NESTING POPULATIONS OF BROWN PELICANS IN FLORIDA[1]

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ABSTRACT

Aerial searches and mail questionnaires revealed 22 active nesting colonies of brown pelicans *(Pelecanus occidentalis)* on small islands close to shore off the Florida peninsula and a number of additional colonies in Florida Bay and the Florida Keys between 1968 and 1970. The same nesting islands were occupied in most years. Nesting took place during late winter and spring in Florida Bay and during late spring and summer in colonies off the peninsula. The maximum numbers of nests counted during 1968, 1969, and 1970 was 6,926, 6,100, and 7,690 respectively. This represents a conservative estimate of 12,200 to 15,380 brown pelicans nesting during the period of the census. Prebreeding age classes were not counted.

Most colonies were in trees on small natural islands. One colony on a spoil island in Anclote Sound was on the ground. At least three other colonies were on wholly or partially filled islands. Trees used for nesting had strong outer branches which offered unimpeded access to and from nests. Black mangrove *(Avicennia nitida)* was the principal tree used on the east coast and red mangrove *(Rhizophora mangle)* was the species most often used for nesting on the Gulf coast, although black mangrove was important on the Gulf coast also. The number of colonies and variety of nesting cover used were greater in the Gulf.

The adult population has apparently remained stable in Florida during the past three years. The census techniques used in this survey are not sensitive enough to reveal small changes in population size; therefore, this survey gives no indication whether reproduction has been sufficient to sustain this population size over a long period of time.

INTRODUCTION

Populations of the brown pelican declined drastically in North America during the 1960's. The species failed to nest in Louisiana after 1961 (Williams and Martin, 1969). It had been a common coastal resident in the "Pelican State" with some colonies containing up to 4,000 birds (Lowery, 1955). Its gradual extirpation is being monitored in Texas by Henry Hildebrand (Pers. comm.) who could find only two nests there in 1968 where hundreds had been. before. The species was thought to have been declining in California for a number of years recently (Ben Glading, pers. comm.) This was documented in a survey (Schreiber and DeLong, 1969). Jehl and others (Jehl, 1969) reported virtually complete reproductive failure in the species in California during 1969.

In 1969 productivity was found to be very low in Baja California (Jehl, 1969) and in South Carolina (T. A. Beckett, III, pers. comm.). The condition of populations outside the United States is not known but some apparently healthy nesting colonies exist in the West Indies (John C. Ogden and Allan H. Robinson, pers. comms.). The species occurs also in South America (A.O.U., 1957). but we can find no recent information about the health of the populations there.

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The brown pelican population which remains in Florida is biologically interesting from at least three standpoints: 1) should the downward population trend continue in other parts of its range and spread to Florida, we may have an unusual opportunity to monitor closely the extinction of a species during a relatively short period of time (this might produce knowledge and experience of use in saving certain other species from a similar fate); or, 2) if the population in Florida maintains itself, the study of this population could facilitate an understanding of the population dynamics of the species which will not be possible to obtain in a population of questionable stability; or, 3) more optimistically, the populations in Florida may offer the possibility that the species can yet be saved from extinction. For these reasons, the Florida populations would seem to warrant careful study.

The purpose of this paper is to report population data we have obtained from aerial surveys of nesting colonies beginning in 1966; to reveal the locations and distribution of the major nesting colonies in the state; and to briefly discuss some other aspects of the Florida population.

ACKNOWLEDGEMENTS

Data for this report have come from many cooperators throughout Florida during the past four years. Personnel of the Florida Audubon Society, National Park Service, National Audubon Society, and Bureau of Sport Fisheries and Wildlife and the universities in Florida have offered assistance whenever called upon. The following individuals have been especially helpful: John M. Allen, T. H. Below, Margaret C. Bowman, Alan D. Cruickshank, Karl F. Eichhorn, Samuel A. Grimes, Lawrence L. Howe, Herbert W. Kale II, Frederick H. Lesser, C. Russell Mason, Donald J. Peterson, William L. Powers, Carl C. Radder, William B. Robertson, Mrs. Joseph Russo, Ralph W. Schreiber, James A. and Lois Trent, Jack Watson, and D. Curtis Wilson. Wildlife pilots James H. Carter and George H. Langford were indispensable in this study. Other Game and Fresh Water Fish Commission personnel who assisted with field work are Larry H. Barwick, John L. Daniel, Michael J. Fogarty, and Jimmie C. McDaniel. John C. Ogden of the National Park Service and Alexander Sprunt IV of the National Audubon Society are acknowledged for the special help they gave in surveying the nesting colonies in Florida Bay. E. B. Chamberlain, Jr. and Ralph W. Schreiber made a number of helpful suggestions on the manuscript. The list of individuals is so long that some have probably been overlooked, for which we apologize. This study was done in cooperation with the Brown Pelican Subcommittee of the Southeastern Section of the Wildlife Society which involves cooperators in all the coastal states in the Southeastern United States.

METHODS

In 1966 written sources and more than 50 field cooperators were consulted to determine the locations of pelican nesting colonies in Florida. The places they suggested were checked for nesting activity and the coastline of the state was searched from a small airplane for concentrations of pelicans. Another aerial search was made during the summer of 1967 to find any colonies which had been missed before. During these preliminary surveys it was evident that non-breeding pelicans are scattered widely and would be difficult to count, but the congregations of breeding adults were readily found and could be more easily counted.

The census made in 1968 was reported earlier (Williams and Martin, 1969). In 1968, 1969, and 1970 known nesting colonies, newly reported nesting places, and all other likely nesting locations were surveyed by air during the early part of the nesting season and the number of nests in each colony was counted. The

counts were made on May 6 and 7, 1968; March 10, March 11, May 15, and May 16, 1969; and March 16, March 17, May 12, and June 16, 1970.

Colonies were approached at an altitude of about 300 feet in a single engine airplane and circled at a speed of about 70 mph several times at various altitudes and angles until the observers were confident that an accurate estimate of the number of nests had been made. Islands known to have once supported colonies were approached on each survey to determine whether pelicans were nesting on them.

The exact location of each colony was plotted on a U. S. Coast and Geodetic Survey "1200" series nautical chart. All colonies along the peninsula and some of the Florida Bay colonies were visited by boat to look for evidence of broken eggs or dead pelicans, collect regurgitated food samples, and to collect data on the characteristics of the nesting sites.

The census figures used in this report are estimates of the number of active nests at the time of peak nesting activity in each colony. This is based primarily on the counts made by us from airplanes, but nest counts made from the ground were used when they were believed to be more accurate. In a few cases, nest counts supplied by especially reliable field cooperators were used. One nest presumably represents two adult pelicans.

A certain amount of observer variation occurs when different people count nests in the same colony, even when the observers are together in the same airplane. Even greater variation in the number of nests reported occurs when different observers visit a given colony at a different time or view it from a different position. We have not attempted to measure this source of error, but after making repeated comparisons between aerial views and ground views of many colonies, we believe that for Florida colonies, the aerial method is more accurate if only one brief visit is to be made. When several visits can be made to a colony and the nests can be carefully counted by searching throughout the colony, a very accurate count can be had. This was possible only in a few cases in the present survey.

There is always the possibility of error in a direct enumeration census because there is no certain way to know whether all the colonies were found, but we do not believe that any large active colonies were missed during the nesting seasons covered in this report.

RESULTS AND DISCUSSION

Census.

The approximate location of each colony along the peninsula known to have been occupied with as many as 30 nests in any year since 1967 or believed to have been occupied by any number of nests in all three years is shown in Figure 1. A more precise location of each of these 22 colonies is shown in the reproduced portions of U. S. Coast and Geodetic Survey "1200" series nautical charts in Figures 2 through 4. Several active colonies, mostly smaller than those on the peninsula, were found in the Florida Bay and Florida Keys but it has been difficult to identify some of the small keys with certainty. Those definitely known to support nesting colonies during the past three years are shown in Figures 5 and 6. The nesting populations in the keys are combined in Table 1.

The variability in the number of nests in different years in some colonies is probably due to adult birds moving to different colonies in successive years. The occasional non-use of previously active colony sites and sudden reoccupation of old colony sites with several hundred nests is good evidence that pelicans do change nesting locations. For this reason, annual fluctuations in individual colonies probably reveal very little, if anything, about the productivity of the species.

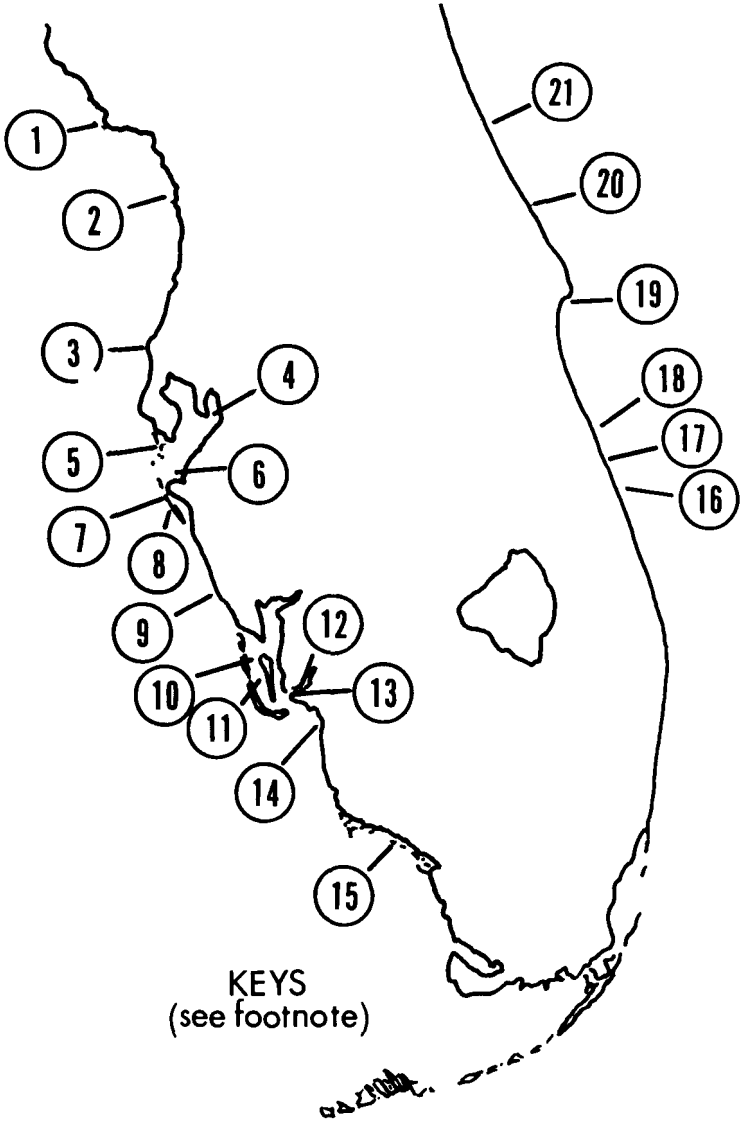

Figure 1. Approximate locations of the major brown pelican nesting colonies off the Florida peninsula. For exact locations, see Figures 2 through 4.

FOOTNOTE: SEE FIGS. 5 AND 6 FOR COLONIES IN KEYS

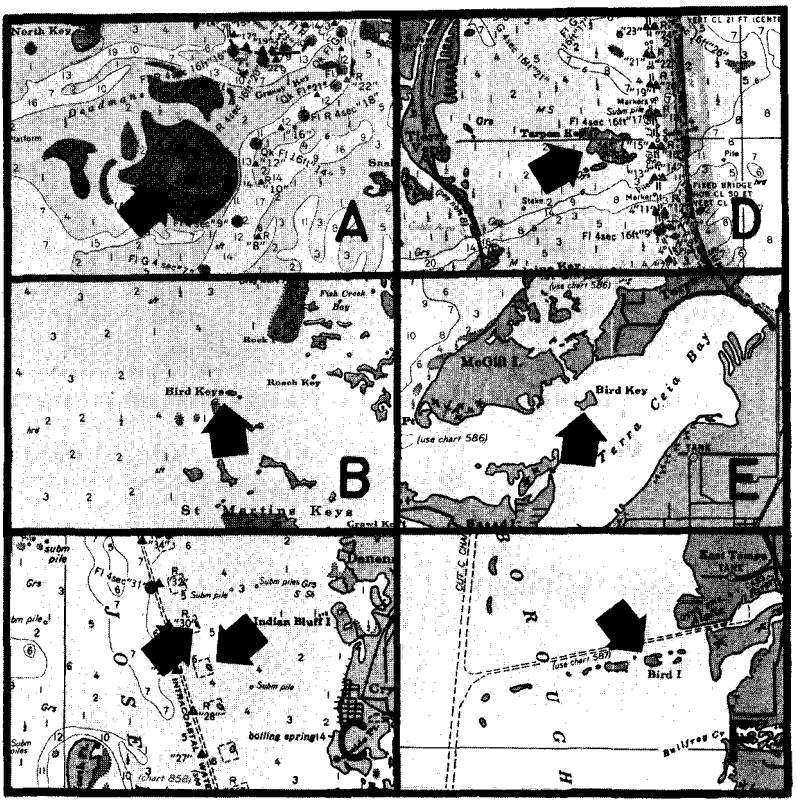

Figure 2. Portions of navigation charts showing locations of some of the colonies in Figure 1. A. Seahorse Key. B. North Homosassa Bay (Bird Keys). C. Anclote Sound. D. Tarpon Key. E. Bird Key (Terra Ceia Bay). F. Bird Island (Alafia River).

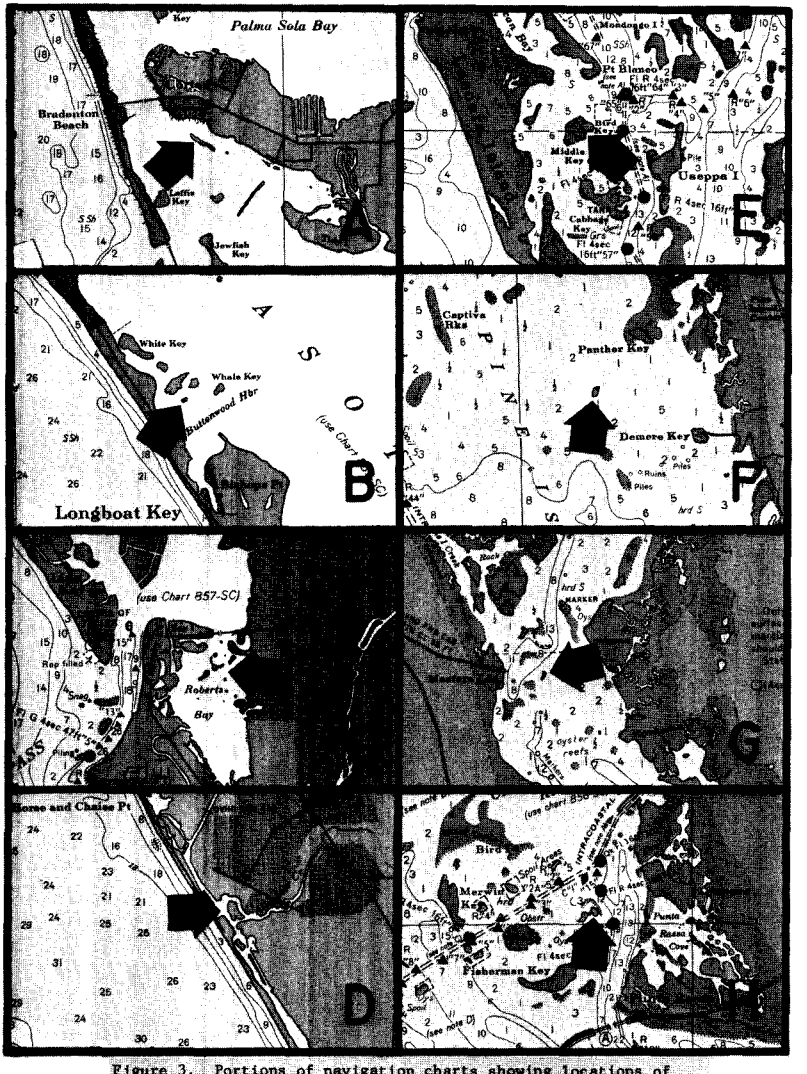

Figure 3. Portions of navigation charts showing locations of eight of the colonies in Figure 1 and Table 1. A. Cortez. B. Sarasota (Buttonwood Harbor). C. Sarasota Pass (Roberts Bay). D. Venice (Alligator Creek). E. Bird Keys (Useppa Id.). F. Hemp Island. G. Matlacha Pass. H. Miguel Key.

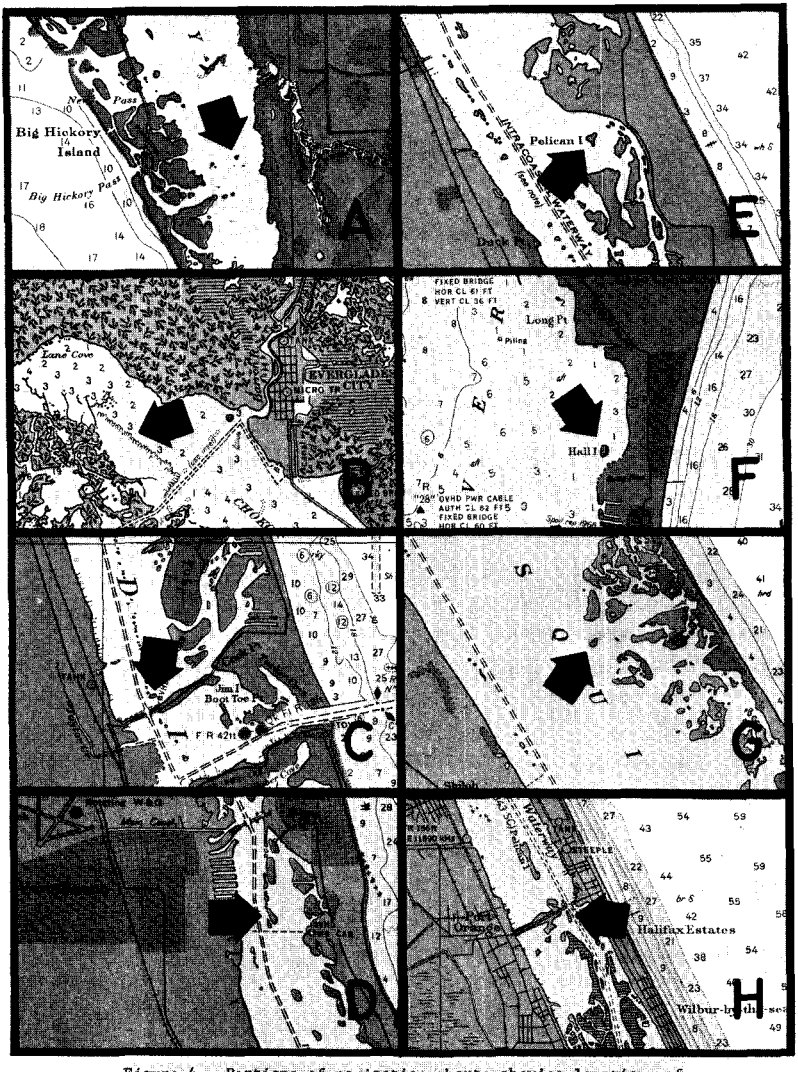

Figure 4. Portions of navigation charts showing locations of eight of the colonies in Figure 1 and Table 1. A. Estro Bay. B. Everglades City. C. Ft. Pierce. D. Vero Beach. E. Pelican Island. F. Hall Island. G. Crane Island. H. Port Orange.

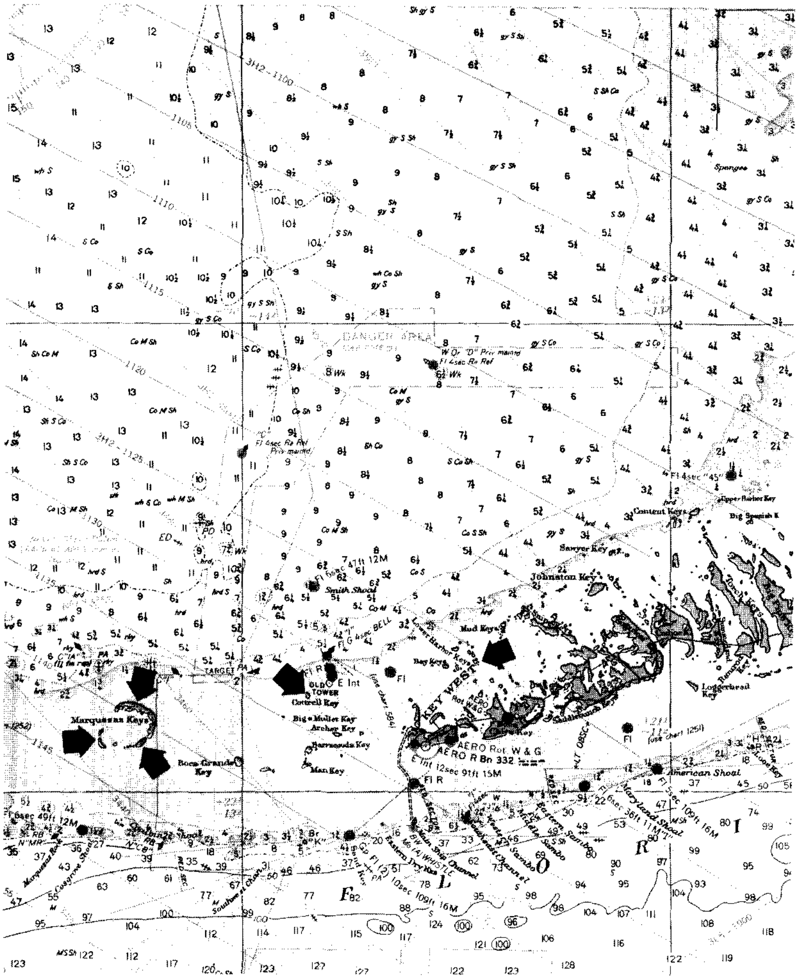

Figure 5. Portion of U. S. Coast and Geodetic Survey nautical chart number 1113 showing pelican colonies in the lower Florida Keys. Arrows point to colonies. This figure joins Figure 6 at right margin.

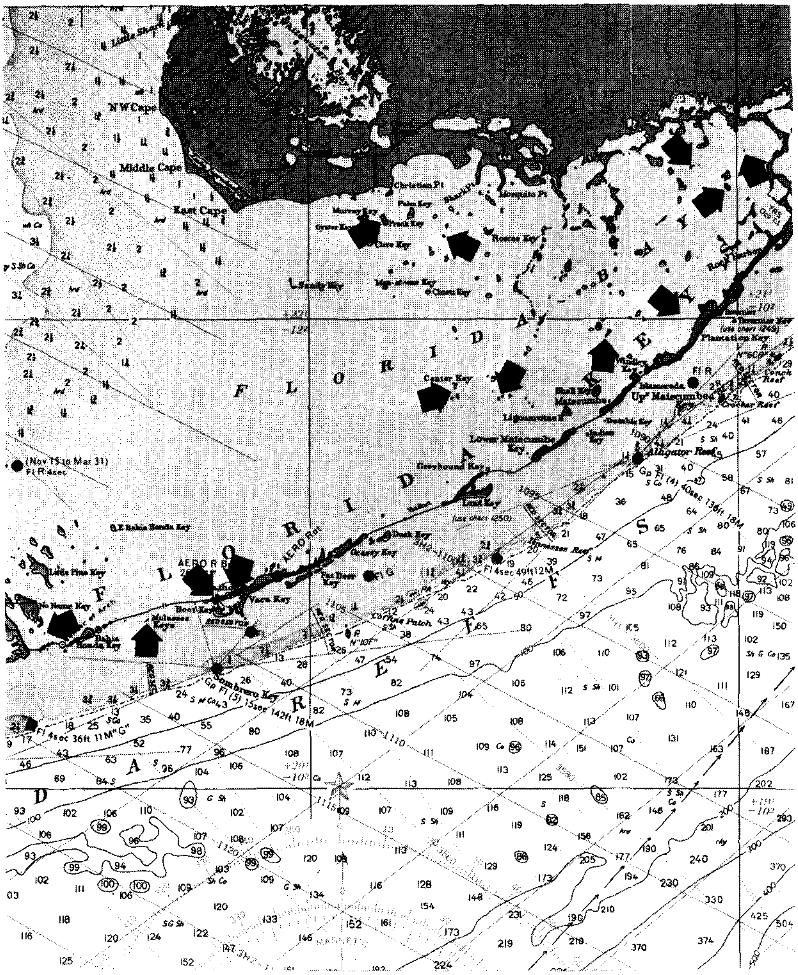

Figure 6. Portion of U. S. Coast and Geodetic Survey nautical chart showing pelican colonies in Florida Bay. Arrows point to colonies. This figure joins Figure 5 at left margin.

Table 1.

Estimated peak numbers of brown pelican nests in Florida in 1968[1], 1969, and 1970.

Number[2]	Locality Name	Number of Nests 1968	1969	1970
1	Seahorse Key	220	340	400
2	North Homosassa Bay	50	70	55
3	Anclote Sound	105	55	45
4	Tarpon Key (Pinellas Refuge)	800	1300	1100
5	Bird Key (Terra Ceia Bay)	400	250	200
6	Bird Island (Alafia River)	Unknown[3]	Unknown[3]	380
7	Cortez	550	400	400
8	Sarasota (Buttonwood Harber)	80	None	250
9	Venice (Alligator Creek)	Unknown[3]	20	35
10	Bird Keys (Useppa Id.)	900	900	1100
11	Hemp Island	600	500	300
12	Matlacha Pass (Masters Ldg.)	75	Unknown[3]	80
13	Miguel Key	None	200[4]	None
14	Estero Bay	90	None	60
15	Everglades City	110	90	95
16	Ft. Pierce	120	130	50
17	Vero Beach	80	Unknown[3]	300
18	Pelican Island	600	300	400
19	Hall Island (Cocoa Beach)	500	350	430
20	Crane Island	550	300	350
21	Port Orange	350	325	400
	Misc. other colonies along peninsula	10[3]	33	170
	Florida Bay & Keys[5]	746	570	1090
	TOTALS	6,936	6,133	7,690

[1]Includes some data pertaining to the 1968 nesting season which were obtained after the first census was published (Williams and Martin, 1969).

[2]Colony numbers correspond to the numbers in Figure 1.

[3]Nesting was not observed at the time of the aerial survey but reports of nesting during the same season were received from reliable sources.

[4]This colony was known to have been abandoned in mid-nesting season.

[5]Total nests in all colonies observed in Keys. See Figures 5 and 6 for the locations of colony sites which were active in the keys on at least one of the three years of this study.

The acceptance of new nesting places or the tendency of pelicans to colonize new territories has a definite influence on the rate of reestablishment by restocking of the species in its former range or by natural re-colonization of its former range. This behavior needs thorough study.

At this time it is not known whether the brown pelicans which once nested in Louisiana may be alive and healthy somewhere else, or whether the decreases observed in South Carolina are because some are simply moving to Florida. Without a better understanding of the rate of interchange between colonies and the factors causing it, population studies will be severely handicapped because the populations cannot be defined.

The apparent decrease in the nesting population in Florida Bay and the Florida Keys from 746 in 1968 to 570 in 1969 and the increase in 1970 to 1090 resulted from irregularity in the time of peak nesting activity in that area. In 1970 the survey more nearly coincided with maximum nesting activity. In the future, aerial surveys will be made on at least two different dates in that area so that the census will more likely coincide with the period of maximum nesting activity.

Colony characteristics.

All colonies were on small islands. Numerous narrow peninsulas with similar vegetation were available nearby but were not used for nesting. The Anclote Sound colony was on two artificial spoil islands near a dredged navigation channel. Another colony was on a spoil island at the mouth of the Alfia River. Dredging spoil appeared to have been dumped on some natural islands thereby enlarging or heightening them. This was suspected but not confirmed in two colonies. All others were on natural islands.

Several of the larger colonies were close to centers of human activity. The navigation channels and bridges shown on most of the nautical charts (Figures 2 through 4) give some indication of the amount of human activity near these colonies. The large colony at Port Orange is on the edge of the busy Intracoastal Waterway about 150 yards from a highway drawbridge. A small human dwelling is on an island with a small pelican colony at Fort Pierce. A dredged land fill supporting a private housing development lies about 100 yards from a colony at Hall Island well within the city of Cocoa Beach.

The effects of human disturbance on nesting colonies and the upper limits of the brown pelican's toleration of close-by human activities are not understood, but it is evident that nesting may proceed with at least some success near human population centers. The effects of human disturbance on pelicans needs objective study so that human activity will not be unnecessarily hindered near pelican colonies and so that the pelicans can be protected from truly detrimental human behavior.

The factors controlling nesting distribution of pelicans also need careful study. The most northern colony in Florida on the east coast is near the same latitude (29°09'N) as the northern-most colony on the Florida west coast (29°06'N) and these correspond closely in latitude to the most northern colony known recently in Louisiana (North Islands at 29°50').

Nest location.

The only colonies in Florida located *entirely* on the ground were two on small nearly treeless spoil islands. On one of these a strong inclination to nest off the ground was exhibited in 1969 by one pair which nested in an overgrown pokeweed *(Phytolacco americana)*, the only vegetation on the island that could have held a nest. James A. and Lois Trent reported (pers. comm.) that a few small Australian pines *(Casuarina equisetifolia)* were used for nesting in one of these colonies during 1970.

At least a few nests were on the ground or on dead, prostrate tree limbs in the larger colonies (Pelican Island, Hall Island, Crane Island, and Port Orange) on the Atlantic coast. This suggests overcrowding in these colonies.

It appeared that when nesting in red mangrove pelicans used the highest suitable trees in the colony for nesting, with the earlier nesters presumably takng the more preferred sites. The tallest trees on an island were not always suitable for nesting. In these cases the nests were around the outside rim of the island, at the edge of a lagoon, or clustered on points. Tree height ranged from 40-foot live oaks *(Quercus virginiana)* at Seahorse Key to black mangrove averaging about 7 feet high (but with some much lower nests) on the eastern coast, red mangrove was the most frequent nesting tree on the Gulf coast, but black mangrove was also used there. Virtually all nests on the eastern coast were in black mangrove which was much more abundant there than red mangrove. Red cedar *(Juniperus silicicola)*, redbay *(Persea borbonia)*, seagrape *(Coccolobis uvifera)*, and several other trees were used for nesting occasionally on the Gulf coast. A tree selected for nesting usually had branches strong enough to provide unimpeded access and support for adult pelicans and enough lateral limbs and sprouts to support the fragile nest. Pelicans avoided nesting in weak or especially leafy vegetation, and no nest has been seen inside a dense canopy. This is obviously related to the method that pelicans take wing, which requires springing into the air, followed by deep, rapid wing beating until a satisfactory air speed is attained.

Figure 7A shows typical nesting cover in black mangrove on the east coast and Figure 7B shows red mangrove and red cedar nesting cover at Seahorse Key. Figure 8A is an aerial view of an active colony showing nests in the more inwardly located (and higher) trees. Figure 8B is a lateral view of a colony photographed from the ground. Few of the dead branches of mangrove offer the necessary support for pelican nests, but one small colony was found entirely in dead red mangrove in Florida Straits. Pelicans used dead trees frequently for perching in the nesting colonies but showed a preference for living vegetation.

Mortality observed in colonies.

A few fresh carcasses of adult pelicans have been found in nesting colonies. Many of these were hooked in the bill or foot and entangled in fishing lines, suggesting that they became caught by the tackle while striking at fishermen's baits and were able to break the lines and return to the colonies where they became hopelessly entangled in the trees and died. Most of these lines were of plastic "monofilament". Six carcasses with fishing lines were found on Pelican Island in one day during the 1969 nesting season. No other carcasses were found. This mortality factor will probably increase as sport fishing activity continues to increase.

We found a baited, barbless hook to be very practical for capturing flying pelicans for research purposes.

We did not attempt to tabulate the mortality of nestlings but it was evident that the death rate between the time of hatching and flying was high. This is being studied at the Tarpon Key colony (Ralph Schreiber, pers. comm.).

Nesting seasonality.

During the four years that this study has been in progress, major nesting acttivity has occurred during early summer in all the colonies shown in Figure 1. The time of nesting has been less predictable in the Florida Bay colonies, but most of the traditional colony sites have been occupied there in late winter and early spring. The colonies on the east coast usually nested a few weeks earlier than the more northern colonies. In midsummer various stages of reproduction were found underway in all colonies indicating that the nesting season is long and suggesting that renesting may be attempted more than once.

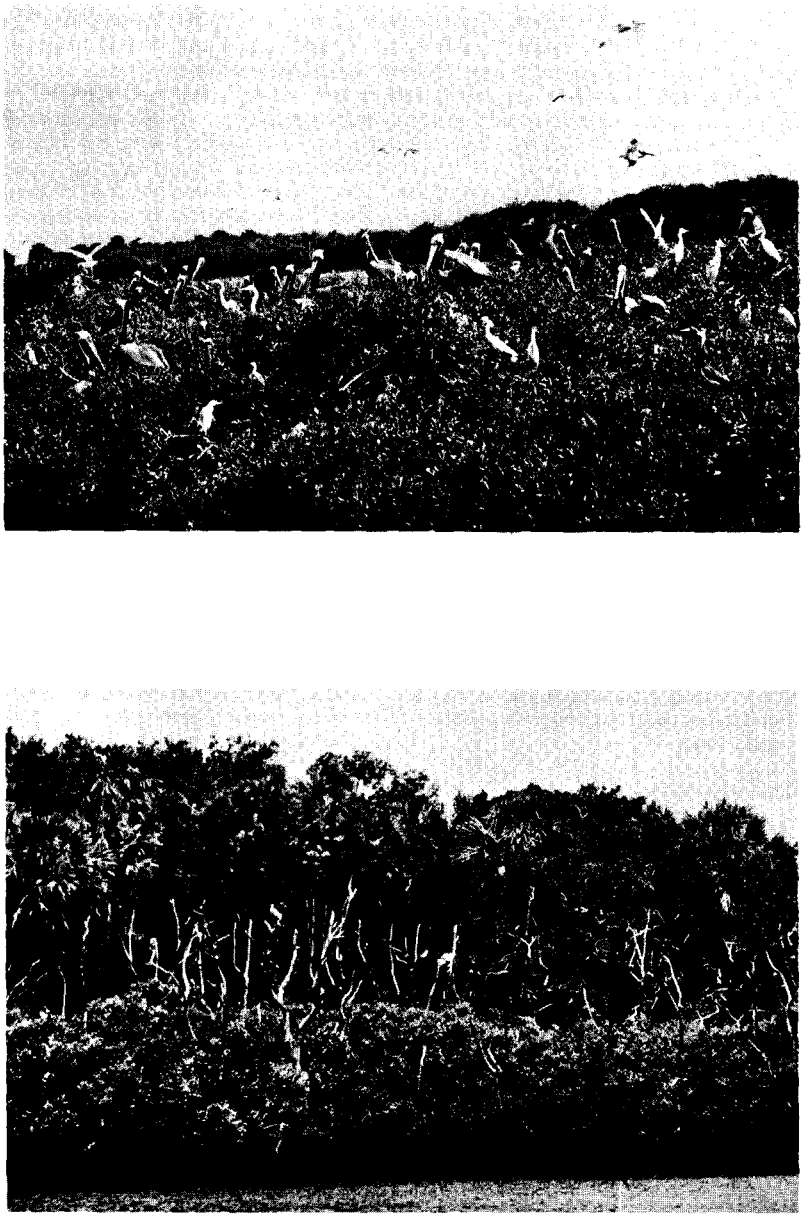

FIGURE 7. Brown pelican nesting cover. A. Black mangrove on the east coast. B. More varied cover at Seahorse Key on the Gulf: red mangrove, red cedar, red bay, and live oak (bottom to top).

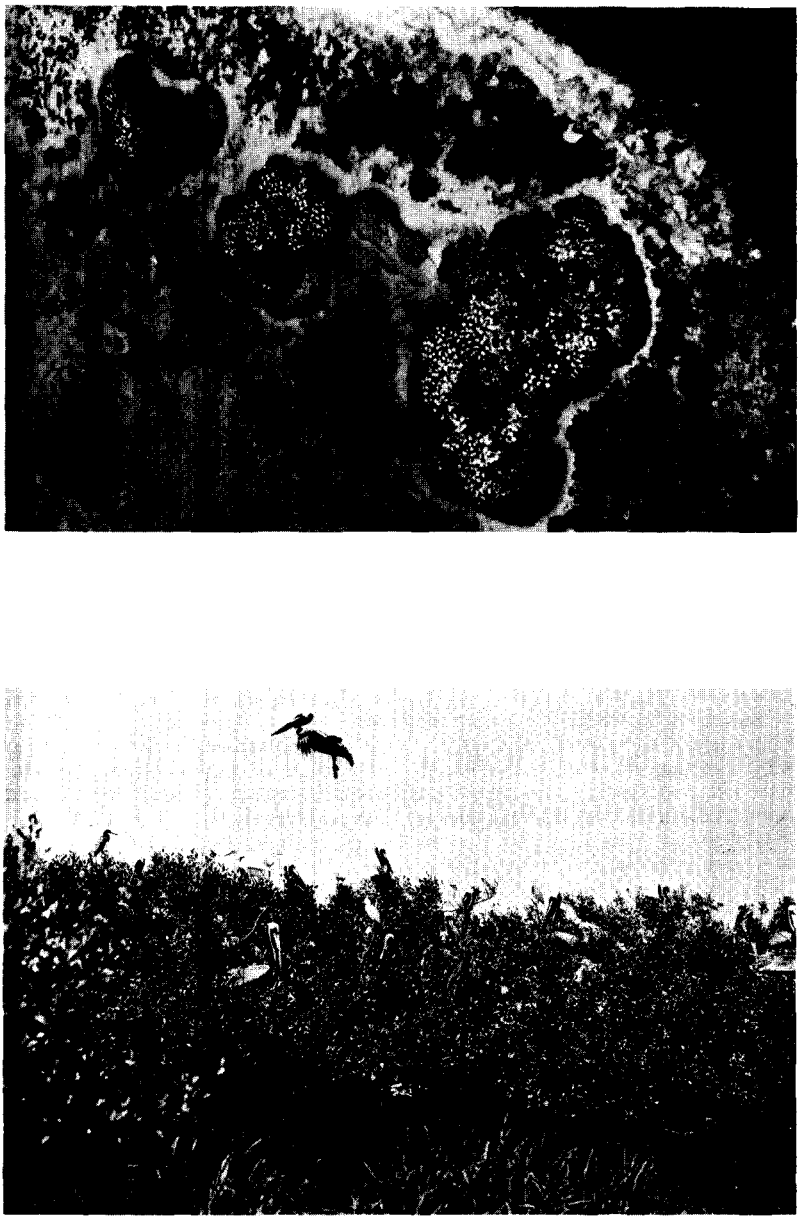

FIGURE 8. Views of pelican colonies from different vantage points. A. photographed from about 400 feet altitude. B. A similar colony photographed from the ground.

With minor exceptions, incubation was well along in the southern colonies of the peninsula during April and about a month later at Seahorse Key. The colony at Port Orange on the east coast is near the same latitude as Seahorse Key but nesting has begun at Port Orange earlier than at Seahorse Key during the four years of our observations.

The history of pelican nesting on Pelican Island is puzzling. When the island was first made a National Wildlife Refuge in 1903 pelicans nested there during the fall and winter (Howell, 1932). They now nest there primarily during early spring and summer, but a few pairs have nested there during the winter recently.

CONCLUSIONS

The adult brown pelican population in Florida has been approximately the same during the summers of 1968 through 1970 but this kind of survey data does not reveal whether reproduction has been "normal" or adequate to sustain this adult population level in the future. Another question which remains unanswered is whether the adult population has ever been any higher in Florida than during the period of this census. In spite of frequent allegations to that effect (by laymen, primarily) we find no evidence that current populations of about 13,000 nesting, adult pelicans are "low".

Persuasive evidence has recently been presented (Anderson et al., 1969) that certain levels of DDT and DDE in the bodies of birds has resulted in reproductive impairment by causing the egg shells to be too thin. Anderson and Hickey (1970) showed that brown pelican egg shells in South Carolina, Florida, and California became thinner after 1943 (about the time that DDT came into use). Robert W. Risebrough (Jehl, 1969) showed that DDT and DDE contamination causes the reproductive failure witnessed in California pelicans in 1969. It would seem only a matter of time now until the adult pelican population in California dies out.

Tissues of brown pelicans examined from representative colonies in Florida also contain significant residues of DDE (our unpublished data). Their egg shells are also abnormally thin (Blus, 1970). It can be expected that reproductive failure will occur (if it has not happened undetected already) in the Florida populations as these residues approach California levels.

If the brown pelican is permitted to become extinct, it will not be because we were not amply warned. And in this day of fantastic technology and wealth, we believe that the extinction of the brown pelican can be prevented.

A positive conservation program must be undertaken immediately with the specific purpose of saving the brown pelican as a species.

In the event of continued population declines and local extirpations, restrictive state and federal regulations which impede research and scientific management of brown pelicans will only hasten—certainly not halt or even slow down—the eventual disappearance of the species. The brown pelican should not be placed on any "endangered species" list if in doing so the collection of specimens for scientific study will be curtailed to any degree. No useful purpose will be served by refuges or regulations which "protect" the pelicans from the things which do not endanger it.

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MONTHLY VARIATION IN NUTRIA PELT QUALITY

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The value of individual nutria *(Myocastor coypus)* pelts is in direct proportion to pelt quality and size. Various factors affect pelt quality such as fur primeness, fur color, and holes in the skin. Pelt quality in nutria is thought to vary during different periods of the year; however, this has not been confirmed.

Observations by O'Neil (1949) show that the Louisiana muskrat reaches the height of its prime from mid-January to mid-February. Shanks and Arthur (1952) found that the value of muskrat pelts in Missouri increased by 202 percent from September to December, because of increased pelt quality. The harvest of nutria has been scheduled to conform with the trapping season for muskrat *(Ondatra zibethica)*. In general, the harvest in Louisiana has been permitted during a 3-month period from December through February. If additional time was required the trapping season was extended into March.

Because of the increasing importance of nutria to the fur industry in Louisiana and of the importance of pelt quality to pelt value, a study was begun on Rockefeller Wildlife Refuge in 1961 to determine the monthly variation in nutria pelt quality. An additional purpose of the study was to compare the various factors affecting pelt quality (such as primeness, damage, and color) and to determine the months which would produce the greatest revenue from a given number of nutria.

After the nutria was introduced into Louisiana in 1938, its population increased and by 1945 the animal had invaded practically all Louisiana coastal marsh areas (Dozier 1951). Nutria were trapped extensively for fur and by the 1961-62 season provided a fairly stable industry with the value of pelts taken totaling over $1 million annually (Louisiana Wild Life and Fisheries Commission, 1964). In Louisiana the harvest of nutria ranked second only to muskrat *(Ondatra zibethica)*.

Nutria also spread into agricultural areas adjacent to the marshes and numerous complaints of damage were voiced by sugar cane and rice farmers