boni, from Fort Bridger, Utah, measured,[1] as reduced to millimeters: wing 106, tail 91. And all the southern Rocky Mountain examples I have access to have the wing longer than 100 in the male. It is of especial value in the determination of the western races of the Hermit Thrush, that there seems to be but little individual variation in the measurements of a series from a single locality. For instance, the extremes among the 9 females of *verecunda* from Sitka are: wing, 82 to 85; tail, 68 to 72.

Probably most of the summer records of *auduboni* from the interior of California refer to *sequoiensis*, while the winter records in some cases seem to be based on large males of the olivaceous *aonalaschkæ*, which winters abundantly in the interior and southern portions of the State. The bright brown-backed, buffy-breasted *verecunda*, as shown by many specimens examined, passes the winter principally in the cloudy coast belt. It is the prevailing form in winter in the San Francisco Bay region and Santa Cruz Mountain district. Both *sequoiensis* and *slevini* evidently winter entirely south of California.

At the suggestion of Mr. L. M. Loomis, the subspecies herein described is named for Mr. T. E. Slevin of San Francisco, a quiet but ardent bird-student.

THE WINTER BIRDS OF PEA ISLAND, NORTH CAROLINA.

BY LOUIS B. BISHOP, M. D.

BLEAK and dreary seemed Pea Island — a monotonous sand-flat with promontories of marsh-grass, its dull level broken only by a few scattered buildings and here and there a low sand hillock — as I watched it on the afternoon of February 7, 1901, from a small boat which two colored boatmen had succeeded in getting hard aground on the flats that stretched for miles into Pamlico Sound.

[1] BAIRD, Rev. Am. Bds., June 1864, p. 17.

Regarding the general character of the place, I had found little to change my views when I left for home on the morning of February 18, but I was more than once surprised at the birds which made these marshes and flats a winter home.

Pea Island lies between Oregon and New Inlets, separating part of Pamlico Sound from the ocean, and is about 30 miles north of Hatteras. It is about five miles long by one mile in width, and along the center stand the dead stumps of cedars, showing its once greater elevation. But I was told these stumps have looked the same for over one hundred years, and now at high tide their roots and most of the island are covered; little but the crest of the ocean beach, a few sandhills covered with a sparse growth of beach grass, and islands of salt marsh showing that there is land beneath the waves.

In storms and by very high tides these too are covered, and only the few buildings show above the water. I was told that the water had been at times a foot deep on the floor of the clubhouse, although this building is situated on the highest land on the Pamlico Sound shore, and elevated several feet from the ground. At such times great destruction of life among the smaller land birds would seem probable, and the wild fowl that find a congenial winter home, with abundant food easily obtained in the shallow water of the Sound, can be shot from the clubhouse veranda.

At the time of my visit some unknown cause, for food was abundant — possibly the unusual saltness of the water from the long drought — had made the Geese and Redheads desert these waters, and the Brant, able to feed through the low tides, kept so far offshore that trying to shoot them was useless.

In the marshes, of which a number are each several acres in extent, often intersected by broad or narrow channels, compose most of the sound shore of the island, may be found in places patches of low bushes, showing no sign of life in winter, and broad stretches of a sharp-pointed marsh grass, apparently the same that compose the salt marshes of western Florida. Our northern marsh grass occurs also, and in sufficient quantity to keep about twenty horses and cattle in good condition, though left to forage for themselves all winter. Not a tree is now growing on Pea Island,

but the vegetation on Roanoke Island — lying about ten miles northwest — two species of pine, live oaks, cypresses, with a dense undergrowth of myrtle, bay and laurel, bound into impenetrable thickets by smilax — would show one had entered a southern fauna were the sharp-pointed marsh-grass insufficient. Bodie Island, a larger island of much the same character as Pea Island, but with more abundant vegetation, and lying north of the latter, contains at its southern end a large marsh. This seemed a typical resort for Wilson's Snipe, but five men and two dogs failed to find one there though hunting carefully.

The weather was, as a rule, clear and warm during my stay; only once did the thermometer fall to 26° at 8 A. M., and on two mornings it registered 50° at that hour. There were two or three stormy days, but no very severe gale, so I think it safe to consider the land and shore birds found were normal winter residents. Many other species, especially of ducks and water birds, are known to occur at Pea Island in winter, but I have included only those of which I saw specimens during my visit.

Among the birds found moulting in only one species was there any sign of renewal of the primaries and rectrices, and in most only a few scattered pin feathers, most frequent about the head and neck.

Regarding migration, the interesting fact appears that of 20 specimens of the Limicolæ, representing five species, omitting *Ægialitis vocifera*, collected at what must be nearly the northern limit of their winter range, 18 were males and only 2 females, while of seven Ipswich Sparrows (*Ammodramus princeps*), at nearly their southern winter limit, all were females. This adds strength to my former belief that in migrating birds the bulk of the males remain farther north than the females in winter, for I do not think that with any of these birds the northward movement had commenced.

In studying the migration of birds it seems to me that too little weight has been laid on the origin of the different species and genera, whether they are Boreal types, developed probably in the Holarctic Zone, or autochthonous in temperate or tropical North America, different rules of migration, and different causes, probably operating in these two classes. The distribution of the subspecies of one species, and the species of one genus during the different seasons, will aid in understanding both causes and rules.

Boreal forms, of which *Otocoris*, *Calcarius* and *Acanthis* are good examples, forced south in winter by lack of food, seem to move in regular order, keeping individually about the same north and south relations to the bulk of the species, or wander in large flocks in search of food, as *Ampelis*, *Loxia* and *Pinicola*.

In the other class will be found species developed either in the Austral Zone of North America or the American Tropics, which, originally forced north in summer for reproduction by the crowding of life in the tropics, repeat this movement yearly through the continued operation of the primary cause and the formation also of habit. In these birds it appears that those breeding farthest north, though appearing at midway stations in the fall after the birds of the same species breeding there have left, pass as far or farther south in winter. Birds of the genera *Hesperocichla*, *Hylocichla*, *Junco*, *Leucosticte*, *Zonotrichia*, *Melospiza*, *Passerculus*, *Ammodramus*, *Dendroica* and *Vireo* will illustrate this. In the spring these northernmost breeding birds seem to pass the halfway stations, as a rule, when the birds breeding there are already at home. This movement I think I have noticed in species of the genera *Quiscalus*, *Agelaius*, *Icterus*, *Melospiza*, and *Ammodramus*. On the basis of this Dr. Coues separated *Dendroica cærulescens cairnsi* before he had seen a bird from the summer habitat of this subspecies.

Austral birds as a class would then pass north in summer chiefly because their winter homes and the intermediate stations are already occupied, and return in winter toward the original habitat of the species. Boreal birds on the other hand, forced south originally and each year by the lack of food in their homes in winter, would return north when approaching summer makes it possible, and in strong-flying species might readily develop the habit of long journeys, as is shown by the boreal Limicolæ.

I do not wish to claim that these rules will hold with all species; I offer them simply as a contribution to the study of migration.

1. **Gavia imber**. LOON. — A young female, in which the first nuptial plumage is appearing on the back, wing-coverts, rump and tail-coverts, was taken on February 15. The feathers of the head and neck still show the downy texture and the black tipping on the side of the throat characteristic of the first winter plumage.

2. **Larus marinus.** BLACK-BACKED GULL. — I thought I saw one or two in young plumage among the flocks of Herring Gulls, and Mr. C. R. Hooker told me he saw an adult on the 15th. Mr. Hooker is perfectly familiar with the species.

3. **Larus argentatus smithsonianus.** AMERICAN HERRING GULL. — Abundant, but shy as a rule. None were taken. I was told that large numbers are caught in the shad nets, and that after storms as many as 100 killed in this manner have been found in a single morning.

4. **Larus philadelphia.** BONAPARTE'S GULL. — An adult male, taken on January 28, was still in a condition to save on my arrival. I saw none during my stay.

5. **Merganser serrator.** RED-BREASTED MERGANSER. — A few were seen in small flocks or alone, but none taken.

6. **Anas obscura.** BLACK DUCK. — Common but shy, coming to the marshes to feed at night and in stormy weather. An adult female had the bill yellowish olive-buff; the nail of bill and interramal space of mandible black; tarsi and toes ochraceous buff, nails and center of palmations blackish. I think the coloring of the tarsi and toes in this species depends on age and sex, and is not distinctive of a different race, as has been suggested. An adult male in very high plumage, having recurved feathers on the tail-coverts like the Mallard (*Anas boschas*), taken at New Haven, Jan. 14, 1901, had the tarsi and toes bright rufous.

7. **Aythya americana.** REDHEAD. — Flocks were frequently seen flying over the Sound, but none taken.

8. **Aythya marila.** SCAUP DUCK. — Flocks were seen while crossing Pamlico Sound and occasionally from the island. None were taken during my visit, but a number had been shot a few days previous.

9. **Charitonetta albeola.** BUFFLE-HEAD. — Fairly common in small flocks but keeping well offshore. An adult male had the bill plumbeous washed with black; nail of maxilla yellowish, interramal space of mandible black; tarsi, toes and palmations vinaceous buff, nails black.

10. **Harelda hyemalis.** OLD-SQUAW. — I saw several small flocks in Pamlico Sound on February 7, and again on the 18th.

11. **Oidemia deglandi.** WHITE-WINGED SCOTER. — The same remarks apply to this species.

12. **Chen hyperborea nivalis.** GREATER SNOW GOOSE. — Among the decoy geese was a fine specimen of this species in full plumage, and almost as large as a male Canada Goose. It was taken in the gray plumage of the first winter on Pea Island in January, 1900. I saw no others, but learned that a number are shot each winter at the southern end of Bodie Island.

13. **Branta canadensis.** CANADA GOOSE. — Not common during my stay, although we sometimes saw twenty flocks or more in a day. Up to the last of January they had been abundant. That the male is much larger than the female does not seem generally recorded. A young female taken February 13 was very thin, and still retained the brownish feathers in the

black of the neck, and particularly at the junction with the pale breast, which are significant of immaturity. Mr. J. B. Etheridge, the manager of the Pea Island Club assures me that these geese keep in families throughout the winter, and that if both old birds are shot the young will return to the decoys, but if one old bird escapes it will guide the young to safety.

14. **Branta bernicla.** BRANT. — The most abundant sea-fowl but staying well offshore in large rafts, probably because the water was so low from lack of rain that they were able to reach the bottom a long distance from land. It may not be known to all that Canada Geese and Brant, though feeding on a plant growing on the bottom, do not dive, taking their food only in water so shallow that they can reach the bottom with their long necks by tilting their white afterparts in the air. The effect of a flock changing thus from black to white is very peculiar. As the tide rises they swim toward the shore, keeping always in water where they can reach the bottom.

Sailing to Roanoke Island on February 18, we saw thousands of Brant, and noticed three dead ones, caught by their necks in the shad-nets which are set in the shallow water of this part of Pamlico Sound as thickly as nets in a tennis field. The wind freshening as we sailed we were obliged to cut four of these nets to avoid capsizing.

Young Brant may be distinguished from adults as late as the middle of April by the white tips to the wing-coverts which persist long after the brownish head and throat have become glossy black, and the white feathers on the sides of the neck have appeared.

15. **Botaurus lentiginosus.** AMERICAN BITTERN. — A female was taken on February 11.

16. **Ardea herodias.** GREAT BLUE HERON. — I saw one on the 8th, and one on Bodie Island on the 16th.

17. **Rallus crepitans.** CLAPPER RAIL. — A male was taken on the 13th and another on the 16th. From what comparisons I have been able to make I think these birds intermediate between *crepitans* and *waynei*, but somewhat nearer the former.

18. **Rallus crepitans waynei.** WAYNE'S CLAPPER RAIL. — A female taken on Feb. 9 and a male on the 11th. Mr. Brewster has kindly examined them and pronounces them typical of this form. The female is much the smaller bird, and was moulting in the contour feathers.

The iris of the male was raw sienna; culmen slate-black, tip of mandible slate, base of tomial maxilla ochraceous, rest of bill clay color; tibiæ, tarsi and toes dark broccoli brown, tibiæ washed in front with buff-yellow; nails clay color.

In habits these birds are like *crepitans*, keeping closely to the thick marsh grass, and are with great difficulty flushed even by a dog.

19. **Rallus virginianus.** VIRGINIA RAIL. — A female was taken on Feb. 9. It was moulting and had the ovary on the right side.

20. **Tringa minutilla.** LEAST SANDPIPER. — I took a male on the seventh that was alone in the marsh. Another of this species taken on the 11th was with other sandpipers on the flats.

21. **Tringa alpina pacifica.** RED-BACKED SANDPIPER. — This was the most abundant sandpiper on the island, feeding in large flocks on the flats. Eight collected were all moulting; and I find it rare to take a Red-backed Sandpiper between the first of September and the last of May that does not show pin-feathers. Two only were females, and both of them and three of the males were in first winter plumage. Young of this species do not moult the feathers of the rump and upper tail-coverts in fall, and by the pale orange rufous tips to these feathers may be distinguished from adults with pale gray edgings, sometimes as late as April.

22. **Ereunetes occidentalis.** WESTERN SANDPIPER. — Common with the other sandpipers on the flats. Four collected, of which two were moulting, were all males, with bills longer than the extreme of female *pusillus*.

23. **Calidris arenaria.** SANDERLING. — Almost as common as the Red-backed Sandpiper — flocks of 30–40 being often seen — and feeding with them on the flats. Of six collected all were males, three young and three adult, and only one was moulting.

The young Sanderling also does not moult the rump and upper tail-coverts in the fall, and may be distinguished in February by the broad dark centers of these feathers in place of the narrow central dark stripe of the adults. The first winter plumage is also a trifle darker than the adult.

24. **Totanus melanoleucus.** GREATER YELLOW-LEGS. — A single bird of this species I saw and heard on February 12.

25. **Squatarola squatarola.** BLACK-BELLIED PLOVER. — Twenty or thirty were living on the flats, but were very shy. The only one taken was a young moulting male.

Young may be separated from adults at this season by the presence on the feathers of the lower neck and breast of a dark distal shaft-streak, while these feathers in adults are tipped or washed with brownish. The white of the forehead is broader also in adults.

26. **Ægialitis vocifera.** KILLDEER. — A few were wintering about the channels running into the marshes on the northern part of the island. In two females, taken Feb. 16, the ova were noticeably enlarged, pointing probably to adjacent breeding grounds.

27. **Cathartes aura.** TURKEY VULTURE. — A few were seen daily, feeding on the bird bodies washed upon the shore. An adult male caught in a trap set for a Bald Eagle had the iris broccoli brown; the bill white; bare part of head vinaceous with white caruncles; tarsi and toes dirty white mixed with black, nails black.

28. **Circus hudsonius.** MARSH HAWK. — One or two seen daily. An adult female, taken Feb. 13, was feeding on the decaying body of a goose. The iris and cere were canary yellow; bill black becoming cinereous toward base; tarsi and toes chrome-yellow; nails black.

29. **Haliæetus leucocephalus.** BALD EAGLE. — Common, sometimes several being in sight at one time. Two in immature plumage were taken on Feb. 4 and 5. The majority seen were adults, and were feeding on the dead fish and birds along the shore.

30. **Otocoris alpestris.** HORNED LARK. — A male and two females were taken on Feb. 7 and 8, but no others seen. The male was moulting.

31. **Agelaius phœniceus.** RED-WINGED BLACKBIRD. Two were taken from a flock of about a dozen females on Bodie Island, Feb. 16. One had the crimson shoulders and salmon throat characteristic probably of maturity, the other the dull ochraceous shoulders and pale buffy throat of the young.

32. **Sturnella magna.** MEADOWLARK. — Common. Of a male and female taken the latter alone showed pin-feathers.

33. **Scolecophagus carolinus.** RUSTY BLACKBIRD. — A single male called at the clubhouse for a few minutes on the evening of Feb. 17, and returned to be collected before we sailed the next morning.

34. **Quiscalus major.** BOAT-TAILED GRACKLE. — I saw one male on Feb. 10, and five males near Oregon Inlet on the 16th. This bird is locally known as the 'Jack-daw.'

35. **Passerina nivalis.** SNOWFLAKE. — I found a flock of three on Feb. 14. Two were males and one a female, and all were moulting. If, as Dr. Dwight states, the whiter birds are adults, these were young birds, and I find the following characteristic differences in plumage at different ages. Males and females in first winter differ chiefly in the males having white on inner web of third rectrix. Adult males differ from young males by more white on wings and wing-coverts. Adult females differ from young females by whiter wings and white on inner web of third rectrix. Adult females differ from young males by the blacker interscapulars of the latter. Adult males differ from adult females by whiter wings and wing-coverts, and by having the dark markings of the interscapulars, wings and tail blacker.

36. **Ammodramus princeps.** IPSWICH SPARROW. — Rather common. Six were collected on Pea Island, and I think I saw others. On Bodie Island I took one and saw several in a short walk. All taken were females, and only one showed moult.

37. **Ammodramus sandwichensis savanna.** SAVANNA SPARROW. — The most common bird on the island, living in the weeds and dry grass about the sandhills. Six males and nine females were collected, one of the latter alone showing moult.

38. **Ammodramus caudacutus.** SHARP-TAILED SPARROW. — Following the last in numbers, this species kept closely to the marshes and could seldom be obtained except on the wing. None were moulting. Ten males and nine females taken seem to show two distinct races, — a dark, highly-colored bird, with strongly contrasted plumage, both above and below, and a paler, duller-colored bird, with little contrast in the plumage, especially of the back, which apparently represents *caudacutus* of New

England, closely resembling December birds from Connecticut. The dark birds have the dark markings below blacker and more conspicuous, the feathers of the crown and interscapulars darker, almost black in some specimens, in marked contrast to the hind neck, and pale interscapular edgings, and the buffy markings everywhere approach ochraceous in tint.

In length of wing and tail the two forms average the same, but the females of the dark race have slightly longer bills. Measurements of 114 specimens of *Ammodramus caudacutus*, *A. nelsoni*, and *A. n. subvirgatus*, lead me to think length of bill one of the best diagnostic characters of these birds.

The dark race was by far the more common, six males and eight females, and one bird of indeterminable sex, being referable to it, against four males and one female to true *caudacutus*.

39. **Ammodramus nelsoni.** NELSON'S SPARROW. — Common, frequenting the same marshes as the Sharp-tail, and even more difficult to flush. While on the wing I could usually distinguish it by its smaller size and brown color. Three males, six females and one of doubtful sex were taken. One of the males is intermediate with *subvirgatus*, having the plumage of this form, but the measurements of *nelsoni*. One female, which I am obliged to call *nelsoni* for lack of any other name, is very highly colored, ochraceous replacing buff throughout the plumage, and buff replacing white. None taken showed moult.

40. **Junco hyemalis.** SLATE-COLORED JUNCO. — A male, the only one seen, was taken on Feb. 8.

41. **Melospiza melodia.** SONG SPARROW. — A moulting male was taken on Feb. 8, but no others observed. This bird was renewing one of the central tail feathers, and was the only bird taken showing moult of remiges or rectrices.

42. **Cistothorus marianæ.** MARIAN'S MARSH WREN. — I took a typical male of this species in a marsh on Feb. 8, but hunt as I might I could not find another. The grass of the marsh seemed the same as that which this bird and Scott's Rail frequent at the mouth of the Anclote River, Florida.

The presence of this species, the Boat-tailed Grackle and Wayne's Clapper Rail on Pea Island in winter would point to the probability that this island belongs in the Semitropical Strip of Dr. Merriam's Austroperian Belt, which is a part, as I understand it, of the Louisianian Fauna of Dr. Allen.