The Condor 87:439–441

LEUCISM IN EARED GREBES IN WESTERN NORTH AMERICA

JOSEPH R. JEHL, JR.

Leucism is the complete loss of a particular pigment, or all pigments, in feathers but not in soft-parts. It may be as slight as a single white feather or as pervasive as an all-white bird with normal eyes, bill, and legs (Buckley 1982). The condition has been documented, usually as a curiosity and under the term "albinism," in hundreds of species. Its incidence is said to differ greatly among species (e.g., Sage 1963, Gross 1965), but the data for that conclusion are unconvincing because a high percentage of reports pertain to species that associate with, or are hunted by, man. As a result, observational bias is potentially strong. For only a few species (e.g., storm-petrels; Baptista 1966) has it been possible to consider the phenomenon more broadly and to investigate the frequency of leucism in natural populations of birds. The subject is interesting because leucism, like any variable condition, may provide indirect evidence of underlying genetic variability. Furthermore, if its frequency can be measured, this may allow some inferences to be drawn about the strength of selection against abnormally-colored individuals. In this paper, I present data on leucism compiled incidental to other research during a four-year (1981–1984) study of Eared Grebe (*Podiceps nigricollis*) biology at Mono Lake, California. Other aspects of this research have been presented elsewhere (Mahoney and Jehl 1985; Storer and Jehl, in press).

METHODS

Mono Lake lies at the eastern base of the Sierra Nevada on the western edge of the Great Basin in central California. From January, 1981 through November, 1984, I used a small boat to census grebes year-round; censuses were usually made at two- to three-week intervals from April to late October, and at six- to eight-week intervals at other times. Sporadic observations were also made in 1980. Grebes do not nest at Mono Lake, although some may be present at any season. Perhaps 100 individuals attempt to spend the winter, and the number of spring migrants does not exceed 15,000–20,000 at any time. Typically, 20,000–35,000 non-breeders summer there. Beginning in late July, these are joined by tens of thousands of post-breeding adults along with juveniles, which stage there before moving to wintering areas in late fall. By October, approximately 750,000 birds are present. The total population can be estimated to within ±15% when grebes number 100,000 or fewer. Estimates become increasingly imprecise as the population grows, but remain sufficiently accurate (±30%) for my purposes here (Jehl, unpubl.).

On censuses, I noted the presence and general color pattern of leucistic birds, when possible. Because of the great variability in plumage patterns and the tendency for individual birds to frequent the same areas for several weeks or more, it was possible to accurately determine the number of leucistic birds in the summering population. In spring, when the total population size is small and most birds can be viewed individually, the detectability of unusually-plumaged birds is also good. In fall, however, whitish birds become surprisingly inconspicuous among the hordes of migrants then present in their grayer basic plumage; as a result, frequency estimates at that season are conservative.

Because the flock is so large and includes birds of all age and sex classes, the data should be representative for the species.

TABLE 1. Patterns of leucism in Eared Grebes recognized in field studies.

Category[a]	Description
1.	Apparently pure white on head, body. Wings presumed to be white, but that is not necessarily the case (Fig. 2).
2.	White with gray smudges on head or neck or both. Ear tufts (if present) white or very pale yellow. Wings variable; remiges or coverts or both may be pigmented (Fig. 2).
3.	Body white with occasional gray feathers on back or rump (not usually evident except at close range). Wings dark except for (normal) white patch of secondaries. Black or gray markings on crown or nape, often extending around ear tufts onto chin. Ear tufts (if present) golden or pale yellow.
4.	Body white. Gray feathers evident on back. Otherwise like category 3, except black area on neck is more extensive and occurs on lateral and anterior surface. Wings as in category 3.
5.	Head, neck, and chest black, with golden ear tufts (if present). Back dark, rest of body white. Wings as in category 3.
6.	Piebald. Appears uniformly gray at a distance but plumage is a mixture of gray and white feathers. Wing pattern apparently variable.

[a] In categories 2A–5A (not listed), the patterns are identical to those in categories 2–5, but black tones are replaced by brown or tan.

RESULTS

Leucistic color patterns.—Although color variation is continuous from "normal" to "all white," I found it convenient under field conditions to recognize six common patterns of leucism, which consisted of various combinations of white with black or gray feathers, and four variations of those patterns in which brown or tan markings replaced black or gray tones (Table 1, Fig. 1). These patterns are similar, although not necessarily identical, to those determined by examination of specimens (cf. Figs. 1 and 2).

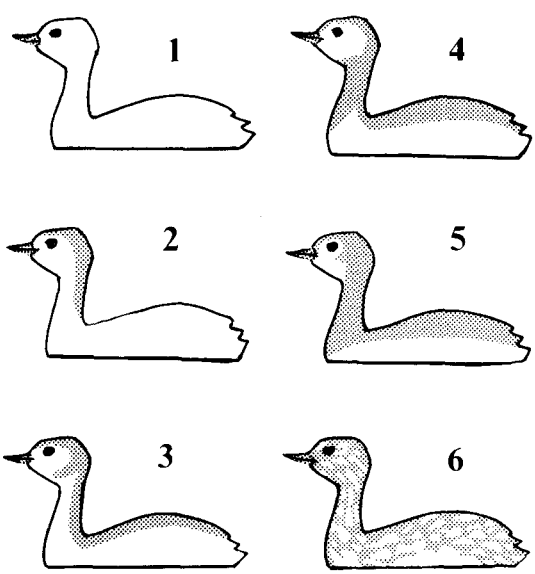

FIGURE 1. Diagrams of leucistic phenotypes of Eared Grebes recognized in field studies.

TABLE 2. Phenotypic variability among leucistic Eared Grebes at Mono Lake, California, 1980–1984.

Category	Number of leucistic birds 1980	1981	1982	1983	1983	1984	Total
				13 July	15 Sept.[a]		
1	2	1	1	1	4	2	10 (18)%
2	1	2	5	2	7	1	16 (28)%
2A		1					1 (2)%
3		2	1	1	1		4 (7)%
3A			2				2 (4)%
4		3	1	4	6	2	13 (23)%
4A		3					3 (5)%
5				3	3		3 (5)%
5A		1					1 (2)%
6			1	2	3		4 (7)%

[a] Includes birds collected or observed earlier in year. This column used to calculate frequency and totals for 1983.

Birds that appeared to be essentially white in the field (Categories 1 and 2) comprised 47% of the white birds (Table 2). Those showing dark markings on the head and neck (Categories 3 and 4) were nearly as common (39%). Birds with a dark head, neck, and chest (Category 5) and piebald birds (Category 6) each comprised 7%. Birds with brown instead of black markings (Categories 2a–5a) made up 13%.

Field estimates were subject to unavoidable errors. Grebes were hard to approach, which made it difficult to be certain of the subtleties or extent of their markings. Furthermore, the reflectance of white feathers was sometimes so brilliant as to obscure any patterning that might have been present. Also, because grebes rarely flapped, I could not verify coloration on the wings. Finally, and most important, the whiter birds were more conspicuous and thus their apparent frequency was probably exaggerated. I cannot be certain how many birds in Category 1 were correctly assigned. All of the leucistic birds that were collected (5 males, 4 females) had at least some trace of dark coloration, which was usually most pronounced on the rump or upper wing coverts but which was not evident in the field. I estimated that Category 1 comprised fewer than 10% of the leucistic birds and that most of the "white" birds fell in Category 2.

Frequency of leucism. — Leucistic birds were rare among spring migrants (Table 3). I saw none among ca. 42,000 birds counted in March–May in 1981, 1982, 1983; in May, 1984, two were seen among ca. 26,000 grebes. I estimated that they were no more common than 1:15,000–20,000 at this season. In summer (June–July), they were much more conspicuous. In 1981, 1982, and 1984, I determined a ratio of ca. 1:5,000–8,000, but in 1983, there were at least 13 in a summering population of 6,000 (1:460). The ratio in fall was hard to judge, but certainly decreased as post-breeding adults and juveniles arrived. In mid-August and September, it seemed to approximate 1:15,000. Data from later in fall were unreliable because of the difficulty in making precise observations on the thousands of wary birds.

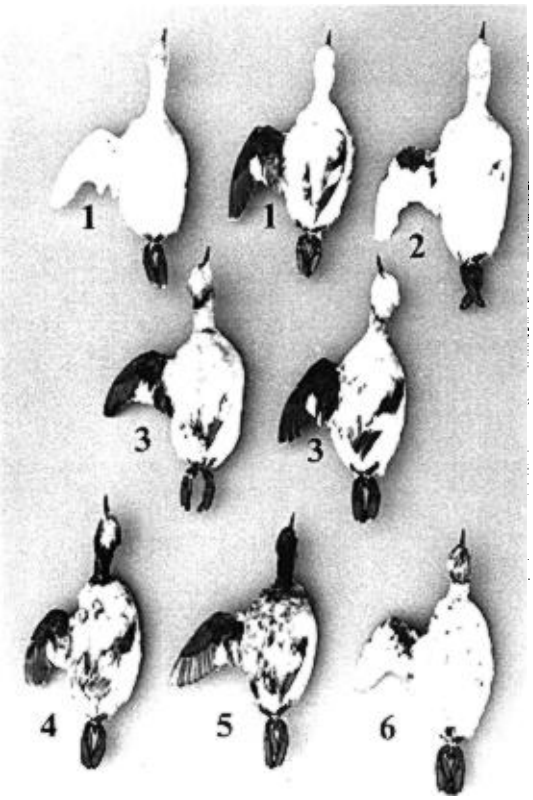

FIGURE 2. Specimens of Eared Grebes showing variability in leucistic phenotypes. Numbers refer to the categories (Table 1) in which these specimens would be placed under field conditions. Note the persistence of dark rump coloration, which promotes thermoregulation.

TABLE 3. Frequency of leucistic Eared Grebes at Mono Lake, California, 1980–1984.

Year	Number leucistic	Date	Total population	Frequency
1980	3	22 July–16 Aug.	N.D.	—
1981	7	9–20 July	50,000–60,000	1: 7,000–8,500
	12	9 July–4 Aug.	85,000–92,000	1: 6,700–7,600
	13	9 July–21 Aug.	160,000–200,000	1: 12,000–15,000
1982	6	11 June–13 July	35,000–40,000	1: 5,800–6,700
	10	11 June–25 Oct.	750,000–800,000	1: 75,000–80,000
1983	13	16 June–4 July	5,500–6,000	1: 420–460
	12	12 July	5,500–6,000	1: 460–500
	24[a]	15 Sept.	375,000–450,000	1: 15,600–18,750
1984	2	12–13 May	15,000–17,000	1: 7,500–8,500
	5	10 June–20 July	25,000–27,000	1: 5,000–5,400

[a] Includes birds known to have been present earlier in the year; actual count = 15 on 15 September.

DISCUSSION

Many grebes sunbathe and in those species the bases to feathers of the lower back and rump, as well as the pigmentation of the underlying skin, are dark (Storer et al. 1976). The persistence of dark feathers on the lower back of leucistic birds suggests a strong genetic resistance to pigment loss in that area and gives indirect support to the suggestion (Storer et al. 1976) that thermoregulation may be a problem for small species of grebes at high altitude lakes.

Despite the roughness of my census data, it is evident that leucism was much more common in the summering population, which was composed mainly of one- and two-year-old birds, than among the spring and fall migrants, which were mainly birds of breeding age and (in fall) juveniles (Jehl, unpubl.). It is unlikely that the leucistic summering birds had been unable to find mates and returned early to the staging areas because: (1) the summering population is stable and the number of whitish birds does not increase as the season progresses; (2) some leucinos do pair (and, presumably, breed) successfully (Jehl, pers. observ.); and (3) the leucistic birds that I collected had at least a trace of a cloacal bursa, which is usually, but not always, evidence of immaturity (Storer and Jehl, in press). Therefore, I doubt that these birds had attempted to reach the breeding grounds. Another possibility is that leucism may be restricted to particular feather generations (P. A. Buckley, in litt.), and that some whitish feathers are replaced by normal plumage in the pre-basic molt. Indeed, the head and neck pattern of one bird that I watched intermittently from July to October, 1981, seemed to be slightly darker after the molt. A third explanation is that white adults on the breeding grounds are more susceptible to predation than are juveniles and non-breeders summering at Mono Lake, where predation is essentially nil (Jehl, unpubl.). Selection against conspicuous birds would result in a decreased frequency of leucism in the post-breeding flock.

In order to interpret the biological significance of abnormal plumage patterns, one requires data on the variation and incidence of such patterns at different seasons. This paper illustrates some of the difficulties encountered in trying to obtain such data for wild birds. If data from a large, mostly sedentary, and easily-studied population are so tentative, one cannot be hopeful of obtaining more precise information for most birds. The incidence of leucism at hatching, however, could be measured through studies of colonial-nesting birds (e.g., gulls, penguins).

C. Braun, E. H. Burtt, Jr., P. A. Buckley, K. C. Parkes, and R. W. Storer kindly reviewed the manuscript and made many helpful suggestions for its improvement. The research was sponsored by the Los Angeles Department of Water and Power, with a cooperative agreement with the U.S. Fish and Wildlife Service.

LITERATURE CITED

BAPTISTA, L. F. 1966. Albinistic feathers in storm petrels (Hydrobatidae). Condor 68:512–514.

BUCKLEY, P. A. 1982. Avian genetics, p. 21–110. *In* M. Petrak [ed.], Diseases of cage and aviary birds. 2nd ed. Lea and Febiger, Philadelphia.

GROSS, A. O. 1965. The incidence of albinism in North American birds. Bird-Banding 36:67–70.

MAHONEY, S. A., AND J. R. JEHL, JR. 1985. Avoidance of salt-loading by a diving bird at a hypersaline and alkaline lake: Eared Grebe. Condor 87:389–397.

SAGE, B. L. 1963. The incidence of albinism and melanism in British birds. Br. Birds 56:409–416.

STORER, R. W., AND J. R. JEHL, JR. In press. Moult patterns and moult migration in the Black-necked Grebe (*Podiceps nigricollis*). Ornis. Scand.

STORER, R. W., W. R. SIEGFRIED, AND J. KINAHAN. 1976. Sunbathing in grebes. Living Bird 15:45–58.

Hubbs Marine Research Institute, 1700 South Shores Road, San Diego, California 92109. Received 13 October 1984. Final acceptance 23 February 1985.

The Condor 87:441–442

CAVE SWALLOW PAIRED WITH CLIFF SWALLOWS

THOMAS R. HUELS

The only confirmed sightings of Cave Swallows (*Hirundo fulva*) in Arizona have been made in Tucson on the University of Arizona campus. One Cave Swallow was seen each year from 1979 through 1982 at the Main Library among the nesting Cliff Swallows (*H. pyrrhonota*), and two were present during the 1983 breeding season. The Cave Swallows fledged three young from an old Cliff Swallow nest on the library building, and all five of the family were marked with U.S. Fish and Wildlife Service bands in 1983 (Huels 1984). Of these five, in 1984 I saw only the adult male as I recorded the periods of occupation of approximately 300 old and new Cliff Swallow nests on the university campus. This note summarizes five moves of the lone male Cave Swallow between four Cliff Swallow nests, his successive association with two or three Cliff Swallows, and his one nesting with a Cliff Swallow in 1984.

My first 1984 sighting of a Cave Swallow on the University of Arizona campus occurred at the Main Library on the evening of 19 March, shortly after the season's first sighting of Cliff Swallows on 8 March by Arnold Moorhouse. I found the Cave Swallow perched on a cup-shaped remnant of an old Cliff Swallow nest, approximately 24 m west of the nest from which he fledged young in 1983 and 0.4 m from a complete old nest occupied by a pair of Cliff Swallows. From 19 March to 9 or 10 April, I saw only the Cave Swallow on the broken nest. He appeared to center his activity at this nest. He frequently chased and displayed in flight to flying Cliff Swallows, and he added about 2 cm of mud to the rim of the nest before temporarily shifting his activity to another nest.

I found the Cave Swallow at his second nest of the 1984 season on the evening of 11 April. He and a Cliff Swallow repeatedly entered a complete old Cliff Swallow nest on the Main Library and then spent the night together inside the nest, approximately 84 m east of the nest he first occupied in 1984 and 60 m east of the nest he used in 1983. He and a Cliff Swallow were active at his second nest of the 1984 season from 11 to 17 April. Both abandoned this nest immediately after I captured them inside the nest before dawn on 17 April. The Cave Swallow proved to be the adult male banded the previous season, and I marked his chin with blue ink. His female nest-mate was banded, inked, and released. No eggs were present in their nest. The Cave Swallow resumed using the nest he used at the start of the 1984 season. From 17 through 24 April, he repeatedly displayed in flight to Cliff Swallows, but only he was seen on the nest. He abandoned this nest after being frightened from it as I captured the pair of Cliff Swallows in the nearest nest before dawn on 25 April.

The Cave Swallow was found again on 29 April 1984 at the old Cliff Swallow nest from which he fledged young