_cover)^a}	4	106.09	0.00	0.184
Fate _(lat_cover)	2	106.25	0.16	0.170
Fate _(site+dist_trail)	4	107.21	1.11	0.105
Fate _(site+lat_cover+dist_trail)	5	107.28	1.19	0.102
Fate _(site+lat_cover+vert_cover)	5	108.25	2.15	0.063
Fate _(site+lat_cover+dist_water)	5	108.26	2.17	0.062
Fate _(site+vert_cover)	4	108.43	2.33	0.057
Fate _(site+dist_water)	4	108.60	2.51	0.052
Fate _(site+lat_cover+vert_cover+dist_trail)	6	109.32	3.23	0.037
Fate _(site+dist_trail+dist_water)	5	109.36	3.26	0.036
Fate _(site+vert_cover+dist_trail)	5	109.43	3.34	0.035
Fate _(site+lat_cover+dist_trail+dist_water)	6	109.44	3.35	0.034
Fate _(site+lat_cover+vert_cover+dist_water)	6	110.46	4.37	0.021
Fate _(site+vert_cover+dist_water)	5	110.64	4.55	0.019
Fate _(site+lat_cover+vert_cover+dist_trail+dist_water)	7	111.51	5.42	0.012
Fate _(site+vert_cover+dist_trail+dist_water)	6	111.64	5.55	0.011

^a Model Fate = -1.334 = (-1.246xMcDaniel Slough)+(-0.028xArcata March)=(0.162xLateral Cover).

broken had 25% higher vertical cover than depredated nests from which eggs were removed (Fig. 3). Previous work suggests that avian and snake predators tend to remove eggs and that mammalian predators tend to break shells (Best and Stauffer 1980, Thompson and Burhans 2003). Footage from a remote 24-hr video camera set up at 2 of our nest sites was consistent with this generalization—a raven removed eggs intact while a raccoon and a gray

fox broke eggs and ate them on site (Humboldt State University 2003. What influences predation of duck nests near Humboldt Bay? Unpublished poster. Department of Wildlife, Arcata, California, USA). Therefore, we believe that higher vertical cover in our study area may help protect nests from avian predators, and higher lateral cover may conceal nests from mammalian predators. Land managers interested in maximizing waterfowl productivity

should work to provide nest concealment opportunities for nesting ducks.

Clark and Nudds (1991) reviewed 38 studies that included sufficient information regarding predator type to examine whether the importance of nest concealment to nest success depended on the predator community. They found that concealment was more important where avian predators were prevalent than where mammalian predators or a combination of mammalian and avian predators were prevalent. This general rule, however, should be considered relative to the particular species of predator. For example, Sugden and Beyersbergen (1986) studied the predation on natural and artificial nests by crows and discovered that when nest predation was not density dependent (nests >100 m apart), nests with >30% overhead cover were not depredated. Crows, however, tended to search on foot and nests close together were more effectively protected by dense lateral cover, which provided physical and visual barriers to ground-based predators. Similarly, Schranck (1972) found that tall, dense cover restricted mammalian movement, and nest success was greater later in the season because of an increase in growth of barrier vegetation. Dense vegetation can act as a visual and scent barrier between nests and predators but, in cases of artificial nests lacking a duck scent, mammalian predators find nests visually. These findings could enhance the relative role of lateral cover (Guyn and Clark 1997). We recommend that future studies of nest predation focus first on identifying which predators are locally important and then design studies to isolate variables hypothesized to increase success of nests in relation to those predators.

Similar to findings of a study of mallards in northern New York that compared the success of actual breeding-bird nests among wetlands, grasslands, and shrublands (Losito et al. 1995), we found that nest success did not vary significantly among broad or local vegetation types. Nest predation rate and the type of egg losses (broken or removed) varied among our study sites, however, with higher rates and high proportions of nests with missing eggs at McDaniel Slough. Avian predators may use visual cues other than nest exposure to locate

nests, and some have suggested that vegetation disturbance may be an important cue (Esler and Grand 1993). Although we made every attempt in our study to minimize effects on vegetation, this factor cannot be completely ruled out. McDaniel Slough most likely received the least amount of non-researcher human visitation, and it is bisected by high-tension power lines that were occasionally used by roosting ravens. These factors may have facilitated ravens observing our movements, which could reveal the nests' locations (Angelstam 1986). This hypothesis could be tested by making efforts to minimize the potential for ravens to observe setting up or checking nests (e.g., by working at night) or by studying real duck nests. Ravens are becoming increasingly important nest predators in suburban landscapes (Luginbuhl et al. 2001), and future work to understand the behavioral processes by which they locate nests will prove useful for wildlife management. Our findings also revealed no significant effect of proximity to water. It is important to note, however, that we constrained the locations of our nests to within 15 m of a permanent waterway. Within that range, distance from water may not show any incremental effect.

MANAGEMENT IMPLICATIONS

Our results at Humboldt Bay confirm the importance of nest concealment documented in other areas. From this artificial-nest study, patterns of predation suggest that managers working to ensure adequate vertical and horizontal cover can help maximize safety from avian and mammalian predators, respectively.

While not the focus of our study, our observations also suggest several anthropogenic factors that may increase the conspicuousness of nests and elevate nest predation rates. For example, we suspect that transmission towers and lines may provide lookout posts for visual predators, especially ravens. In addition, excessive human visitation may make nests more vulnerable by leading predators to nests and/or trampling vegetation and diminishing vertical and lateral concealment. Managers should carefully consider all potential impacts of human activity on waterfowl nesting grounds.

Table 3. Variation in the predation rate, type of egg loss, and independent variables hypothesized to affect likelihood of nest predation across 3 strata (study sites, broad habitats, and local vegetation types) for artificial nests studied near Humboldt Bay, California, USA, spring 2003.

Strata and study sites	Depredated Nests							
	<i>n</i>	% depredated	% with eggs broken	% with eggs removed	Lateral cover ^{a,c}	Vertical cover ^{b,c}	Distance to trail ^b (m)	Distance to water ^b (m)
Study Site								
Arcata Marsh	27	59	13	87	6.0±0.5	66.5±6.7	5.0±0.5	4.8±0.8
McDaniel Slough	29	86	44	56	4.3±0.4	40.3±7.4	5.0±0.6	7.1±0.7
Fay Slough	30	60	44	56	5.7±0.4	71.7±5.5	4.9±0.6	4.4±0.7
Broad Habitat								
Levee	35	71	20	80	5.3±0.4	56.6±6.6	3.6±0.4	5.6±0.6
Grassland	20	70	36	64	5.5±0.5	51.1±8.7	5.5±0.8	5.4±0.94
Willow/marsh	31	65	55	45	5.2±0.5	68.2±6.1	6.1±0.6	5.3±0.8
Local Vegetation Type								
Grasses	38	71	30	70	4.1±0.3	48.4±6.5	4.4±0.5	6.3±0.67
Thorny shrub	23	70	44	56	6.5±0.5	67.9±7.1	5.0±0.7	6.4±0.7
Cattail/willow	25	64	38	63	6.1±0.5	68.6±6.5	5.8±0.7	3.2±0.7

^a As measured with Robel pole; see "Methods".

^b Percent cover as measured with a densiometer; see "Methods".

^c Mean ± 1 SE.

Table 4. Models for the type of egg loss (eggs missing or eggs broken) of 59 depredated artificial duck nests placed in 3 study sites near Humboldt Bay, CA, USA, spring 2003; number of estimable parameters (*K*), second-order Akaike's information criterion values (AIC_c), AIC_c differences (Δ_i), and AIC_c Weights (w_i). Subscripts give parameterization as described in Table 1. Coefficients for best-fit model are shown; the global model fit the data well ($\chi^2 = 3.25$, *df* = 7, *P* > 0.86).

Model	<i>K</i>	AIC_c	Δ_i	w_i
Strata model selection				
Loss Type (site+br_veg)	5	74.70	0.00	0.516
Loss Type (br_veg)	3	77.23	2.53	0.145
Loss Type (site)	3	77.52	2.82	0.126
Loss Type (site+br_veg+loc_veg)	7	78.10	3.40	0.094
Loss Type (.)	1	78.90	4.20	0.063
Loss Type (site+loc_veg)	5	80.71	6.01	0.026
Loss Type (br_veg+loc_veg)	5	81.29	6.59	0.019
Loss Type (loc_veg)	3	82.35	7.65	0.011
Final model selection				
Loss Type (site+br_veg+vert_cover) ^a	6	72.87	0.00	0.297
Loss Type (site+br_veg+vert_cover+dist_water)	7	74.61	1.73	0.125
Loss Type (site+br_veg+vert_cover+dist_trail)	7	75.23	2.35	0.091
Loss Type (site+br_veg+lat_cover)	6	75.23	2.36	0.091
Loss Type (site+br_veg+lat_cover+vert_cover)	7	75.25	2.38	0.090
Loss Type (site+br_veg+dist_water)	6	76.02	3.15	0.061
Loss Type (site+br_veg+lat_cover+dist_water)	7	76.90	4.03	0.040
Loss Type (site+br_veg+vert_cover+dist_trail+dist_water)	8	77.10	4.23	0.036
Loss Type (site+br_veg+dist_trail)	6	77.13	4.26	0.035
Loss Type (site+br_veg+lat_cover+vert_cover+dist_water)	8	77.14	4.26	0.035
Loss Type (site+br_veg+lat_cover+dist_trail)	7	77.76	4.89	0.026
Loss Type (site+br_veg+lat_cover+vert_cover+dist_trail)	8	77.78	4.90	0.026
Loss Type (site+br_veg+dist_trail+dist_water)	7	78.54	5.67	0.017
Loss Type (site+br_veg+lat_cover+dist_trail+dist_water)	8	79.52	6.65	0.011
Loss Type (lat_cover)	4	79.66	6.79	0.010
Loss Type (site+br_veg+lat_cover+vert_cover+dist_trail+dist_water)	9	79.79	6.92	0.009

^a Model: Loss Type = -0.814+(0.705×McDaniel Slough)+(-1.947×Arcata Marsh)+(-1.400×Levee)+(1.298×Grassland)+(0.020×Vertical Cover).

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