

Mortality of Eared Grebes in Winter of 1982–83

*A piece of deductive analysis on the causes
of a massive grebe die-off
on the southern Pacific coast*

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ABSTRACT

A minimum of 25,000 Eared Grebes (*Podiceps nigricollis*) died along the Pacific coast of southern California and Baja California in mid to late January 1983. Although the cause of the mortality cannot be established with certainty, we argue that the grebes were forced down by bad weather during a trans-Sierra crossing after leaving Mono Lake, California. Those that survived reached the coast in such poor condition that they soon succumbed. If this explanation is correct, the die-off is likely to have been much greater than we can document, because grebes require open water from which to become airborne, and birds forced down in the mountains or deserts would likely have been unable to resume their journey.

IN JANUARY 1983, thousands of Eared Grebes (*Podiceps nigricollis*) died along the Pacific coast of North America, in the region between San Ignacio Lagoon in central Baja California and northern San Diego County, and perhaps as far north as Santa Barbara, California (Fig. 1). The timing of the event can be established with good accuracy because many of the sick or injured sea birds found in the San Diego area are brought to the Sea World park for rehabilitation. In early 1983, over 80 Eared Grebes arrived, perhaps 10 times the usual number. From December 28, 1982 through January 25, 1983 one or two birds arrived daily. This increased to 2 to 4 birds daily from January 26 through February 3, after which only a handful arrived, the latest on March 6. On beach surveys near Ensenada, Baja California, mortality was recorded from January 9 to February 5, 1983 (K. Nishikawa, *pers. comm.*). Additional surveys in San Diego established that peak mortality was realized in mid-late January, at which time it became so conspicuous that it attracted the attention of the local news media. To estimate its extent and intensity we surveyed local beaches and sought information from colleagues in other areas.

Mortality was very high on exposed beaches as well as in sheltered waters from San Clemente to the Mexican border (Table 1). Although other species that winter commonly in the region were also found dead in mid-January (*e.g.*, Arctic Loon, *Gavia arctica*, Western Grebe,

Aechmophorus occidentalis, Northern Fulmar, *Fulmarus glacialis*), their numbers were very low and similar to those detected in "normal" years, leaving little doubt that the high mortality was specific to Eared Grebes. This was also the case in Baja California.

We obtained quantitative data for a few areas. In La Jolla (Black's Beach) we found 40 birds/km on January 21; on Fiesta Island in Mission Bay, 70 were reported in 1 km of beach on January 25; and at Border Field, near the Mexican border, there were 47/km on January 23. These densities seem representative, because during the same period the California Department of Fish and Game received many reports of 50-100 grebes dead "in a small area" at sites scattered along the entire coast of San Diego County. Lower densities were recorded on the shore at Mission Beach, San Diego (15/km, January 24) and at Pacific Beach, San Diego (22/km on January 18) but those beaches are regularly cleared of debris. We know that many cadavers had been removed prior to our censuses and watched others being discarded before we could salvage them.

Follow-up surveys at Black's Beach on January 25 showed that the number of grebes had dropped to only 3/km, and at Pacific Beach on January 21 to 2/km. These observations, which suggested that the die-off had essentially ended, were confirmed by the condition of the specimens, most of which had been dead for several days to a week. No further sur-

veys were attempted because starting on January 26-27 a series of intense winter storms destroyed many beach areas

HEAVY MORTALITY extended well southward into Baja California. In the Ensenada area, Nishikawa (*pers. comm.*) reported densities of 115/km on the outer beaches and 43/km in the harbor areas in mid-January. In the mid-Peninsula region, D. MacIntyre reported "hundreds" dead in San Ignacio Lagoon on about January 20 (*vide* W. T. Everett), and B. Henneman (*pers. comm.*) saw perhaps 100 dead at the San Benitos Islands and Cedros Island in the last week of January, plus 25 more in San Ignacio Lagoon.

Mortality may have been less north of San Diego County. We have no report of a die-off in the Los Angeles area, although in Santa Barbara, dead grebes were conspicuous on January 22 (D. R. Jehl, *pers. comm.*). Four censuses in Santa Barbara and San Luis Obispo counties in early January, revealed no unusual mortality and only a few grebes were found in San Luis Obispo County on January 25.

The mortality was concentrated along the coast. None was detected at San Nicolas Island (B. Stewart, *pers. comm.*), although that is not surprising because few grebes winter offshore. We have no indication of mortality in inland areas. Beached bird censuses at Klondike Lake and Tinemaha Reservoir in the Owens Valley of eastern California on January 25 revealed no dead grebes (B



Figure 1. Geographic extent of Eared Grebe mortality in January, 1983. Mortality was probably light north of San Clemente (Area 1) was high and relatively uniform between San Diego and Ensenada (Area 2), and apparently was high as far south as San Ignacio Lagoon (Area 3). No mortality was reported from the Salton Sea or the Gulf of California, where Eared Grebes winter in great abundance.

Tillemans, *pers. comm.*), and Jehl found no evidence of mortality at Mono Lake, California, where hundreds of thousands stage prior to departing for the wintering grounds.

Many thousands winter at the Salton Sea, but J. Garcia (California Dept. of Fish and Game) saw none dead on aerial surveys on January 4 and 19, or on a brief survey of beach areas January 27. No

mortality was reported in the Gulf of California, the species' main wintering area, in January. Nishikawa *et al.* (1983) found concentrations of dead grebes in several areas of the Gulf, as far south as La Paz, Baja California, in March, but did not report either the dates of their observations or the condition of the specimens so that it is impossible to determine when those birds died. We sus-

pect that this represented normal mortality among wintering birds and was not directly related to the January event.

So far as we can determine, the mortality occurred rather uniformly from San Clemente to the Mexican border, and may have been even greater to the south, at least as far as Ensenada. Assuming a mortality rate of 40/km (Table 1), 9200 birds perished in that 230/km interval before January 25. That estimate is very conservative because by January 23, we had evidence of over 900 deaths from just a few beaches in San Diego County, and in the Ensenada area Nishikawa and colleagues had found 823 birds dead by January 21.

WE HAVE NO QUANTITATIVE data for other areas. Even if the mortality had been only one-tenth as great north of San Clemente (4 birds/km \times 350 km) and half as great south of Ensenada (20 birds/km \times 900 km) an additional 19,400 birds would have been involved. Extrapolations are always risky and in this case might be especially so, because this species typically concentrates in bays and lagoons which are few and scattered in the region. Nevertheless, because dead grebes were as common on the coastal beaches as in sheltered waters, we suspect that the mortality occurred rapidly, before most birds were able to reach their preferred wintering locations.

We estimate that at least 25,000 grebes perished in late January. Others died in the following weeks (as evidenced by the continued arrival of weak birds at Sea World) but were not found because of the winter storms. Indeed, Nishikawa *et al.* (1983) estimated a total of 2500-3000 dead in the Ensenada area alone. This was a major event, and it represents the largest die-off of grebes known to us.

We salvaged birds to determine the composition of the population; of 39 birds sexed, 20 were male and 19 female. We were unable to age all birds, either by plumage or bursa characters, but adults as well as juveniles were represented. Thus, the mortality was not specific to any age or sex class.

Grebes brought to Sea World or found freshly dead were emaciated, weighing an average of 196 g (range 130-240 g, N = 45), and their stomachs were empty. Weights for healthy grebes at this season approximate 300-320 g (Jehl unpubl.). Birds kept in captivity showed no signs of illness and many quickly regained health when placed on a diet of mealworms, crickets, and small shrimp.

Four cadavers were submitted to the National Wildlife Health Laboratory of the U.S. Fish and Wildlife Service in Madison, Wisconsin. No specific cause of death could be determined, but there was no indication that any abnormal sources of mortality (e.g., poison, oiling, pesticides) were involved. Nishikawa *et al.* (1983) reached a similar conclusion.

DISCUSSION

THOUSANDS OF EARED GREBES perished in coastal southern California and Baja California in the last half of January 1983. Other than emaciation, they showed no signs of ill health and many recovered when supplied with an adequate diet. These facts suggest that the die-off might have been caused by a major food shortage that extended along several hundred miles of coast. This species feeds mainly on invertebrates (Cramp and Simmons 1977, Palmer 1962) but its main prey on Pacific coast wintering grounds is unstudied. An El Niño condition raised sea temperatures by 2-6°F above normal in early January. It is unlikely that this affected prey population because (i) the invertebrates are residents and encounter similarly warm temperatures only a few months later in the year, and (ii) the mortality was specific to grebes. That the severe winter storms of early 1983 disrupted prey populations also can be dismissed because they occurred after the peak of mortality. Thus, we doubt that conditions on the wintering grounds were responsible.

The alternative is that the grebes' viability was so reduced by a prior event that they quickly perished upon reaching the coast, although conditions there were favorable. There is circumstantial evidence for this idea. Prior to moving to the wintering grounds, Eared Grebes stage and remain for several months at Mono Lake, California, and Great Salt Lake, Utah, and perhaps other alkaline lakes in the far west. At Mono Lake, 750,000 grebes occur in late fall (Jehl *in prep.*), and in 1982, when brine shrimp (the major food) populations were high, several hundred thousand stayed at least until the end of December. We do not know the condition of birds at Mono Lake at that time, but the large numbers present are *de facto* evidence that it was good. Further, beached bird censuses indicated that no unusual mortality was being experienced. By the time grebes leave the staging areas they are typically very fat and have more than sufficient energy to cover

Table 1. Geographic distribution and extent of Eared Grebe mortality.

Date	Locality	Coverage	No. Birds	Birds/km	Source
CALIFORNIA					
San Luis Obispo County					
Jan. 25	Cambria		1	0.6	P.R.B.O.
Santa Barbara County					
Jan. 22	Santa Barbara	Several hundred meters	"dead birds conspicuous"	—	D. Jehl
San Diego County					
Jan. 20	San Clemente	—	50-60	—	Cal. Fish & Game Dept
Jan. 20	San Elijo	—	50	—	Cal. Fish & Game Dept
Jan. 25	Carlsbad	In small area	25	—	Anon.
Jan. 21	Black's Beach	2.0 km	81	40	This study
Jan. 25	Black's Beach	2.0 km	6	2	This study
Feb. 20	Black's Beach	2.0 km	0	—	This study
Jan. 18	Pacific Beach	1 km	21	21	This study
Jan. 21	Pacific Beach	1 km	1	1	This study
Jan. 20	Mission Beach	—	50	—	Cal. Fish & Game Dept
Jan. 21	Mission Beach/ Pacific Beach	—	50	—	Cal. Fish & Game Dept
Jan. 24	So. Mission Beach	1.6 km	25	16	This study
Jan. 22	Mission Bay	20 m	7	350 ^a	This study
Jan. 22	Mission Bay	—	20	—	Cal. Fish & Game Dept
Jan. 25	Fiesta Island	1 km	70	70 ^a	This study
Jan. 20	San Diego Bay	—	30	—	Cal. Fish & Game Dept
Jan. 20	Coronado	—	80-100	—	Cal. Fish & Game Dept
Jan. 21	Silver Strand	—	30+	—	Cal. Fish & Game Dept
Jan. 20	Imperial Beach	—	50-100	—	Cal. Fish & Game Dept
Jan. 23	Border Field	1.6 km	76	47	P.R.B.O.
MEXICO					
Baja California					
Late Jan.	Ensenada-outer beaches	—	—	115	K. Nishikawa
Late Jan.	Ensenada harbor	—	—	43	K. Nishikawa
Jan. 21-29	San Benitos/Cedros Is.	—	100	—	B. Henneman
Jan. 21-29	San Ignacio Lagoon	—	25	—	B. Henneman
Jan. 23	San Ignacio Lagoon	—	100s	—	D. MacIntyre, <i>vide</i> W. Everett

^aDensity figures unreliable because of probable concentration by tidal activity.

the 400-500 miles to the wintering grounds in a single flight. Yet, grebes are notoriously weak fliers and are easily grounded. We suspect that birds that tried to reach the Pacific Ocean by crossing the Sierra Nevada late in the season encountered adverse weather, which forced them to land at unfavorable inland sites and interrupted their migration, so that they reached the coast exhausted. Snowfall was essentially absent in the southern Sierra in the first half of January, but occurred on 8 of 10 days between January 16-25, or just before the main die-off was noticed.

There are many reports about the effect of weather on grebe migration. For example, Eaton describes (this issue, p. 836) an event in which several hundred Horned Grebes (*Podiceps auritus*) were downed by an ice storm in western New York State in January 1978. Recent observations in Utah seem even more pertinent. Kingery (1983) reported that "many Eared Grebes remained at Great Salt L., into December [1982] when several thousand died, probably of malnutrition." M. P. Coffeen (State of Utah Division of Wildlife Resources, memorandum dated Feb. 8, 1982) reported two

significant downings in that month. On December 9 over 2000 were forced down by a snowstorm, along a 180-mile stretch of Interstate Highway 15 between Provo and Brianhead, and on December 24, 1000 were downed near Cove Fort. In both cases the birds were attracted to the lights of the highway or small cities and landed in the snow. Many rescued as much as 5 days later were still in good condition.

These observations seem to show that Eared Grebes avoid migrating as long as possible in the fall. Yet, if forced down in unfavorable areas, they can survive for several days. In the present case, lacking certain knowledge of the source of the migrants and the time of their departure we cannot resolve whether food shortage or adverse weather, or either, may have been the major factor in causing the die-off. However, if the birds originated at Mono Lake, as seems likely, we suspect that bad weather during a trans-Sierran migration is the more likely possibility. If so, the amount of mortality may have been many times higher than we can document because grebes require open bodies of water from which to become airborne. There would have been few such refuges available to migrants downed in the mountains or deserts at that season.

In any event, there is no hint that non-

natural phenomena were involved in this event. Perhaps our most important finding is that, even in relatively well-documented cases of large-scale mortality, it may be often impossible to come to a firm conclusion about causality or numbers involved.

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Autumn Book Roundup

Reviews by Robert Arbib, Susan Roney Drennan and Lois Gebhardt

Check-list of North American Birds: The species of birds of North America from the Arctic through Panama, including the West Indies and Hawaiian Islands. Sixth Edition. Committee on Classification and Nomenclature of the A.O.U. A.O.U. (Allen Press, Lawrence, KS.) 1983. xxix + 877 pp. Octavo, hardbound. \$29.95. At long last—here is the Sixth Edition in all its glory, its red cloth binding now to take place next to the blue of the superseded Fifth of 1957. And although this critic had some harsh comments and strongly critical views of the work in progress, particularly of the changes in some vernacular names, the Sixth, as it finally is revealed, is in sum a tremendous undertaking, admirably done. It is a work that will be essential to any ornithologist, professional or amateur, author or editor for at least

the rest of this century. It provides us with the new official order of species, the accepted names, and current species ranges for our entire continent. The total now comes to 1913 species with almost 90 more listed in the Appendices of hybrids, doubtful named forms, and introductions.

The format of the work essentially follows that of previous editions. A detailed introduction explains the history and rationale for decisions that were required of the committee, on geographic coverage (Hawaii, Central America and the West Indies added, Greenland deleted), on taxonomic categories, including the concept of the superspecies, on the book's format, the procedure of the book's long task, and the future needs. Then follows the Check-list itself, beginning with Great Tinamou, and ending with African

Fire-Finch. For each species the vernacular and scientific names are followed by a brief notation on nomenclatural origins, these followed by an abbreviated note (a sentence, usually) on Habitat, and a longer, but still condensed paragraph on Distribution. At appropriate places, one finds other taxonomic headings such as orders, suborders, families, subfamilies, tribes, and genera, also with appropriate derivations. Many of us are already familiar with the numerous changes in order and nomenclature and the lumpings and splittings that the Sixth Edition brings, and thus they come with less shock. The committee has been alternately, even simultaneously, criticized for being too radical in its revisions and for being much too conservative. The com-

(continued on page 919)