

It appeared when two broods were raised by Harris' Hawks in one year that the first brood reduced its ties to the adults and were normally not dependent on them when the second brood was being raised. When the second brood fledged they were often dependent on or associated with the adults for 2 to 3 months. If a second brood was not raised, the immatures from the first sometimes remained with the adults into winter.

A color-banded immature female that hatched in 1973 laid three eggs in a rebuilt nest in an old, unoccupied nesting range in August 1974, approximately 7.2 km from the nest where it fledged. This female laid eggs just after attaining adult plumage and was paired with an adult male that had falconry jesses on its legs. This nest was in a blue palo-verde tree (*Cercidium floridum*) about 300 m from an apartment complex; the nest failed during incubation.—WILLIAM J. MADER, 41 West Alpia Way, Tucson, Arizona 85704. Accepted 26 Nov. 75.

Nest site selection for Prairie Falcons.—Throughout the range of Prairie Falcons (*Falco mexicanus*) nest sites vary in height from 7 m to over 122 m (Ogden 1973. Nesting density and reproductive success of the Prairie Falcon in southwestern Idaho. Unpublished M.S. Thesis. Moscow, Univ. Idaho.). As with other large falcons, the nest is usually a scrape, i.e. no nest structure is built by the nesting birds. Most nests are sheltered by an overhanging portion of the cliff (Enderson 1964, Auk 81: 332–352), but variations do occur, such as the use of old common raven (*Corvus corax*) nests on cliffs (Ogden 1973), and there is one recorded incident of tree-nesting Prairie Falcons (Goss 1891. History of the birds of Kansas, Topeka, Kansas, Geo. W. Crane & Co.).

In March 1972 I discovered a pair of Prairie Falcons nesting in the King's Bowl at the Crystal Ice Caves in southeastern Idaho. The King's Bowl, in the Great Rift lava fault near Aberdeen, is a hole 92 by 61 m, its deepest point being 61 m. The east and west-facing walls are vertical and the north and south-facing walls are undercut, flowing into the fissure of the Great Rift. The eyrie was on the east-facing wall approximately 40 m above the bottom and about 5 m below its top. Cool air escaping from the fissure caused a constant updraft during the warmer seasons of the year. The surrounding area is essentially flat except for small lava outcroppings. Sagebrush (*Artemisia* sp.) is the dominant vegetation in the places not covered by lava flow. No typical or suitable structures for nest sites occur within 50 km.

The owner of the land at that time, Mr. Papadakis, stated that the falcons had occupied the nest site since he arrived in 1961. He stated that they produced young every year but that he never kept records as to the number. I did not see eggs or young, only the courting adults. My last visit was in early April. A recent letter (1976) indicated that the birds no longer nested there, but they did nest through at least the 11 years of disturbance by tourists. Recent failure is most likely due to the loss of one or both of the adult falcons. As this nest site differs so drastically from the normal, it seems unlikely that other Prairie Falcons will ever select it for breeding.—EDWARD J. PITCHER, 729 Airport Road, Sheridan, Wyoming 82801. Accepted 6 Dec. 76. (This paper was subsidized by the author.)

Clutch size determination, egg size, and eggshell thickness in the Pie-billed Grebe.—The favored explanation for the ultimate determination of clutch size in nidifugous birds is Lack's hypothesis that clutch size is limited by the number of eggs a female's food resources allow her to form (Lack 1968, Klomp 1970). One argument against this egg limitation hypothesis is that some birds appear to be indeterminate layers and thus capable of laying more eggs than constitute a normal clutch (Krebs 1972: 568), but Klomp's (1970: 78–79) review shows most evidence for indeterminacy in nidifugous birds is anecdotal and/or derived from domesticated individuals that may have had an abundance of food. Also we suggest the egg limitation hypothesis should not be rejected even if indeterminacy is demonstrated reliably under natural conditions. Possibly a female's resources are depleted gradually and eggs laid after the normal clutch size are so inferior that selection favors laying fewer eggs than the female is capable of laying.

We manipulated clutches of two wild Pied-billed Grebes (*Podilymbus podiceps*) to determine whether this species is best categorized as a determinate or indeterminate layer. We predicted that if food resources limit clutch size, eggs might decrease in quality as laying proceeds. Our criteria for egg quality were size and shell thickness. One of us (Rothstein 1972) suggested material for shell formation may limit clutch size in a nidicolous species, the Cedar Waxwing (*Bombycilla cedrorum*).

We studied grebe nests at the Andree Clark Bird Refuge in Santa Barbara, California from 20 April to 13 May 1974. We generally removed one egg per day from each experimental nest. Eggs were marked with a

standard no. 2 pencil. In removing eggs, we chose the oldest one except when ages of eggs were unknown. Eggs were cleaned under running water, which removed their chalky coating (see Palmer 1962 and Harrison 1975) and left a hard surface. Through a hole of about 5 mm drilled near the midpoint of each egg we measured shell thickness (including the shell membrane) on both equatorial sides of the hole with a Fowler model GP micrometer.

Nest A had 1 egg on 26 April. On 27 April it had 2 eggs and we removed the older one. With 3 exceptions, we removed an egg each day until 11 May when the nest was empty and had probably undergone predation. The nest was still empty on 13 May. The exceptions were that we did not remove an egg on 2 and 7 May because a new egg was not present on these days. Presumably the female skipped a day in her laying on 2 and 7 May. Also the egg laid on 29 April was missing on 30 April, although a fresh egg was in its place. We did not remove an egg on 30 April either. All told the female laid 13 eggs in 15 days.

Nest B had three eggs when found on 23 April. The newest egg was easily identified because it was much cleaner than the others. We removed one of the older eggs leaving the nest with two eggs. On 24 April the nest contained 3 eggs and we again removed an egg. On 25 April the nest contained only the 2 eggs we had left in it the day before and we did not remove an egg. New eggs were laid on 26, 27, and 28 April and on each of these days we removed an egg. No new eggs appeared after 28 April and on 1 May we removed the two eggs still present. All told the female laid 7 eggs.

The female at nest A demonstrated indeterminate laying. She laid 13 eggs before predation occurred as opposed to the 5 to 7 eggs normally laid (Bent 1919). The largest unmanipulated clutches among the several hundred recorded in the literature had 10 eggs (Bent 1919, Glover 1953, Palmer 1962). Unmanipulated nests in our study area had only 6, 6, and 7 eggs and a nest in the Goleta Slough, 16 km to the west, had a complete clutch of only 4 eggs. The large difference in clutch size between nest A and these unmanipulated nests seems attributable only to our experimental procedure. This species does not appear to show changes in clutch size as the breeding season progresses (Palmer 1962) and besides, all nests in our study were found within a short period. Events at nest B did not demonstrate indeterminate laying, but Klomp's (1970: 3-10) review shows indeterminate species are more likely to lay large clutches the earlier in laying egg removal begins and the fewer the eggs left in the nest. As egg removal at nest B began later in laying than at nest A and left two eggs rather than one, our results are in accord with experiments on other species. Nest A provides the first case of indeterminate laying in the order Podicipediformes.

Neither clutch showed decreases in egg length (L), width (W), or shell thickness (T) as laying proceeded (Table 1). As a measure of egg size we calculated $L \times W^2$ for each egg, because formulas for egg volume typically include these values and certain constants (Romanoff and Romanoff 1949). As a measure of the volume of shell material we calculated $L \times W^2 \times T$ as egg surface area formulas include L, W^2 and constants. These analyses did not show decreases in egg size or shell volume as laying progressed. However, our data provide one line of evidence supporting the egg limitation hypothesis. If a female's resources were becoming depleted, longer intervals between each laying might be expected after the normal clutch size is surpassed. The grebe at nest A probably skipped a day in her laying schedule between eggs 6-7 and 10-11.

TABLE 1
MEASUREMENTS(MM)-OF EGGS FROM TWO GREBE NESTS

Nest A				Nest B			
Egg number ¹	Length	Width	Shell thickness ²	Egg number ¹	Length	Width	Shell thickness ²
1	45.38	32.23	0.257	1-2	46.96	30.92	0.262
2	43.89	32.00	0.263	1-2	46.47	31.71	0.269
3	43.75	32.10	0.262	3	46.71	31.83	0.256
5	43.08	31.43	0.261	4	48.02	32.19	0.269
6	43.58	31.20	0.258	5	47.78	31.29	0.278
7	42.74	31.78	0.264	6	46.54	30.60	0.277
8	44.15	31.78	0.269	7	46.54	31.02	0.287
9	43.58	31.80	0.262				
10	43.75	31.69	0.256				
11	43.02	32.03	0.260				
12	43.50	32.26	0.255				

¹ Number corresponds to order of laying. The first and second eggs for nest B could be distinguished. Eggs 4 and 13 were taken from nest A, presumably by a predator, before we were able to remove them.

² Average of 2 measurements.

Also, Glover (1953) reported that grebes at unmanipulated nests usually lay an egg per day but sometimes skip a day toward the end of laying.

Our data provide only limited support for the egg limitation hypothesis, but other meaningful measures of egg quality could have been used, e.g. overall caloric content. Furthermore even if the quality of eggs in abnormally large clutches is found to be equal to that in normal clutches, it is still possible that resources for egg formation may indirectly limit clutches. Conceivably the cost to the female of producing a large clutch may be so great that her survivorship is lowered and lifetime reproductive output is maximized by laying fewer eggs during each breeding attempt.

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G. N. FUGLE AND S. I. ROTHSTEIN, *Department of Biological Sciences, University of California, Santa Barbara, California 93106. Present address of first author: Department of Zoology, University of California, Davis, California 95616.* Accepted 2 Jan. 1976.

American Redstart feeding by artificial light.—On 2 August 1973, at 0300, one of us (GSB) was attracted to a second-floor window in the Lakeside Laboratory at the University of Michigan Biological Station at Douglas Lake by the fluttering of what we presumed to be a large sphingid or saturniid moth. Investigation revealed the source to be a warbler feeding on insects attracted to the screened window by fluorescent lights in the room. In rapid alternation, it hovered and perched on the window screen while selecting the larger insects (principally Ephemeroptera, Lepidoptera, and Trichoptera). After 5 to 10 minutes of observation, the bird was captured with an insect net and identified as a "yellowstart" or male American Redstart (*Setophaga ruticilla*) still in first nuptial plumage. We released it at the point of capture about 20 minutes later. After approximately 5 minutes, the bird returned to the window and fed for another 3 to 5 minutes. The bird then left the window and did not return during 20 minutes of subsequent watching, possibly because satiated, but most probably because feeding and opening the window screen to capture and release the bird depleted the insect supply. The behavior was not seen again, although an observer was present in the room until 0300-0400 most nights for a week, and large numbers of insects were often present on the screen.

We know of no other instance of nocturnal feeding by diurnal birds, outside of migration season, other than those commonly found in association with man. Species frequently reported to engage in such behavior include those that are generally opportunistic (e.g. gulls; Leck 1971, Blackett 1970) and those that exploit man-made environments on a regular basis. House Sparrows have been reported feeding by artificial light in airports (Broun 1971), at factories (Felton 1969), in regularly lighted areas on a college campus (Marti 1973), and at floodlights as much as 80 stories above the ground (Brooke 1973). Many other species that occur commonly in settled areas in Britain have been reported feeding during the hours immediately before dawn and after dusk (King 1967, Felton 1969, Blackett 1970, King and King 1974). This behavior may be seen as an extension of normal daylight activity in response to the continued availability of light and food. In each case, however, the birds were reported as exploiting a highly predictable situation.

The redstart behavior seen at 0300 occurred so long after sunset (2107) that it cannot be viewed as a