4.6 Colonial Nesting Birds

4.6.1 Colonial Nesting Bird Annual Trends

Data on colonial nesting bird populations for the Texas coast are collected by volunteers on an annual basis and are maintained by the U.S. Fish and Wildlife Service (USFWS). The database contains 679 records in the GBEP study area and reports number of nesting pairs of 29 species of birds sighted in Galveston Bay during the years 1973-2001.

Colonial nesting bird data collection from a colony is dependent upon sighting by a set of non-randomly and non-evenly distributed observers. It is not clear whether the spatial coverage of the Bay and associated land areas is adequate to claim complete coverage.

Volunteers conducting the survey try to visit the colony sites during a two-week period at the end of May and the beginning of June. Sometimes weather may delay the census or may prevent counting of some colony sites. This data set has a consistent temporal pattern based on dates, but it is not consistent in the context of seasonal change and environmental triggers of breeding behavior in birds. It is the best data set available on water birds associated with Galveston Bay. We make the assumption that the annual surveys are equivalent samples of breeding bird abundance.

The most abundant bird in nesting colonies around Galveston Bay is the laughing gull. From 1973 to 2001 an average of 24,527 nesting pairs per year were censused at colonies around the Bay system. The most abundant tern has been the Royal tern, which has averaged 4,524 nesting pairs over the years from 1973 to 2001. The most abundant heron or egret has been the tricolored heron with 1604 nesting pairs per year. One extremely variable member of this census is the white ibis, which has ranged from 12 nesting pairs to an estimated 22,496 with a mean of 3,720. Of special interest are the rare and endangered species. The reddish egret has a mean of 42 nesting pairs per year. The brown pelican has a mean of 86 pairs per year, but nesting pairs are first noted in the census in 1992. Black skimmers have a mean of 2,176 nesting pairs per year in the Galveston Bay system.

The annual summation of surveyed abundance of nesting pairs at Galveston Bay area colonies of 19 species of colonial nesting water bird were analyzed by regression and correlation. The 19 regressions of number of nesting pairs on years were used to determine which species are stable, increasing or declining in abundance at nesting colonies. The criterion used to determine whether to label a regression as increasing or decreasing was a regression slope greater than 1% of the mean number of nesting pairs over the sample period. For example, black skimmers have an average number of nesting pairs of 2,176 and a slope of –44.676; therefore, black skimmers are labeled as a declining species because 44.676 is greater than 21.76. Using this criterion, the species are classified in Table 4.6.4a. Trend graphs for all species are shown in Appendix E.

Table 4.6.1. Summary for 19 species of colonial nesting water birds of mean number of nesting pairs censused from 1973 to 2001, slope of a linear trend line for nesting pairs plotted against year and the classification of the species' trend based on the slope. A species is increasing or declining if the slope is greater than +/-1% of the annual average number of nesting pairs.

Species	Mean Abundance	Slope	Classification
Black Skimmer	2,176	-44.7	Declining
Brown Pelican	86	14.8	Increasing
Caspian Tern	115	-0.1	Stable
Forster's Tern	1,539	20.8	Increasing
Great Blue Heron	379	-14.4	Decreasing
Great Egret	1,049	-20.0	Decreasing
Gull-billed Tern	62	4.2	Increasing
Laughing Gull	24,527	-343.5	Decreasing
Least Tern	462	-19.5	Decreasing
Little Blue Heron	360	5.2	Increasing
Olivaceous Cormorant	556	19.9	Increasing
Reddish Egret	42	-0.1	Stable
Roseate Spoonbill	645	-17.9	Decreasing
Royal Tern	4,524	246.4	Increasing
Sandwich Tern	2,166	141.0	Increasing
Snowy Egret	1,101	-11.0	Stable
Tricolored Heron	1,604	-41.3	Decreasing
White Ibis	3,720	318.0	Increasing
White-faced Ibis	407	-13.2	Decreasing

In some cases, this criterion of slope may have identified normal fluctuations for trends in nesting pair abundance. A more stringent criterion for a linear trend would be the proportion of the variance in abundance explained by the linear regression line, i.e. the r-square value. Those species with r-square values greater than 20% are brown pelican, great blue heron, gull-billed tern, laughing gull, royal tern, sandwich tern, and tricolored heron. The terns and pelicans are showing an increasing trend in nesting pairs, while the herons and laughing gulls are showing declines. It is interesting that the strongest declining trends are in species that have received little attention from conservation efforts. For example, Figure 4.6.1 shows the trend of nesting pairs for tricolored heron, the most abundant heron and egret species in the Galveston Bay ecosystem.

As noted, some species are exhibiting an increasing trend in number of nesting pairs. Half of the eight species showing increases are terns, which shore open water feeding and bare substrate nesting habits. One example of this guild is the Royal tern. The plot of nesting pairs of Royal tern against nesting year is shown in Figure 4.6.2.

Only one heron or egret is showing an increasing trend. That is the little blue heron. Of course, brown pelicans are showing the most dramatic increase in nesting numbers and are considered a great success of regional conservation efforts. Also white ibis and olivaceous cormorants have increasing trends.

Figure 4.6.1. Annual Abundance of Nesting Pairs of Tricolored Heron

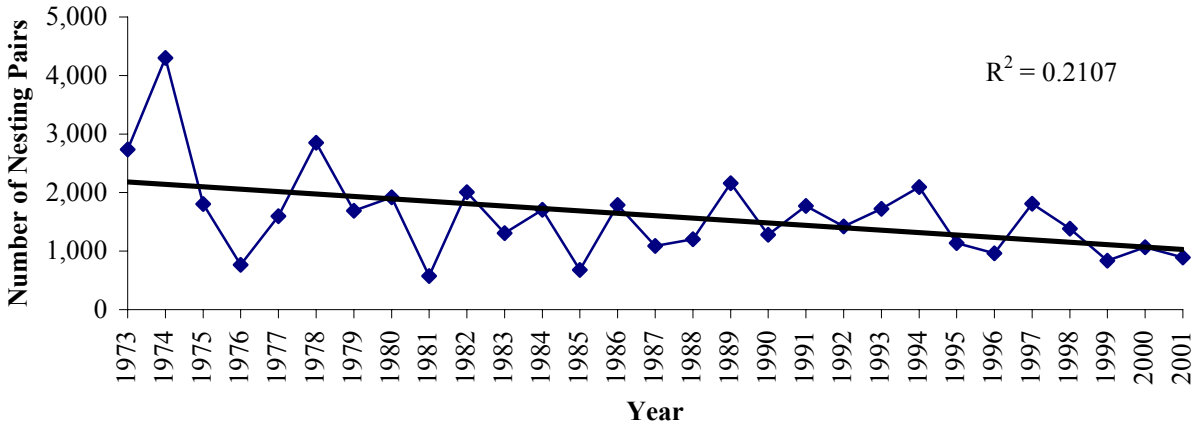
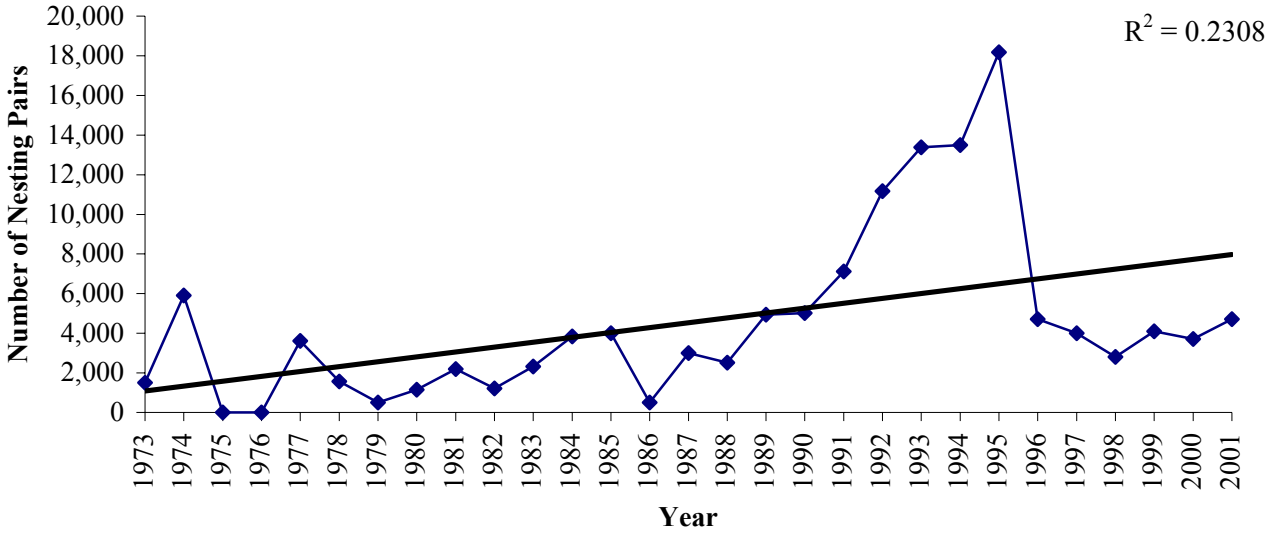


Figure 4.6.2. Annual Abundance of Nesting Pairs of Royal Tern



4.6.2 Multivariate Analysis of Water Bird Resources

A correlation matrix of the abundances of nesting pairs in the years from 1973 to 2001 yields few significant relationships. All of the significant correlations are shown in Table 4.6.2. The highest correlation is between Royal and sandwich terns, which is justified by their similarities in feeding and nesting requirements and behavior. The correlation of snowy egret to little blue heron is logical based on their similarities of feeding and nesting requirements. Roseate spoonbills would appear to share fewer characteristics with snowy egrets, but may have habitat requirements sufficiently similar to explain the correlation found. It is quite surprising to find significant correlations between herons and terns. In the case of tricolored heron and least tern the relationship is positive, but in the case of great blue heron and Royal tern it is a negative correlation. The former case is unlikely to be a statistical aberration because the level of significance is very high. Finally the correlations of brown pelican with gull-billed tern and laughing gull appear to represent nesting habitat relationships. High laughing gull nesting numbers affect pelican nesting negatively, but gull-billed terns appear to be an indicator of pelican nesting effort.

Table 4.6.2. Correlations between Species of Colonial Nesting Water Birds in the Galveston Bay System from 1973 to 2001.

Species	Brown pelican	Royal tern	Snowy egret	Tricolored heron
Black Skimmer				
Brown Pelican				
Caspian tern				
Forster's tern				
Great blue heron		-0.48*		
Great egret				
Gull-billed tern	0.54*			
Laughing gull	-0.47*			
Least tern				0.68***
Little blue heron			0.57*	
Olivaceous cormorant				
Reddish egret				
Roseate spoonbill			0.48*	
Royal tern				
Sandwich tern		0.90***		
Snowy egret				
Tricolored heron				
White ibis				
White-faced ibis				

* = $p<0.01$
*** = $p<0.0001$

Lastly, a principal component analysis of the colonial nesting bird census data was performed using 29 years of data. If a species lacked data for a year it was entered as a zero in the data set. All of the species in the above table were included. Principal component analysis uses a matrix analysis of the original data set to explain the variation of the original variables in fewer synthetic variables (eigenvectors) called principal components (PC). This approach incorporates the correlation relationships between variables. Correlation causes parameters to load together onto the new synthetic variables (vectors). Loadings to the principal components are like correlations in that they range from 0 to 1.0 and describe the relationship between the original variable and the new variable.

The first principal component of the colonial water bird data set explained 21% of the variance, but did not have a strong relationship with any species. The seven species with the highest loadings to PC1 were roseate spoonbill (0.32), laughing gull (0.31), tricolored heron (0.30), great blue heron (0.29), great egret (0.25), and black skimmer (0.24). All of these species show a declining linear trend. Although it is difficult to explain the relationship between PC1 and some biological phenomena, it is worth describing it because it shows a strong decline over the period of the census as shown in Figure 4.6.3. It is striking that so many species are correlated to a variable showing such a strong linear

decline across the period of data collection. This is probably related to some general pattern of habitat loss or degradation as yet unidentified.

Figure 4.6.3. Trend of First Principal Component Scores Based on Nesting Pair Abundance of 19 Species of Colonial Nesting Water Birds