

SOME EXPERIENCES IN IMPRINTING DUCKLINGS

By MARGARET MORSE NICE

The rapid learning of the characters of the parent, which occurs during the first hours of life in some precocial birds, has been called imprinting (*Prägung*) by Lorenz (1935:163ff; 1937). He quotes Heinroth's (1911) statement that the newly-hatched Grey Goose (*Anser anser*) adopts as its parent the first living being it sets eyes upon, but that incubator-hatched ducklings flee at their first sight of man. Lorenz (1949) describes this phenomenon with the Grey Goose. He succeeded in imprinting a brood of Mallards (*Anas platyrhynchos*) by constantly quacking (1935:180) and led them by crawling on all fours (1952:42).

The detailed, carefully controlled experiments of Fabricius (1951*a*, 1951*b*) showed that ducklings could be imprinted much more simply than Lorenz believed. He imprinted Tufted Ducks (*Aythya fuligula*) to older ducklings of Shovellers (*Anas clypeata*) and Eider Ducks (*Somateria mollissima*). He also imprinted all three species to himself, either by sitting silently and stretching out his hand toward them or moving away from them, or, with Tufted Ducks, by simply saying *kom kom kom* while invisible to them. Newly-hatched Mallards followed him in response to this call (1951*b*:376-377). "Though rhythmically somewhat resembling the call of the female mallard, conducting its young, my call was by no means an exact imitation of a mallard's quacking." "Monosyllabic verbs other than 'kom,' when uttered in rapid succession, also released the action" in Tufted Ducks.

In 1951 my daughter Constance and I spent June at the Delta Waterfowl Research Station at Delta, Manitoba, watching the behavior of eight species of ducks and of other precocial birds for the first hours after hatching. Fabricius' papers were not then available to us. We took pipped eggs from the incubator, put them into a duck nest in a basin on a table, and watched. The first living beings that the birds saw were us and various precocial birds—ducklings a few hours old, Coots (*Fulica americana*), and Franklin Gulls (*Larus franklini*) a few hours to a few days old. Sometimes I held a duckling in one hand while I sketched it. We kept the hatchlings in the warm incubator room from two to eight hours, then returned them to the hatching tray. The next morning they showed no special bond to us, nor to the Coots (smaller than they), nor to the gulls (of about the same size). One of these ducklings, a Mallard of 6½ hours, followed us for six feet; we did not test it later, nor did we test any of the others. Our first subjects were Pintails (*Anas acuta*) and they seemed to be partially imprinted on us; we watched them for eight hours the first day they were moved into a brooder and two hours the next, but with no good results for them, for they spent their energies trying to jump out to us instead of settling down to the business of learning to eat. So we kept away: they forgot us and thrived.

I asked Dr. Fabricius why our birds had not become imprinted to us. He suggested that we had not released their following reaction by calling and walking slowly away from them and that we had not conducted them. In June of 1952, I was again at Delta and made definite efforts to imprint the ducklings which I watched. I am greatly indebted to Eric Fabricius for his invaluable advice, and to Albert Hochbaum, Director of the Delta Waterfowl Research Station, and to Peter Ward, Superintendent of the Hatchery, for the opportunity to prosecute the study and for their generous assistance in every detail.

THE EXPERIMENTS

Six Shovellers hatched on June 11, 1952. At 3 p.m. I took two ducklings, A and B, from the incubator; they were dry, but not yet standing on their feet; I estimated their ages as between 6 and 10

hours. I put them in the duck nest in a basin and covered them with my hand. I said *kom kom kom* many times, then slowly withdrew my hand, but they remained motionless. After seven minutes they started climbing out of the nest, *coming straight towards me*. I cuddled them in my hand. I then took them out of doors and slowly walked away, calling *kom kom kom*. *They scrambled after me*. I marked them and returned them to the hatching tray.

I took two piped eggs out of the incubator. C hatched at 4:29. It kept its eyes shut for most of the first hour as it burrowed in the down of the nest. At 5:34 it rose on its tarsi, opened its eyes and stretched its mandibles. I said *kom kom kom*. It said *wheat wheat wheat* and gave a little bow in greeting. I covered it with my hand and it gave conversational notes. It preened and moved about, giving contented notes, while I answered with *kom kom kom*. At 5:45 it stood up and greeted me. At 7:25 it stood up and "cried," *i.e.* gave the distress call, but was quiet when I said *kom kom kom*. At 7:29 it *crept towards me*.

D hatched at 6:03. At 7:33 it cried, but stopped when I said *kom kom kom*. It then *tried to crawl towards me*.

The Redhead (*Aythya americana*) hatched in the incubator the same day. I took it out that afternoon several times, put it in the nest and said *kom kom kom* to it, but did not try to get it to come to me.

On June 12, at 7:30 a.m., I took out the four imprinted Shovellers (A-D), and two others (E and F) that had hatched in the night, and put them in the nest. B and D cried, but stopped at *kom kom kom*. All nibbled my fingers and my arm. I returned them to the hatching tray.

At 9:30 I found that these six and the Redhead had been moved into a brooder out in the brooder room. All came toward me instead of hurrying in the opposite direction as did all the other sets of ducklings. All gave conversational notes, the Shovellers bowing in greeting. A six-day-old Shoveller, T, had been added to the group as a teacher to start them off eating and drinking. It seemed a little nervous, but stayed with the imprinted ducklings.

On June 12, at 1:43 p.m., the Mallard hatched in the same duck nest and proved vigorous and lively. At 1:46 I said *kom kom kom* and held my hand over it; it nibbled my fingers. At 1:52 it called, but stopped when I said *kom kom kom*. It burrowed under my hand. At 4:43 I put it on the shelf; *it crawled to me with conversational notes* and nibbled my fingers. I watched it all afternoon, but did not try to get it to follow. The next morning I had it out on the shelf for a while, marked it and returned it to the tray.

On June 13, at 6 a.m., all the Shovellers came to my call; all bowed and talked; all ate out of my hand, as did the Redhead. I took C and D, put them on the floor and backed away, saying *kom kom kom*; they paddled after me. Then I took out F and the Redhead; they cried a little bit, but followed at my heels. I took out A alone and he hurried after me.

The following morning at five, I went into the brooder room and as an experiment said *kom kom kom* to a brooder into which a set of new ducklings had been put the previous evening; out from under the curtain came one duckling. I picked it up and found it was the Mallard. I had not seen it since early on the 13th, although it had probably seen me as I opened the incubator door as I worked with Coots. I took it on a little walk and it followed closely, crying loudly when I returned it to the brooder. Ten minutes later it was still crying. I came quietly to the brooder; it at once changed to the conversational notes, peeping contentedly. I took it up and cuddled it, then hurried away, followed by loud cries of distress.

At 11:00 several of us took the Shovellers, Redhead, and Mallard into the laboratory. The whole set came running to Margaret Hickey's *kom kom kom* and followed her when she moved. They followed the men just as readily, but did not respond to their *kom kom kom*. The Mallard was always in the lead, followed by the small Shovellers in single file, then the Redhead, and finally the older Shoveller. We put the Mallard in a pail and it cried loudly, but the others paid no attention. They followed us just as well without the Mallard, so they had not been following it, but us. I put the Mallard into the brooder with the Shovellers and Redhead and it appeared content.

On June 15 the group again followed two of us closely, the Mallard in the lead, as before. When we sat down, they settled down near our feet. On the 17th I took out two of the Shovellers and they behaved as before. They showed no anxiety for the rest of the group, as did Lorenz's (1935:374) brood of Mallards. On the next day the birds were put into a large pen with a chance to swim. I

called them; the Shovellers bowed and bowed while the Mallard and Redhead seemed a little less confident. I took two Shovellers into the laboratory; they followed us as usual. On the 22nd I called *kom kom kom* and all of the birds came out of the brooder, the Shovellers bowing. I took two out and conducted them up the hill and back; they were excited to be outdoors and were a little difficult to catch on our return. The next day I took out three and conducted them with three Gadwalls. This was the last day I took them out. On July 1 I called *kom kom kom* to them, but received no response.

On June 19 I watched three Gadwalls (*Anas strepera*) hatch from 2:32 to 3:05 p.m., saying *kom kom kom* to them and cuddling them in my hand. At 5:10 all scrambled out of the nest in my direction. In the evening I took them out of the incubator and again said *kom kom kom*. In contrast with all the other ducklings we had watched, I kept these three with my group of coots and gulls. The next day at 2:30 the ducklings were very restless, as if ready to follow their mother from the nest. I took them and the coots and gulls outdoors and all followed at my heels. At 4:30 they were again restless and I took them on a walk of over 100 yards; on our return they settled down contentedly to eat, drink, and rest. From the 21st to 26th they followed me well, but after that they had no opportunity until July 1st and 4th, on neither of which dates did they respond to my calls nor to my walking away from them.

Of two Wood Ducks (*Aix sponsa*), A hatched on June 20 at 8:15 p.m. As it was alone in the nest, I held it in my hand a good deal, saying *kom kom kom* at intervals. At 8:55 it tried to climb out to me; at 9:05 it tried to jump out and again at 9:45 and 10:11. At 10:20 it succeeded and went to sleep in my hand. B hatched at 10:01 and spent its first hour sleeping. I made no attempt to imprint it and left the hatchery at 11:00, leaving both ducklings in the incubator. The next morning A came straight to me, while B retreated. I put both in the duck nest where B settled down beside a gull, but A came right out to me, twittered to me, climbed onto my arm and into my hand. I tried to get it to eat, but with small success. It followed me with the Gadwalls early in the afternoon. By 4:30 it was so determined to jump out to me that I took all the birds on a longer walk. The next day it followed me up the hill and back trailing after the Shovellers, but in the hatchery its one aim was to get to me, so I put it in the brooder in the brooder room with B and other new ducklings. It would not eat, however, and did not survive.

DISCUSSION

The experiences with the 12 recently-hatched ducklings are summarized in table 1. Seven of them were watched as they hatched, while the others were first seen when dry, perhaps five to ten hours old. Thus, they all fell within the most favorable period for imprinting—the first 12 hours (Fabricius, 1951a:65). All were exposed to acoustic signals and nine were deliberately stimulated by the moving of my hand. Shovellers A and B came toward me seven minutes after the experiment started. The seven that hatched under my eyes came to me as soon as they could crawl—from the age of 1½ to 3 hours.

Fabricius (1951a:163) found a combination of visual and acoustics signals the most effective means of imprinting the ducklings; "the releasing effect was enhanced when they interacted by *heterogeneous summation* (Tinbergen, *op. cit.*)." He experimented with visual signals alone, sitting in silence before his subjects, moving his hand away from them, then walking away; three Tufted Ducks aged 4 to 6 hours, two eiders of 6 to 12 hours and five Shovellers of like age all followed him. He also imprinted three Tufted Ducks 24 to 48 hours old by saying *kom kom kom* while invisible to them (1951a:36). (In his later paper he speaks of these as "new-born" (1951b:377) but he writes me that he used this word in the sense of "inexperienced.") He concludes that "At least in the tufted duck, the shoveller, and the mallard, the acoustic stimuli seemed to have a stronger releasing effect than the optical ones" (1951a:163).

In 1951 several Pintails and one Mallard studied by me seem to have been imprinted with visual stimuli only. In 1952 nine of the ducklings were deliberately imprinted with acoustic and visual signals, the other three incidentally with acoustic signals. None of the three came to me until 5 to 14 hours after first exposure to a human being, but F and the Redhead followed me on their first test with no example from companions.

Why did the six-day-old Shoveller T follow us? When first seen by me it was long past the age for imprinting, yet it followed after the other ducklings, always at the end of the procession. It must have been "tame" to begin with and the bond to the other birds was strong enough to carry it along with them, a matter of social contagion.

Social contagion had no influence in one of Fabricius' experiments (1951a:72) with five Tufted Ducks a few hours after their imprinting, and in two that had accepted no parent-companion. Of these, four were imprinted on an eider, and one ("43") on him-

Table 1
Imprinting of Twelve Ducklings at Delta in 1952

Duckling	Age when first seen	I moved hand away	Age when it came to me	Age when first conducted
Shoveller A	6-10 hrs.?	x	6-10 hrs.?	6-10 hrs.?
B	6-10?	x	6-10?	6-10?
C	Hatching	x	3	37
D	Hatching	x	1½	35
E	7?		12?	60?
F	7?		12?	30?
Redhead	5?		20?	40?
Mallard	Hatching	x	3	39
Gadwall A	Hatching	x	2½	24
B	Hatching	x	2	24
C	Hatching	x	2	24
Wood Duck A	Hatching	x	2	18

self. He put the ducklings together in a cage and all swam close together until the eider was introduced into the neighboring cage, whereupon its four "children" swam to it. It was removed and Fabricius showed himself; "43" at once swam to him, while all the others tried to escape.

With Fabricius' birds there was no personal recognition of the care-taker so far as optical stimuli were concerned, but no one could successfully imitate his *kom kom kom*. Our birds followed any man or woman—our costumes were much alike—who moved away from them. As to *kom kom kom*, they responded to Mrs. Hickey's version as well as to mine, but not to that of any man.

The Shovellers followed us until 12 days of age, the Gadwalls until 7 days. At this time five days elapsed without observation, and when I later tried to induce the birds to follow me by calling or by moving away from them, they failed to respond. The fact that they saw people all day long who did nothing to release following-reactions might well have nullified the early conditioning to regard human being as parent-companions.

Fabricius spent far more time with his ducklings than did I with mine; he cared for them entirely himself and conducted them every day on land and in water. Also, many of his birds were lost through a storm and it is natural that the few survivors would be more attached to their parent than were my ducklings that were surrounded with avian companions. He first noticed a decrease in the following reaction "in the eiders at 26, in the tufted ducks at 20, and in the shovellers at 23 days of age" (1951a:165). Tufted Duck "43" and an eider were given to a zoo at the ages of 4 and 7½ weeks, respectively. When Fabricius visited them 2½ weeks later and again 5 weeks after this, and called *kom kom kom*, both birds greeted him emphatically and tried to follow him (1951a:82). In 1952 the conditions of his experiments in imprinting to models were somewhat similar to mine. He writes me: "if our ducklings were not allowed to follow the model for at least about 15 minutes every day, they very soon 'forgot' the following."

When I wrote to Dr. Fabricius about imprinting ducklings I said I doubted whether

I should attempt it since I would not be able to care for them myself as he had done. He answered: "I think there is no danger in making ducklings imprinted, for if there are many sisters together, they will begin to eat and grow up very well even if the 'parent-companion' is absent." This was clear from his experiments in 1951 with imprinting ducklings to models. The one unfortunate experience in my imprinting in 1952 was with the Wood Duck. If I had kept both birds in my flock, or if I had put A right away in the brooder with B and other ducklings their age, although not their species, it is possible A might have survived. Wood Ducks hatched in captivity are often difficult to get started unless there is a good number of them. This species has a lonely call, differing from that of any other duckling I have heard; it is a kind of twitter. A was hatched alone and remained alone two hours; then B hatched, but B merely slept and scarcely functioned as a companion. The next morning A showed little interest in the two-day-old Gadwalls or in the small coots and gulls, and the following day there seemed no bond at all. It had a fixation on me; it would not eat and died when three days old.

The Mallard was left in the hatching tray longer than usual—some 30 hours—before it was transferred to a brooder with other small ducklings. It probably would have adjusted here successfully if I had not happened by early the next morning with *kom kom kom*; it might well have done so if left alone after that. At any rate, the experience at 11:00 with the Shovellers and Redhead was sufficient to form a bond with these ducklings so there was no more crying after the parent-companion.

My attempts at imprinting were incidental to my general study of behavior of newly hatched precocial birds and are in no sense an investigation of the underlying factors, as are Fabricius' intensive studies. The aim of this paper has been to show the ease with which imprinting can be achieved in ducklings with Fabricius' simple technique and also to point out some of its dangers. In most behavior studies it is an advantage to have one's subjects tame rather than wild. Yet imprinting involves a serious responsibility, if there is not a group of young birds to offer companionship to one another. Also, if ducks are being raised for later release, they should not become attached to people.

SUMMARY

In studies of newly-hatched ducklings in 1951 almost no imprinting occurred. In 1952, by using Fabricius' simple technique, 12 ducklings of five species were imprinted on human beings as their parent-companions at hatching or shortly after hatching through acoustic signals (the call of *kom kom kom*) and through visual signals (movement of the hand or of the whole person away from the subject).

LITERATURE CITED

- Fabricius, E.
 1951a. Zur Ethologie junger Anatiden. Acta Zoologica Fennica, 68:1-175.
 1951b. Some experiments on imprinting phenomena in ducks. Proc. Xth Int. Orn. Cong. :375-379.
- Heinroth, O.
 1911. Beiträge zur Biologie, namentlich Ethologie und Psychologie der Anatiden. Verh. V. Intern. Ornith. Kongresses, Berlin, 1910:589-702.
- Lorenz, K.
 1935. Der Kumpan in der Umwelt des Vogels. Jour. Ornith., 83:137-213; 289-413.
 1937. The Companion in the Bird's World. Auk, 54:245-273.
 1949. Er redete mit dem Vieh, den Vögeln und den Fischen. Vienna.
 1952. King Solomon's Ring. New York.
- Tinbergen, N.
 1948. Social releasers and the experimental method required for their study. Wilson Bulletin, 60:6-51.

Chicago, Illinois, August 22, 1952.