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THE GREAT BLUE HERON
THE BREEDING BIRDS OF THE PHILADELPHIA REGION
(PART II)

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In the 1942 *Cassinia*, p. 22, I outlined the plan and limits of the series of local life histories continued here with a study of the Great Blue Heron.

I want to acknowledge again the indispensable help given me by the efforts of a number of contributors—by written responses from John K. Arnett, Cordelia H. Arnold, Randolph Ashton, Herbert H. Beck, Richard O. Bender, B. S. Bowdish, Frank L. Burns, Ernest A. Butler, Henry Fox, John A. Gillespie, H. H. Hanson, Francis Harper, John Herholdt, Lillie R. Levallen, George MacReynolds, Edward R. Manners, Turner E. McMullen, Ralph W. Miller, Robert T. Moore, R. Bruce Overington, Frederick B. Philipp, Julian K. Potter, Richard Pough, C. Chandler Ross, Frederick C. Schmid, Barton L. Sharp, George H. Stuart, David E. Thompson, J. Charles Tracy, and William Yoder; by verbal comment from Joseph M. Cadbury, David Cutler, John Higgins, Quintin Kramer, Bayard Long, George E. and William M. Miller, Robert Smith, William A. Shryock, and J. Fletcher Street; by unpublished journals and data of J. Harris Reed and the late H. H. Jamison, W. C. Springs, and William C. Crispin; by Indian lore contributed by Frank G. Speck in letter and interview; by the illustrative work and field notes of Dale R. Coman; by map and manuscript preparation shared in by Robert and Marcella Newman; by the critical suggestions of James Bond and Charles E. Mohr.

GREAT BLUE HERON

Ardea herodias herodias (Linnaeus)

Local names.—Crane, the usual lay term throughout the area, sometimes qualified as Blue Crane (cf., Shriner, *Birds of N. J.*, 1896, p. 85); Big Crane (cf., Warren, *Birds of Penna.*, 1888, p. 19); Big Blue Crane (Beck); Fish Crane and the completely misapplied Sandhill Crane (cf., Sutton, *Birds*

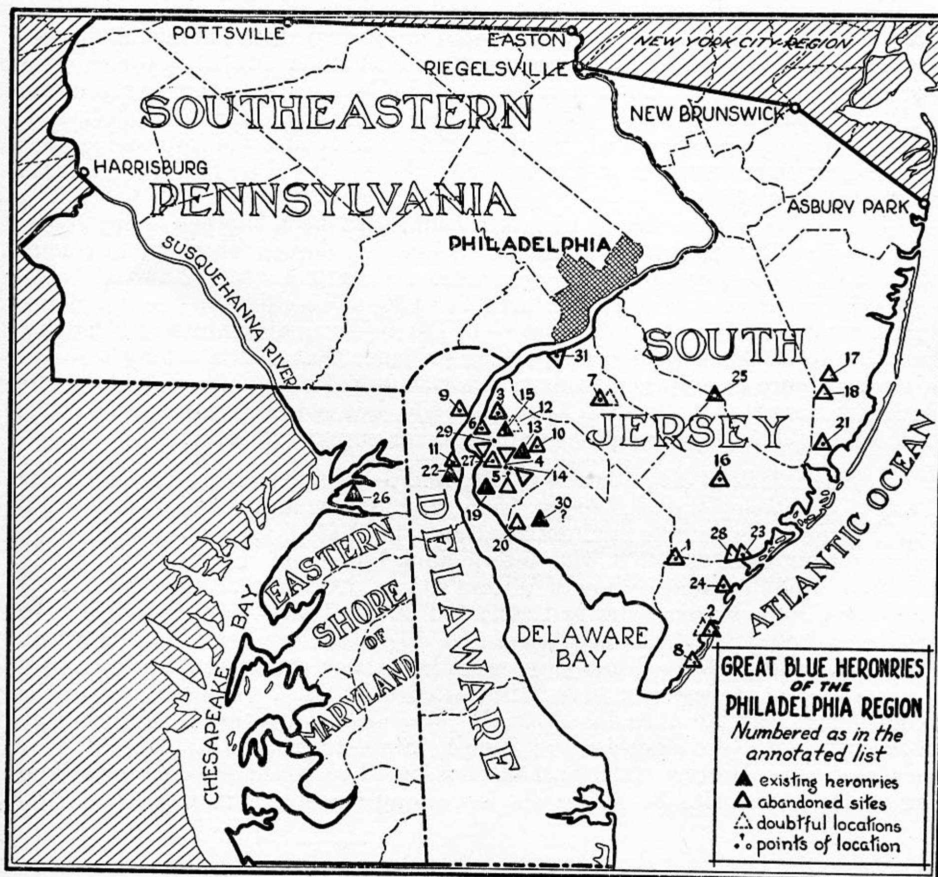
of Penna., p. 34); Stork, Royer and Fishroyer; Pennsylvania-German derivatives of the high German "reiher," meaning heron, and applied indiscriminately to all herons (Beck); Blue Heron (by Baird), oftener used for the Little Blue Heron; Great Heron, Wilson's only name for it; Ashy-colored or Cinereous Heron, an alternative of Barton's; Great Bittern, in Barton's text, *lentiginosus* being distinguished as Marsh-Bittern; *kaxko,* in the language of the Delawares an imitation of its cry; *daleka* or *taleka* in Lenape and *ah! secque* in the Nanticoke of the Choptank region, defined as "crane" in published vocabularies, but probably more accurately identified with the present species (Speck).

History

When Alexander Wilson sat down to write of the "Great Heron," just before his death in 1813, there had already been 180 years of settlement in our region—a longer period than separates our day from his. It has been an unpopulous age, hard-lived and inarticulate, with little to say in writing of even so conspicuous a bird as the Great Blue Heron—just an entry in Barton's calendar of bird arrivals and flowerings for 1791, three words and a date in John Bartram's diary, "1803, April 14. Ardea Herodias arrived." Yet the very bigness of the bird must have entered deep into the consciousness of men who hunted and fished and tilled the soil down Jersey. Fully one-third of Wilson's 2175-word account has the ring of the second-hand. Already there had sprung up about the heron the beginnings of a folklore. People were saying that the Great Blue grew fat at the full of the moon, fell lean at its decrease; that its flight upstream from the coast foretold wet weather, downstream, dry; that sometimes the eels it captured passed so swiftly through it that they survived to be swallowed again and again. The Northeastern Indians, too, employed it in their mythology where it appears as the hero of several legends. They wore its feathers in their hair and headdresses when they danced the Dance of the Praying Bird.

After Wilson, who recognized the ecologic unity of the herons and the occurrence of the Great Blue in winter but neglected to give much idea of its status, it was frequently mentioned, seldom discussed. Haldeman (*Note on the Birds of Penna.*, 1843) was the only one to miss it entirely. A few upland lists, such as Barnard's for Chester County (1860), called it irregular. Both Warren (*Rept. on the Birds of Penna.*, 1890) and Harlow (*Notes on the Breeding Birds of Penna. and N. J.*, 1918) feared it was about to become a rare straggler, but theirs was a restricted view, unconfirmed by any real data they had to offer or by developments since. A succession of lists, beginning with Baird's in 1843 and never more than 15 years apart, set it down as "common." If fluctuations occurred, they never escaped the vague confines of that word. Even now our recording is not finely enough adjusted to catch changes with any certainty. Our leading students are not agreed whether it has increased or remained stationary during the last decade.

I incline toward the former view. Living well within the limits imposed by its ecology, it has never suffered visibly from the changing features of the region, and its direct relations with man have improved. Our fathers ate Great Blues, adults, young, and eggs. They sought it as an item of taxidermy, leaving its remains to gather dust in many an attic corner. Near the beginning of the century, experiments in the West threatened to spread the use of its flexor and extensor tendons for surgical sutures (*Oologist,* June 1905, pp. 85–86). The old eggers persecuted it continuously. The late William B. Crispin alone left records of 1137 eggs taken! Fortunately, as we shall see, this does not mean what it seems to mean, that he destroyed that many potential herons. Yet the gradual passing of all these practices must have improved the numerical status of the bird. Its size still attracts the fire of frustrated gunners to some extent, and old-time rivermen in Jersey have told Bender that it commonly wanders into muskrat traps. His banding data and Gillespie's throw some light on present-day mortality. They have had 24 "recoveries" from 315 birds banded, over 7½%—2 shot, 14 "found dead" (also shot?), 4 caught in muskrat traps, 1 killed by auto, 1 tangled in electric wires, 1 "injured," and 1 "captured."



Historical notes on the heronries.—Since the beginning of ornithological interest in our region, many Great Blue colonies must have passed out of existence, unseen and unrecorded. Records of many more must be lost in unpublished notes. In the following annotated list of those I have been able to trace, I have followed the chronological order of the first records known to me:

1. Tuckahoe River, Cape May Co., N. J.—Known only from visit of Wilson and Ord, May 18, 1813, at "Head of River," a name applied to the spot where it sharply narrows just west of its junction with Mill Creek. In the primeval white cedar, said to have produced specimens 80 to 100 feet high, rising mast-like for 50 feet without a limb, some as much as 7 feet in circumference with over 1000 rings of annual growth, standing so close together that their matted branches made a canopy through which only a few broken shafts of light fell down into the riot of mossy logs, upturned roots, and brandy-colored cedar water in the swamp below. 10 to 15 pairs.

Wilson did not state in so many words the when and where of the colony. That he had even visited it personally was left to inference. George Ord later established these things in his text on another bird he and Wilson had hunted together on that day in spring long ago—the Great-footed or Duck Hawk (*American Ornithology*, Vol. IX, pp. 124–125). Wilson's wording further implied that he had heard of at least two other colonies—one of them not in a cedar swamp. That the Great Blue nested in hardwoods in his day, as it does in ours, seems certain. But the chance that led him to Tuckahoe for the first description of a Great Blue heronry in America; quoted and paraphrased again and again, by Nuttall, by Giraud, and in popular works that followed, over-emphasized its attraction to white cedar, and gave the impression that its breeding places were, as in Ord's words, characterized by "all the frightful imagery of desolation."

Though all virgin stands of white cedar had been lumbered out by at least the late 1860's, there is some indication that descendants of this colony still nested in the same general region almost a century later. Laurent, looking to the lee of Five Mile Beach in 1892, spoke of breeding on the mainland. Burns, searching Griscom's Swamp near Estelville, in the midst of a logging operation in 1894, uncovered unspecified evidence that such a colony actually existed. Moore is supposed to have reported eggs from the north side of the Tuckahoe River at its mouth, April 10, 1906, but, when I wrote to him this year, he could no longer locate the record for supporting details.

2. Seven Mile Beach, Cape May Co., N. J.—Definite record for 1886 only (Parker, *Ornithologist and Oologist*, 1886, p. 138), on south side of the island near Peermont, a remote, uninhabited spot in that day. In stand of huge pines growing close together with interlocking limbs and standing in water in the manner of the great cedars of Wilson's time. A dozen or more birds.

When John Krider, who had collected on the island, mentioned in 1879 (*40 Years Notes of a Field Ornithologist*, p. 59) that the Great Blue bred "on the beach in Cape May County, he must have been speaking from memories of years earlier on Seven or Five Mile Beaches, or both. The survival of the colony for at least another decade in this or a nearby location is suggested by an excerpt from Reed's notebook: "June 4, 1899—I was told by my guide that the Great Blue Herons and Night Herons breed in considerable numbers on Long Island, opposite Peermont station, along the sound in woods back on

the meadows, which could be reached by taking the road direct from Peermont station towards the sound. I saw several Great Blue Herons feeding along the sound while out sailing."

It is an interesting sidelight that botanists generally have recognized only solitary scrubby specimens of pine as ever having grown on the barrier beaches of New Jersey. Bayard Long, present leading authority on New Jersey flora, is confident, however, that Parker's trees were correctly designated and were specifically pitch pines (*Pinus rigida*), which will stand water. They were cut down before botanists made a really thorough survey of Seven Mile Beach, then heavily wooded and extremely difficult of traverse at the upper end.

3. Auburn, Salem Co., N. J.—Described in Jamison's journal, April 29, 1887, my only source, in what was locally known as the "Crane Swamp." In stand of 70 feet high pines, open above, densely thicketed with 15 foot holly and laurel below; a few nests in interspersed oaks and hickories. Estimated "300 to 400 pairs," if accurate, would make it largest local colony ever discovered. Jamison placed it 3 miles east of Auburn, about 7 miles from Edgemoor, Delaware, and at a point from which the latter was clearly visible—three conditions which will not fit together. Though the-exact location is, therefore, guesswork, it is indisputably distinct from all other rookeries in this list. That Pennsville was similarly called "Heron Swamp" means nothing; it is a term farmers apply to all wet-bottomed heronries. This latter colony may, however, have been derived from it.

4. Quinton, Salem Co., N. J.—1888 and after, situated, says Thompson, on "Blue Pot Farm, Beasley Neck, near Quinton Pond" close to, if not identical with, the present day Water Works Pond ¼ mile from town. In oaks. 16 to 20 nests. Survived at least 2 years before tree cutting drove the birds to Pennsville and the Barrens.

Nothing has ever been published on this heronry. The only living naturalist remembeiing it is Thompson, who went birds'-egging there when a mere boy, arousing the ire of his Quaker parents.

5. Barrens, Salem Co., N. J.—As early as 1889, according to Thompson, on Easter Run at "Barrens" about 1 mile below Quinton near main highway, therefore less than a mile from site at Water Works Pond; shifted to other side of run in 1892 (T.). In 75-feet high pines. 124 nests in 1896 (T.). Eggs collected there in 1898, 1900, and 1901 by Crispin. Subsequent history in doubt. A cryptically brief "no eggs at Barrens" in Crispin's notes for 1904, implies abandonment; but 30 sets with Barrens' label in his records for April 3 and 24, 1910, point to re-inhabitation after a 9 year lapse. The trees eventually were felled.

This is probably the colony referred to by Bent on Crispin's authority as the largest near Salem, containing 80 nests. Darlington (*Oologist*, 1904, p. 41) described a visit with Crispin in 1889 to a pine site answering this general description.

6. Pennsville, Salem Co., N. J.—As early as 1892 (Thompson). Sometimes referred to in literature as "near Pennsgrove" or "near Salem"; called Lower Penn's Neck by Crispin from name of township, about 1 mile southeast of Pennsville. In swamp-rooted, virgin growth of sweet gums and oaks, 90 to 110 feet tall; ¼ mile from nearest farmhouse and difficult to reach years ago. Over 30 nests in 1896 (Stone); eggs collected in 6 of years between 1897 and 1909 (Crispin); 23 completed and several partially built nests in 1921 (R.F.M.);

4 inhabited nests in 1925 (R. F. M.); single bird beside nest, March 29, 1926 (R. F. M.). Our longest inhabited heronry—34 years.

The trees in this locality were giants and still are. Crispin, the most famous of all local climbers, tells of going up an oak 12 feet in circumference that contained 12 nests. Thompson writes that, after buying another tree and chopping it down just to make the herons move to a lower one, he cut 30 loads of wood from it.

7. Pitman, Gloucester Co., N. J.—Estimated to be as old as 1892 (Reed). Also appears in literature as Pitman's Grove and Glassboro, about 3 miles northeast of Glassboro, on upper branch of Mantua Creek, at a wet location a short distance from the main road. In 75- to 85-feet high pines. 8 sets collected in 1898 (Meyer and Hughes, *Abs. Proc. of D. V. O. C.*, no. 3, p. 5); about 40 nests in 1899, reduced to 20 pairs in 1900 (Reed).

This rookery had a prior location. Says Reed, "I was told by a man named Mr. Teets that another heronry previously existed in a swamp about a mile or so distant from this one, but was destroyed by clearing the timber off." In 1903, Fowler (*Cassinia*, p. 44) still referred to the Pitman colony as though it continued in existence, but it has now been gone for many years. It was only 13 miles airline from the city limits of Philadelphia. One of the nests found its way to the Wagner Institute.

8. Five Mile Beach, Cape May Co., N. J.—Known only from Laurent's paper of 1892 (*Ornithologist and Oologist*, Apr., p. 53)—"A few breed on the beach"—though Krider also may have had it in mind when he made his previously quoted statement. When Stone wrote in his *Bird Studies* (p. 115), "Whether the Great Blues ever nested nearer to Cape May than the colonies above mentioned [Salem and Atlantic Cos.], I do not know, but I am unable to find any evidence of it," he must have been thinking of his own period only. That he would not deliberately have cast suspicion on the records of Wilson, Krider, Parker, and Laurent, all within Cape May Co., is shown by mention of them in two of his earlier works and by a line in the introductory part of the *Studies* themselves (p. 30)—"Back in the cedar thickets are the heronries where nest vast numbers of the beautiful Snowy Egrets along with . . . Great Blue Herons."

9. New Castle, New Castle Co., Del.—As early as 1892 (Thompson), not far from Newport on "Basin Road" leading from Newport to Newcastle (R. Earle Dickey per Hanson). In gum trees (Overington). This is probably the colony "of long standing" that Pennock visited in 1906 (*Auk*, July 1908), when there were at least 10 or 12 pairs still present though wood-choppers were at work on all the large timber. There were only 7 pairs when Overington saw it "a number of years ago" and 1 or 2 pairs about 1908 according to Dickey. Yet Crispin collected 20 sets under this place label in 1910 and Thompson includes it in his list of heronries for 1915. Probably an entirely different location is involved. I used to be under the impression that the heronry was *below* New Castle on the river road.

10. "Seven Hills," Salem Co., N. J.—Known to Thompson in 1904. The old Alloway rookery, referred to by Harlow as "near Woodstown." In 65- to 85-feet high chestnut trees, on high, dry ground. Originally 70 to 90 nests (T.), reduced to 16 pairs by 1913 (Harlow, *Oologist*, May 1914, p. 91); a few deserted nests still in place when I visited it in 1915.

Crispin's raid on this colony on April 13, 1913 was his last encounter with

the Great Blues. Three weeks later he plunged to his death from the Nockamixon Cliffs.

11. Delaware City, New Castle Co., Del.—1906 or earlier. On Dragon Run, close to the Delaware and Chesapeake canal. In midst of extensive swamp. In 1906, 52 nests, at least 32 occupied, one oak alone containing 10 (Pennock and Crispin); on March 31, 1912, 89 nests, 35 occupied, in red maples (Sharples, in Bent, pp. 103–104); in March 1921, about 150 nests, 90% in red maple swamp, the rest in great white oak, tulip, and chestnut trees on a nearby bluff adjoining farmland, at an average height of 60 feet, in maples, 75 in others; about 200 nests in 1927 mostly in oak and tulip trees between cultivated fields and marsh (Hanson); 100 occupied nests in 1928 (H.); only 12 nests left by 1934, restricted to tulips and oaks on the higher ground, excrement having killed the swamp maples; a few nests but no birds, March 29, 1936, the remaining trees being rapidly felled for firewood and a new colony in existence at St. Georges.

12. Mannington Township, Salem Co., N. J.—Crispin's collection contained 2 sets of eggs of the Great Blue labelled "Mannington,—April 14, 1907." This may be an early record for Marshalltown, the only other colony on our list in Mannington Township, but there are two strong indications it is not. First, Marshalltown was not otherwise known until a decade later. It seems impossible that an enthusiast like Crispin would have failed to collect again at "Mannington" if it had continued in existence, particularly since his home was right in the township. Secondly, he used the name "Frogtown" rather than "Mannington" for the Marshalltown vicinity as shown by his notation on Barred Owl eggs. Since he was able to secure only 2 clutches at a date when most Great Blue have full sets, I infer the colony was a small one, probably sporadic and short-lived.

13. Alloway, Salem Co., N. J.—As early as 1911. Called "F's or Sunbarnam's Woods" by Thompson. In wet woodland near upper end of Ewen's Lake, north of town, ¼ mile from road with farmhouses a little more distant. In slim 70-feet high pin oaks and red maples. In 1911, 45 to 50 nests; colony said to have disappeared soon after but included on lists for 1915 and 1917; "built again same place, 1921"; 60 nests in 1938, and more in 1943. (Data all Thompson's.)

14. Water Works Pond, Salem Co., N. J.—1917. A specific site of one of the several heronries generically called "Quinton." On pond proper "across road" and "other side of pond" (from first Quinton location?). In oaks 60 feet tall.

The history of heronries in the Quinton-Barrens district is extremely complex. Thompson seems to be the only living authority who knows much about them. Unfortunately the telegraphic style of his notes often makes them ambiguous. I am unable to determine in the present instance whether 1917 applies to the discovery of the colony, to its abandonment, to both, or to neither. Under the "Quinton" label, Crispin took 4 sets in 1908, 2 in 1909, and 1 in 1913 with the notation "last remnant." Parallel collecting under the heading "Barrens" proves he did not employ the names synonymously. His "Quinton" may possibly be the same as the 1917 colony, possibly the same as colony No. 4 of this list. It seems a better guess that it is distinct. To complicate matters further, Thompson's notes apparently show that the trees at the Water Works site were cut down in 1917, yet "Quinton Pond" reappears in his list for 1922.

15. Marshalltown, Salem Co., N. J.—Known since 1917. Familiarly called Frogtown, near the village on the southeastern side, along Horne Run. Originally all in the tops of red maple trees, 50 to 70 feet tall, growing in water 1 to 2½ feet deep. 20 nests in 1918 (Potter); 40 in 1920 and 1921 (R. F. M.); 96 in 1934 by my count from one side of the swamp, mostly in maples over water, some on higher ground, within 25 yards of water's edge, in white oaks; 126 in 1936 (Stone); estimated 200 pairs in 1938, maples fast dying from excrement (Potter); reduced to 100 nests in 1941 (Bender); about 45 nests in 1942, not all occupied, most of the trees, particularly those in water, with their tops broken off and without limbs, offering no support for nests; more than 30 nests in 1943, all in 1 or 2 widespreading oaks.

The Frogtown rookery probably originated from the one at Pennsville, which in a straight line was hardly more than a mile distant. With a 27-year history, it is our oldest existing heronry.

16. Makepeace Reservoir, Atlantic Co., N. J.—Established before 1919. Referred to also as Elwood, being near Elwood Road, and as Weymouth, being just east of the village. On flooded meadow 2 to 3 feet deep, ½ mile from nearest farmhouse. In white cedars, dead during most of the period, at a height of 12 to 30 feet (average 22) above water. 66 nests in 1919, in 3 groups within sight of each other (Pearson); 70 pairs, 40 nests actually examined, in 1927 and 1931 in two separate clumps of cedars; 29 nests in 1935 (McMullen); 17 in 1936 (Stone); reduced to 7 pairs in 1938, due to falling of trees (Potter); probably no longer in existence.

17. Cedar Bridge, Ocean Co., N. J.—Dates unknown, but prior to Warren Grove heronry. In white cedar swamp, 9 miles from Barnegat Bay (Cadbury). As high as 100 birds at one time (Street).

18. Warren Grove, Ocean Co., N. J.—As early as 1925, near road running from Route 40 to Tuckerton, a few miles south of Cedar Bridge. In dense white cedar swamp, mostly dead, encompassed by pine barrens. Presumably the unidentified heronry visited by Stone (*Bird Studies*, pp. 113–114)—50 birds on March 30, 1925; still in existence in 1928 and 1930. Once as many as 100 birds, according to Street. He and Cadbury believe the colony came here from Cedar Bridge, later moved on to establish the Atsion rookery.

19. Elsinboro Neck, Salem Co., N. J.—In existence in 1925, in "Frazier's Woods." In 100-feet high white and pin oak trees. Known only from Thompson's data—8 to 10 nests in 1925, 24 in 1938, 35 in 1943.

20. Stretch's Neck, Cumberland Co., N. J.—1929. Called "Stretch Point" by Thompson, on Delaware River below village of Stow Creek. In pines. Known only from fragmentary mention by Thompson, who says site was later taken over by Black-crowned Night Herons. His reference to a Great Blue colony at "What's Point," Cumberland County, also may mean this one.

21. Tuckerton, Ocean Co., N. J.—Abandoned about 1935 (Potter), on Shord's Mill Brook, 1 mile northeast of the town, 3 miles from Barnegat Bay. In white cedar swamp, 15 to 20 nests at one time, destroyed when trees were cut (Potter).

If 1935 is the correct date of desertion, this northernmost of our coastal colonies moved to a new location close by. Charles Urner discovered egrets in a Great Blue rookery near Tuckerton in 1936.

22. St. Georges, New Castle Co., Del.—Discovered in 1935. Sometimes referred to as Delaware City. South of Chesapeake and Delaware Canal,

about 2 miles from Dragon Run colony, from which it originated. In narrow strip of dry woods, beside water, a few hundred yards from a farmhouse. In beeches, tulip trees, mockernuts, white and black oaks, at 65 to 110 feet, average 70. About 40 pairs in 1935 (Potter); 34 nests on March 29, 1936 (Miller); about 100 nests in 1943, an increase over 1942 (Bender).

23. Scullville, Atlantic Co., N. J.—Discovered in 1937 (?) by Charles Urner, 1 mile south of Scullville, above Job's Point, and close to Egg Harbor River. In swampy area, at 70 to 80 feet in height in old sweet gums, 32 nests, 10 pairs, on April 4, 1938; still in existence in 1939; now gone (Potter).

24. Palermo, Cape May Co., N. J.—1938. Known only from McMullen's and Wolfe's discovery of 10 nests on May 8, at 100 feet in immense pines along meadows. Palermo is only about 3 miles from Corson's Inlet.

25. Atsion, Burlington Co., N. J.—As early as 1938 (Potter), about 1 mile south of town near corners of 3 counties; not more than 200 yards from Route 39, from which it is partly separated by a cranberry bog. Nests at 40 to 50 feet in damp woods of red maples, 22 miles from Great Bay, 23 from the Delaware, a small near-by stream offering little in way of food. In 1938, 32 pairs (Potter); over 50 pairs at present time (Street). Most northern of existing N. J. rookeries.

26. Crystal Beach, Cecil Co., Md.—No data prior to 1938. Referred to also as Earleville and Reybold's Wharf, near Cecilton, Md., and WNW of Earleville, about ½ mile north of road to Crystal Beach, about 2 miles east of the resort. Mostly in huge beeches, some in oaks, hickories, and other hardwoods, at 35 to 60 feet; on both sides of arm or river leading into Chesapeake, close to cat-tail marsh; ½ mile from nearest house. Over 200 nests in 1938 (Gillespie); 265 in 1942 (Bender); well over 300 in 1943 (Bender). Largest of present-day heronries.

27. Salem, Salem Co., N. J.—Established in 1939, about 1½ miles outside Salem on the Salem-Quinton Road. In big oaks in woodlot of 5 to 6 acres, encompassed by farmland, within several hundred feet of farmhouse, and less than ⅛ mile from road junction. 8 nests in 1939 and in 1941; 10 in 1943; 20 in 1944. Probably originated from Frogtown colony about 5 miles away.

28. Jeffries Landing, Atlantic Co., N. J.—1940, near mouth of Egg Harbor River. In oaks, "as tall as oak trees grow in this region," ¼ mile from boat renting establishment, the nearest building. About 10 nests in 1940 and 1941. Now abandoned (Arnold). Probably a relocation of the "Scullville" heronry.

29. Cobb's Island, Salem Co., N. J.—1941, near Marshalltown. On small island, in red maple; 10 pairs on May 25, 1941 (Potter); now deserted (Coman).

30. Sheppard's Mills, Cumberland Co., N. J.—Undated. Along road between Bridgeton and Greenwich, in woods about ½ mile southeast of road and opposite the Mills. McMullen and W. S. Springs counted 15 nests from road. Relation to Stretch's Neck colony undetermined.

31. Repaupo, Gloucester Co., N. J.—Undated. In large swamp, opposite Repaupo, between Crown Point Road and the Delaware River. Data from McMullen, who adds ". . . rather large at one time. I visited a fisherman along the river there and he showed me where it was." This would have been

less than 7 miles from the city limits of Philadelphia and rumors of it may have caused Fowler to write "The Great Blue has a nesting colony at Glassboro, N. J., and *possibly another nearer.*" [Italics are mine.] (*Cassinia*, 1903, p. 44.)

There also have been rumors of Great Blues nesting in colonies at Milford, Del., and Mantua and Absecon, N. J., as well as McCormick's Island in the Susquehanna (Frey, *Centennial Check List of the Birds of Cumberland Co., Pa.*, 1943, p. 14). These may be suspected of having sprung from the Great Blues' habit of visiting Black-crowned Night Heron colonies as a purely social gesture.

Habitat

Feeding haunts.—Great Blues require two things for a normal living—wadable water and a supply of fish or similar fare. Locally they find them in five types of habitat, here arranged in descending order of preference.

1. *Tidewater*—along the endless water edges of the ditches and winding thoroughfares in the maritime marshes, of the tidal rivers and tidewater creeks, particularly at their mouths, and of the bay shores; in tidal pools, fresh, salt, and brackish, where the pattern of shifting shallows always provides the right depth at some point.

2. *Nontidal marsh*—especially in well-watered stretches where frogs and other amphibia spawn.

3. *Open, nontidal water margins*—on the growth-free shores of ponds, lakes, and unwalled reservoirs and on the unwooded parts of brooks and rivers above tidewater where there are no steep banks.

4. *Wooded water associations*—along forest streams and in swampy woodland.

5. *Casual feeding areas*—at park lakes, ornamental fish ponds, fish hatcheries, and rearing ponds.

You will note that, in the first four associations, food supply is the chief controlling factor. Tidewater surpasses all other classifications because its food supply is not self-contained. Twice daily a fresh infusion of aquatic animal life is swept in from ocean, bay, and river deep, much of it to be trapped by the receding tides. The Great Blues do little hunting in the woods, not because they dislike cover but because the fishing and frogging there is poorer than in open areas. In the fifth association, where food is abundant, they run into aggressive human interference.

Now and again, in addition, they forsake the way of living for which they are designed to forage along deep water and on the dry land. I have seen them stalking along the stone-shored Torresdale reservoir, which is deep-watered, probably after minnows. I have come across no definite instance of their feeding by the surf in or out of our area. I know of only one record of a living Great Blue on the ocean beach—one below the Coast Guard Station at Stone Harbor (Levallen). Newman believes the dead bird he found one winter on Long Beach was washed in from migration at sea. The few data I have on foraging activities away from water are given under **Feeding habits.**

Resting haunts.—There is repose in the very manner of the herons' hunting. Yet there are times, even in daylight, when they lapse into complete inactivity in places other than feeding or nesting haunts. Sand bars and tidal mud flats are such situations. The herons evidently find little to eat on them. They just idle away their time standing there on one leg, head well drawn down, apparently asleep, but never, insofar as I have noted, with their eyes closed. The Fish House dike, a stone pile like the one at Cape May, is also a favorite resting place for herons and gulls whiling away the hours of flood tide. Other situations in which their presence suggest repose are open fields near the rookeries (Bender), the towpath of a canal (Ashton), mill dams (Sharp), and the concrete mill at Hog Island (Kramer). Fox reports that in the vicinity of Cape May Court House they often sit in trees in low tracts bordering the tidal meadows. Elsewhere, I have only very rarely seen them perched outside the heronries during the day.

There is supposed to be a Great Blue roost on the fringe of brush between Cape May Court House and the marshes (Levallen). Except in the rookeries, I have only two roosting records myself—2 birds in a large red maple thicket near Moorestown, N. J., April 26, 1924; 4 in woods at Whitesboro, N. J., early evening, June 17, 1922.

Nesting haunts.—It is impossible to reduce the essentials of the Great Blues' nesting habitat to any satisfactory formula. It is easy enough to say that they again must have two things, a sufficient available food supply and a suitable woods, but the statement will have little meaning until we can concretely define its terms.

What is "sufficient?" I do not know, but the amount must be staggering. If each individual, young and old, at Crystal Beach ate only 1½ pounds of fish every 24 hours, it would take almost a ton a day to supply that one colony. It is readily apparent that the less favorable classes of feeding habitat cannot sustain heronries of any size. That is why large portions of our area, notably southeastern Pennsylvania, are without rookeries, why the known colonies in North Jersey are limited to a few pairs.

What is "available"? Since we have had no way of identifying feeding individuals with a particular heronry, and since each year some birds do not breed at all, we cannot really tell how far the parents forage. Reinecke, writing of a colony near Buffalo, N. Y., speaks of 50-mile flights for food (*Oologist*, Jan. 1910, p. 17). Only a few square miles at the extreme northwest of our region are farther than that from nesting birds. Actually, there is no need for such time consuming forays locally. Thirty years ago I wrote that the Great Blue on the Pensauken Creek, "Occurs all summer, but does not breed, these birds being feeding individuals from heronries over 30 miles away" (*Oologist*, June 1914). I have had no reason since to change my opinion that this is the extreme effective feeding radius in the region. Birds from Atsion, our most centrally located rookery can cover expanses of tidewater by flights of less than 30 miles either to the east or to the west.

What is a "suitable" woods? There are four points to consider—kind of trees, their height, their distance from human activity, and natural barriers.

The Great Blue has built here in at least 12 species of trees—various oaks (white, black, willow, and pin), at 12 locations; pines at 6; white cedars and red maples each at 5; hickories and sweet gums, each at 3; tulip trees, chestnuts, and beeches, each at 2. These selections have so little in common that we must conclude that the species of the trees has little or no influence on the choice of a nesting site.

The other three considerations, which might be called isolating factors, are just as variable, though the typical site has been a wooded swamp. Tree height has ranged from 15 feet to 110, averaging around 70; locations, from the heart of the wildest terrain to wisps of woods almost in farmers' yards. Natural barriers, which have included island situations, flooded bottoms, tricky sloughs, and almost impenetrable undergrowth, have been absent entirely in some high, dry, open locations. But at least one isolating factor has always been present, barring too much human intimacy.

Ecologic differentiation.—All of our herons are strikingly alike in their relations to the local environment, far more so than any other family of the size. All compete for the same food, in the same way, in the same places. Many of them share the same colonies.

Nevertheless, Great Blue ecology does show some individuality in detail. While the other Ardeidae exploit all the feeding blocks discussed, they do not all show the same preferences. Furthermore, the Great Blue has certain competitive advantages and disadvantages, chiefly resulting from its size. It can devour larger fish. It can wade to greater depths and thereby fish a greater area. It enjoys physical dominance and at least sometimes exercises it (cf. Stone, *Bird Studies*, pp. 111–112). It is a hardier bird and can remain to some extent in winter, when only a few Night Herons are left to compete with it. On the other hand, its size makes it conspicuous and ill at ease in some favorite haunts of lesser herons, and its greater food consumption renders inadequate other areas that will support these smaller species, particularly during the breeding season.

Habitat as a limiting factor.—There are at least two indications that the Great Blue is not living up to the capacity of the habitat to sustain it. First, the recent dramatic increases among competing species, notably the white herons, have not been made at the expense of corresponding decreases in the Great Blues, as would have been the case if the latter were already fully exploiting the food sources. Second, the increased feeding in the coastal marshes after the breeding season proves that they would support a much larger breeding population, and there are plenty of suitable sites for new colonies in the vicinity. We may expect to see many more marshes drained and many more forests felled before the trend is reflected by the waning of the Great Blues.

Occurrence

During January and February, the Great Blue is virtually unknown in eastern Pennsylvania beyond the environs of tidewater and irregular in the middle Delaware Valley, where, however, there have been many records—Penn Manor, Tinicum, Camden, etc., mostly of single birds. My 5 count (1–1–2–1) along Darby Creek, January 19, 1935, is high. Even at the seacoast, where it may be expected to turn up on the majority of all-day trips, the totals seldom exceed that number. It is along the lower Delaware that we encounter the greatest concentrations. I found a widely scattered flock of 9 at Mannington Lake, N. J., January 30, 1938; Arnett saw 13 at Bombay Hook, Del., January 2, 1943. Our winters are never severe enough to drive it out of the region entirely, though at times a few dwindling ice-holes in tidewater creeks are all that stand between it and starvation. On February 8, 1934, the temperature fell from 26° to 7° F. On the 9th, while it continued on down to —11°, Potter came upon an individual at Brigantine so weak it could no longer fly. On the 10th, it still ranged from 3° to 25°; on the 11th, from 13° to 32°. Yet on that day in the Pennsville swamp, I counted 5 birds and the next week end saw another at Delaware City. In 1937 on the last day of a mild February in which the thermometer never went below 20° and in which there were seven days when it ran into the 50's, I found no less than 16 Great Blues in the Frogtown heronry. I am inclined to regard these birds as early migrants.

March is a period of gradual infiltration of the tidal regions by birds from the south, of increasing assemblage at the rookeries; examples—15 at St. Georges heronry, March 12, 1939; 30 at Marshalltown heronry, March 18, 1936, increasing to an eventual maximum of 126; 200 in and about the Delaware City rookery, March 27, 1921, virtually full strength. On March 21, 1943, Coman recorded 44 between Paulsboro, N. J., and Salem. By March 20, in some years at least, laying has begun. The incubation in sets of eggs taken by W. C. Springs at Makepeace Reservoir on April 11, 1925 and April 9, 1927, as well as the condition of young examined by Reimann in the same rookery, April 28, 1935, suggests deposition at least that early. Yet, I know of no one who has actually seen eggs in the nest before April 2, the date on which Crispin took 2 sets of 6 in 1904; an investigation of several nests in the St. Georges rookery on March 29, 1936 by Reimann revealed no eggs at all; and there were not even any herons at the Pennsville site on April 1, 1923. In spite of such variation among colonies and among individuals, I feel fairly safe in saying that most of the laying is done during the last week in March and the first week in April.

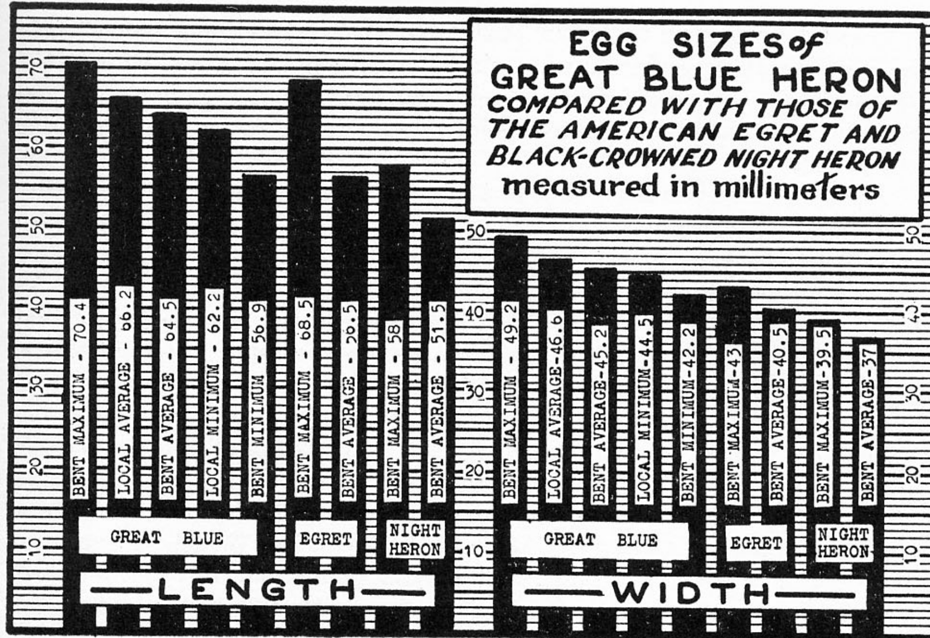
High up tidewater and beyond, spring arrivals do not become evident until the very end of the month. My earliest Great Blue record of any kind for Philadelphia came at 5 P. M. on March 15, 1930 when a single bird flew northward, high over the river, at Holmesburg. I have not encountered them

in the Richmond marshes before March 27. Just above us, in the New York City Region, they do not appear until the first week in April. By this time our increasing population has begun to spill over into the uplands, bringing some of the less favored counties their first records. At this season, they are likely to turn up at such unexpected places as Centennial Lake in Fairmount Park (Cutler), Byberry, Bustleton, and Hartel's Swamp in the Pennypack. In the days when the D. V. O. C. was making an intensive study of migration, some stations, such as Moorestown and Yardville, N. J., and Lenape, Pa., would often fail to record them until after the middle of the month—when, in some of the colonies, young were ready to hatch. This spread in dates between nesting activities in South Jersey and migration in the middle Delaware Valley always was puzzling. I cannot account for it.

During May, when breeding distribution is not obscured by late migrants or early birds of the year, we find the Great Blues widely distributed, but scant in numbers beyond the region of the rookeries. Around the city, records fall off sharply from the April peak, such favorable spots as Tinicum usually producing only one or two birds at a time. Even at coastal points not closely flanked by a rookery, the result of the average cursory field trip is little better. Against this background, Bender's high figures for the Bridgeport marshes in the heart of the heronry region make a striking contrast (See **Feeding habits**).

Through June, July, and August, as the young strike out on their own and the adults are freed from family ties, we find increasing concentrations along the seacoast, up the Delaware, and in the Pennsylvania counties west of the river. One-day counts in the middle Delaware Valley seldom exceed a dozen birds. Reports from single localities along the sea-coast do not show many more than that; the record of over 400 on Grassy Bay, N. J., August 31, 1912 (Cromie, *Cassinia*, 1913, p. 42) is certainly a misprint.

September, although it happened to produce my highest count for Philadelphia, 6 at Holmesburg on the 24th in 1936, is not notable for dramatic changes. October brings extensive migrations over the area, as proven by the great south-flying coastal flocks noted by Stone (*Bird Studies*, p. 111), followed by visible decreases in the total population. The downward trend continues through November until casual observation reveals only one or two birds in any single area. The Christmas census with its intensive coverage proves that such casual observation gives a wholly false impression of the actual population. During the last decade the counts have ranged from 16 (1933) to 48 (1941) at Cape May, 4 (1936) to 23 (1937) at Barnegat, 5 (1939) to 20 (1941) at Bombay Hook, 0 (1942) to 4 (1936) at Glenolden, 0 (1941) to 1 (1940) at Princeton, 0 (1940) to 2 (1942) at West Chester, and 0 (1940) to 4 (1941) at Reading.



Nesting

Eggs.—The light greenish-blue, usually smooth eggs of the Great Blue Heron do not differ noticeably from those of other herons in color, texture, or shape, but average larger. Variation in size is considerable. Small eggs of the Great Blue could be confused with those of the American Egret. When identifying eggs of these species, one should consider the relation of length to breadth. Unusually long eggs are relatively narrow and vice versa. The accompanying bar graph shows the actual size of the eggs of the Great Blue and two other species and the extent of their variation. The maximum length of Egret eggs as given by Bent is an extreme deviation from the normal. It may have been based on a Great Blue egg deposited in an Egret nest. His maximum length for the Great Blue was taken from a locally collected egg.

The notes of Jamison, Reed, Crispin, Springs, McMullen, and myself provide data on 347 local clutches of the Great Blue. Among them are 63 sets of 3 eggs, 117 of 4, 141 of 5, and 26 of 6. In my opinion most of the sets of 3 are incomplete. An indication of this can be seen in the low proportion of 3's among 17 sets that Crispin lost through advanced incubation—far advanced, since he blew his eggs through enormous holes—1 of 3, 6 of 4, 9 of 5, and 1 of 6. According to Bowdish, a set of 7 was once taken by the late P. B. Philipp from a nest in Salem County, N. J. This clutch was probably the work of two females. I should like to examine these eggs to see how they compare in size and shape. Eggs of a clutch are invariably of the same shape. If two females laid in a nest, the chances that the two sets would be alike in form are extremely remote.

Small in proportion to the size of the bird, the egg has a shell only slightly thicker on the average than a hen's. Yet Crispin has told of finding one that had plummeted 80 feet from the nest, plunged through underbrush, and landed in a mulch of dead leaves, point down and unbroken (*Oologist*, June 1905, p. 90).

Nest.—The nest is large, flat, and composed of coarse sticks. It usually is lined with twigs or fine sticks and, where the material is close at hand, with a third layer of coarse grasses, sedges, weed stalks, vine stems, or pine needles. Harlow once even found greenbriar in the lining. A heron's nest generally is described as a "platform of sticks." More precisely it is saucer-shaped, that is, the interior is depressed like a saucer, but never cupped like a Robin's. The interior depth varies from barely 1 inch to 4 inches, averaging about 2½. Old nests repaired for several years, are naturally greater in diameter and thickness but never in depth of the interior. Bender has recorded new nests as small as 18 inches across, and more than one writer has spoken of structures so thin that the eggs were visible from the ground through the interstices, something I have never observed, although I have visited the sites mentioned. When used for a number of years, they may be built up to heavy structures 3 and 4 feet across and a foot thick. The average is about 30 inches in diameter and 4 inches in thickness. Smith once collected a nest and dropped it 75 feet from a tulip tree. It struck the ground bottom down, minus a few twigs, and a little flattened but practically intact, proving that the construction is not so frail as is generally supposed.

The Great Blues get most of their sticks from trees at the nesting site, breaking them off the branches with their bills. Some few they pick up from the ground. All these sticks are rather strong ones, not rotten or brittle. I have occasionally seen them carry such material into the Frogtown heronry from long distances but have never known them to bring pine needles into colonies in deciduous woods. They have nested from as low as 12 feet (Makepeace) to 110 feet (Pennsville), averaging between 60 and 70. They have generally favored the upper levels—high in the famous three-pronged and four-pronged crotches of the chestnut trees, far out in the forks of the large limbs of spreading trees, in the very top of others, particularly evergreens. In cedars, single nests are the rule, second nests, where they occur, being placed on horizontal branches close to the trunk. In spacious trees, such as oaks, beeches, and maples, 10 or more nests to a tree are not unusual. The 10 pairs in a single maple on Cobb's Island, Salem County, in 1941 comprised the entire colony (Potter). The local record goes to the 19 nests in one oak at Marshalltown in 1943. The nests are simply laid in the crotches or on the branches, never attached. It is almost miraculous that any survive stormy winters, yet they may last for several seasons. Reed was able to fix the age of one old nest at Glassboro at eight years by counting the layers of pine needles in the sub-structure.

Can the nest be identified readily? Yes, at least as to family. The

Osprey and the Bald Eagle, the only other local species that build saucer-shaped nests of comparable size, are not colonial and do not whitewash the surroundings with the peculiarly odorous excrement that we associate with heronries. Specific identification is more difficult. Heron nests vary less in composition, shape, and size than those of any other local family. The few American Egret nests I have examined seemed indistinguishable from those of the Great Blue, although the tendency of the latter to nest higher and to build a saucer that averages somewhat deeper is a partial clue. Size alone will separate most Great Blue nests from those of the Black-crowned Night Heron, which average only about 18 inches in width. Great Blue nests under 30 inches are a rarity. Usually if a Black-crown's nest is placed on top of a Great Blue's, the birds will have at least a 6-inch walk around it.

Colonization.—As far as I can definitely establish, the Great Blue has never nested within the limits of this study in an association of less than the 4 pairs as at Pennsville in 1926. I do not know that the single bird I saw beside a nest there in the following March actually bred, and Dickey's "1 or 2 pairs, about 1908" at Newcastle since it lacks an exact date does not necessarily represent the full strength of the heronry in that year. Ressell's Chester Co. list (*Oologist & Ornithologist*, July, 1899) says "Breeds in pairs along the Octorora Creek," but Stone considered the list unreliable. At a small lake near Bernardsville, N. J., John Dryden Kuser supposed "one or more pair" nested during the summer of 1909 (*Oologist*, June 1911, p. 99), but one would judge from the indefinite number that he did not actually find the site. Frey's mention of an old nesting record from the Yellow Breeches Creek, (*Centennial Check List of the Birds of Cumberland Co., Pa.*, p. 14) is similarly vague. General works have mentioned solitary nests without giving any supporting data. Against this background, another record not far from our borders is of unusual interest. Overington has written me that several years ago at Sunnybank, on the Virginia side of the mouth of the Potomac, he found a solitary nest 15 feet up in a pine tree with one pair of adults and two young. Bryant Tyrrell secured photographs.

The only colony I have had the good fortune to discover in its first year is the new one near Salem, founded probably by birds from the waning rookery at Frogtown. It began in 1939 with 8 nests, increased to 10 in the following year, remained at that figure through 1943, and suddenly in 1944 doubled to 20 or more. Its failure to grow in a 4-year period lends support to the contention of some banders that herons do not return as breeders to the rookery where they were reared. But typically our colonies seem to start small and increase from year to year until destructive forces compel the birds to abandon them. Gradual death of the trees from excrement, a process most commonly observed among red maples, brings a correspondingly gradual desertion, some pairs apparently moving to established heronries nearby, others founding new ones, before the parent colony entirely disappears. At Makepeace and Marshalltown, some pairs hung on stubbornly after the trees had lost so many

branches that there was barely a place to put a nest, until finally at the latter spot they had to crowd a fair sized colony into two trees. There is evidence in the case of Marshalltown that gradual abandonment may result in dispersion into several small colonies. Woodcutting, the most frequent destructive force, effects a swifter removal, during which the birds are more apt to act as a group, particularly if there is a suitable new site close at hand. Thompson's Salem County records, though not always entirely clear, have established at least two instances of abandonment and return to essentially the same site after a lapse of years—at Water Works Pond and at Alloway.

How close have two colonies co-existed? That depends on how we define a *separate* heronry. Frogtown and Cobbs Island in 1939, less than a mile apart, came just about as close as two colonies could and still be considered distinct. They and the Salem rookery could be enclosed by a 4-mile circle.

Second laying.—The Great Blues are definitely one-brooded here, but, when the eggs are lost, will always lay a second or third time. Second sets are sometimes inferior in number, but not always as much so as stated by most ornithologists. Twelve such clutches taken by Crispin averaged 4, and, among 60 late date eggs of Darlington's, 3's, 4's, and 5's were about evenly divided. It was Crispin's practice to wait from 20 to 30 days to secure second sets; he usually took them between the last week in April and the middle of May. In 1909 at Pennsville, he found a clutch of 2 on June 3, the latest egg date we have. Though egging never produced the catastrophic results charged to it—there is no local case where it was even a contributing cause to the desertion of a heronry although I believe that Crispin's excessive activity may have affected the birds' numbers to an appreciable extent. They all laid again, but the removal of second sets retarded hatching nearly two months. It probably would be September instead of July, before the fledglings from twice-robbed nests would be on the wing. Whether these late-hatched birds would be as physically fit as normally hatched ones is open to question.

Incubation.—Almost invariably local oologists have found uniform incubation in the eggs of any single clutch, whatever the stage at which they examined them. The rare exceptions are probably the product of two females laying in one nest. In a set of 4 collected by McMullen at Deleawar City many years ago, 3 eggs were perfectly fresh, and the fourth was unblowable, with an embryo nearly ready to hatch. But this egg was also of a different size and shape from the other three. Difference in size of young in the same nest has always interested me. Many ornithologists attribute it to the birds' beginning incubation with the laying of the first egg. For instance, a set of 5 laid in April would probably be deposited in this order—April 1, 3, 5, 7, and 9, which would make the first egg 9 days incubated by the time the last is laid, if the theory were correct. Unfortunately, examination of the eggs does not bear it out. There is some other factor involved, not only in the unequal size of young herons, but of nestling hawks and owls as well, but I am unable to fathom it.

Young.—Infant mortality exceeds 40%. The commonest number of eggs is 5, and most of them hatch. In the early stages 4 young to a nest are not uncommon. At Crystal Beach in 1939, Schmid discovered 2 broods of 5; Bender has seen 6's. Yet I have never found a nest with more than 3 young *over ⅓-grown*, and often there are only 2. Schmid, who has done more local banding of the species than anyone else, has noted that broods of 3 usually are nearly equal in size, while above that number there is always a marked gradation. Bender has found that the young can crawl out of the nest when half-grown. His notes from Marshalltown show that most of them reach this stage by the last week of May and are well fledged by June 10.

Just as nest and eggs are sometimes capable of surviving a long drop, so are the young. Gillespie banded a fledgling that had fallen 50 feet. Apparently uninjured, it was returned to the nest and was recaptured 6 months later about 15 miles from the banding site. On the other hand, Schmid gave up the banding of Great Blues when two that he was trying to catch 60 feet above the ground fell clasped together to their death.

Behavior

Post-nuptial movement.—It has long been assumed that our immature Great Blues wander northward after the breeding season, just as we could actually see the white herons do in the years before they returned to nest. This movement, once only dimly discernible in their increase in non-breeding territory to the north, has been definitely substantiated by the banding returns of Bender and Gillespie.

It is interesting to compare the recovery of the bird from North Arlington, N. J., in February 1940, with another bird banded in the same colony on the same day, found dead in December 1939 at Itabo, Matanzas, Cuba, the most

Banded		*Recovered*			
Location	*Date*	*Location*	*Date*	*Miles North*	*Days Lapse*
Marshalltown, N. J.......	5/22/38	Vincentown, N. J........	7/ 4/38	20	38
Crystal Beach, Md.......	5/22/38	Atlantic Beach, L. I......	7/ 9/38	75	43
Marshalltown, N. J.......	5/22/38	Pike County, Pa.........	7/18/38	120	52
Crystal Beach, Md.......	5/22/38	Salisbury, Conn.........	12/11/38	175	198
Crystal Beach, Md.......	5/22/38	Tivoli, N. Y............	8/31/38	190	96
Marshalltown, N. J.......	5/22/38	Lisbon, Me.............	10/ 7/38	320	133
Crystal Beach, Md.......	5/21/39	Ringoes, N. J...........	12/ 5/39	70	198
Crystal Beach, Md.......	5/21/39	N. Arlington, N. J.......	2/26/40	95	281
Marshalltown, N. J.......	6/ 5/39	Moodus, Conn..........	7/ 7/39	155	32
Crystal Beach, Md.......	6/ 1/40	Freehold, N. J..........	9/18/40	60	109
Crystal Beach, Md.......	5/25/41	Teaneck, N. J...........	8/11/41	105	78
Crystal Beach, Md.......	5/25/41	Milford, Conn..........	5/17/42	125	357

Banding Returns Showing the Northward Wandering of Young Great Blue Herons

distant recovery of a Great Blue we have ever had. The movements of the immatures seems to be a highly individual matter.

Interspecific relations.—Alexander Wilson wrote in 1813:

"I have several times seen the Bald Eagle attack and tease the Great Heron; but whether for sport, or to make him disgorge his fish, I am uncertain."

Gillespie, 125 years later, answered him:

"My wife and I witnessed the attack of an immature Bald Eagle on a Great Blue at Fort Mott, N. J., October 9, 1938. The latter was endeavoring with some difficulty to swallow a fish about 10 inches long, when the eagle swooped down within some 3 feet of the heron and passed on, circled about, and renewed the attack about six times. At each assault, the heron, which was standing in about 1 foot of water, ducked and uttered a harsh croak. Finally, either by design or from fright, the heron dropped the fish and it sank from view. On its next assault, the eagle, perceiving the fish had disappeared, flapped above the heron for a few seconds, and then flew off to a distant perch, at which the heron recovered the fish and proceeded to swallow it unmolested."

Strange to say, an eagle used to nest in the Pennsville heronry and Thompson mentions another pair near the Barrens rookery in 1905. The Bald Eagle is probably the only species that bothers the Great Blue very much. The pursuit of a Great Blue by a crow down Tacony Creek at 10 A. M., July 26, 1938, is the only incident of its kind I know of, and crows too have been known to nest in heronries (Glassboro, 1900, Reed). Bender tells of an Osprey, nesting close to the Crystal Beach colony, which chased herons all one day. A pair of Ospreys however, have been located on the outskirts of the Frogtown heronry for over 20 years. Sharples' highly-colored account of a raid by a Red-shouldered Hawk on the Delaware City rookery, quoted by Bent (*Life Histories*, p. 112), seems to be a misinterpretation. The bird probably had a nest there, as a pair once did in the Frogtown colony, and it is a habit of hawks to drop out of the sky into a wood where they are nesting.

Great Horned Owls commonly take over nests in the rookeries for their own use. Twenty instances at hand, 14 of them from personal observation, involve 7 localities—Pennsville, Frogtown, Delaware City, and Crystal Beach (Miller), St. Georges (Newman, et al.), Barrens (Thompson), and Alloway (Higgins). On the many occasions I have scared up Horned Owls in heronries, their flight over incubating or brooding birds never alarmed the herons. Once I discovered evidence of a Great Blue deliberately building in the same tree where an owl was rearing 2 young.

Turkey Vultures annually nest beneath the Frogtown colony as they did also at Pennsville and at least once at St. Georges (Newman). Possibly they find carrion there. In the case of the Wood Ducks that located several times at Frogtown, there are no inter-specific implications to suggest that they would not have done so, heronry or no heronry. That is generally true also of the various small birds that make their homes in heronries. The grackles noted by Pearson at Makepeace Reservoir were not taking advantage of the ragged edges of the Great Blue nests to shelter their own, as they have on

occasion done beyond our borders. But the Tree Swallows there were making good use of heron feathers in the linings of their nests (*Bird-Lore*, 1919, pp. 272–273).

All of our other herons, except the Yellow-crowned and the Louisiana, have nested in association with the Great Blue—the Black-crowned Night Heron, at Seven Mile Beach (1886, Parker), Long Island, back of Peermont (1899, Reed), Pennsville (Stone), and Cobb's Island in Salem Co. (1941, Potter); the Green Heron, at Makepeace Reservoir (1919, Pearson) and Frogtown and Crystal Beach (currently, Bender); the American Egret, at Frogtown (1928 and after, McMullen, et al.), Tuckerton (1936, Urner), and Cobb's Island, N. J. (1941, Potter); the Little Blue Heron, at Cobb's Island (Potter); the Snowy Egret, at Seven Mile Beach (1886, Parker). The Great Blue itself does not seem to seek these associations. More than any of our other herons, it has colonized alone. In nearly all the instances noted, it appeared that the lesser species located in an established Great Blue colony, rather than the reverse. The one exception was Cobb's Island, where the Great Blues, confined to the only large tree on the island, were outnumbered 12 to 10 by the Little Blues in the shrubbery below. It is also the only local case where they were not the numerically superior species.

Feeding habits.—The Great Blue seeks its prey by stalking or waiting. According to Ralph W. Miller, who has charge of the fish hatchery at Accident, Md., it nearly always delivers the death thrust at the dorsal fin on fish up to 15 inches in length, but attempts to break the backs of larger victims by striking the back of the head. It generally takes fish under 7 inches with a forceps action of the bill but actually spears the others, the serrated edges of the rami of the beak preventing their sliding off. Shryock has described a Great Blue at Haverford Pond that half raised its wings and fluttered them, as if in anticipation of its feast, each time it struck at a goldfish, whether it caught it or whether it missed—antics I do not recall having heard of before. A series of photographs taken in the Brooklyn Botanic Garden and published in *Life*, September 6, 1943, prove that it is not entirely limited to shallow water operations. They show a Great Blue actually making a strike from a stake over a foot above the water, almost standing on its head, its feet still grasping the perch, its neck half under the lily pads. The bird that I saw foraging along the deep-watered, stone-rimmed Torresdale reservoir and another standing on a board in open water in the Richmond marshes may have intended to employ a similar method, but I did not see it catch any fish.

Many years ago, while camping on North Pensauken Creek, my father, my Uncle Dick, and I would bob for eels nearly every night. We always left the catch in several inches of water in the bottom of the bateau, which we moored to the shore near camp, as the slippery fish were easier to handle by daylight. But before we rose in the morning, Great Blue and Night Herons invariably raided the boat and ate some few of the small ones under 15 inches in length. The Great Blue always stood on shore or in very shallow water and

reached in and speared an eel with its long, sharp beak, usually catching it in the middle or nearer the head than the tail and swallowed it head first. Its course down the heron's long gullet was convulsive, and it took several seconds for its movements to disappear.

Time of day studies by Bender on the Bridgeport, N. J., marshes support the general impression that morning is the period of greatest activity.

	Date	*Count*		*Date*	*Count*		*Date*	*Count*
7–8 A. M.	5/14	89	8–9 A. M.	5/9	3	8:30–9:30	5/11	5
	5/15	90		6/6	23		5/10	6
	5/17	35		6/7	6	9–10 A. M.	5/8	1
	5/20	25					6/5	14
	Av.	56		Av.	11		Av.	6

HOUR COUNTS OF THE GREAT BLUE HERON

It is unfortunate that these counts could not have been followed through on the same day. It would be interesting to know whether date, hour, weather, or other factors produced the tremendous spread between 1 and 90.

At fish hatcheries, R. W. Miller tells me, the Great Blues work principally at night, perching on some tall tree as close to the ponds as possible, just before dark. A bird that flew into the marsh at Richmond, July 18, 1927, at 8:30 P. M. (E. S. T.), to feed suggests that they may also frequent inhabited localities under the cover of darkness to a greater extent than daylight records would indicate.

From Deep Creek Lake, Md., Miller has removed fish of from 3 to 6 pounds in weight, expiring from spear wounds evidently delivered by Great Blues. The largest fish I have ever known a Great Blue to eat was a carp disgorged by a fledgling that Schmid was trying to band at Frogtown in 1937. Twelve inches long and 1½ pounds in weight, it came crashing down 60 feet and narrowly missed Gillespie's head. I have also seen the bird take roach, yellow catfish, several kinds of minnows, bullfrogs, green frogs, and leopard frogs. Harper found a golden shiner and a croaker (?) beneath the colony at Crystal Beach. Miller thinks it prefers the salmonoid fishes, the basses, and all species lacking the spinous dorsal fin which may cause throat injury. Doctor C. C. Abbott mentioned the eating of crayfish, as well as beetle larvae. Four birds that I chanced upon in a wheat field near Riverton, N. J., in December suggest mousing. Seventy in a wheat field by the old Delaware City rookery in March and individuals in a tomato patch and a rye stubblefield in August were perhaps similarly engaged, or perhaps were eating insects. Both mice and insects are proven items of diet outside the area, but I know of no

one since Alexander Wilson to have found them consumed here. He adds grasshoppers, dragonflies, and the seeds of spatterdock to the list. North of our boundaries, at Oradel, N. J., Bowdish took movies of a Great Blue playing cat-and-mouse with a chipmunk-sized muskrat (*Oologist*, Aug. 1941, p. 94). The youngster eventually escaped, but I have no doubt that the bird includes the muskrat in its diet more often than we know, a swell as young Rice and Norway rats.

Swimming and bathing.—Great Blues have been observed many times swimming in deep lakes in the interior. They almost never do so here, where there are extensive shallows. Ashton's record of one alighting in deep water at Penn Manor is locally unique.

From Mannington Lake, August 22, 1943, Coman describes another most unusual sight—a Great Blue taking a bath:

"The bird would settle down in the water until only his 'shoulders,' some of his neck, and his head remained above water. He seemed to fluff out his feathers and just sit and soak. Then every once in a while he would duck forward and flutter, briefly submerging all but his head, which was thrust upward, the bill toward the sky. He would then rise up, shake, preen, and repeat the performance."

Wariness.—Although Great Blues have an ingrained distrust of man, I think their wildness has been exaggerated. They are not averse to habitation in small doses, as they have nested almost in farmers' back yards, in their woodlots anyhow. When unmolested, they may become quite tame. While fishing the Rancocas Creek, my brothers have paddled within 15 or 20 feet of birds feeding on the shore without scaring them into flight. I have rowed within 40 feet of them myself. I have never known, though, any Great Blue quite as forward as the one that flew into the village of Brewer, Me., one Sunday and perched on the chimney of a dwelling letting a noisy crowd gather and eye him as long as they liked. (Hardy, *Oologist*, Oct. 1879, p. 32).

Problems

I have brought up many questions that I have been unable to answer satisfactorily. One that I should particularly like to see settled is the cause of disparity in sizes of young in the same nest when the eggs show uniform incubation. Though such disparity is not confined to herons, their colonial nests offer the most abundant opportunity for study. The use of colored bands to distinguish the young of the various rookeries should produce material for a magnificent paper on foraging range, intercolonial relations, and the breeding dispersion of second year birds. The student unused to climbing irons should find stimulation in the fact that we have never had a census of the breeding pairs in all the known heronries in any one year, that none of us has ever spent a night in a Great Blue rookery, that such simple questions as how long the bird will wait for a fish, or which leg it more commonly rests on, remain unanswered. The great breeding region of the Great Blue Heron in the North lies at our door steps. The answers are there.