

Weather conditions were discussed as affecting the number of quail. The recent years of drought and the reduction of the water supply were said to have affected the survival of both young and adults, and the late rains of the preceding year were believed to have soaked some of the eggs and reduced the hatch.

Man, in one way or another, was implicated as an important agent affecting the number of quail. Generally emphasized was the use of poisoned grain against ground squirrels. The kind of poison used was not definitely known. One of the men said that after poisoned grain had been put out, he had found numbers of quail, rabbits, and even deer dead in fields or along the margins of areas kept green by springs. He thought the squirrels should be controlled, but he felt that a squirrel shoot, on the order of a jay shoot, would be good fun, would be as effective in reducing the squirrels as poisoned grain, and would operate only against the animal which they wished to kill.

Illegal practices such as spotlighting and bootlegging game were mentioned, but the present game warden is believed to be successfully eliminating these practices. The increase in the number of hunters on account of good roads and cars seems to be a problem without a solution. One non-hunter believed that if the sportsmen were better "sports," the quail would have a chance, since most of the hunters regularly shot until they got the bag limit, whether they could make use of the birds or not.

Besides attempting to protect the quail already present, the local hunters are trying to increase their number by the establishment of areas closed to shooting, by keeping water holes available, by feeding, and by rearing and planting young stock. The latter has been accompanied by the release of the Hungarian Partridge and the Wild Turkey, neither of which has become established. Hopes were expressed that the Chukar Partridge could be planted when stock is available.

Whatever the relation of the jays and quail, the shoot described would likely at best bring only an imperceptible reduction in the numbers of jays. Vermin shoots persist partly because the enmity of the sportsman is inflamed by seeing jays kill young quail, partly because, like the husking bee or barn raising, they constitute a pleasant aspect of rural society.

Museum of Vertebrate Zoology, University of California, Berkeley, November 27, 1936.

WATER BIRDS OF THE BOULDER DAM REGION

WITH MAP

By DWIGHT C. SMILEY

At intervals from January 20 to June 30, 1936, I made wildlife studies for the National Park Service in the vicinity of Lake Mead—the reservoir of Boulder Dam. The Colorado River drains the western slope of the central Rocky Mountains. It flows westward through the Grand Canyon of northern Arizona, and then it turns abruptly southward. In its southward flow to the Gulf of California, it forms a boundary which separates Arizona from southern Nevada and from southern California. Boulder Dam is situated ten miles south of the west-to-south turning point of the river.

Late in the winter of 1935, the flow of the Colorado was first checked by Boulder Dam, and Lake Mead reservoir began to fill. The latter is now a Y-shaped body of water; two arms of the "Y" are formed by the valley of the Colorado, and

the third by the valley of the Virgin River. (See map, fig. 36.) In the spring flood of 1939, Lake Mead is expected to reach its mean high level. Maximum elevation of surface will be 1229 feet above sea level; maximum depth, 589 feet; maximum length, 115 miles; maximum width, 8 miles; surface area, 227 square miles.

The adaptability of Lake Mead as a bird habitat is conditioned by the physical character of this part of the Colorado River valley. When viewed from some high point, the valley appears, because of the lack of conspicuous vegetation, like a massive relief map formed from vari-colored plaster. The lake is extending 20 miles into the terminal part of Grand Canyon. From the end of Grand Canyon to Boulder Dam, a distance of 80 miles, five narrow, cliff-sided canyons cut through as many mountain ranges. The Virgin River arm of the lake is forming in a broad, V-shaped valley; at the upper, free apices of the "V," mountains parallel the ribbon-like valley floor.

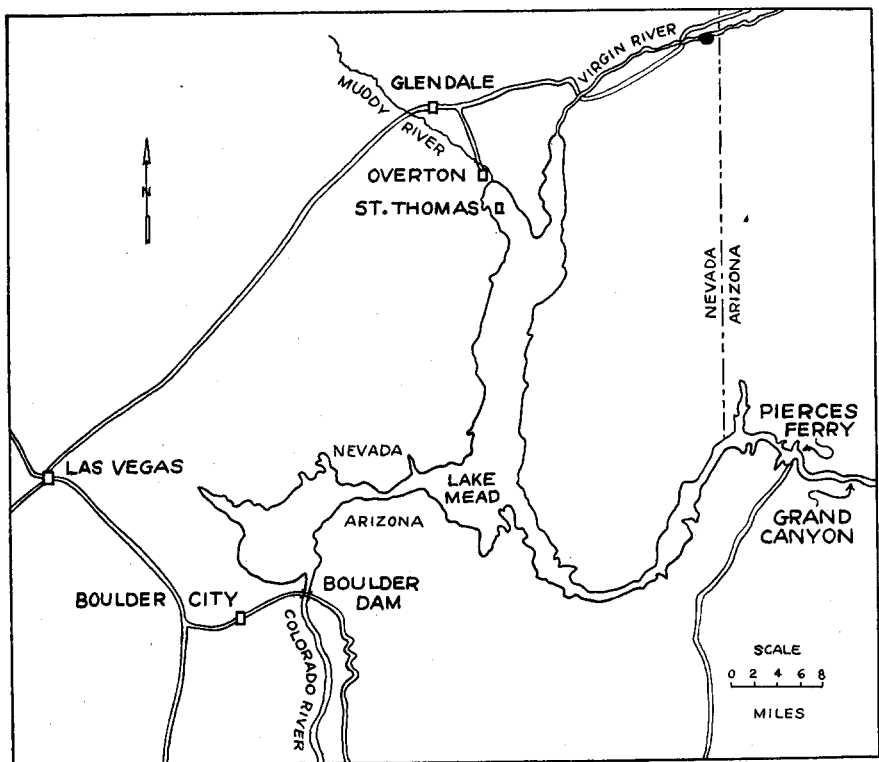


Fig. 36. Shows location of Lake Mead, impounded by the Boulder Dam in a forking section of the Colorado River valley.

As to the effect on bird life resulting from the formation of this lake and from its eventual destruction as such, it is safe to make one general statement. The opaque water of the Colorado and of the Virgin carries enough sediment into the lake to obliterate it in less than two hundred years. The submerged deltas forming at the mouths of the two rivers point to the future abundance of waders and shore birds. The rapid destruction of this lake may be prevented by the construction of another dam upstream on the Colorado; the reservoir thus created would for a further period of time catch the sediment.

Of factors inducing change in status of birds here, the submersion of habitats is of major importance. The flats at the mouth of the Virgin River have been submerged. The birds which occurred there must find other places for foraging and resting. Some of them may increase and others decrease under the new conditions. My notebook account contains no record of ducks seen "tipping-up" for food in shallow water. Conditions during the formative stage of the lake are unfavorable to birds of this foraging habit. Aquatic organisms sought by these birds do not become established in the temporary shallows of the lake.

When the lake reaches its mean high level, conditions will be as unfavorable as at present for shallow-water-feeding birds. The level of the lake will fluctuate usually about 60 feet each year, on account of the annual floods of the two tributary rivers. This belt of shore between low- and high-water marks will be subjected alternately to desert climate and to submersion by water. Therefore neither aquatic nor terrestrial food organisms can become established. An exception to this situation, perhaps, will occur on the adobe clay flats at the mouth of the Muddy River. Judging from the semi-aquatic tendency of cocklebur (*Xanthium* sp.) in this locality, these may grow in abundance over the alternately submerged and exposed adobe flats. The only evidence that ducks may possibly eat either the plant or the seed of cockleburs was found in the listing of it by Wetmore as one of several plants "available as duck foods" in the Bear River marshes, Utah (U. S. Dept. Agric. Bull. No. 936, 1921, p. 13). Cattails (*Typha* sp.) important in southern Nevada as "cover" for ducks probably will not grow along the shore of the lake.

The status of surface-feeding ducks may hinge upon one factor—a slight tendency to the development of barely submerged algae on Lake Mead. The amount and kind of animal food in these algae may determine the abundance of surface-feeding birds.

The transparent clearness of the water of Lake Mead and of the river downstream from the dam, is one of the most significant factors evoking response by birds of the area. Although this affects all aquatic birds in more or less degree, the greatest change may be induced in fish-eating species. The clear water no doubt facilitates the capture of fish. It is evident that the increased availability of prey, in addition to a quantitatively expanded foraging area (Lake Mead), should be favorable to avian fish-eaters.

Three species of migratory fish-eating birds were recorded by me on Lake Mead. The most abundant species seen was the Double-crested Cormorant (*Phalacrocorax auritus*). On April 15, 65 (the numbers in each of the 4 flocks were 45, 2, 8, and 10) were observed during an 80-mile boat trip from Boulder Dam to Pierce's Ferry. Twice, I saw White Pelicans (*Pelecanus erythrorhynchos*). On April 15, a single individual floated idly on the lake 50 feet from the Nevada shore; the locality was near the former place of convergence of the Colorado and Virgin rivers. On May 31, five pelicans circled in a line over the newly-formed shallows of the lake, 12 miles south of Saint Thomas.

As to the American Merganser (*Mergus merganser*), on April 15, I noted a flock of thirteen flying not far east of the former point of convergence of the Colorado and Virgin rivers. The presence of this species on the clear water of the Colorado below the dam suggests a major effect that this structure is having on aquatic bird life. The water released at the outlet valves is clear and has a relatively constant flow—a contrast with the former seasonal floods. Both the clearness and the relative constancy of flow should allow this part of the river to support a more stable organic community than was formerly present. Conditions should be favorable to

the establishment of aquatic and semi-aquatic vegetation with consequent conditions favorable to fishes and to fish-eating birds as well as to predominantly vegetarian ducks.

Three female American Mergansers were seen on February 21 as they foraged on the river, one-half mile downstream from the dam. For a time each strained the surface of the water with side to side movements of the half-submerged bill. Simultaneously two of them detected the proximity of a fish and dived. With amazing speed they pursued the quarry along a circuitous course. In less than a minute one came to the surface with a fish in its bill.

The only resident fish-eating bird of which I have record is the Great Blue Heron (*Ardea herodias*), the abundance of which in the vicinity of Lake Mead, on April 15, is indicated by a count of 14 between Boulder Dam and Pierce's Ferry, a distance of 80 miles.

It is doubtful that herons were previously as abundant along this section of the Colorado River as they now are. There is reason to believe, however, that the species may have been present; this is tenable as a presumption in spite of the fact that the opacity of the Colorado River precludes the possibility of a heron sighting fish that are entirely submerged. The presence of herons along the California-Arizona section of the Colorado has been explained by the fact that these birds are able to obtain fish in the relatively clear water of overflow ponds situated on the flats extending back from the edge of the river. Because the steep-sloping, or canyon-like banks of the Colorado River in the Lake Mead area are unfavorable to the formation of overflow ponds, it is necessary to invoke a different explanation of the assumed pre-Boulder Dam presence of herons along this more northerly section of the Colorado.

That herons may have been able to obtain fish directly from this sediment-laden stream was rendered possible by a reaction to excessively muddy water, of carp (*Cyprinus carpio*), now a common species of fish in the Colorado. In Iowa, several years ago, I observed this reaction by wading into a knee-deep pond in a manner so vigorous as to stir up heavy clouds of sediment. Coincident with the moment of the greatest mud-cloudiness of the water, the dorsal fins of carp were seen ripping through the surface of the water. Perhaps these fish sought the upper stratum of water where there was less mud than at the bottom. In like manner carp may seek the peripheral quiet water eddies of the Colorado. Under such circumstances any carp so unwary as to allow its dorsal fin to protrude above the water would subject itself to capture by a heron.

As a working hypothesis it may be considered that any fish-eating birds which have been reported from the interior of southwestern United States, eventually might visit Mead Lake to catch fish. Consequently, I sought for distributional information concerning, and attempted to get sight records of, the Bald Eagle (*Haliaeetus leucocephalus*) and the Osprey (*Pandion haliaëtus*).

The Bald Eagle may become a resident close by the lake. Van Rossem (Pac. Coast Avif. No. 24, 1936, p. 21) reported it from approximately 50 miles west of Boulder Dam. Mr. Frank Waite, of Las Vegas, reported that about 1924 an injured Bald Eagle was found 15 miles west of the site of the lake.

There is even more reason to believe that the Osprey will become resident near Lake Mead. Grinnell (Univ. Calif. Publ. Zool., vol. 12, 1914, p. 127) observed two Ospreys on the California-Arizona section of the Colorado River. Linsdale (Pac. Coast Avif. No. 23, 1936, p. 45) reported several seen in 1891 by members of the Death Valley Expedition at Pahrangat Lake. This lake is fifty miles north-northwest

of Lake Mead. On May 11, I saw an Osprey as it preened on a high, somewhat horizontal dead branch of a cottonwood tree; the bird was seen at a point on the future northern shore line of Lake Mead, three miles south of Overton.

Census counts of aquatic birds were taken on every possible occasion in two localities: Lake Mead and Kaolin Lake—the latter a 40-acre reservoir 3 miles south of Overton. The following table represents seven bird counts.

	Lake Mead			Kaolin Reservoir			
	Mar.	Apr.	May	Mar.	Apr.	May	May
White Pelican (<i>Pelecanus erythrorhynchos</i>).....			1				
Double-crested Cormorant (<i>Phalacrocorax auritus</i>).....			65				
Great Blue Heron (<i>Ardea herodias</i>).....	3		14				1
Black-crowned Night Heron (<i>Nycticorax nycticorax</i>).....							3
Mallard (<i>Anas platyrhynchos</i>).....			6				
Baldpate (<i>Mareca americana</i>).....		5			21		
Pintail (<i>Dafila acuta</i>).....	60			6	4		1
Cinnamon Teal (<i>Querquedula cyanoptera</i>).....				4			2
Shoveller (<i>Spatula clypeata</i>).....				8	29		
Ring-necked Duck (<i>Nyroca collaris</i>).....							1
Bufflehead (<i>Charitonetta albeola</i>).....					4		
Ruddy Duck (<i>Erismatura jamaicensis</i>).....				6	20		2
American Merganser (<i>Mergus merganser</i>).....			9				4
American Coot (<i>Fulica americana</i>).....	2		1	10	55		2
Killdeer (<i>Oxyechus vociferus</i>).....	1			2			1
Spotted Sandpiper (<i>Actitis macularia</i>).....							4
Avocet (<i>Recurvirostra americana</i>).....					14		
Black-necked Stilt (<i>Himantopus mexicanus</i>).....					12		6
Wilson Phalarope (<i>Steganopus tricolor</i>).....							4
Gull (<i>Larus</i> sp.).....	12		8				
Black Tern (<i>Chlidonias nigra</i>).....							1
Belted Kingfisher (<i>Megaceryle alcyon</i>).....			1				

I wish to thank staff members of the Museum of Vertebrate Zoology for suggestions during the preparation of this discussion.

Berkeley, California, February 17, 1937.

A COMPARISON OF BEHAVIOR OF CERTAIN NORTH AMERICAN AND EUROPEAN SHRIKES

By ALDEN H. MILLER

An article by Theo. Schreurs, appearing in the last volume of the Journal für Ornithologie (vol. 84, 1936, pp. 442-470), gives an account of the natural history of two Old World shrikes, the Red-backed Shrike (*Lanius collurio*) and the Woodchat Shrike (*Lanius senator*). It is well known that there are certain instincts common to different kinds of shrikes, most spectacular of which is the impaling instinct. Schreurs' paper affords a convenient assemblage of facts, especially about *L. collurio*, which seem worth comparing with information which I have gathered pertaining to the Loggerhead Shrike (*Lanius ludovicianus*) of North America (see Univ. Calif. Publ. Zool., vol. 38, 1931, pp. 11-242). That Schreurs has interpreted action in many instances in accordance with my own views is especially significant because his con-