green, are seen in Mexico and Brazil, both in *Lophornis*; and in *Oxypogon* of Venezuela the black of head and crest shows a white line in the center and a bounding band of white, with a lengthened tuft or beard of white hanging from the throat.

In *Lophornis adorabilis* of Chiriqui in Central America a ruby-red forehead passes into a pure white crown, but in *Anthocephala floriceps* of Colombia a buffy white on the forehead yields to a peach blossom on the crown, while in *Microchera albocoronata* of Veragua both front and crown are of a silky white. The last is almost as small as the sole occupant of the genus *Mellisuga* with which it was once grouped. Silvery greens, and greens yielding silvery sheens, are shown by *Heliangelus spencei* and by *Heliotrypha barrali* of Venezuela and northern Colombia. These whites and silvery sheens it will be noted are found in countries at the southwestern corner of the Caribbean Sea. Perhaps albinism is involved in some forms now leaning toward the silky whites.

Cinnamon, buff and rufous evidently make contrasting and harmonizing settings, and are found ranging far along the Pacific side of the Americas. In *Lophornis* of Venezuela various species show crests of rust red, of rufous, of deep chestnut, or of chestnut red as if to contrast the metallic green, in some on the forehead, in some on the throat, or perhaps spotting or tipping the feathers that spring, racquet- shaped, in tiny tufts from the side of the neck. But we must not carry the idea of contrasts too far as to plumage, and far less as to landscape. The Rufous Hummingbird appears to seek color harmony in its plumage rather than color contrast, but thereby it attains even greater contrast with its environment of bluish-green conifers when among such.

To summarize: Any and all colors of display plumage are to be found among hummingbirds in the deeper tropics. In their northward ranges, possessors of these colors tend to drop out in the following order: Oranges, yellows, greens, blues, purples, and reds, a similar arrangement to that found on the pigment wheel of the colorist. A similar order is *indicated* in the southern hemisphere.

As De Candolle found the xanthic flowers more tropically inclined and the cyanic more nearly circumpolar, the xanthic or yellowish hues of display plumage tend to drop out in the tropics, while the bluish hues extend farther into the temperate zones. In each hemisphere, however, the species reaching farthest from the equator shows a yellowish or xanthic red in its display plumage, rather than a bluish or cyanic.

Greenville, South Carolina, August 7, 1934.

A HISTORY OF THE BIRD COLONIES OF GREAT SALT LAKE

WITH MAP

By WILLIAM H. BEHLE

There are four breeding colonies of water birds on the islands of Great Salt Lake, each situated on a different island. The four islands vary considerably as to size and the number of avian inhabitants. The colony which is most widely known, though not the largest, is located on Bird Island (local name, Hat Island on most maps). This island is roughly circular in form and about 150 yards in diameter except for a sand bar extending southward for several hundred yards. Back from the beach the surface of the island is fairly level for several yards and then rises gradually to the rugged rocks which form the summit of the island, some 75 feet above the water. Scattered about are greasewood bushes (*Sarcobatus vermiculatus*) and other desert shrubs. These bushes are largest near the beach where they are five to seven feet tall. Much of the open space on the island is rocky, but a large

part is sandy or gravelly. At the nesting time of the birds the island abounds with flies, beetles, and spiders. A few whip-tailed lizards (*Cnemidophorus tessellatus*) are found there. Hat Island is approximately thirty miles northwest of Saltair and is northernmost of a series of three islands on the west side of the lake. It is so low as not to be observable from any point on the east shore of the lake.

The largest of the colonies is on Gunnison Island which is the largest of the bird-inhabited islands. The average height of this island above the water is about one hundred feet, and the shore line is about three miles in extent. Between a centrally located peak and the abrupt cliff on the north, there is a low saddle which slopes off gently to bays on either side. The nesting grounds are located on both sides of this saddle. The nesting area is free from rocks but, as on Hat Island,

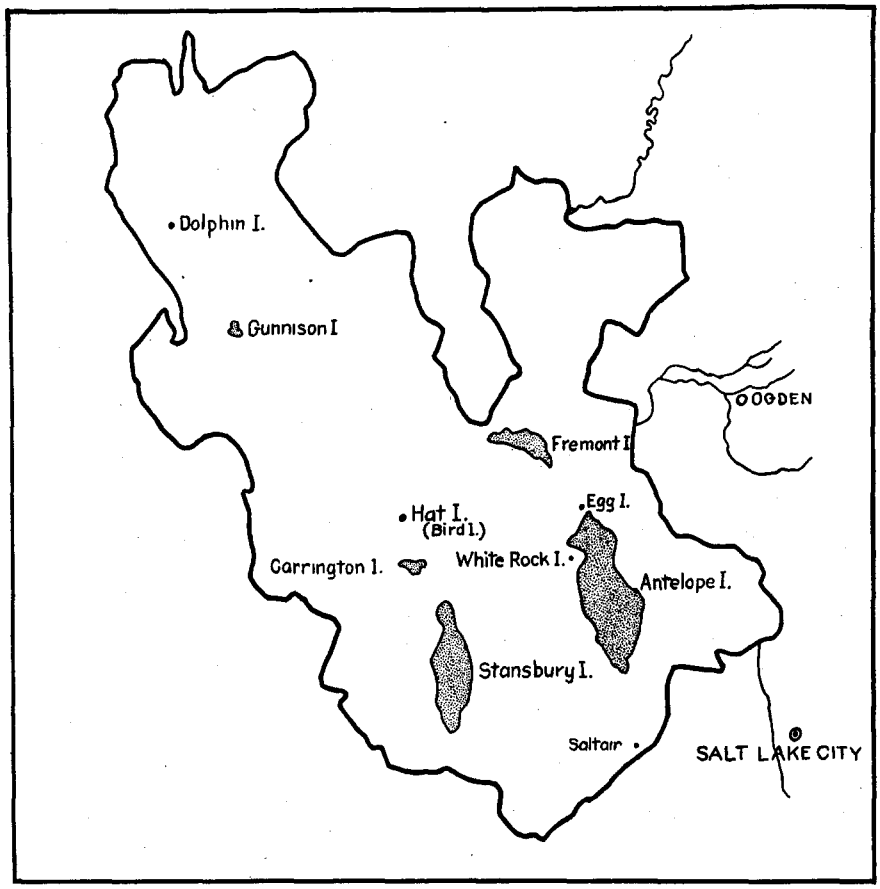

Fig. 6. Map of Great Salt Lake showing the location of its islands, including those utilized as nesting sites by colonies of birds.

it is clothed with desert shrubs. On the island are brown-shouldered lizards (*Uta stansburiana*) and white-footed mice. Gunnison Island is about sixty-five miles northwest of Saltair. It lies north of Lakeside and approximately five miles from the railroad trestle at this point and some twenty-five miles from Promontory Point.

Egg Island, the third largest nesting place, is situated about half a mile north of the extreme northern tip of Antelope Island, which island is the largest in the

lake. Egg Island seems to be a rocky projection from the water-covered ridge extending north from Antelope Island. The nesting area here is small in comparison with those of the two previously mentioned colonies. It is oval in shape, about fifty yards long and forty yards wide. It is simply a jumbled mass of quartzite boulders of all sizes; the largest of these is at the north end. This island is the type locality of the Treganza Great Blue Heron (*Ardea herodias treganzai*). The island is barren of all vegetation, but the built-up nests of the herons and cormorants give the surface a peculiar appearance. The entire area is, at the present writing, but a few feet higher than the water. No vertebrate life other than birds exists on the island. The nests, however, contain countless insect larvae and beetles, and spiders are numerous.

Near the north end of Antelope Island, and on its west side, there is a deeply indented bay known as White Rock Bay from a large white rock in its center. It rises out of the water vertically on all sides except the east one, where a landing can be made. Its summit is about thirty feet above the water. On top, this mass of rock is about twenty-five yards long and ten yards wide. A good part of it is bare and sloping, but at the south end an area of about twenty square yards is available for nesting sites. Here, rough, hollowed spaces hold guano deposits and make flat surfaces for nesting sites.

There are indications that two other islands have been used in years past as nesting sites. Ridgway (1877, p. 371) mentions a colony of birds nesting on Carrington Island. Cormorants were reported as nesting on Dolphin Island about 1919 (Lewis, 1929, p. 7). Neither of these sites was used in 1932 and probably had not been for many years. Carrington Island is much larger than any of the other bird-inhabited islands, being about a mile across. It is situated four miles south of Hat Island. Dolphin Island is the farthest north of all the islands, being located eleven miles north of Gunnison Island.

In 1932, White Pelicans (*Pelecanus erythrorhynchos*), Treganza Great Blue Herons (*Ardea herodias treganzai*), and California Gulls (*Larus californicus*) were found nesting on Hat Island. These three kinds were also found nesting on Gunnison Island. At Egg Island were nesting California Gulls, Treganza Great Blue Herons, and Double-crested Cormorants (*Phalacrocorax auritus,* subspecies?). The White Rock colony was composed of California Gulls.

As near as can be determined from my observations and those of others, all the kinds of birds that nest on the islands are seen in the region in considerable numbers by the last week in April of each year. It seems that the birds, or at least the pelicans, reach the islands in several flights at different times. If this is not so, then the time of laying of small groups differs considerably. On May 1, 1932, at Hat Island, most of the pelicans seemed to be in the egg laying stage, but one group of about twenty-five nests contained eggs that were mostly pipped. A few of these hatched that day. From this we infer that some pelicans arrive as early as April 1, but most seem to enter the region later. On Gunnison Island, June 29, 1932, the majority of pelican young were three-fourths grown. One group of nests contained eggs, while other groups had young some ten days old. It is possible that each group of pelicans represents a single strain or stock and that the colony is made up of birds reaching the island not only at different times but from different wintering grounds. On May 1, 1932, many adult pelicans were shedding the horny excrescence of the upper mandible.

The Treganza Great Blue Herons seem to be the earliest of the birds to nest, since on May 1, 1932, at Hat Island, young were found about two weeks old. Fresh eggs and newly hatched young were also noted at this time. It appears that some

cormorants start laying about the last of March, while others continue to lay eggs after the middle of May. My earliest visit to Egg Island was on May 18, 1932, at which time a few fresh cormorant eggs were being incubated and young of all ages up to about three weeks were seen. On Egg Island, June 25, 1934, most of the young were full grown, but three nests in a group all contained eggs still being incubated. As to the gulls, mostly fresh eggs were found at Hat Island, May 1, 1932, only ten or twelve chicks being seen. It is my impression that the gulls lay their eggs at a more uniform time. I have not noted eggs, nestlings and juvenals all at one time, as I have with the other kinds of birds on the islands.

A number of eggs collected on the islands by different people during several years were measured, as follows. Figures in italics indicate the extremes of these measurements. Nineteen heron eggs from Hat and Egg islands averaged 64.4 by 45.2 millimeters; the eggs showing the four extremes measure *70.5* by 46.5, 70.5 by *46.5*, *58.5* by 44.8 and 68.8 by *43.0* millimeters. Fifty gull eggs from Hat Island averaged 64.8 by 44.8 millimeters; the eggs showing the four extremes measure *72.0* by 44.7, 67.3 by *48.1*, *57.6* by 45.3 and 62.0 by *41.4* millimeters. Twenty cormorant eggs from Egg Island averaged 59.3 by 37.1 millimeters; the eggs showing the four extremes measure *64.0* by 37.2, 58.1 by *39.4*,*53.0* by 36.3 and 62.2 by *34.8* millimeters. The measurements of fifteen pelican eggs from Hat Island average 87.0 by 56.9 millimeters; the eggs showing the four extremes measure *97.0* by 56.0, 86.3 by *66.4*, *77.6* by 58.0 and 93.1 by *54.4* millimeters.

Colonial partition and other nesting features on the islands are interesting. One finds the center of Egg Island occupied by herons and cormorants. The nests of the cormorants are in one group and those of the herons in another. Yet one may find a few of the larger, heron nests within the cormorants' territory. The nests of both of these kinds of birds are built on and between large boulders. Those of the herons are low and wide, with some measuring three and one-half feet across on top. The nests of the cormorants are all over a foot high and some have reached a height, through the years, of twenty-two inches from base. This height is close to the greatest reported by Lewis (1929, p. 31). On Hat Island the pelicans inhabit a strip of rather level ground on the northeast and east portions of the island. The herons of recent years have chosen the bushes on the north and east sides only. Some of their nests have been utilized and remade year after year until now the bushes present a solid appearance from the ground up. A man's weight is easily borne by the interwoven structure. Under crowded conditions the rocky portions of the island were evidently utilized, because remains of nests were seen there. Evidence of the durability of the nests of herons is shown by the fact that on White Rock were found in 1932 seven of the eight nests that Treganza (Court, 1908, pp. 292-93) reported for the years 1905 and 1906. Eroded and weather beaten, they are now used by gulls.

At Gunnison Island the pelican colonies are more scattered than at Hat Island. Colonies were found on both sides of the saddle. That pelicans return to the same sites on this island was indicated by the pavement of excrement in some places, which stood out in contrast to surrounding dirt areas. The heron nests were all confined to one rocky projection near the center of the saddle. On all the islands gulls occupied available spaces not utilized by other kinds of birds. Some eggs were found on bare rock, but most were in depressions on the ground. Some of these nests were bare, others sparsely lined with sticks, feathers, and bones. That California Gulls will build bulky nests when material is available was shown at Rock Island, Utah Lake, where nests several inches high were found.

It is a well known fact that no fish live in the waters of Great Salt Lake. But

to say that no food for the birds is furnished by the lake is untrue, because I have frequently seen flocks of gulls floating on the surface of the water feeding on brine shrimps (*Artemia fertilis*). But the gulls as well as the other birds must fly great distances to their more productive foraging grounds, such as newly ploughed fields, river banks, garbage dumps, and school grounds. When Salt Lake City schools are in session flocks of gulls gather around the buildings waiting for scraps from the children's lunches. Several janitors have reported that the gulls come regularly five days in the week but remain away Saturdays and Sundays, when there are no classes! Of recent years some complaint has been made by farmers of Davis County that the gulls are damaging their cherry crops. As evidence that this is true one can see countless cherry stones around the nesting sites. I am told that gulls flop down in the tops of cherry trees with outspread wings so that their weight is largely wing-supported and then proceed to devour all the fruit within their reach. The herons forage principally in sloughs bordering the lake or in the marshes at the mouth of the Bear River. Here, in characteristic fashion, they obtain fish, frogs, and the like, for their bill of fare. Cormorants, when fishing, seem to frequent Utah Lake and the Bear River marshes chiefly, but also are seen at other sloughs in the valley.

Pelicans subsist almost entirely on fish, the type eaten being determined by the kinds present in the breeding region. Where sluggish, more-easily-caught, non-game fish are present, this type is utilized almost exclusively. When these are not obtainable, trout and other game fish are preyed upon, as at Yellowstone Lake. The lakes and rivers in the Great Salt Lake region abound in non-game fish. Utah Lake, about thirty-five miles south of Great Salt Lake, has been for years particularly over-run with carp, and has furnished most of the food for the pelicans. Nearly always, in spring and summer months, has one been able to see great flocks of pelicans near the mouth of Provo River.

Fishermen and fish culturists seem to be desirous of getting rid of all fish-eating birds, while ornithologists and conservationists are anxious to preserve these same birds, no matter to what extent fishes are levied upon. As a result there is a never-ending controversy over the fish-eating propensities of the birds. While it is not my intention to discuss this here with regard to pelicans, I do want it known that in 123 regurgitated piles of food that have been examined on the islands by me not a single recognizable trace of trout was found. Carp of various sizes made up the bulk of the indentifiable remains. Occasional perches, chubs and suckers were also present. By making great inroads on the numbers of carp in Utah Lake, more good than harm has been accomplished by the birds. The detrimental effects of carp in destroying vegetation and making the lake unsuitable for other types of fish is well known. It seems, then, that "control" of pelicans, or their persecution, in this region has been and is without justification.

The only control measures that I know of on any of the islands occurred during the nesting season of 1918. Representatives of the state department of fish and game journeyed to Hat Island and, according to Charles G. Plummer who visited the island less than a week later, they shot and clubbed to death literally hundreds of young and adult pelicans and nearly the entire population of herons. According to the Utah fish and game laws "the blue and black-crowned night heron and pelican may be destroyed under regulations made by the commissioner."

Speaking of the economic bearing of these birds, one should mention the fact that attempts have been made to sack guano from the islands for fertilizer. Part of Gunnison and Hat islands have been privately acquired by means of mineral patents in connection with these enterprises. However, torrential rains wash most of the deposits into the lake each year and now all the ventures have been abandoned.

In July, the brine flies (*Ephydra gracilis*) appear in swarms on the islands and elsewhere about the lake. In places the rocks are black with them. I have seen gulls stir them up with their wings and then gather in mouthfuls as fast as they were able to open and close their mandibles and swallow. As the summer draws to a close there seems to be less and less activity on the islands, at least as far as the birds are concerned. Eventually the birds wend their way southward again, just when is not known. The guano and filth make the nesting sites well suited for flies (Muscidae) and they exist there in great numbers. The spiders, which reside in crevices and under driftwood, seem to become more noticeable after the birds leave. In late August and September, Hat Island presents a silvery sheen from countless spider webs. Presumably the flies are fed upon by the spiders, while the lizards prey upon both flies and spiders as means of sustenance. Crippled birds remain on the island until they starve to death. Often there are hundreds unable to fly because of injuries suffered when young, from being trampled or from being attacked by vicious adults. Their remains are used the next spring as nest building material.

Man's visits to the islands during the nesting season are most always detrimental to the pelicans' welfare. The following incident illustrates this. On May 22, 1933, a large party of sightseers was forced to remain nearly twenty-four hours on Hat Island. Emil Johnson, Salt Lake boatman, had visited the island about a week before the marooned party was there and found hundreds of nests containing eggs and young just hatched. On a second trip, May 30, 1933, he noted only a few half-grown pelicans and some newly-laid eggs. Presumably the adult pelicans were kept away from their nests for several hours by the marooned party, thus allowing the gulls to pillage eggs. Many young pelicans probably died from exposure to the sun. I have witnessed mortality from this cause during my own short visits. When the water level was much higher and boats could be operated, excursions were frequently made to the nesting grounds. The Gunnison Island colony has suffered the least from sightseeing parties, because of its remoteness.

The environmental set-up that pelicans seem to require for nesting is a low tract of terrain surrounded by water. The water level of Great Salt Lake has dropped so greatly during the last few years that it is now at the lowest stage recorded. The lake bed west of Hat Island is exposed to such an extent that one could walk out to the island on exposed sand bars. It may be that this condition has affected, or will affect, the pelican colony there.

Pumping operations together with drought reduced Utah Lake in the summer of 1934 to an extremely shallow depth. High winds throughout the summer swept the shallow water back and forth across mud flats, leaving thousands of fish stranded. Should a hard freeze-up occur this winter the remaining fish in the lake may be annihilated. It remains to be seen how this curtailment of the most important food source in the region will affect the pelicans. Some may leave the region. There may be an extension of their cruising radius for food. It is possible that game fish may be levied upon. I can conceive of little being done in a practical way to help out the food situation, but something can be done to safeguard the pelicans of the region and that is to give the birds state and federal protection and include the nesting sites in a bird sanctuary. This would discourage future sightseeing trips and slaughters.

First records of any bird life on the islands are to be found in the report of Captain Howard Stansbury (1852) on the exploration and survey of the Great Salt Lake which was carried on in 1849-50. No specific numbers of the different kinds of nesting birds are given; rather the term "thousands" is used. Dolphin Island

receives considerable attention in connection with camps established there and the erection of a triangulation station, but not once is any mention of birds made. We assume that the island was then uninhabited. No mention of bird life on Hat (Bird) Island is made although Stansbury (1852, p. 162) relates that the island was covered with a species of wild onion and that there were interesting slate outcroppings. Surely he would have described the birds there if they occupied the island as they do today. White Rock is not discussed in the account. Considerable space is devoted to the birds on Gunnison Island where pelicans and gulls were found. Stansbury notes the location of the nesting colonies on Gunnison Island as being on the shores of both bays and on the neck of land between them. This is where the birds were nesting in 1932.

Reading through Stansbury's daily account of his activities the following passage is one of several that may be found pertaining to Egg Island. Under the date May 20, 1850, he records (p. 188) in his journal: "Before we passed around the point of Antelope Island, we stopped for a few moments at the little islet near it, where the number of gulls and pelicans was, if possible, greater than we had seen on Gunnison's Island. The whole islet was covered with eggs, chiefly those of the gulls, and with innumerable young birds, just hatched, ..." This passage can only refer to Egg Island which is so located and not to Hat (Bird) Island, as Thompson (1933, p. 46) has inferred. Stansbury mentions finding young herons, pelicans and cormorants on Egg Island amid the colony of gulls. We conclude from Stansbury's account that in 1850 there were only two colonies of significance, namely, those on Egg and Gunnison islands. Dolphin and Hat islands were uninhabited. White Rock may have been utilized. It is interesting to read that on several occasions eggs proved an important source of food for the party.

Searching through the literature after Stansbury's report I have been able to find no further reference to the colonies until we come to the report of J. A. Allen (1872a) on the ornithological results of an expedition of which he was a member, to the plains and Rocky Mountains in 1871. His party was in Great Salt Lake Valley from September 1 to October 8, 1871. The following excerpt, among others, refers to the colonies (Allen, 1872a, p. 401): "The Delaware gull or its western representative, is a numerous summer resident, breeding on the islands in great numbers." Today *Larus delawarensis* is only found in the region during the autumn and winter months and does not breed on the islands. The nesting gulls (*Larus californicus*) move out of the region some time in August or earlier. Allen may have seen only winter visiting gulls and concluded from Stansbury's references to the nesting of gulls on the islands that *Larus delawarensis* was the breeding gull of the region. Stansbury apparently did not collect any gulls, since no mention is made of gulls in Baird's report on his collections. Very possibly *Larus californicus* was not accepted as a distinct species by Allen, Nelson, and others, and may have been regarded as a variety of *Larus delawarensis*. I see no reason why the gulls of the islands now should be any different from those during the years of Stansbury's or Allen's visits to the region. Allen mentions Cormorants, White Pelicans and Great Blue Herons being found in the region. Herons were rather common.

E. W. Nelson observed birds around Salt Lake City between July 27 and August 8, 1872, and records (1875, pp. 348-49) that White Pelicans were common in flocks and gulls (*Larus delawarensis*) were abundant at the mouth of the Jordan River. Possibly he was influenced by Allen's report as to the status of the gulls.

A number of short notations during the next few years gives some indication that the colonies perhaps were detrimentally affected by the advent of man into their region. These early references, however, pertain to the White Pelican. Coues

(1874, p. 586) in discussing the White Pelican says: "It formerly bred in immense numbers about Great Salt Lake, where it has decreased in abundance of late." Henshaw (1875, p. 485), dealing with pelicans, writes: "In Stansbury's report of Great Salt Lake, mention is made of large numbers of these birds being seen in the lake, they breeding in the islands thereof. In July, but few were seen and we are informed they no longer breed there. These birds were seen at Utah Lake late in July sparingly and on the sloughs of the Sevier." In a later publication Henshaw (1879, p. 329) while discussing clubbing and slaughter of pelicans says: "Such is the case at Great Salt Lake where the former great abundance of the pelican is attested by all the early explorers, but where now the bird is known only as a casual visitant."

It has been thought that relentless persecution caused this apparent decrease in numbers by 1875. An even greater factor was probably the high water level throughout the 70's. In 1873 the lake reached the highest level ever recorded and this was roughly eleven feet higher than during Stansbury's survey and sixteen feet higher than today (November, 1934). This means that Egg Island was almost completely covered, as also a good part of the available nesting area of Hat Island. Gunnison Island must have had its breeding area somewhat diminished but not to such an extent as on Hat Island. White Rock would be little affected.

That the birds probably nested on Carrington Island during the high water years is shown by Ridgway's recording (1877, p. 371) that two members of his party visited this island bringing with them on their return, eggs of *Recurvirostra americana, Branta canadensis,* and *Larus californicus.* They reported various other waterfowl as breeding on this island and a smaller one nearby which undoubtedly refers to Hat Island. The inference is that the birds used what available space there was on Hat Island, the unprovided-for birds retiring to the larger island.

In 1908, Court (1908, pp. 291-292) described a new subspecies of Great Blue Heron, calling it *Ardea herodias treganzai* in honor of A. O. Treganza, then of Salt Lake City, who furnished him with a specimen from Egg Island. This specimen was chosen as the type. Accompanying Court's description are Treganza's notes pertaining to the herons on the islands. On May 15, 1905, at White Rock he found eight pairs of herons breeding. The following year the same number of nests was found and all were occupied. The herons were nesting with *Larus californicus*, but no mention is made of the number of gulls. On Hat Island, May 8, 1906, there was a colony of forty pairs nesting in company with *Larus californicus* and *Pelecanus erythrorhynchos.* No numbers are given for these last two kinds. September 10, 1907, on Hat Island, all the birds had left, but a great increase in the number of herons' nests was noted. At Egg Island, May 11, 1906, fifty breeding pairs of herons were nesting in company with California Gulls and cormorants. On May 16, 1907, he recorded that seventy-five pairs nested there, an increase of fifty per cent over the previous year. As to Gunnison Island he states that Captain Davis reported that the herons nested more abundantly there than on any other island in Great Salt Lake.

On May 14, 1915, R. H. Palmer (1916, pp. 113-123) found at Hat Island about 2000 White Pelicans, about 8000 California and Ring-billed gulls, about 400 Treganza Great Blue Herons, and 50 Caspian Terns. The figure for the gulls was based upon the number counted in a photograph, but Palmer also states that other estimates ranged from 15,000 to 20,000. I am inclined to doubt that Ring-billed Gulls ever nested on the islands, since no specimen has been collected there, and as previously stated their presence in the region is known only in winter. Palmer's article contains the only record of Caspian Tern breeding on any of the islands. However, Treganza (in letter) tells me he found about 15 pairs breeding on Hat

Island on several occasions prior to 1920. A colony of these birds was visited by me on Rock Island, Utah Lake, on June 1, 1932, and may represent the descendants of the colony that once nested at Hat Island.

As to Egg Island, Palmer after describing it and mentioning herons and gulls says (1916, p. 123): "The special object of interest and also of our visit to this island was the Double-crested Cormorant (*Phalacrocorax auritus auritus*). Of these there were between five and six hundred individuals on and around the island." There is doubt as to the subspecific identification of the cormorants of Great Salt Lake. Lewis (1929, pp. 7, 9, 10) lists the Great Salt Lake cormorants under *P. a. auritus*, but his information probably came from Palmer's article, since this reference is included in Lewis' bibliography. The A. O. U. Check-list indicates that the Great Salt Lake cormorants are *P. a. albociliatus*. Measurements do not seem to offer adequate means for differentiating between the two races. About the only distinguishing feature is that *P. a. albociliatus* has white nuptial plumes while *P. a. auritus* has black ones. Palmer does not mention the plume character and I am inclined to think that his visit was rather late for the nuptial plumes to be seen, since they wear off early in the season. All specimens collected in the region and examined by me, or inquired about, lack the plumes. The actual subspecific identity remains undetermined.

Allee (1926, p. 492) visited Hat Island in July, 1915, about two months after Palmer did. His estimates ran much higher than Palmer's for the gulls and about the same for the pelicans.

Sugden (1926, pp. 142-146) reported after his trip on May 17, 1925, that there were thousands of California Gulls and what were supposed to be Ring-billed Gulls, but the members of the party couldn't tell the difference. Great numbers of pelicans were noted. No Caspian Terns were seen. Of herons he says (1926, p. 144): "Only the old nests of the Great Blue Heron . . . marked the former nesting sites and but one bird was noted on the wing." The following year, on May 9, 1926, Sugden (1927, p. 47) again visited the island, finding six adult herons on the island and three of that year's nests. California Gulls were as plentiful as before, but there had been a decided increase in the number of pelicans. The flock was larger and the nesting grounds covered a larger area.

In Lewis' (1929, p. 7) table on the breeding colonies of *Phalacrocorax auritus auritus* he gives 50 pairs for Egg Island and 75 pairs for Dolphin Island. A colony of 200 pairs is also noted for Bear Lake, Utah. All this information was supplied by Treganza in a letter some time in 1929. Observations were made, however, about 1919. This is the only information I have been able to find showing that Dolphin Island has been used as a nesting site by a colony of birds. Regarding the status of the Bear Lake colony, the only specific information I have obtained comes from Mr. Lynn Hayward. On June 15, 1928, he found 118 nests containing eggs heavily incubated. On May 29, 1929, he counted 200 nests.

Thompson (1933, p. 48) gives an estimate of over 4000 adult White Pelicans at Hat Island on May 15, 1932, and about 1500 occupied pelican nests. Assuming that half the colony of pelicans was away foraging, it was estimated that approximately 8000 adults were in the Hat (Bird) Island colony in 1932. Assuming that pelicans nested on Gunnison Island, the figure for the region was placed at 10,000.

It was this same year that I was able to make a complete survey of all the islands and take nest counts and censuses. My first visit to Hat Island was made on May 1, 1932, and regular visits throughout the summer were made about three weeks apart. At no time were more than 2000 pelicans seen at Hat Island. The pelicans were counted through the glasses as they floated on the surrounding water. Nest counts

for the pelicans totaled roughly 1500. Allowing two birds per nest this would make a figure of 3000 birds. Or doubling the estimated 2000 on the basis that half the pelicans were away foraging there would be 4000 birds. This last figure I considered as a reasonable estimate for the pelican population of the island. At Hat Island thirty herons were counted and it was estimated that there was a breeding population of 20,000 California Gulls. Estimates as to the gull population were made by counting the adults at rest in a small measured area and comparing this with the total area. The figure thus reached was then doubled to allow for absent birds and those in flight around the island. No attempt was made to count juvenals.

A visit to Gunnison Island, June 29, 1932, revealed an estimated California Gull population of 60,000 adults. An actual nest count showed 3300 White Pelican nests and 16 Great Blue Heron nests. On the basis of two birds per nest I have placed the population of the pelicans at 6600 and of the herons at 32, these being, I think, conservative figures; and they do not include possible non-breeding birds. Egg Island in 1932 supported a population of 1200 California Gulls, 32 Treganza Great Blue Herons and 100 cormorants. The White Rock colony was composed of gulls to the number of 500.

There were then, according to my figures, breeding on the islands of Great Salt Lake in 1932 some 80,000 gulls, 10,600 pelicans, 96 herons and 100 cormorants.

Dolphin Island was also visited that year. It was not then being utilized nor was there any evidence found to indicate that it had been used in recent years. No cormorant nests or remnants of nests were found. Judging by the solid structure of the nests on Egg Island, Dolphin Island has long been unoccupied. Carrington Island also was uninhabited by birds in 1932.

The only information I have been able to obtain about the 1933 nesting season pertains to the cormorants on Egg Island. Moving pictures taken there by Dr. Sugden about the second week in June show 65 young cormorants gathered in one large group in the water around the island. They seemed unable to fly and undoubtedly represented all the surviving offspring for the season.

In the summer of 1934 I attempted to revisit the islands. It was a particularly windy season and efforts to reach Hat Island invariably failed. It was not until June 25, that Egg Island was reached through the courtesy of Dr. T. C. Adams, whose sailboat was employed. The breeding season was almost over. The adult cormorants and herons immediately departed as we approached, but eight herons were counted before they had disappeared. Ten of the heron nests showed evidence of use for the season. Twenty-five young cormorants were seen in the water around the island. Most of these were fully grown but not able to fly. I feel sure that these represent the entire yield of the colony. About 35 of the nests of the cormorants appeared as if they had been used that season. The presence of many skeletons in the cormorant nests showed a high mortality of young. Figuring on the basis of two adult birds per nest we would get a probable breeding population of 70 cormorants and 20 herons. I realize that computing population figures from nest counts is not entirely satisfactory; still it presents about the only available method under the circumstances. Because of heavy winds we were unable to land at White Rock, but in circling it only gulls were noted there.

CONCLUSIONS

1. The four species of birds first reported to nest on the islands in Great Salt Lake, namely, White Pelicans, Double-crested Cormorants, Great Blue Herons and California Gulls, continue to do so.

2. The present colonies are to be rated as among the largest in North America.

3. In view of the general decline in the numbers of White Pelicans the country over, the Great Salt Lake colonies seem to have held their own down through the years and they may even have increased in numbers. Food shortage and the connection of Hat Island with the mainland by sandbars may greatly reduce the pelican population of the general region.

4. The Great Blue Herons have been seriously reduced in number. A high figure was reached in 1915, when 400 were reported nesting on Hat Island alone. They reached a low figure in 1925, when no nests at all were found on that island. In 1932 there were not more than 96 on all of the islands. Indications of still further reduction in 1934, were shown on Egg Island.

5. Seventy-five pairs of cormorants nested on Dolphin Island about 1919, but this site has not been used in recent years. In 1915, 500 were reported on Egg Island. Only 100 nested there in 1932, and indications are that but 70 individuals were breeding there in 1934.

6. Gulls have always been reported by the thousands and seem to suffer the least from fluctuating lake levels and visits of man. Their presence may be considered as menacing to the other birds, especially at times when man's presence results in disturbance of the colonies.

7. The rising and lowering of the lake level has undoubtedly been a factor affecting the colonies. During extremely high water Egg Island has been inundated and the breeding areas of Hat and Gunnison islands reduced. At extremely low levels of the lake, as obtain at the present time, some of the islands become connected with the mainland.

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FROM FIELD AND STUDY

Another Invasion of Wood Ibises in Southern California.—It may be that, after its nesting season, the Wood Ibis (*Mycteria americana*) visits Imperial County, California, every summer. But its appearance in San Diego County or the western part of southern California seems to be at intervals—determined, doubtless, by water conditions elsewhere. In the Condor (33, 1931, p. 29) I have recorded visitations of Wood Ibises to coastal San Diego County in 1923, 1925 and 1930. The year 1934, marked by a particularly notable invasion of these conspicuous birds, may now be added.

Considerable correspondence on the subject of this past summer's visitation was received at the Natural History Museum, San Diego, as well as many verbal reports of observations. The earliest record was June 10, from the caretaker of Hodges Reservoir, the latest September 28 when the local game warden stated that the birds were still at both Sweetwater and Hodges reservoirs. Almost every body of water in San Diego County seems to have had its Wood Ibis visitors. In addition to the two reservoirs just named, occurrences were reported at Lindo Lake, Lower Otay Lake, Henshaw Lake, Cuyamaca Lake (elevation 4600 feet), Guajome Pond, Chollas Reservoir, and various coastal sloughs from Torrey Pines to Oceanside. Even the band leader of the U. S. Marines wanted to know the name of the large white birds, with black on their wings, which he had seen between the parade ground and San Diego Bay. On the other hand, the caretakers of Barrett, Morena and Wohlford lakes, which are rather deep, mountain reservoirs, wrote that they had failed to see any of the ibises there.

The largest count was that of L. M. Huey, of the Natural History Museum staff, who tallied 77 individuals at Lindo Lake, Lakeside, on August 12. This small, shallow lake was a favored resort of the ibises throughout their stay. The characteristic unconcern of the birds was remarked upon by many persons who watched them at close range there. During a rodeo which was held in Lakeside on September 2 and 3, a number of ibises perched in a tree which was in full view of the grandstand and attracted considerable attention.

Supplementing observations in San Diego County, Professor Raymond B. Cowles, of the University of California at Los Angeles, wrote me that on August 13 he had seen 5 Wood Ibises flying above the salt lagoon at Point Mugu. He stated that they later settled in the salicornia at the edge of the water about a mile northwest of Fish Camp. Both of these localities are in Ventura County, and they provide the northernmost record for this visitation that has come to my notice. Dr. Loye Miller, of the University of California at Los Angeles, wrote: "We saw wood ibises in early August