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GROWTH AND DEVELOPMENT OF THE KING RAIL

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GROWTH and development of the King Rail (*Rallus elegans*) from hatching to first flight were studied by observations and measurements of captive birds and by observations of natural nests in the field. This is the fourth in a series of reports on the life history of the King Rail (Meanley 1953, 1956, and 1957). Information in this paper is intended to supplement the data of Bent (1925) on growth and development and the description of juvenal plumage given by Friedmann (1941).

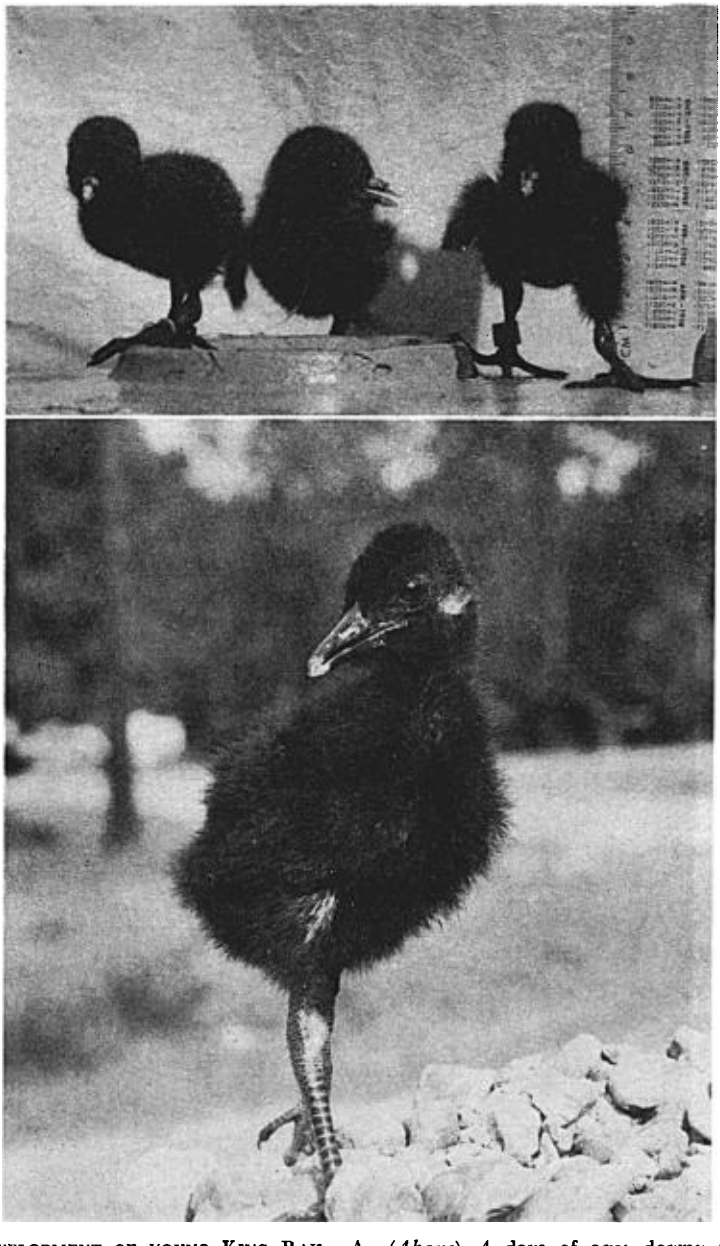
METHODS

In July of 1956, we removed three newly-hatched rail chicks from their natural nest in a Louisiana rice field, planning to rear them in captivity. We were surprised to find that it was not at all difficult to care for the chicks. They fed readily on a variety of foods including chick starter and chick grower mash, rice seed, canned sardines, angle worms, and grasshoppers. In May of 1957, we obtained two more chicks and cared for them as for the first. Three of the chicks lived to flying age and were released in the wild when they were twelve months old. We believe that obtaining the chicks when they were very young and keeping several chicks together were both important factors in our success in rearing them.

As the chicks developed, we weighed and measured them at intervals, as shown in Table 1, and made notes on their behavior and calls. We also studied the behavior of newly hatched chicks in five natural nests we found in the rice fields.

APPEARANCE AND BEHAVIOR OF FIRST-DAY CHICK

The newly hatched King Rail is very weak and wet. Contrary to the statements of Audubon (1835) and Howell (1932), it is unable to run about and follow its parents as soon as it is hatched. Sometimes it



DEVELOPMENT OF YOUNG KING RAIL. A. (*Above*) 4 days of age: downy young showing pied bill and egg tooth. B. (*Below*) 31 days: downy young with juvenal plumage beginning to develop. White auriculars and white feathers on crural tract visible; tip of bill and nares white. Photos by B. and A. G. Meanley.

emerges from the shell on its back, and lies kicking and struggling for some minutes before righting itself. A nest mate may grab its toes or beak and so stimulate further activity. Most of the chicks we observed were more than an hour old before they were able to go over the side of the nest and return. Chicks 15–20 minutes old had considerable difficulty when we placed them in weeds and water outside of their nest and they could not get back into the nest under their own power.

As the down dries out the young bird moves more actively about the nest, the undeveloped wings assisting in this effort. As the rail chick begins to gain strength, it sits on its tarsi and assumes a begging display, with wings extended for balance.

The period of fluffing-out often takes one-half hour or longer. It took four and one-half hours for one of the chicks we observed. The fluffing-out process may be necessary to produce buoyancy needed to enter the water safely, as Gullion (1954) suggested for the Coot (*Fulica americana*).

Chicks took food from their parents' beaks the first day but we did not see them picking up food from the ground until the second day.

The day-old chick has at least two calls: a loud begging call, *chee-up;* and a soft lower pitched call of contentment, *wee* and *wee-up.*

The young bird loses weight throughout the first day of life. One female chick weighed 16.3 grams at hatching, 16.0 grams at one hour, 15.7 grams at two hours, and 13.2 grams at 24 hours. The day-old rail is covered with black down that has a faint greenish sheen or cast except in areas where it is thickest. The down is very dense on the abdomen and sparse on the crown. The bill has a pied pattern: the basal half is grayish black, the narial region is white, the distal portion is flesh-colored, and the egg tooth at the tip is white. The egg tooth is lost between the fourth and sixth day. Legs and feet are brownish-gray in color, although at a quick glance they appear black. A vestigal claw is present.

One to Thirty Days

During the first month of life the major change in the appearance of the King Rail chick is one of size and conformation (Plate 18 A and B). A young captive male weighed 16.7 grams when he was one and a half days old and 96.3 grams when he was a month old. His measurements, at one and a half and 30 days respectively were: Exposed culmen, 11.0 and 28.0 mm.; tarsus, 20.0 and 42.0 mm.; middle toe with claw, 22.0 and 50.0 mm.

The thick natal down remains throughout the period; but during

TABLE 1

GROWTH OF YOUNG KING RAILS

Age	*Bird*	*Weight (grams)*	*Exposed Culmen (mm.)*	*Middle Toe with Claw (mm.)*	*Tarsus (mm.)*
Hatching	A	16.3 (wet)			
1 hr.	A	16.0			
2 hr.	A	15.7			
1 day	A	13.2	11.0	20.0	20.0
1 day	B	15.6			
1½	C	16.7	11.0	22.0	20.0
1½	D	15.6			
7 da.	B	18.9			
7 da.	B	18.9			
7–8 da.	C	25.7			
7–8 da.	D	19.7			
8 da.	A	14.0	12.5	26.0	21.5
17	B	37.0	20.0		
17–18	C	46.5	21.0	36.0	32.0
17–18	D	32.0			
21 da.	A	40.0	19.5	36.0	29.0
21 da.	B	50.7			
21 da.	C	63.8			
21 da.	D	47.7			
1 month	B	75.4	25.0	42.5	38.5
1 month	C	96.3	28.0	50.0	42.0
1 month	D	70.8	25.0	43.0	36.5
1½ mo.	A				
1½ mo.	B	177.9	40.0	49.0	52.0
1½ mo.	C	219.8	40.0	61.0	56.0
1½ mo.	D	176.0			
2 mo.	A	202.0	40.0	57.0	53.0
2 mo.	B				
2 mo.	C	327.0	48.0	61.0	58.0
2 mo.	D	258.6			
3 mo.	A	265.0	49.0	57.0	53.0

the fourth week there is evidence of development of the juvenal plumage.

Toward the end of the first month the young rail begins walking more deliberately and assumes the gait of the adult bird. When it is seeking food intently, it also tips its tail in typical adult fashion. Tail tipping was observed in one two-week-old individual.

Month-old King Rails have at least four calls: (1) *seep-seep-seep-* (repeated). This call indicates general satisfaction and, particularly,

acknowledges the presence of others and notifies them of its presence; (2) *tah-eee! tah-eee!* (repeated), very high pitched, and progressively lower in volume as sleep approaches. This call indicates relaxed comfort and sleepiness. (3) *soo, tsoo* (tsŏo) indicates lonely dissatisfaction. (4) *keelp-keelp-keelp-*, a series of five or six hoarse notes in rapid sequence, expresses protest.

THIRTY TO SIXTY DAYS

The second month is the period of most dynamic plumage development—the juvenile body plumage replaces the natal down (Plate 19, C and D). The first juvenal feathers may be obscured by down until the young rail is nearly a month old. By the *seventh* or *eighth week,* development of virtually all body feathers is complete. The plumage of four captive rail chicks developed at about the same rate through the first six weeks, but thereafter there was considerable variation.

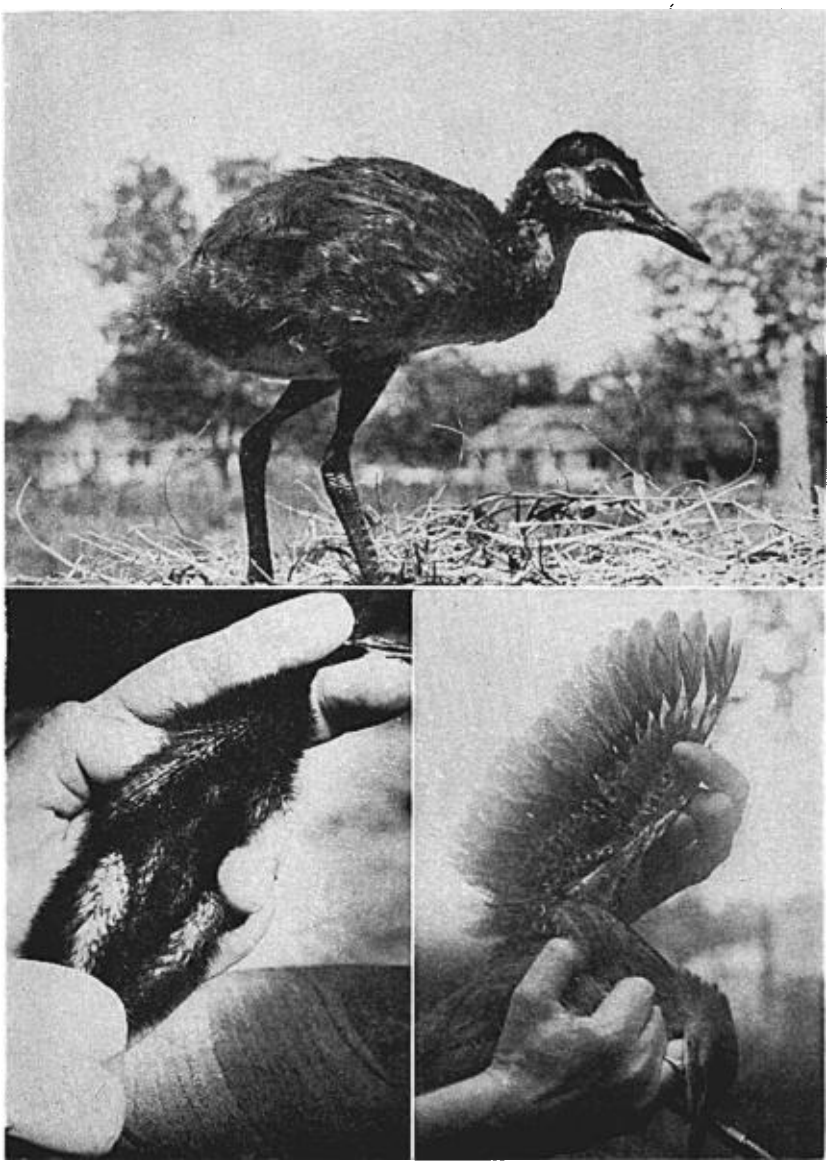
The first evidence of a change from the natal down plumage is the appearance of white auricular tufts and pale juvenal feathers on the underparts and flanks. Feather development in these areas during the *fourth week* is as follows:

(1) The sternal region of the ventral tract: The pinfeathers in this area are pale buffy brown, and are tipped with natal down that is being pushed out.
(2) The crural tract: Pinfeathers are whitish with black down at tips.
(3) Femoral tract: Feathers are approximately the same color as those of ventral tract.

By the latter part of the *fifth week* the juvenal plumage is developing in all body areas of most young rails. Feathering of the crown and back of the neck may begin slightly later in some individuals. The abdominal and axillary regions, the chin and upper throat are whitish and contrast rather sharply with the dusky upper parts, particularly the lower back and rump. The dark brown feathers of the upper back and humeral tract are well advanced. The feathers of the cervical region (lower throat) are approaching cinnamon in color. Feathers of the sternal region and femoral tract are faintly barred. The upper and undertail coverts are making their appearance and the anal circlet is surrounded by short white feathers.

Quills began to appear the *latter part of the fifth week* on the wings and tail of two of four captive birds. The primary and secondary coverts develop faster than the primaries and secondaries. The lining of the wing develops last.

By the *sixth week* the side of the head is whitish, faintly washed with



DEVELOPMENT OF YOUNG KING RAIL. (*Above*) C. 50 days: young with juvenal plumage nearly complete. Tail and wings are undeveloped. This individual is slightly behind the average for this age. (*Below, left*) D. 31 days: ventral view showing development of white juvenal plumage on ventral feather tract. (*Below, right*) E. 62 days: development of remiges nearly complete. Can make short flights. Photos by B. and A. G. Meanley.

gray, and a white superciliary stripe is beginning to appear. The legs and bill now approach a flesh color, and the distal half of the bill is darker than the proximal part.

By the *seventh* or *eighth week,* the juvenal body plumage is almost complete and the young King Rail has a more brownish and less dusky appearance. The cinnamon coloring of the lower throat and breast approach that of the adult. The juvenal feathering of the crown and nape is complete in most young birds of this age. The flight feathers and tail are well advanced on most birds.

There may be considerable variation in the weight and size of young rails during the second month of development. At two months of age, a captive male and two captive females weighed 327.0, 258.6, and 202.0 grams respectively. For comparison the weight of a live wild adult male was 339.9 grams; and the weights of three freshly killed wild adult females were 364.5, 325.0 and 305.0 grams.

Call notes of young rails remain essentially the same during the second month of life as they were during the first month, but the voice becomes a little hoarser and deeper. During the second month the young rail frequently exercises by jumping up and down, flapping its wings at the same time.

DEVELOPMENT AFTER 60 DAYS

The development of the juvenal plumage is nearly complete by the age of *60 days.* Molt of the juvenal plumage occurred in the fall, when most of the birds were *four to six months* old. Captive rails hatched in early May and those hatched in early July all began the post-juvenal body molt in late October and early November.

The beginning of flight seems to coincide with the completion of juvenal plumage development (Plate 19, E). Two of the three captive rails began to fly at *nine weeks,* the third at *eleven weeks.*

The begging display still may be observed occasionally during the *ninth* and *tenth weeks* but it soon disappears.

A considerable change in calls occurs during the *ninth* and *tenth weeks.* Some of them now approximate the calls of the adults. The call most like that of an adult bird is a raucous crying squawk or catlike "meow." This call is made when the bird is separated from the family group or is excited. The typical *jupe-jupe-jupe* call of the adult was not heard until about the *fifth month.*

SUMMARY

Information about the growth and development of the King Rail from hatching until first flight was obtained from five birds reared in captivity. The newly hatched rail chick is weak and wet, and is at

least one-half hour old and dried out before it is able to go over the side of its nest. It loses weight during the first day. Two different calls were given by the day-old chick.

During the first month of life the major change in the appearance of the King Rail is one of size and conformation. Four different calls were recorded for month-old King Rails.

The period from thirty to sixty days is the one of most dynamic plumage development—the juvenal body plumage replaces the natal down. Juvenal plumage first appears with the white auricular tufts and on the underparts and flanks. The crown and nape are the last areas to attain juvenal plumage.

The beginning of flight seems to coincide with the completion of juvenal plumage development. Three of four captive rails began to fly at nine weeks, the fourth at eleven weeks.

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LITERATURE CITED

AUDUBON, J. J. 1835. Ornithological Biography. (Edinburgh, Adam and Charles Black), Vol. III, 631 pp.

BENT, A. C. 1925. Life Histories of North American Marsh Birds. U. S. Natl. Mus. Bull. **135**: 1-490.

FRIEDMANN, H. 1941. The Birds of North and Middle America, Part 9. U. S. Natl. Mus. Bull. **50**: 1-254.

GULLION, G. W. 1954. The Reproductive Cycle of American Coots in California. Auk, **71**: 366-412.

HOWELL, A. H. 1932. Florida Bird Life. (New York, Coward-McCann, Inc.), 579 pp.

MEANLEY, B. 1953. Nesting of the King Rail in the Arkansas Rice Fields. Auk, **70**: 261-269.

MEANLEY, B. 1956. Food Habits of the King Rail in the Arkansas Rice Fields. Auk, **73**: 252-258.

MEANLEY, B. 1957. Notes on the Courtship Behavior of the King Rail. Auk, **74**: 434-440.

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