so to speak, a graduated scale of regularly arising, cumulative differences, but at their points of contact they are more unlike than at their geographical extremes.

We consequently are led to consider the possibility of the Yellow-throats having acquired their present range through some such method of progress as the Grackles appear to have followed,[1] and an earlier stage of which the Loggerhead and Migrant Shrikes exhibit. An apparently not dissimilar case is afforded by the Parula Warblers, in which the New England form is the same as that found in the Mississippi Valley.

In other words, Yellow-throats may have advanced from Florida northward, and also from the Mississippi Valley eastward and northward; when, as has been said, the Northern Yellow-throat is not a direct geographical offshoot of the southern bird, although both doubtless had a common point of origin. Intergradation, therefore, is not necessarily climatic but follows actual contact occasioned by extension of range.

NOTES ON THE EARLY LIFE OF LOON CHICKS.

BY C. WILLIAM BEEBE.

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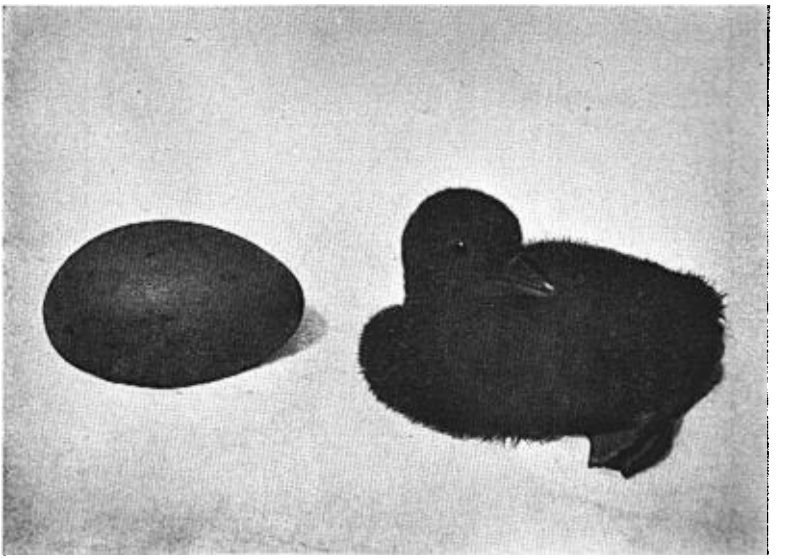
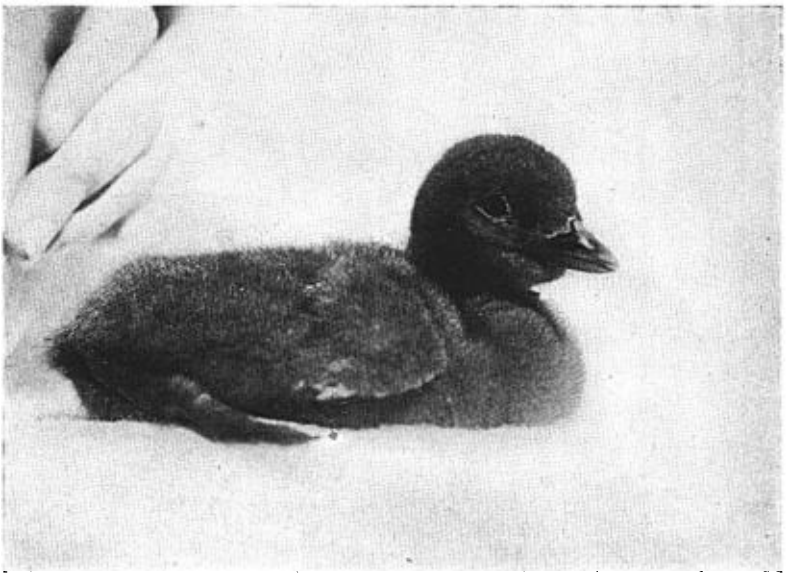
Plate II.

ON AUGUST 4, 1906, two eggs were taken from the nest of a Loon, *Gavia imber* (Gunn.), on a lake of the Muskoka District, Ontario. The eggs were cold, and from observation it was judged that the parents had deserted them some 48 hours previously. Packed in a suit-case, the eggs were brought to New York City and on the evening of August 6, one young loon hatched. The following day this chick was brought to the New York Zoölogical Park, together with the second egg, which was chipped.

[1] *Cf.* Chapman, Bull. Am. Mus. Nat. Hist., IV, 1892, pp. 1–20.



LOON CHICK, 24 HOURS OLD, AND THE EGG FROM WHICH IT WAS HATCHED.



LOON CHICK, 48 HOURS OLD.

Observations made on the two young loon chicks for ten consecutive days revealed a number of interesting facts in regard to the development of their instincts, and these are especially significant and conclusive because the birds had never seen their parents or their natural environment.

August 7.— Chick No. 1 was hardly dry when I took him from his box. Placed on the floor he can make his way about by spasmodic leaps, frog-like, with both feet at once, falling flat on his breast after each effort. Cannot sit upright.

He pecks eagerly at a finger or anything bright, such as a steel instrument. Several small pieces of fish are eaten and he drinks two medicine droppers of water, soon learning to coördinate his vision with his motions of prehension. His eyes are rather dull, appearing covered with a faint bluish haze, and, except at short range, his vision is poor.

At first he strikes out blindly in the direction of the forceps holding the fish, but after a dozen efforts he can seize the bit of food after the first or second trial. He must certainly take his food direct from the parent's beak, and not by regurgitation.

From time to time, when hungry, he utters low peeps, very like a barnyard chick. After he has eaten six small pieces of fish, he seems satisfied and the plaintive, piping note ceases. Instead, occasionally, a half-smothered, whistling sigh is uttered. This sound is made through the nostrils and sounds like *whew-weeo.*

He settles contentedly down on a bed of dampened leaves. Frequently one of the legs is given a violent shake and lifted high up on the side of the body, the wing then being raised and placed over the foot. Again a leg is stretched out straight behind and held in this position for several minutes.

When placed in a deep tub of water the loon chick swims at once, with very quick, short strokes, alternating with first one, then the other foot. While swimming along, without warning, he pushes his head clear under and looks about beneath him. This is repeated several times during his first ten minutes of aquatic experience.

In the afternoon the loon is given a second swim, this time with a hundred small live fish beneath him. Although he ducks his head several times, he does not see, or at least does not notice, the fish.

August 8.— Chick No. 2 is in difficulty, and I have to roll him out of his shell. When first exposed to the world, every down plume is sheathed in a very fine, hair-like wrapping of tissue, reminding one of the covering of a porcupine or of a week-old kingfisher. In about an hour's time these wrappings begin to split at the tips and at the end of three hours the bird seems covered with tiny, palm-like down, with long, stem-like trunks and fluffy, expanded tips. The chick is very restless and frequently rolls over on his back, regaining his normal position only after a scramble. All this action hastens the unsheathing of the down, the protecting tissue covering the chick with a fine dust, myriads of shreds flying off as one flicks the plumage.

Chick No. 2 preens his feathers before being put into water and this instinctive action aids not a little in ridding the down of the sheaths.

Chick No. 1, now two days old, is strong and apparently in excellent health. He is covered with a short, dense down, sooty brown in color, interspersed with a coat of long, black, filoplume-like down. The lower breast, the belly and the entire under surface of the wings are white. In appearance the down is remarkably like the fur of a beaver or otter, when wet as when dry.

The chick weighs four ounces. The length of the culmen is 14 mm., depth of the two mandibles at the rear edge of nostril, 10 mm.; at tip of mandibles, 4 mm. The length of the body when swimming is about 5 inches, and from the tip of the beak to the back of the head, 50 mm. The great difference between the size of the wing and leg is shown in a comparison of the measurements of the two organs; the wing 30 mm., and the tarsus to end of longest toe, 65 mm.

A typical short down bears a close resemblance to that of a thrush; a thick short calamus, giving rise to sixteen branches, rather thickly set with cilia, an average branch having upwards of two hundred. The longer branches are about 20 mm. in length.

When I partly support the body of the chick, it waddles along very readily over the surface of the table. When its head is suddenly immersed in a tumbler of water, its feet and legs instantly respond, moving so rapidly with simultaneous swimming strokes, that they become almost a blur. The arc of motion is almost at

right angles to the normal position of the legs beneath the body, recalling the condition in *Hesperornis*, where a similar side stroke was necessitated by the angle of the juncture of the femur with the pelvis. When the chick squats, the legs approach each other.

In the course of the morning, chick No. 1 swallows six live killifish, each about 2 inches in length. When the loon is swimming quietly about, I intentionally make a sudden movement overhead, and, like a flash, he leaps forward, head first, and dives, coming up after a few hard strokes. He shows no fear of my hand when moved slowly. In fact by moving my hand along and snapping my fingers, he will follow all over the tank, from end to end and side to side, or in circles, wherever I please to lead.

His hearing is very acute and his vision remarkably keen compared with yesterday.

When violent efforts are being made to escape from the rim of a bowl of water, or when the chick swiftly pursues a fish held in the forceps, the alternating stroke changes to a series of powerful, frog-like strokes, given simultaneously with both feet.

When taken from the water and placed on the pile of dampened leaves, which is my imitation loon's nest, the chick at once begins to preen himself. The first instinctive motions are a twitching of the head around to the sides and back in a way so different from any previous actions that my attention is held at once. After the third or fourth time the loon opens his beak and combs several drops of water from his down. After this he preens swiftly and skilfully until most of the water is shaken or dried from the plumage. After the body is well dried, the tail (or rather the tuft of down representing that organ) is shaken vigorously from side to side and the chick stands erect for a moment, wildly flapping his diminutive wings.

August 9.— Loon chick No. 1, on the third day of his existence, after his first swim this morning, immediately seeks and finds his oil gland, instinctively pressing out a quantity of the oil and rubbing it through the wet down of his breast and sides.

Later he picks up a fish which has dropped from the forceps, seizes it by the tail, and, with successive jerks, passes it through his bill until the head is reached, when he swallows it. There is no hesitation, no vague motion; he knows instinctively that the head must be swallowed first.

On the floor he progresses rapidly by the usual frog-like plunges. Between feeds and sleeps, he spends much of the day in attempting to escape over the six-inch wall of his nest box. By noon, he finds a way to achieve this, crooking his head and neck over a corner and kicking his way over. Wire netting is put over the top and he shows no further desire to get out. He eats ten killifish during the day.

Loon No. 2 seems unwell. His eyes are swollen and partly closed and it is not until noon that I discover the cause to be his brother, who makes most vicious lunges at him, when tired of trying to escape. I bathe the head of the chick with boracic acid and separate the two birds for the night.

August 10.— Both chicks are bright this morning. Number 1 eats seven fish before noon, picking up two himself and swallowing them head-first. Number 2 eats four and picks up one, shifting it as skilfully as his brother. Both preen after bathing and use their oil-glands. Their cries, when hungry, are much louder than yesterday.

There is no doubt about the intermittent feud existing between them. They sleep side by side most of the morning, but at noon when I wake them, they fly at each other like game cocks, rolling over and over in a frenzy of pecking. Both take equal parts in the attack. If not separated they would soon destroy each other's eyes. I do not trust them together again except when under observation.

Most interesting is their response to the loud, rolling cry of a Giant Kingfisher, *Dacelo gigas* (Bodd.), in the Bird House. Other loud cries and calls are audible from time to time, especially the notes of a Seriema and a Crested Screamer, but only the notes of the kingfisher affect the young loons. During all the time that this remarkable sound is in progress, the chicks stand or attempt to rear themselves upright, straining their necks and piping their loudest. By concealing myself and imitating the cry of a loon as closely as possible, I am able always to arouse the young birds and set them piping; but the laughter of the kingfisher never fails to throw them into the greatest fits of excitement. I cannot account for it unless it is that some latent instinct in the young loons is aroused by the similarity of the rolling call of the kingfisher to the wild laughter of the adult loons. There is certainly a close re-

semblance between the two, but that these motherless chicks should recognize it is most unexpected.

August 12.— Loon chick No. 2 this morning, made his first attempts at ducking and washing his head and back. The loud, plaintive chirps which they utter are called forth only by the desire for food, or when the kingfisher is heard, when they become too excited to eat.

August 14.— To-day, when one week old, chick No. 1 has caught two dying fish while they swam slowly through the water beneath him. I have made no attempts to teach them to catch fish, feeding them from forceps while in their nest boxes, so that this is an entirely new achievement for him.

Both birds are moulting hundreds of the long, slender, hair-like down feathers from all parts of the body. None of the multi-branched, typical down has as yet loosened.

August 15.— Each bird has eaten twelve fish to-day, most of which they pursued and caught without help. They take great delight in the water, splashing and washing themselves for an hour at a time.

August 16.— A sudden drop in temperature last night has proved fatal to the young loons, and both are dead this morning, with lungs extremely congested. They are well nourished and otherwise in perfect condition.

Loon No. 1 shows the following measurements. Culmen, 16 mm.; bill and head, 57 mm.; wing, 30 mm.; tarsus and longest toe, 68 mm. This shows an increase of growth in all parts except the wing.

CONCLUSIONS.[1]

A. It is probable that young loons are, from the first, fed on whole, not on macerated or regurgitated fish.

B. The actions of swimming and preening are instinctive.

C. The method of swimming is usually by alternate strokes. These become simultaneous when a sudden spurt or great speed is desired.

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[1] Comparisons are from observations on an adult loon living in the Park last year.

D. The arc of the swimming stroke, in the young chick, is much more lateral than in the adult bird. This is difficult to explain and hard to correlate with the idea that loons and *Hesperornis* are descended from ambulatory species with more typically Avian convergent hind limbs.

E. Loon chicks can progress more easily and rapidly over the ground than can the adults, in spite of the preceding conclusion. Progression, however, is never by walking, but by frog-like leaps.

F. Diving, catching fish and swallowing them head-first are almost congenital instincts, much improved by practice within the first week.

G. There is no instinctive fear in these young birds.

H. It is probable that the young loons instinctively recognize the usual rolling, laughter-like call of the parents, judging from their reaction to the notes of the Giant Kingfisher.

It is interesting to compare these conclusions with several made in connection with Common Terns, *Sterna hirundo* Linn., and Black Skimmers, *Rhynchops nigra* Linn. These were hatched from the egg and reared to maturity in July, 1903, and are now living in the Zoölogical Park.

A. The call, food and alarm notes of Common Terns, Black Skimmers and Laughing Gulls are instinctive; not taught by parents nor learned by imitation. The one positive proof of this would warrant the assertion.

B. The remarkable disparity in the length of the mandibles in the adult Black Skimmer is foreshadowed even in the embryo and in the newly hatched bird.

C. My experience with a dozen terns and gulls showed that these individuals prefer fresh water to salt.

D. There is absolutely no instinctive fear of man or other objects which enter quietly into the environment of the young birds, but a sudden shadow or loud noise causes them to perform certain acts — wholly instinctive — which have for their object an escape from supposed danger. Under such conditions the terns (which are not so protectively colored as the skimmers) take time to run to the darkest corner or shadow before squatting, while the skimmer crouches instantly, and with two or three instinctive flicks of feet and legs, almost buries himself in the sand.

E. The sight of small but entire fish excites the newly hatched skimmer much more than does macerated fish. Terns are not so excited until after the first week.

F. The action of pecking is instinctive to a certain extent, but is acquired very slowly in this way. By imitation it is learned quickly and is performed successfully within a few minutes.

G. Flight is wholly instinctive, the terns learning the use of their wings as soon as the primaries are large enough to support them.

BACHMAN'S WARBLER BREEDING IN LOGAN COUNTY, KENTUCKY.

BY G. C. EMBODY.

BACHMAN'S WARBLER (*Helminthophila bachmani*) first came to my notice April 26, 1905, when two birds, from their song, were mistaken for Worm-eating Warblers. They were feeding in a maple tree situated in a high, dry wood about ten miles northeast of Russellville, Ky., quite an unusual place for *bachmani*, but of the right sort for *vermivorus*.

Although the surrounding country was searched for a likely breeding ground, none was found nor were more warblers seen.

My field work was continued the following spring (1906) and on May 14, I came upon a swamp fairly swarming with warblers, if one were to judge from the great confusion of songs.

These, one by one, disentangled themselves to my ear into the songs of the Cerulean, Parula, Kentucky, Hooded, Black and White, and Blue-winged Warblers and Redstart. But at frequent intervals there were faint trills which in the open might have passed by as coming from the Chipping Sparrow. I counted several of these coming from as many directions and decided that there were Bachman's Warblers about.

The first song was traced to its source only a short distance away