

FIELD OBSERVATIONS PERTAINING TO THE  
SYSTEMATIC STATUS OF THE GREAT  
WHITE HERON IN THE FLORIDA KEYS

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OF the multitude of fascinating biological problems encountered in the Florida Bay region, none seems to have excited as much interest among ornithologists as the systematic status of the Great White Heron (*Ardea occidentalis*) and its relationship to the Great Blue Heron (*Ardea herodias*). In his recent analysis of this problem, Mayr (1956) emphasized the necessity of substituting solid field work for any further speculation. During the period from December 10, 1955 to May 20, 1956, I had the opportunity of making daily observations of the herons of Florida Bay. Although my primary concern was with comparative courtship behavior, much information obtained was pertinent to the problem of the systematic status of the Great White Heron. The following is a summary of my field work relating to this problem.

*Area studied.*—The maps (Figures 1 and 2) show the areas covered during this study. The keys visited during the period mentioned above were Bottlepoint, Cotton, Cowpens, Johnston, Key Largo, Low, Lower Matecumbe, Plantation, Stake, Upper Matecumbe, West, and Windley.

*Behavior.*—Considerable information was accumulated on the behavior of Great White and Great Blue herons in Florida Bay, but since the problem in question is a taxonomic one, the description and analysis of behavior in these birds will be presented elsewhere. However, as far as their behavior aids in clarifying the systematic status of the birds, it can be stated here that the behavior of the blue and white birds shows no significant differences. Although he gave no details, Bond (1935) likewise found that the Great White and Great Blue herons of the West Indies "behave precisely alike."

Holt (1928) argued, in defense of his contention that the Great White Heron was a distinct species, that the white birds were shyer than the blue ones; this position cannot be defended on the basis of my observations. Those white and blue birds which were exposed daily to the visits of sport fishermen, bird watchers, etc. (e.g., along the intracoastal waterway), were quite tame as compared to those inhabiting the more remote keys. Some of my journal notes give the impression that in occasional situations the blue birds are shyer than the white ones. Two excerpts from my journals should suffice:

"December 26, 1955.—Four whites and one blue in shallows near Bottlepoint Key—the blue is standing about 25 yards from the four whites—the blue shows low-intensity escape reactions as boat drifts closer—four whites are actually closer to boat, but escape reactions very low—the blue turns and wades away very slowly, then flushes—still wary as it lands about 50 yards away—whites hold their ground."

"January 25, 1956.—Poling slowly around Bottlepoint Key—eight *Ardea* standing in shallows—7 white, 1 blue—blue extremely wary—shows high intensity escape behavior, flushing readily—lands about 30 yards beyond last white bird—still wary—no whites flush."

There is, however, no consistent difference of behavior between the blue and white birds. Other notes reveal varying degrees of shyness exhibited by individuals in groups consisting entirely of white birds. It is my impression that "shyness" cannot be used here as a species characteristic.

In addition to shyness, Holt (1928) discussed three additional behavioral points in favor of a specific status of the white birds: 1) white birds are solitary, blue birds gregarious; 2) white birds are much fiercer and more pugnacious than blue ones; and 3) white birds are diurnal, while blue birds feed throughout the day and night. Although the populations of the white birds are not nearly as large as many populations of blue birds from the mainland, the white ones cannot be categorized as solitary. I have numerous records of groups of white birds feeding, courting, and nesting in close proximity. A minimum of eleven white birds nested on Cotton Key (see Table 2), and at least this many whites were seen frequently in one group feeding on the exposed flats immediately south of Cotton Key. I could find no significant differences in the attack behavior of the adult white birds as compared to that of the blue ones; blue and white young were equally vigorous in intra-nest disputes in nests on Cotton Key which contained mixed broods. After the young had hatched on Cotton Key, the white parents visited their feeding areas throughout the night. On many occasions, white birds fed during the night within ten yards of my tent, which was located on the northern tip of Cotton Key.

*Variability of "würdemannii."*—In 1858 Baird gave the name *Ardea würdemannii* to an intermediate plumage type taken in Florida Bay. Holt considered this form to be a hybrid between the Great White Heron and the Great Blue Heron. No specimens were col-

lected during my stay in Florida Bay, but my notes on color variation in blue birds show that they are highly variable. All the blue birds observed along U. S. Route 1 between Key Largo and Homestead were dark. Those blue birds which used Dove Creek Slough, north-east of Tavernier on Key Largo, as a feeding area were also dark. The blue birds seen in the censuses (see below) varied from very pale to very dark. Of the three positive blue parents on Cotton Key (see Table 2), two were pale and one was very dark; the dark bird and one of the pale ones had black occipital plumes, but the other pale bird had white plumes. I strongly agree with Robert P. Allen's

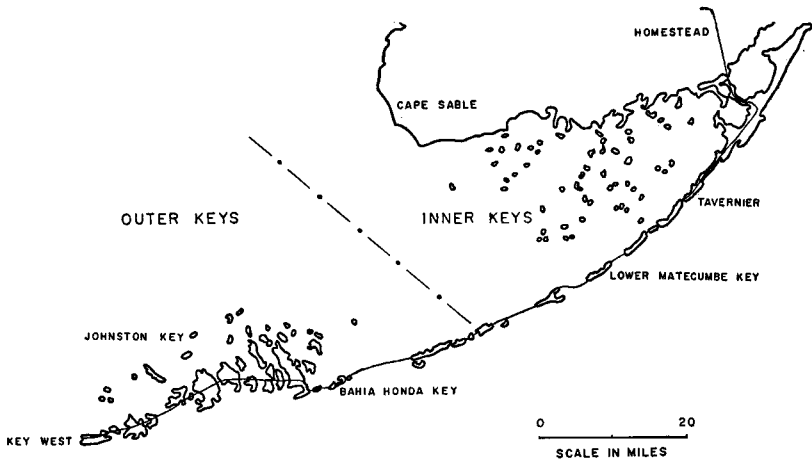


FIGURE 1. Simplified map of the Florida Keys. The broken line arbitrarily divides the keys into an inner group and an outer group.

recollection (Mayr, 1956) that the palest of the blue birds in Florida Bay are found in the outer keys, i.e., those keys west of Bahia Honda Key (see Figure 1).

*White : blue ratio censuses.*—Although he made no series of counts of white and blue birds, Holt's impressions were that the blues outnumbered the whites in the Cape Sable area of the mainland and on the keys just off Cape Sable, but that whites outnumbered blues on the keys to the south (Barnes, Buchanans, etc.). Greene (1946), working mainly in the outer keys around Key West, made separate counts of white and blue birds, usually on different days in different areas, but on several days both color types were counted in the same area: March 13, 1939, 93 whites, 9 blues (Marquesas Keys); October 21, 1940, 33 whites, 16 blues (Eaglenest, Mud, and Harbor keys, Calda Channel); and November 6, 1940, 55 whites, 20 blues (Calda

Channel). The impression gained from Greene's counts is that whites outnumber blues in the outer keys; however, many additional counts on the same keys in the Key West area are required.

My counts, with few exceptions, were confined to the inner keys of eastern Florida Bay (Bottlepoint, Stake, Low, etc.; see Figure 2). Table 1 lists all censuses taken. In the area shown in Figure 2, the whites outnumbered the blues consistently. These data agree with Holt's impressions for the Barnes-Buchanan area. There may be a clinal increase in the percentage of blue birds as one approaches the mainland, as Mayr (1956) suggests, but many more counts are required to prove this.

Such additional counts, in both the outer and the inner keys, might show a break between the two groups of keys. A glance at the map (Figure 1) reveals an interesting situation—there is a distinct gap, from about the region of Lower Matecumbe Key to Bahia Honda Key, which separates the inner keys from the outer keys. To my knowledge, there are no *Ardea* breeding records for the keys located between these two points. Little is known about the movements of adult Great White Herons and the dispersal of immatures, but if they are as sedentary as generally supposed, the lack of movement across the "Matecumbe-Bahia Honda gap" might effectively split the breeding population of the Great Whites into two distinct populations, one in the outer keys, the other in the inner keys. The available evidence seems to point to a strong gene infiltration from the mainland to the inner keys, with a reduced flow to the outer keys. Such a restricted flow to the outer keys might account for the supposedly greater frequency of very pale "Würdemann" types in the outer keys. However, the meager evidence available in the case of the Great White Heron does not warrant any further speculation.

*Evidence for random mating.*—A study of mated pairs not only aids in solving the problem of random versus non-random mate selection as far as color type is concerned, but together with an enumeration of their resultant young assists in the construction of genetic models for the inheritance of such color types. Previously published references to mated pairs in the Florida Bay region are, at best, vague and inconclusive. Table 2 summarizes the nesting data gathered during this study. Parentage was established at each nest as follows: a blind was set up near the nest until both parents returned, i.e., perched on the nest rim, fed the young, etc. In the case of nests in which both parents were of the same color type, I

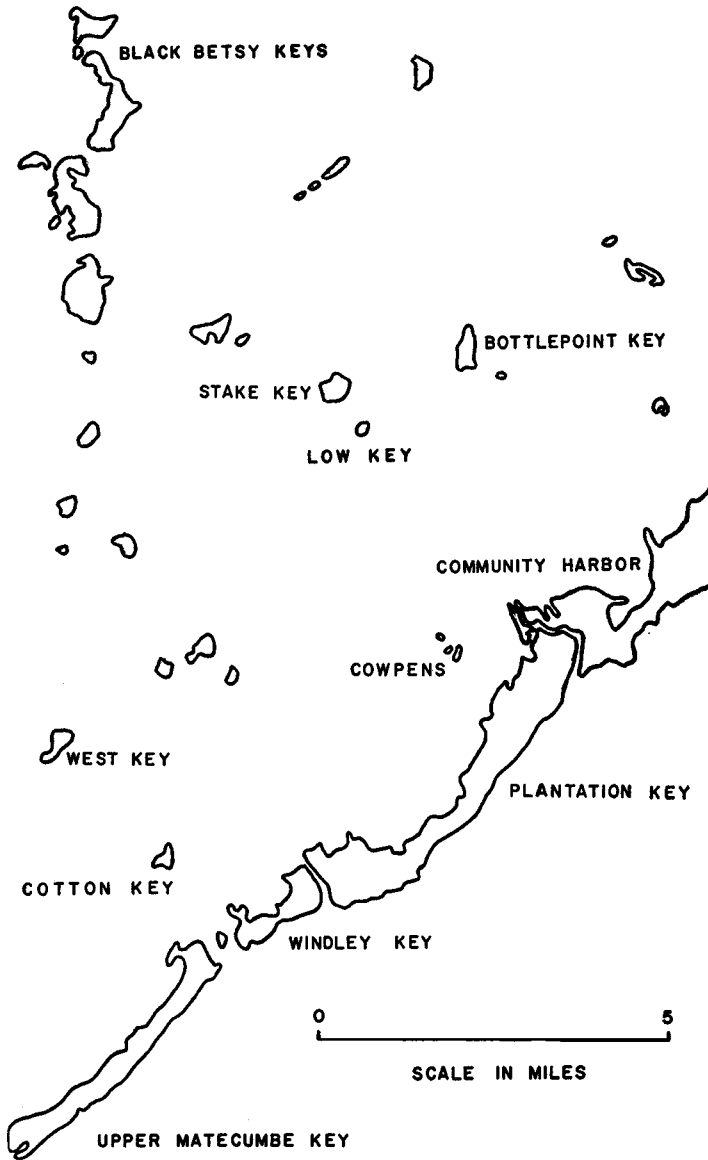


FIGURE 2. Simplified map of a portion of the inner keys. Most of the observations recorded in the text were made in this area.

TABLE 1  
CENSUSES SHOWING THE RATIO OF WHITE : BLUE HERONS IN PORTIONS OF FLORIDA BAY

<i>Date</i>	<i>Census Route</i>	<i>Ratio, White : Blue</i>
	<b>BOTTLEPOINT KEY AREA</b>	
December 10, 1955	Community Harbor-Bottlepoint-Stake-Low-Cowpens-Community Harbor	18 : 2
December 13, 1955	Community Harbor-Cowpens-Tavernier Creek-Community Harbor	2 : 3
December 15, 1955	Community Harbor-Cowpens-Community Harbor	8 : 1
December 18, 1955	Community Harbor-Bottlepoint-Stake-Low-Cowpens-Community Harbor	6 : 1
December 24, 1955	Community Harbor-Cowpens-Tavernier Creek-Community Harbor	3 : 1
December 26, 1955	Community Harbor-Bottlepoint-Community Harbor	4 : 1
December 27, 1955	Community Harbor-Bottlepoint-Community Harbor	4 : 1
December 31, 1955	Community Harbor-Cowpens-Community Harbor	5 : 1
January 2, 1956	Community Harbor-Bottlepoint-Stake-Low-Cowpens-Community Harbor	8 : 0
January 3, 1956	Community Harbor-Cowpens-Community Harbor	5 : 1
January 20, 1956	Community Harbor-Bottlepoint-Cowpens-Community Harbor	7 : 0
January 24, 1956	Community Harbor-Cowpens-Community Harbor	5 : 0
January 25, 1956	Community Harbor-Bottlepoint-Community Harbor	9 : 1
January 28, 1956	Community Harbor-Bottlepoint-Community Harbor	6 : 0
January 31, 1956	Community Harbor-Bottlepoint-Stake-Low-Cowpens-Community Harbor	5 : 0
March 9, 1956	Community Harbor-Bottlepoint-Stake-Low-Cowpens-Community Harbor	26 : 0
April 13, 1956	Community Harbor-Bottlepoint-Stake-Low-Cowpens-Community Harbor	18 : 2
April 14, 1956	Community Harbor-Cowpens-Community Harbor	11 : 2

TABLE 1—Continued

<i>Date</i>	<i>Census Route</i>	<i>Ratio, White : Blue</i>
January 27, 1956	JOHNSTON KEY AREA	5 : 8
February 2, 1956	Perky (Sugarloaf Key)-Johnston-Perky Perky (Sugarloaf Key)-Johnston-Perky	4 : 5
December 11, 1955	VICINITY OF TAVERNIER, KEY LARGO	0 : 2
December 14, 1955	** Dove Creek Slough	0 : 1
December 21, 1955	** Dove Creek Slough	0 : 2
December 22, 1955	** Dove Creek Slough	0 : 2
December 12, 1955	ALONG ROUTE U. S. 1	0 : 3
December 30, 1955	* Tavernier-Homestead	0 : 3
May 20, 1956	* Tavernier-Homestead	0 : 3
February 2, 1956	* Lower Matecumbe-Indian-Upper Matecumbe-Windley-Plantation-Tavernier	9 : 5
February 6, 1956	COTTON KEY AREA	
February 11, 1956	Community Harbor-Cowpens-Cotton- West-Community Harbor	12 : 2
February 20, 1956	Cotton	14 : 4
February 23, 1956	Cotton-West Cotton-Windley	18 : 2 23 : 3

\* All censuses were taken by boat, except those marked (\*), which were taken by car, and those marked (\*\*), which were taken on foot.

required both parents to appear at the nest together. Establishing parentage at *Ardea* nests in Florida Bay is a time-consuming task, and I strongly recommend that future investigators make their counts early in the egg-laying period. From my experience with other ardeids, I have found that at this stage in the breeding cycle, both parents spend considerable time at the nest together.

My data from Cotton Key are the most informative because of the presence of white-white and white-blue pairs. The fact that all blue adults on this key were mated to white birds gives the impression that mate selection on Cotton Key was random. However, three factors should be considered before non-random mating is rejected as a possibility: 1) the sample is small; 2) no blue-blue pairs were found (possibly too few blues were available); and 3) whites far outnumbered blues in the vicinity of Cotton Key (see ratio counts above). The young in the nests of white-blue pairs were at different stages in the nesting cycle, possibly indicating that any one blue bird in the rather brief courtship phase of the cycle had only white birds available in the same phase and capable of reacting to the blue's courtship (factor 3 above). Obviously, more information is required, especially during courtship.

As far as the genetics of color inheritance is concerned, the data in Table 2 neither support nor refute any of Mayr's genetic models. However, nest No. 12 on Cotton Key strongly suggests that white is dominant.

*Breeding season.*—During the winter of 1955–1956 and the spring of 1956, there was a pronounced difference in breeding time between the white birds of the inner keys and the blue birds of the mainland. Holt noted the same difference in the winter of 1923–1924. However, the fact that mixed blue and white pairs bred at the same time as white-white pairs in Florida Bay argues for the conspecificity of the white and blue birds in the inner keys. In addition, the fact that blue birds in the inner keys bred at the same time as white birds supports the contention that the blue and white birds of the inner keys are conspecific with the blue birds of the mainland; one would expect that if the blue and white birds were of different species, the blue birds in Florida Bay would breed at the same time as the blue birds on the mainland, but this did not take place.

*Conclusions and suggestions for future research.*—In his summary and conclusions, Holt (1928: 31–32) listed eleven points (six morphological, three behavioral, two distributional) defending his conclusion that the Great White Heron was a distinct species. Two morphological points, whiteness and bill size, were shown to be non-diagnostic by Mayr (1956). In addition, Mayr showed that maritime popula-

TABLE 2  
COLOR TYPES OF MATED PAIRS, THEIR YOUNG, AND SURVIVAL OF YOUNG  
An asterisk (\*) denotes a tiny mangrove island near Johnston Key.

<i>Nest</i>	<i>Nest Location</i>	<i>Parent 1</i>	<i>Parent 2</i>	<i>Young</i>	<i>Survival of Young</i>
1	Bottlepoint Key	white	white	2 white	all
2	Low Key	white	white	3 white	2 white
3	Low Key	white	suspect white	2 white	1 white
4	Cowpens Cut	white	white	3 white	1 white
5	Cowpens Cut	white	white	2 white	1 white
6	Cotton Key	white	white	3 white	2 white
7	Cotton Key	white	blue	2 white, 1 blue	1 white
8	Cotton Key	white	blue	3 white	2 white
9	Cotton Key	white	suspect blue	2 white	1 white
10	Cotton Key	white	blue	2 blue, 1 white	all
11	Cotton Key	white	suspect white	3 white	2 white
12	Cotton Key	white	almost positive white	1 white, 1 blue	1 blue
13	Cotton Key	white	unknown	2 white	1 white
14	Cotton Key	white	unknown	3 white	2 white
15	Cotton Key	white	unknown	1 white, 1 blue	1 blue
16	Cotton Key	suspect white	unknown	2 white	1 white
17	* Johnston mangrove	blue	blue	2 blue	unknown
18	* Johnston mangrove	blue	suspect blue	2 blue	unknown
19	* Johnston mangrove	white	suspect white	2 white	1 white

tions of the Great Blue Heron are widespread and common, invalidating another of Holt's arguments. On the basis of evidence presented here, I feel that I have effectively eliminated Holt's three behavioral points. My additional data relating to random mating and differences in breeding time add weight to the argument that the Great White and Great Blue herons are conspecific. Although I conclude that the evidence gathered to date favors the view that *occidentalis* and *herodias* are conspecific, I must add that much more information is required before a final decision can be made.

Florida Bay is not an easy area in which to study this problem; one must always reckon with vicissitudes of the weather (hurricanes, sudden squalls, etc). In addition, many keys are isolated by extensive banks (e.g., Dildo Key), rendering them relatively inaccessible. Because of the marine nature of the area, a good knowledge of boat and motor operation is a prerequisite to research. However, many of the keys are accessible, and valuable contributions can be made by thorough white : blue ratio censuses on these keys. The courtship of these birds is still inadequately known; additional information on mate selection is needed, but this problem, like the rest, is a time-consuming affair. The problem of color inheritance remains unsolved; those who have the patience to sit in a blind for hours could secure the necessary data at the appropriate nest, i.e., one in which both parents are of the same color type but the brood is mixed. In short, the problem can be approached from many angles, but the investigator must be aware of the technical difficulties involved.

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#### LITERATURE CITED

- BOND, J. 1935. The status of the Great Blue Heron in the West Indies. *Auk*, 52: 76-77.
- GREENE, E. R. 1946. Birds of the Lower Florida Keys. *Fla. Acad. Sci.*, 8: 199-265.
- HOLT, E. G. 1928. The status of the Great White Heron (*Ardea occidentalis* Audubon) and Würdemann's Heron (*Ardea würdemannii* Baird). *Sci. Publ. Cleveland Mus. Nat. Hist.*, 1: 1-35, 6 pls.
- MAYR, E. 1956. Is the Great White Heron a good species? *Auk*, 73: 71-77.

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