

NESTING ECOLOGY OF DUCKS AT EAGLE LAKE, LASSEN COUNTY, CALIFORNIA

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I collected data on duck nesting community composition, nest density, nesting chronology, nest cover, and nest success at Eagle Lake, Lassen County, California from 1990 to 1993. Lesser scaup, *Aythya affinis*, and gadwall, *Anas strepera*, were the most common nesters, constituting 80.3–82.3% of all nests located. Nest densities of lesser scaup ranged from 1.2 to 31.4 nests/ha and nest densities of gadwall ranged from 3.1 to 13.8 nests/ha. Gadwall initiated clutches from 15 April to 15 July, with a peak from 1 to 15 June. Lesser scaup initiated nests from 16 May to 15 August, with a peak from 16 June to 15 July. Stands of nettle, *Urtica holosericea*, and gray rabbitbrush, *Chrysothamnus nauseosus*, were frequently used as upland nest cover by lesser scaup; gadwalls; northern pintails, *Anas acuta*; and mallards, *A. platyrhynchos*, supporting 30.9% and 26.0% of all nests. Hardstem bulrush, *Scirpus acutus*, was the most important shoreline cover plant, supporting 23.3% of all nests. Annual estimates of nest success on islands ranged from 66.7% to 90.0%. On peninsulas, estimated nest success ranged from 6.5% to 38.5%. Predation was the primary cause of nest failure, resulting in nest losses from 0.0% to 18.3% on islands and from 61.5% to 93.5% on peninsulas.

INTRODUCTION

Studies on the nesting ecology of ducks in northeastern California have focused primarily on habitats in the Klamath Basin and at Honey Lake which support large numbers of nesting ducks (Miller and Collins 1954, Rienecker and Anderson 1960, McLandress et al. 1996). Management of duck populations in the Pacific Flyway may benefit from an understanding of smaller, more isolated nesting communities such as that of Eagle Lake, Lassen County, California. Currently, information on the waterfowl nesting community at Eagle Lake is limited to data on common mergansers, *Mergus merganser*, from 2 studies of piscivorous nesters (Gould¹ 1974, Lederer 1976).

The objectives of my study were to 1) describe the nesting community and calculate nest densities for duck species nesting on island and peninsular habitats at Eagle Lake, 2) determine the chronology of clutch initiation for each species, 3) describe vegetation used as nesting cover, and 4) determine the relative success of island and peninsular nests.

¹ Gould, G.I., Jr. 1974. Breeding success of piscivorous birds at Eagle Lake, California. M.S. Thesis, Humboldt State University, Arcata, California, USA.

STUDY AREA

Eagle Lake, the 2nd largest natural freshwater lake in California (approximately 11,000 ha), lies on the Modoc Plateau east of the Cascade Range (40°N, 120°W) (Fig. 1). The lake is bordered by coniferous forests of Jeffrey pine, *Pinus jeffreyi*; incense cedar, *Calocedrus decurrens*; and white fir, *Abies concolor*, to the southeast, south, and west and by steppe habitats dominated by big sage, *Artemisia tridentata*; gray rabbitbrush, *Chrysothamnus nauseosus*; and western juniper, *Juniperus occidentalis*, to the north and east.

Two study sites were selected based on the presence of nesting cover and active duck nests. The Pelican Point site (PP) is an 88-ha peninsula located on the west side of the lake, 3 km south of Spaulding Tract (Fig. 1). The peninsula, made up of basalt and granitic substrata, is characterized by stands of hardstem bulrush, *Scirpus acutus*; gray rabbitbrush; locoweed, *Astragalus lentiginosus*; and nettle, *Urtica holosericea*. In addition to ducks, vegetation patches on PP provide nesting cover for Great Basin Canada geese, *Branta canadensis moffitti*; snowy egrets, *Egretta thula*; black-crowned night-herons, *Nycticorax nycticorax*; and great blue herons, *Ardea herodias*. Also, areas of open basalt at the east end of PP serve as habitat for colonial-nesting California gulls, *Larus californicus*; ring-billed gulls, *L. delawarensis*; and double-crested cormorants, *Phalacrocorax auritus*, during years when PP is insular. Approximately 1.6 ha of nesting cover for ducks is located near the eastern tip of the peninsula, isolated from the mainland by 1.2 km of non-vegetated substrata. In 1990, at the onset of my investigation, PP was isolated from the mainland by 75 m of shallow open water, but was peninsular from 1991 to 1993.

The Miner's Point Island site (MPI) is located 450 m off the east shore of the lake (Fig. 1). This 1.5-ha island is characterized by 0.3 ha of nesting cover composed of nettle interspersed throughout basalt cobble- and boulder-sized substrata, as well as dense stands of hardstem bulrush. The remainder of the island is non-vegetated basalt gravels. In addition to ducks, MPI provides nesting habitat for Great Basin Canada geese; killdeer, *Charadrius vociferus*; spotted sandpipers, *Actitis macularia*; yellow-headed blackbirds, *Xanthocephalus xanthocephalus*; and Forster's terns, *Sterna forsteri*.

METHODS

Field surveys were conducted from mid-April through early September 1990–1993. Sites were surveyed on 1 or 2 successive days every 2 weeks in order to minimize disturbance to nesting females (Lokemoen et al. 1984). All surveys were conducted between 0700 and 1200 hours, when laying or incubating hens are most likely to be at the nest (Miller and Johnson 1978). Nests were located through systematic searches of all patches of woody and herbaceous vegetation with persons spaced 5 m apart. Flushed hens were identified to species and nests were marked with yellow flagging bearing an identification number. Flags were attached to vegetation approximately 5 m from the nest to facilitate relocation.

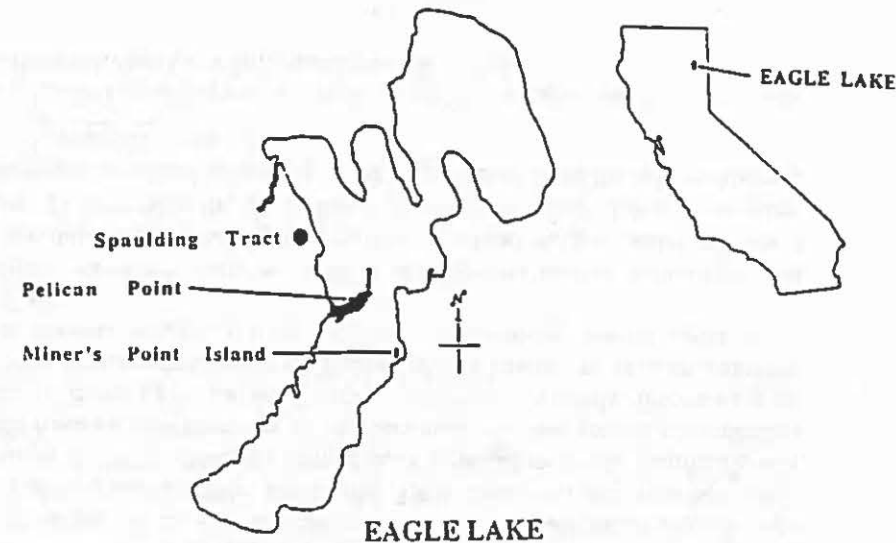


Figure 1. Eagle Lake, Lassen County, California, showing the location of the Pelican Point and Miner's Point Island study sites.

Vegetative cover at nests was identified to species and height of the cover above the nest bowl was recorded to the nearest 0.1 m. Lateral concealment (LC), a measure of nest visibility from each of the 4 cardinal directions, was rated from 0 to 4 (number of sides concealed) for each nest (Hines and Mitchell 1983).

Nest densities were estimated by dividing the largest number of active nests at any time by the area of total available nesting cover. Habitat patches were small and easily measured by hand using a Brunton Compass, flagging, and two 30-m tapes.

Clutch initiation date was estimated using only those nests located during the egg-deposition period and only for those species with ≥ 5 nests. I assumed that hens laid 1 egg per day and that egg deposition had already occurred on the date the nest was first located.

Total clutch size, defined as the maximum number of eggs known to have been deposited, was recorded for each nest. Only 3 host species eggs were measured per nest to minimize disturbance. All eggs deposited by interspecific parasites were identified to species, counted, and measured. All egg measurements were maximum length to the nearest 0.1 mm. Down feathers were then arranged over all eggs to minimize heat loss.

Nest success was estimated as the proportion of nests in which at least 1 egg hatched successfully (Miller and Johnson 1978, Hines and Mitchell 1983). The estimate is referred to as the "Traditional Method" estimate (Klett and Johnson 1988, Bruggink et al. 1994). Traditional estimates for 1992 and 1993 were compared within and between years by habitat using chi-square tests (Zar 1984). The null hypotheses were that 1) nest success was independent of habitat type and 2) the pattern of nest success by habitat did not differ between years. That is, the relationship between habitat type and nest success was consistent from year to year. "Mayfie

0% Method" estimates of nest success (Mayfield 1961, 1975; Miller and Johnson 1978; Johnson 1979), although not analyzed statistically, were also calculated for lesser scaup and gadwall in 1990. Nests parasitized intraspecifically were excluded from all analyses of nest success.

In testing for the influence of LC on nest success, nests were pooled by class (0-), and nest success was calculated for each class. Nest success was then compared using a test for linear trends in proportions (Snedecor and Cochran 1967), with nest success as the dependent variable for the null hypothesis that nest success was not different among LC classes. Mean cover height values for successful and failed nests were compared using t-tests (Bruggink et al. 1994), with the null hypothesis that nest success was independent of vegetation height above the nest bowl. The null hypothesis that nesting cover height did not differ among duck species was tested with ANOVA (Zar 1984).

Nest failure was attributed to predation based on the following criteria: 1) the presence of scattered, broken, or partially consumed eggs in or near the nest bowl; 2) eggs, shells, and shell membranes missing from the nest bowl; and 3) egg or nest bowl destruction in association with the carcass of a host-species female.

Interspecific parasitism was identified based on the presence of eggs of different colors, shapes, and sizes in a single nest. Intraspecific nest parasitism is often difficult to identify due to the similarity in egg morphology. Host species eggs deposited into the nest bowl following the onset of incubation, as well as clutch sizes exceeding published ranges (Bellrose 1980, Ehrlich et al. 1988) by ≥ 1 egg were attributed to intraspecific parasites.

RESULTS AND DISCUSSION

Nesting Community

Lesser scaup, *Aythya affinis*, and gadwall, *Anas strepera*, were the most abundant nesting ducks in sampled habitats at Eagle Lake during my study (Table 1). Nests of these species made up 80.3–92.3% of all nests located between 1990 and 1993. Mallards, *Anas platyrhynchos*; northern pintails, *Anas acuta*; cinnamon teal, *Anas cyanoptera*; redhead, *Aythya americana*; and common merganser also nested at Eagle Lake in lower numbers.

Several authors (Duebbert 1966, 1982; Duncan 1986; Hines and Mitchell 1983; Lokemoen et al. 1984; Miller and Collins 1954; Vermeer 1968, 1970) have discussed the relative importance of islands and isolated peninsulas to gadwall, mallards, and lesser scaup, because these habitats provide protection against mammalian predators. As all nests located during this study were either on islands or isolated peninsulas, it was not surprising to find these species making up the bulk of the terrestrial nesting community at Eagle Lake.

Nest Densities

Densities of simultaneously active lesser scaup nests at PP from 1990 to 1993 were 19.4, 8.1, 1.9, and 1.3 nests/ha of nesting vegetation. Gadwall nest densities at

Table 1. Duck nests located at the Pelican Point and Miner's Point Island sites, Eagle Lake, Lassen County, California, 1990-1993. Pelican Point was insular in 1990.

Pelican Point	Nest numbers			
	1990	1991	1992	1993
Lesser scaup	31	13	3	2
Gadwall	22	17	8	5
Mallard	6		1	
Northern pintail	6	1	1	
Cinnamon teal	1	1	-	-
Common merganser	-	1	-	1
Total	66	33	13	8
Miner's Point Island				
Lesser scaup	-	-	11	8
Gadwall	-	-	2	2
Redhead	-	-	-	1
Total	-	-	13	11
Grand total	66	33	26	19

PP for the same period were 13.8, 10.6, 5.0, and 3.1 nests/ha. At MPI, lesser scaup nest densities were 31.4 and 22.9 nests/ha in 1992 and 1993. Gadwall nest density at this site was 5.7 nests/ha in both 1992 and 1993. Nest densities were not estimated for other, less-common nesting species.

Results from several studies conducted throughout the Prairie Pothole Region of North America (PPR) suggest that nest density values for ducks tend to be higher on islands (Duebbert 1982, Hines and Mitchell 1983, Duncan 1986, Vermeer 1970). Density figures for lesser scaup and gadwall at Eagle Lake illustrate the importance of island habitats to these species in northeastern California. However, densities of gadwall on MPI were low in 1992 and 1993 (5.7 nests/ha), probably as a result of poor cover conditions.

With the exception of several sparse stands of nettle, the only dense nesting cover on MPI occurred along the shoreline as stands of hardstem bulrush. Results suggest that dense stands of rabbitbrush and nettle, which did not occur on MPI during this study, are the most frequently used cover types by nesting gadwall at Eagle Lake (Table 2).

Clutch Initiation and Size

Clutch initiation data from Eagle Lake (Fig. 2) are consistent with results from other studies in northeastern California (Miller and Collins 1954, Rienecker and Anderson 1960) and the PPR (Duebbert 1966, Klett et al. 1988, Lokemoen et al. 1984, Vermeer 1970), with northern pintail nesting first and gadwall and lesser scaup nesting last. The 1 August clutch initiation for scaup at MPI in 1993 was likely a re-nesting effort, based on the date, as well as a clutch size (6 eggs), which are consistent

Table 2. Vegetation used as nest cover by ducks on Pelican Point and Miner's Point Island, Eagle Lake, Lassen County, California, 1990-1993.

Nesting species	Nest cover type												Total	
	Rabbitbrush		Nettle		Locoweed		Bulrush		Other ^c					
	No. ^a	%	No.	%	No.	%	No.	%	No.	%	No.	%		
Lesser scaup	12	17.6	13.5	19.8	8	11.8	24	35.3	10.5	15.5	68	100		
Gadwall	19.5	34.8	25	44.7	2.5	4.5	4.5	8	4.5	8	56	100		
Northern pintail	5	62.5	1	12.5			2	25			8	100		
Mallard	1	14.3	5	71.4	1	14.3					7	100		
Cinnamon teal					1	50			1	50	2	100		
Common merganser							2	100			2	100		
Redhead							1	100			1	100		
Total	37.5	26.0	44.5	30.9	12.5	8.7	33.5	23.3	16.0	11.1	144	100		

^a Number of nests with designated cover type.

^b For those nests constructed beneath 2 cover types, a value of 0.5 nests was recorded for each cover type.

^c Includes dock, *Rumex angiocarpus*; rush, *Juncus balticus*; sedge, *Carex* sp.; Russian thistle, *Salsola kali*; cheatgrass, *Bromus tectorum*; saltgrass, *Distichlis spicata*; basalt boulder; and non-active heron and egret nests.

with data for renesting scaup (Hunt and Anderson 1966). In addition, 2 cinnamon teal clutches were initiated during the period of 16 May–15 June and 1 clutch each of common merganser and redhead was initiated prior to 1 June.

As a result of small samples for other species, only mean clutch sizes for gadwall and lesser scaup were compared with results from other studies. Gadwall mean clutch size of 9.3 eggs (range = 7–13, SE = 0.28, n = 32) at Eagle Lake is similar to values observed in North Dakota (Duebber 1966), although somewhat smaller than reported for Tule Lake (11.0 eggs) (Miller and Collins 1954) and Lower Klamath refuges (11.0 eggs) (Rienecker and Anderson 1960) or the 10.4 eggs reported for several studies by Bellrose (1976). Similarly, clutch size for lesser scaup at Eagle Lake (mean = 9.7, range = 7–14, SE = 0.29, n = 44), although within published ranges, was somewhat lower than values at Tule Lake (10.7 eggs) (Miller and Collins 1954) and Lower Klamath (10.7–11.0 eggs) (Rienecker and Anderson 1960) refuges. The elimination of nests suspected of having incurred intraspecific parasitism could account for the lower values at Eagle Lake.

Nesting Cover

Stands of nettle and gray rabbitbrush were frequently used as nest cover in upland areas of PP by lesser scaup, gadwall, northern pintail, and mallard. Small patches of nettle served as the only upland plant species on MPI used by nesting ducks in 1992 and 1993. In all, 17.6% of lesser scaup nests and 34.8% of gadwall nests were constructed beneath stands of rabbitbrush (Table 2). Nettle served as a cover plant for 19.8% of lesser scaup nests and 44.7% of gadwall nests during this study. Other

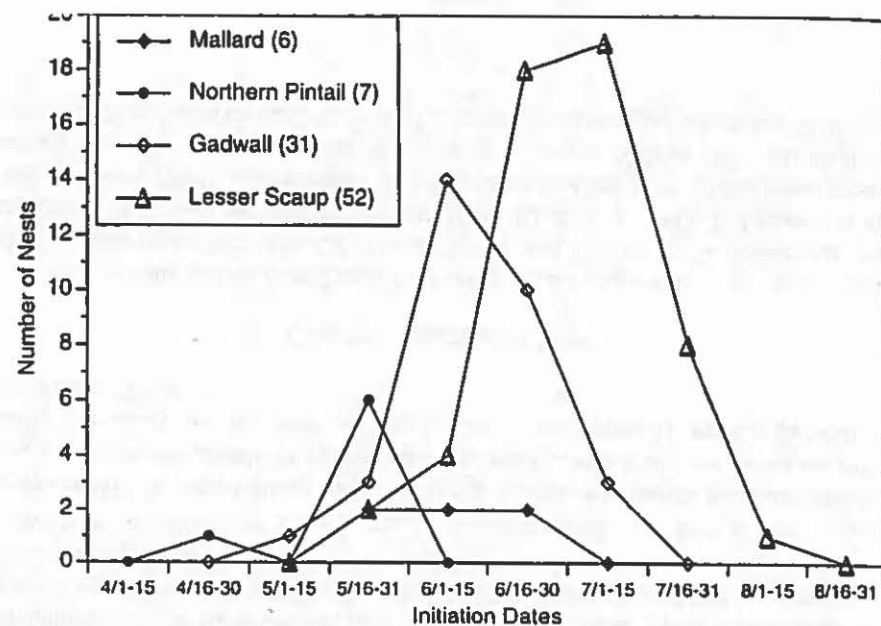


Figure 2. Nest initiation dates for common duck species at Eagle Lake, Lassen County, California 1990–1993.

upland species such as locoweed and dock, as well as non-active heron and egret (*Ardeidae*) nest structures also served as upland nest cover for ducks at PP.

Stands of decadent (residual stubble) and new growth hardstem bulrush served as the most important shoreline nesting cover for ducks at both PP and MPI supporting 23.3% of all nests located. In total, 35.3% of lesser scaup (n = 68), both common merganser, and 1 redhead nests were constructed in hardstem bulrush stands, but gadwall and northern pintail used these habitats sparingly (Table 3).

Dense stands of rabbitbrush, nettle, bulrush, and locoweed were used most frequently by ducks nesting at my study sites (Table 2). Although the species composition among habitats may vary, the literature from northeastern California (Miller and Collins 1954, Rienecker and Anderson 1960) and the PPR (Duebber 1966, Hines and Mitchell 1983, Lokemoen et al. 1984, Duncan 1986) are consistent in stating the relative importance of dense stands of shrubs and upright forbs to nesting ducks. Although not designed to address issues of nest site selection and habitat preference, data from my study suggest a preference for dense stands of nesting cover. This generalization is based largely on the presence of relatively unused cover type such as saltgrass, *Distichlis spicata*; sedge, *Carex* spp.; rush, *Juncus* sp.; an heliotrope, *Heliotropium curassavicum*.

Nest Success

Nest success varied widely between nesting locations and among years (Table 3). Traditional Method estimates of nest success for gadwall ranged from 50.0%

(1992) to 100.0% (1993) on islands and from 0.0% (1991, 1993) to 50.0% (1992) on peninsulas (Table 3). The Mayfield estimate for gadwall nesting on PP in 1990 was 34.3%. Traditional Method nest success estimates for island-nesting lesser scaup ranged from 65.4% (1990) to 90.0% (1992); nesting success ranged from 0.0% (1991, 1993) to 33.3% (1992) on peninsulas. The Mayfield estimate for scaup nesting on PP in 1990 was 34.0%.

Traditional Method nest success estimates for all duck species by habitat ranged from 66.7% to 90.0% on islands and from 6.5% to 38.5% on peninsulas (Table 4). The difference in nest success between habitats (islands and peninsulas) was not significant ($\chi^2 = 2.0$, $df = 1$, $P > 0.1$) in 1992, but was significant in 1993 ($\chi^2 = 10.77$, $df = 1$, $P < 0.005$). Differences in the pattern of nest success by habitat in 1992 and 1993 were significant ($\chi^2 = 6.30$, $df = 1$, $P < 0.025$). This pattern of higher nest success on islands than on peninsulas is consistent with other studies from northeastern California (Miller and Collins 1954, Rienecker and Anderson 1960) and the PPR (Keith 1961, Duebbert 1966, Vermeer 1968, Hines and Mitchell 1983, Lokemoen et al. 1984), which have illustrated the importance of carnivore-free islands to nesting ducks.

Studies from the PPR (Cowardin et al. 1985, Klett et al. 1988) suggest that Mayfield estimates of 15% nest success for mallards and 20% for late-nesting species such as lesser scaup and gadwall are necessary to sustain a population, assuming normal levels of duckling mortality, hen survival, and philopatry. Although Traditional Method estimates tend to be biased high, evidence suggests that estimates for small, easily searched habitat patches such as those at Eagle Lake tend to be much more accurate (Lokemoen et al. 1984). Thus, while acknowledging that Traditional Method estimates for Eagle Lake (Tables 3 and 4) are likely to be somewhat high, data from my study suggest that vegetated island habitats are necessary for nesting populations of ducks to sustain themselves through time.

Predators were the primary cause of nest failure for ducks nesting on the island and peninsula at Eagle Lake, resulting in the loss of 13 (15.9%) island nests and 44 (84.6%) peninsular nests. These data are consistent with other studies in similar habitats in the PPR (Duebbert 1966, Vermeer 1970, Duebbert 1982, Lokemoen et al. 1984). Evidence of predation in my study included eggs missing from clutches ($n = 10$ nests), eggs with 1–2-cm-diameter holes ($n = 5$ nests), egg shells broken and scattered along with nest materials ($n = 40$ nests), and 1 dead and partially consumed hen gadwall in the nest bowl.

No acts of predation on ducks or duck nests were observed at either sampling location, but raccoon, *Procyon lotor*, and coyote, *Canis latrans*, tracks were common at PP from 1991 to 1993. In addition, 1 adult coyote was sighted on PP during a survey in 1991. Egg shell and nest bowl characteristics at failed nests sites on PP, as well as the condition of 2 female scaup carcasses suggest some predation by both species (Reardon 1951). Also, characteristic signs of striped skunk, *Mephitis mephitis*, and gray fox, *Urocyon cinereoargenteus*, predation (Reardon 1951) were noted at PP.

Evidence of predation at failed nests on PP in 1990, when gull colonies were active, were consistent with predation by gulls which may have resulted in the failure

Table 3. Traditional Method estimates of nest success through hatch for island- and peninsular-nesting gadwall and lesser scaup at Eagle Lake, Lassen County, California, 1990–1993

Year	Species	Island		Peninsula	
		Total nests	Nest success (%)	Total nests	Nest success (%)
1990	Gadwall ^a	21	71.4		
	Lesser scaup ^b	26	65.4		
1991	Gadwall			16	0.0
	Lesser scaup			12	0.0
1992	Gadwall	2	50.0	8	50.0
	Lesser scaup	10	90.0	3	33.3
1993	Gadwall	2	100.0	5	0.0
	Lesser scaup	7	85.7	2	0.0

^a Mayfield 40% estimate of nest success for gadwall in 1990 is 34.3%

^b Mayfield 40% estimate of nest success for lesser scaup in 1990 is 34.0%

Table 4. Traditional Method estimates of nest success through hatch of ducks in island and peninsular habitats at Eagle Lake, Lassen County, California, 1990–1993.

Year	Island habitats (%)	Peninsular habitats (%)
1990	73.3	
1991		6.5
1992 ^a	66.7	38.5
1993 ^b	90.0	12.5
$\bar{X} \pm SE$	76.7 $\pm$ 6.9	19.2 $\pm$ 9.8

^a 1992 nest success figures for island and peninsula sites were not significantly different ($\chi^2 = 2.0$, $df = 1$, $P > 0.1$).

^b 1993 nest success figures for island and peninsula sites were significantly different ($\chi^2 = 10.77$, $df = 1$, $P < 0.005$).

of up to 18.3% of those nests monitored. While some researchers have suggested that waterfowl nesting in association with colonial-nesting gulls may incur heavy predation unless their nests are well concealed (Odin 1957), others have found that nesting ducks may benefit from an association with larid colonies, which may be effective in driving off predatory gulls and crows (Keith 1961, Vermeer 1968).

Nest failure resulting from abandonment ranged from 8.3% (1990) to 16.7% (1992) on islands, but no nest abandonment was observed on peninsulas. Of the 8 abandoned island nests, 3 incurred nest parasitism; reasons for the other 5 desertions are unclear. Potential factors influencing abandonment include human disturbance and predation by raptors on attending females (Greenwood et al. 1995, Keith 1961). In support of the predation hypothesis, osteological remains of lesser scaup and other medium-sized ducks have been identified by the author and others in pellets regurgitated during spring and summer by great horned owls, *Bubo virginianus*, at Eagle Lake (unpublished observations). In addition, 1 gadwall nest parasitized interspecifically

by lesser scaup and 2 scaup nests parasitized intraspecifically were also abandoned. Frequent disturbance by nest parasites has been shown to precipitate nest desertion in ducks (Joyner 1983, Weller 1959). Low abandonment rates for Eagle Lake are consistent with those from studies in northeastern California (Miller and Collins 1954, Rienecker and Anderson 1960) and the PPR (Duebbert 1966, Duebbert 1982).

Nest Concealment and Cover Height

Nest success for LC classes on the peninsula were significantly different ($Z = -2.54$, $df = 62$, $P < 0.05$); success was 11.1% for nests with 0–2 sides concealed and 16.7% for nests with 3–4 sides concealed. No association between LC and nest success existed on islands, where success was similar for nests with 0–2 sides (82.4%) and 3–4 sides (72.6%) concealed ($Z = 0.58$, $df = 88$, $P > 0.05$). These results conflict with studies by Odin (1957) and Hines and Mitchell (1983) that found nest success was positively correlated with LC on islands in Utah and Saskatchewan. The absence of colonial nesting gulls on MPI in 1992 and 1993 may account for these inconsistencies, as the only island nests subjected to gull predation were on PP in 1990.

Although it has been suggested that a positive correlation often exists between cover height above the nest bowl and nest success in ducks (Heiser² 1971, Dwernychuk and Boag 1972, Hines and Mitchell 1983), nest cover height on islands ($t = 0.093$, $df = 88$, $P > 0.90$) and peninsulas ($t = 0.825$, $df = 52$, $P > 0.40$) was not significantly different for successful and failed nests at Eagle Lake (Table 5). The relative absence of predatory gulls at both study sites could explain the lack of any significant correlation between cover height and duck nesting success at Eagle Lake. Also, cover height selected by nesting lesser scaup, gadwall, and northern pintail did not differ significantly (Table 6).

Nest Parasitism

Lesser scaup and gadwall served as hosts for both inter and intraspecific nest parasites at Eagle Lake. Parasitic species included lesser scaup, redhead, and gadwall.

Table 5. Mean vegetation height (m) over duck nests on island and peninsular habitats at Eagle Lake, Lassen County, California, 1990–1993. Sample sizes are in parentheses.

Nest fate	Island ^a	Peninsula ^b
Successful nests	0.87 (67)	0.68 (8)
Failed nests	0.89 (23)	0.78 (46)

Difference in mean vegetation height above successful and failed nests on island habitats at Eagle Lake was not significant ($t = 0.093$, $df = 88$, $P > 0.9$).

Difference in mean vegetation height above successful and failed nests on peninsular habitats at Eagle Lake was not significant ($t = 0.825$, $df = 52$, $P > 0.4$).

Heiser, N.G. 1971. Nest site selection of blue-winged teal (*Anas discors*) in northwest Iowa. M.S. Thesis, Iowa State University, Ames, Iowa, USA.

Table 6. Vegetation height (m) over duck nests at Eagle Lake, Lassen County, California, 1990–1993.

Species	Number of nests	Range	Mean	SE
Lesser scaup	68	0.2 - 1.6	0.83	0.05
Gadwall	56	0.1 - 1.8	0.81	0.05
Northern pintail	8	0.4 - 1.4	0.88	0.14

In all, 12 of 50 lesser scaup nests (24%) and 4 of 26 gadwall nests (15.4%) were parasitized on islands, whereas 1 of 16 lesser scaup nests (6.3%) and 2 of 32 gadwall nests (6.3%) incurred parasitism on peninsulas.

Nest parasitism by lesser scaup, redheads, and gadwall has been well documented in the literature (Miller and Collins 1954, Weller 1959, Rienecker and Anderson 1960, Joyner 1983). Data from Eagle Lake suggest a higher frequency of parasitism events on islands. These findings are similar to those of Weller (1959) and Joyne (1983).

MANAGEMENT IMPLICATIONS

Findings from this study are consistent with other North American studies that have estimated the relative importance of islands and isolated peninsulas to nesting ducks (Duebbert 1962, Vermeer 1970, Hines and Mitchell 1983, Duncan 1986). As a result of dramatic annual shifts in lake levels, these habitat types are often limited at Eagle Lake, thereby increasing the importance of each. Hence, watershed and wildlife managers should be aware of 2 potential threats to these habitats and their nesting communities, namely human and livestock intrusion. Eagle Lake, with its trophy rainbow trout, *Oncorhynchus mykiss aquilarum*, fishery, receives an enormous amount of recreational use by shore and boat anglers. Also, cattle grazing, a common practice on U.S. Forest Service, Bureau of Land Management, and private parcel along the shores of the lake, can have a devastating effect on nest cover. Cattle encroachment onto PP in 1991 resulted in the complete removal of all locoweed stands used in 1990 by nesting lesser scaup and gadwall. A fence constructed across the base of PP by the Forest Service prior to the 1992 nesting season was effective at excluding cattle from the peninsula thereafter.

Management recommendations should include: 1) posting of signs asking that recreationists avoid critical nesting habitats from March through mid-September; 2) posting and distribution of interpretive information on local wildlife and wildlife habitats at marinas and campgrounds, and 3) construction of fences by land owner and administrators to prevent intrusion of domestic livestock into patches of critical avian nesting habitats.

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