

RECENT OBSERVATIONS ON THE WHITE PELICAN ON GUNNISON ISLAND, GREAT SALT LAKE, UTAH

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INTEREST has steadily mounted in the precarious plight of the gregarious, colony-nesting, White Pelicans, *Pelecanus erythrorhynchus*, which in the United States in 1932 numbered somewhere in the neighborhood of 30,000 birds in seven large and about 50 small breeding colonies (Thompson, 1932). In the perpetuation of a bird with so few "baskets" for its eggs, the success of each colony is highly important.

Because of the remoteness and inaccessibility of the colonies nesting on the islands of Great Salt Lake, opportunities for study by ornithologists have been limited to short visits during the past 35 years. Juvenile pelicans have been banded as a part of the activities of the ornithologists. Studies of life history, present status and economic importance, picture-taking for educational films, and sight-seeing have largely motivated the parties which have visited the islands during the last few years. These present studies have been made through the Utah Cooperative Wildlife Research Unit supported jointly by the Utah State Agricultural College, the Wildlife Management Institute, the Utah Fish and Game Department, and the U. S. Fish and Wildlife Service. To William Marshall, Wildlife Professor, University of Minnesota, and to Noland Nelson, Federal Aid Biologist, Utah Fish and Game Department, thanks are given for assistance rendered in field work and in preparation of the manuscript.

Banding returns on the pelicans from Gunnison Island have shed some light on the wintering grounds of the pelicans, causes of death, and travels of the pelicans after leaving their island nesting grounds.

The interesting group of islands of Great Salt Lake, of which Gunnison is one, has been described geologically by Gilbert (1890) and climatically by Alter (1936). Eardley (1938) studied the lake bottom and Adams (1932) described the lake levels and variations. Writers, beginning with Stansbury (1852), have recorded the birds on the islands, while the mammals have been studied by Marshall (1940) who listed earlier workers.

Gunnison Island, one of seven islands in the million-acre Great Salt Lake, is located approximately 55 miles northwest of Salt Lake City and about six miles from the west side of the lake. The island attains an altitude of several hundred feet above the lake shore which is 4,215

feet above sea level. Of the four types of island habitat—(a) salt flats, (b) sand bars, (c) benchlands, and (d) original land above the highest level of ancient Lake Bonneville—occurring presently on the islands of Great Salt Lake, Gunnison Island has the first three types. The island is roughly a mile long and half a mile wide, running in a north-south direction (Fig. 1). There is a low saddle between two higher hills on either end of the island. Bays are on either side of the saddle. Sand forms the benchlands around the bays on which the nesting colonies of pelicans are located. A small rocky point called Cub Island is located just off the north tip of Gunnison Island but has not supported pelican nests.

Vegetation of the island consists largely of *Sarcobatus vermiculatus* along the edge of the shore on the sandbars; *Atriplex confertifolia* and *Bromus tectorum* occupy the higher and southern exposures on the benchlands. Other plants occurring on the island include *Allenrolfea occidentalis*, *Artemisia spinescens* and *Eriogonum tenellum* and perhaps other desert-type plants.

Mammal life of Gunnison Island consists only of two species, the white-footed mouse, *Peromyscus m. gunnisoni*, and the kangaroo rat, *Dipodomys m. alfredi* (Marshall, 1940). Nesting bird life of the island, in addition to the pelicans, consists of: California Gulls, *Larus californicus*; Treganza's Heron, *Ardea h. treganzai*; Raven, *Corvus corax*; Prairie Falcon, *Falco mexicanus*; and Rock Wren, *Salpinctes o. obsoletus*.

The records of the White Pelican colonies on the islands of Great Salt Lake started with the historical journey of Stansbury to Gunnison Island in 1852. Stansbury (1852) recorded only that immense flocks of pelicans, as well as many thousands of gulls, were seen and heard. Little was written again until Henshaw (1875, 1879) noted that the flocks of pelicans, formerly reported in great abundance in the vicinity of Great Salt Lake, were no longer nesting on the islands and had become casual visitors, after much clubbing and slaughtering. Thompson in 1932 gave an estimate of 2000 birds by Dave Madsen for Gunnison and islands other than Bird Island where an estimated 8000 adult birds were nesting. Woodbury and Behle (1932) and Behle (1935) recorded 6600 adult birds and an estimated 3300 nests on Gunnison Island in 1932. Kay (1935, *in litt*) and Bailey (1935) counted 2000 adults and somewhat fewer nests than recorded by Behle in 1932. Kay also pointed out that there were 16 nesting colonies on the islands with birds, varying from 50 to 1000 birds each and that six of the colonies averaged 150 nests (Table 1).

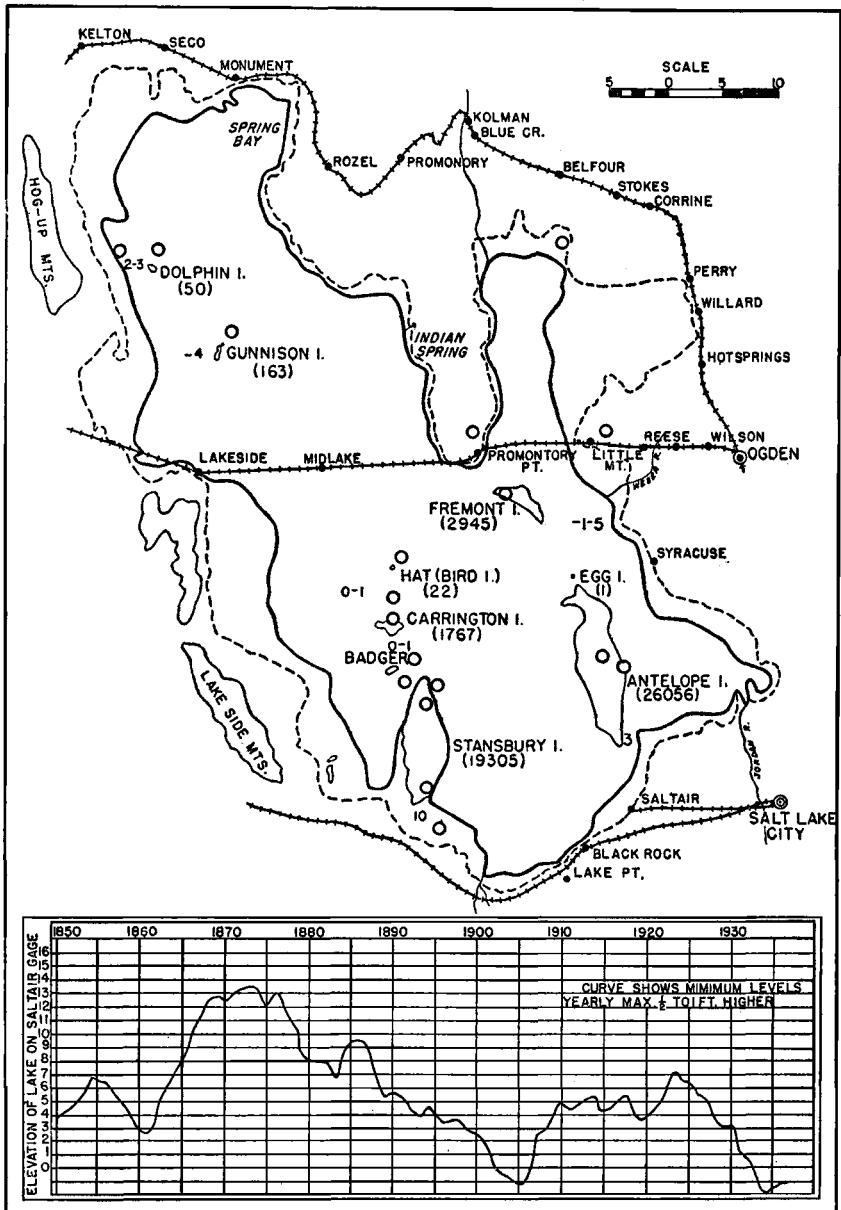


FIGURE 1. Principal points in northwest part of the Great Salt Lake.

TABLE 1

POPULATION DATA ON WHITE PELICANS, GUNNISON AND BIRD ISLANDS, GREAT SALT LAKE, UTAH

Date	Number pelicans reported					
	Adults		Juveniles		Observer	Island
	Birds	Nesting pairs	Number	Number nests		
1850	Immense flocks				Stansbury	Gunnison
1875	Formerly in great abundance, now casual visitants				Henshaw	Gunnison
May 15, 1915	2,000				Palmer	Bird
May 15, 1932	8,000		1,500		Thompson	Bird
May 15, 1932	2,000				Thompson	Gunnison
May 15, 1932	3,000	2,000 counted 4,000 total estimated	1,500		Behle	Bird
May 15, 1932	4,000				Woodbury and Behle	Bird
June 29, 1932	6,600			3,300	Behle	Gunnison
June 18, 19, 1935	2,000		16 colonies	900 (6 colonies)	Kay	Gunnison
June 19, 1935				3,300	Bailey	Gunnison
June 4, 1935	300				Kay	Bird
June 1, 1935	400				Kay	Bird
June 4, 1936	2,868			3,300	Kay	Gunnison
April 7, 1937		308			Marshall	Gunnison
April 7, 1937		55			Marshall	Bird
June 22, 1937		373			Marshall	Bird
June 23, 1937	439		775	190 approx.	Marshall	Gunnison
July 11, 1937			200 pods		Kay	Bird
Sept. 7, 1937			65		Marshall	Gunnison
July 11, 1938			1,800	1,600	Cottam	Gunnison
May 29, 1943	3,700			20 colonies	Behle	Gunnison
June 19, 1947	972 (10 colonies)		3,673 + 80 eggs (14 colonies)	2,617 (14 colonies)	Low	Gunnison
July 15, 1948	1,593		1,085		Low	Gunnison

BANDING OF THE WHITE PELICAN

During the past ten years, 1938 to 1948, a total of 600 juvenile White Pelicans have been banded on Gunnison Island by five different banders (Table 2). Dates of banding have varied from June 19 to July 15. Young pelicans have varied in age at banding time from an estimated three to ten weeks of age and have been roughly one-fourth



(Upper) PART OF GUNNISON ISLAND, ONE OF THE BREEDING GROUNDS OF WHITE PELICANS IN GREAT SALT LAKE.

(Middle) NESTS OF WHITE PELICANS ON GUNNISON ISLAND.

(Lower) A POD OF YOUNG WHITE PELICANS ON GUNNISON ISLAND.

to full grown. None of the pelicans had flight feathers at the time of banding (Plate 11, *lower*).

Regurgitation of food by the young pelicans was a common occurrence during the banding operation. To avoid this regurgitation of food, the pelicans were generally banded early in the morning before the young had been fed. An attempt was made to band only a sample of the birds each year; the ease of banding would have made it possible to band large numbers if it had been considered desirable. The great disturbance to the young birds and their offensive odor were factors which limited largely the numbers banded.

TABLE 2

BANDING DATA ON WHITE PELICANS, GUNNISON ISLAND, GREAT SALT LAKE, UTAH

<i>Date</i>	<i>Pelicans banded</i>	<i>Bander</i>
July 11, 1938	97	Rasmussen, Kay
July 12, 1938		
June 22, 1940	100	Rasmussen, Kay
June 23, 1943	100	Rasmussen, Kay
May 29, 1943	40	Behle
July 3, 1946	100	Nelson, Kay
June 19, 1947	100	Low, Nelson, Kay
July 15, 1948	63	Low, Kay

Of the 600 juvenile pelicans banded, there have been 26 returns, a 4.3 per cent recovery (Table 3). Slightly more than half of all band returns were from Mexico where 14 (54 per cent) of the bands were recovered by Mexicans (Table 4). Most of the bands were taken from birds near the coast on the west side of Mexico. Although the returns are few, they probably point to some of the principal wintering grounds of the White Pelican. The remaining 46 per cent were recovered from the United States as follows: Utah, 4; Idaho, 7; and California, 1 recovery.

Analyzing by seasons the returns of the bands indicates that the juvenile pelicans fly northward into Idaho in the fall after leaving their nesting islands in Great Salt Lake. They probably fly south, however, prior to the freeze-up in the fall, since the majority of the banded pelicans was taken in Mexico the same year as banded (Table 3).

Sixty per cent of the returns were made the first season after banding; 24 per cent the second year; 12 per cent the fourth year, and 4 per cent the fifth year after banding (Table 3). More recoveries were made in the fall than in any other season of the year.

Recovery of the bands from White Pelicans is rather limited probably because most of the birds are taken by Mexicans. Although it is thought by some that the Mexicans take the pelicans for food, the majority of the recoveries have been from birds "found dead." Undoubtedly, some of the birds are eaten; others probably are victims of fishermen who believe the pelicans endanger their fishery resources. Recoveries in the United States were all from birds reportedly found dead.

TABLE 3
BAND RECOVERIES OF WHITE PELICANS Banded ON GUNNISON ISLAND,
GREAT SALT LAKE, UTAH

Area of recovery	Number bands returned	Season of recovery			Recoveries by years after banding			
		Spring and summer	Fall	Winter	First year	Second year	Fourth year	Fifth year
Utah	4	3	1		2	1		
Idaho	7	5	2		5		1	1
California	1		1		1			
Mexico	14	3	7	4	7	5	2	
<i>Totals</i>	26	11	11	4	15	6	3	1
Per cent of band recovery	4.3	42.3	42.3	15.4	60	24	12	4

HABITS OF THE WHITE PELICAN

The White Pelicans, nesting as they do on the islands in Great Salt Lake, must make a flight of 100 to 150 miles round trip to obtain the fish necessary to feed their young. Undoubtedly, some pelicans fly as far as 90 miles to Utah Lake, a former nesting site, to obtain food. Observations indicate that the pelicans now fish the man-made water areas constructed as migratory waterfowl refuges. This represents a shift from the pre-white-man days when Utah Lake is said to have been their principal source of food. Principal feeding grounds around the shores of Great Salt Lake are the shallow waters of Bear River Refuge, Locomotive Springs Refuge, Public Shooting Grounds Refuge, Ogden Bay Bird Refuge, Farmington Bay Bird Refuge, private gun clubs at the mouth of the Jordan River, and undoubtedly other small local water areas. The relation of some principal feeding areas to the nesting islands is shown in Figure 1.

Most feeding activities take place at night or early morning, although there have been notable exceptions to this. At these feeding times, large groups of pelicans, sometimes accompanied by lesser numbers of Brewster's Snowy Egrets, *Leucophoyx thula brewsteri*, and Double-

crested Cormorants, *Phalacrocorax a. auritus*, may be seen cruising around in close formation on the shallow water areas, evidently driving schools of fish ahead of them. Constant dipping of their heads beneath the water indicates when the pelicans are catching fish.

TABLE 4
RETURNS FROM WHITE PELICANS Banded ON GUNNISON ISLAND,
GREAT SALT LAKE, UTAH

<i>Date banded</i>	<i>Date recovered</i>	<i>Place of recovery</i>
July 12, 1938	November 23, 1938	Jalisco, Mexico
July 12, 1938	November 20, 1938	Valle de Mexico, Mexico
July 12, 1938	May 1, 1940	Guadalajara, Mexico
July 12, 1938	December 5, 1942	Sonora, Mexico
May 29, 1943	December 2, 1947	Mexico Culiancan, Mexico
June 23, 1943	July 4, 1948	Bear Lake, Idaho
June 23, 1943	June 28, 1944	Laguna de Chamilari, Sinaloa, Mexico
June 23, 1943	November 25, 1943	Excumiapa Sinaloa, Mexico
June 23, 1943	November 12, 1944	Pueblo Viejo Versacruz, Mexico
June 23, 1943	February 21, 1945	Maravatio, Mich., Mexico
July 3, 1946	December 21, 1946	Jalisco, Mexico
July 3, 1946	August 21, 1946	Terreton, Idaho
July 3, 1946	November 17, 1946	Minidoka, Idaho
July 3, 1946	December 8, 1946	Buena Vista Lake, Kern Co., California
July 3, 1946	September 15, 1946	Ashton, Idaho
July 3, 1946	October 28, 1946	American Falls, Idaho
July 3, 1946	April 9, 1947	Durango, Mexico
May 29, 1943	September 1947	Ogden Bay Bird Refuge
June 19, 1947	February 26, 1948	Santa Teresa, Mexico
July 15, 1948	September 5, 1948	Shore of Great Salt Lake
July 15, 1948	September 5, 1948	Mud Lake, Jefferson Co., Idaho
July 14, 1948	February 7, 1949	Juarez, 28, Veracruz
July 3, 1946	June 11, 1949	Gunnison Island, Great Salt Lake, Utah

Much difference of opinion has existed in regard to the economic value of the pelican, largely because of the bird's food habits. Early reports (Henshaw, 1879) indicated that the pelican was persecuted on its nesting grounds by people who believed the pelican took the prized game fish. Repeated personal observations, however, have shown that the pelican feeds almost exclusively on non-game fish. These "trash" fish, slow in motion and found in abundance in the large shallow water areas far from human disturbance, undoubtedly determine their selection as food by the pelicans. Examination of regurgitated food showed that the carp, *Cyprinus carpio*, was the most abundant fish species used as food. No trout were found in 123 regurgitated piles of food of young birds examined by Behle (1935). Suckers, *Catostomidae*, minnows, *Leucichthys* sp., Utah chub, *Gila atraria*, and catfish, *Ameiuridae*, have also been found in the diet of the pelican (Cottam, 1939).

After capturing the fish necessary for feeding the young, the pelicans make their way to the nesting sites on the island. A study was made

of the pelican's return flight to the nesting islands from the feeding grounds on the Bear River Refuge, the promontory range, mid-way to the islands, and at the nesting sites.

There is a regular morning flight of the birds from the Bear River Refuge almost exactly on a compass line with the location of Gunnison Island. The time and character of this flight varies with wind conditions. When the wind is from the north or northeast, the birds may be seen starting to the southwest in groups of a few to several hundred. They apparently make little or no effort to gain altitude immediately as they leave. Winds from the south, however, appear to be unfavorable, and the birds may be seen circling over the refuge and stringing out at various levels until they apparently find the most favorable wind. They then fly in a southwest direction from the refuge. On calm days the departure times are later and the procedure is different. The birds then form long lines, usually in single file and at about 50 feet in height, and fly west from the refuge. Once over the refuge dikes, they are above flats with alternating areas of *Scirpus paludosus* or *Salicornia rubra* and bare areas of white alkali soil. Here the birds begin to circle in wide arcs, soaring all the time. Sometimes they do this for short periods only and then string out again and proceed farther west toward promontory range (Fig. 1). Soon, however, it is noticed that in their soaring they have gained altitude and at the same time other groups of birds have flown to the same place and have begun to soar. The birds have been watched until they were at a height estimated as equal to the promontory range when they straightened out and flew to the southwest. At times, about 11:00 in the morning, a column of several of these groups may be seen to the west of the refuge. Aviators in the region have indicated that flats of alternating vegetation and bare white soil often have upward currents of air over them. It is believed that the birds may take advantage of these air currents to gain altitude in their flight from the feeding ground on Bear River Bird Refuge to their nesting sites on Gunnison Island.

From the east side of promontory range (Fig. 1) large groups of pelicans have been observed at about 11:00 a. m. flying to the range from the direction of the Bear River Refuge. Upon approaching the range, they circled and raised at the nose of a ridge running up from the lake shore. At the end of this ridge, they flew directly to another some two miles away and circled over it, rising all the time. This ridge ran to the crest of the main divide. After the birds appeared to be as high as the hills, they flew west again and disappeared over the divide. Observations made on the opposite side of the ridge showed that the pelicans flew directly west toward Gunnison Island, their nesting site.

At Gunnison Island, 260 groups of birds, counted June 23, 1937, showed the average flock to be 9.7 birds, while 122 flocks averaged 13 birds in 1948. One flock returning to the island in 1937 totaled 151 birds, while 66 was the largest flock counted in 1948. Single birds were observed approaching the island from the mainland. On both the above dates, the numbers of pelicans returning to the island from the direction of Bear River Refuge diminished towards afternoon. In 1937, the largest number returned to the island between 8:30 and 9:30 a. m.; in 1948, peak numbers were reached from 12 to 1:00 p. m. The flocks numbered over twice as many in 1937 as in 1948 and the count of returning adults in 1937 was 2518 compared to 1593 in 1948.

NESTING

The nests of the pelicans on Gunnison Island are in colonies of a few to several hundred. The nest is generally a raised pile of sticks, soil, and guano often several inches above the surrounding soil. Some nests which appear to be new are hollowed-out depressions.

As previously pointed out (Behle, 1943) the age of the young differed between the colonies of nests, but the young in individual colonies were approximately the same age. Thus, at the visit on June 19, 1947, there were eggs in some colonies, newly-hatched young in others, and young three-fourths grown in still other colonies. On July 15, 1948, there was only one colony with eggs; other colonies had hatched and the birds from some colonies were nearly full grown.

The differences in stages of reproduction indicate different starting dates, perhaps corresponding to the dates of arrival on the islands of the birds from the different colonies. Earliest nests, judging from the age of young at the time the island was visited, probably were started shortly after the first birds arrived. Dates of first arrivals at the Bear River Refuge differ by a few days through the years; the first arrivals have generally been recorded around March 20 each year (Table 5).

In 1947, a count of 254 nests showed 152 had either one egg or one young, and 102 nests had two eggs or young. Mortality in the nests and of adult birds undoubtedly is high. Gulls, *Larus californicus*, take both eggs and newly-hatched pelicans when the nest is left exposed. Sixty young and 15 adult pelicans were found dead in nine colonies in 1947. All loss of young birds was not found in this survey, since decomposition, predation and scavenging would eliminate some evidence of loss. In eight of the colonies, 65 nests had one egg unhatched (infertile or embryo dead), and in 26 nests two eggs had not hatched.

Some nesting colonies apparently have been in the same relative positions on the islands for many years. Different observers, however, have counted different numbers of nesting colonies. Kay (1935, *in litt*) recorded 16 colonies, while Behle (1943) listed 20 colonies; Low (1947, *in litt*) sketched and tallied 14 colonies on both sides of the island.

The oldest and largest young in the nest was repeatedly observed pecking and molesting its smaller nest mate. The largest young is able to consume more food and oftener, probably depriving the last-hatched young of its proportionate share. A majority of the dead birds observed were in nests where two birds had hatched and where one was still living.

TABLE 5
DATES OF ARRIVAL AND DEPARTURE OF WHITE PELICANS AT BEAR RIVER
BIRD REFUGE, UTAH

<i>Year</i>	<i>Arrival date</i>	<i>Year</i>	<i>Arrival date</i>	<i>Departure date</i>
1929	April 4	1940	March 19	
1930	March 28	1941	March 10	
1931	March 22	1942	March 20	December 19
1932	March 19	1943	March 25	December 6
1933	March 16	1944	March 9	November 16
1934	February 14	1945		December 4
1935	March 16	1946	March 21	October 30
1937	March 17	1947	March 11	December 2
		1948	March 8	November 10

Any disturbance of the pods of juvenile birds resulted in a sudden rush of the birds away from the danger. Smothering and trampling undoubtedly are mortality factors. Young, when frightened, may climb on rock ledges from which they fall or jump.

Older juveniles, when disturbed, run for the water. Thus, on July 15, 1948, the older young in four pods ran down the beaches of the island and into the water. The juveniles, however, returned to the island when the "danger" was gone.

Food is readily regurgitated by the disturbed young. Generally, the food, consisting wholly of fish, is in an advanced stage of digestion when regurgitated. Since this seems to be the case even when regurgitation takes place shortly after feeding it might indicate that the adult birds pre-digest the food to some extent.

Young pelicans would undoubtedly accept food if they had the opportunity, from any of the adult birds. The adults, however, appeared to be very particular as to the juveniles they fed.

NEED OF PROTECTION

On far-off isolated rocky island retreats, the White Pelican is safe from the everyday disturbances by man and beast. However, the invasion of their nesting grounds by man can raise havoc during the critical nesting and rearing period. Frightening of adult birds from their nests before hatching, generally the middle of June, gives an opportunity for the ever-present gulls to invade the nesting colonies and destroy both eggs and newly-hatched young. Disturbance later in the season, after July 1, when young are approaching maturity, may result in the young being driven from the island and lost "at sea." Rising water levels, though no fault of man, undoubtedly have driven birds from former nesting sites as in Utah Lake and, conversely, as at Bird Island, a lowering in the lake water connecting the island to the mainland has permitted land predators access to the birds.

The need for protection of the nesting rights of these birds is keenly felt. Exploitation of guano deposits at one time threatened the nesting site of these birds. If the use of the island in past years, as bombing and strafing range, has taken place during the period of nesting and rearing the young, the disturbance to the birds probably has been great. Such activities should be carried out during late fall and winter. Protection should be accorded the pelican in the Great Salt Lake Valley where it finds the enormous amounts of food necessary to sustain itself.

SUMMARY

1. Gunnison Island, in the northwest part of Great Salt Lake, Utah, was the locale for banding 600 juvenile White Pelicans during the 10-year period, 1938-1948.
2. Population estimates of pelicans breeding on Gunnison Island have varied through the years but there have probably been somewhere between 3000 and 6600 adult birds and from 2600 to 3300 nests.
3. A band return of 4.3 per cent was recorded; 60 per cent of those being returned the first year following the banding.
4. Fifty-four per cent of the band recoveries were from Mexico, with other returns from Utah, Idaho, and California.
5. The juvenile pelicans appear to fly north before going south for winter.
6. Food of the pelican is non-game fish taken largely from waterfowl refuges around the shore of Great Salt Lake.
7. As many as 20 separate nesting colonies on Gunnison Island have been counted.

8. Evidences have been found of mortality to juveniles from disturbances by man, gulls, and from strife among the young.

9. There is a special need of protection for the pelican on the nesting-ground islands in Great Salt Lake.

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