



Plate I. A family of Torrent Ducks, *Merganetta armata*, pauses in the sun (*above*) and navigates the rapids of the Rio El Ternero (*below*).





A STUDY OF NESTING TORRENT DUCKS IN THE ANDES

by

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Photographs by the author

September heralds the advent of spring in the Rio Negro Province of western Argentina. Here, in September, the peaks of the Andes, rising to only about 6,000 feet, are still white with snow as are the pine and beech covered slopes and valleys and the scrubby, treeless windswept plains that lie between the rugged cordilleras. Immediately to the west, the Cerro Nevada forms the boundary between Chile and Argentina; to the south, lies Patagonia; to the north, about 80 miles distant, is Lake Nahuel Huapi with its alpine resort of Bariloche; and to the east, just over the bare mountains, stretch the pampas. El Bolson is the principal town in the extreme western part of Rio Negro Province.

In September 1968, Marvin Cecil and I came to an area near El Bolson to search for Torrent Ducks (*Merganetta armata*): he, to take eggs back to Florida to hatch them at the Caribbean Gardens in Naples; I, to photograph the birds. We searched mainly along the Rio El Ternero, a very fast moving stream, about 18 miles in length, on the western divide of the Andes. I tramped along it and camped beside it from September to mid-November, observing and photographing Torrent Ducks (Figures 1 and 2).

The Torrent Duck lives along the rapid mountain streams of the Andes from Venezuela to Tierra del Fuego. Only slightly larger than the Blue-winged Teal (*Anas discors*), the Torrent Duck possesses a number of unusual features that set it apart from all the others. The slender narrow body undoubtedly allows the bird to move underwater against strong currents with ease. A long tail with stiff rectrices aids its propulsion through the water. A narrow, flexible, almost rubber-like bill enables it to feed among the crevices of submerged rocks. There is a pronounced sexual dimorphism—a difference in the appearance of the sexes. The larger male has a boldly marked plumage. The head and neck are white with several black stripes (see Plate I); the upper back is white fading into black and white streaking; and the underparts are dark brown streaked with black. The blue wings possess a bright green speculum margined above and below with white. The bill is bright red; the legs a duller red. In contrast, the female is uniformly gray above and rich brown below.

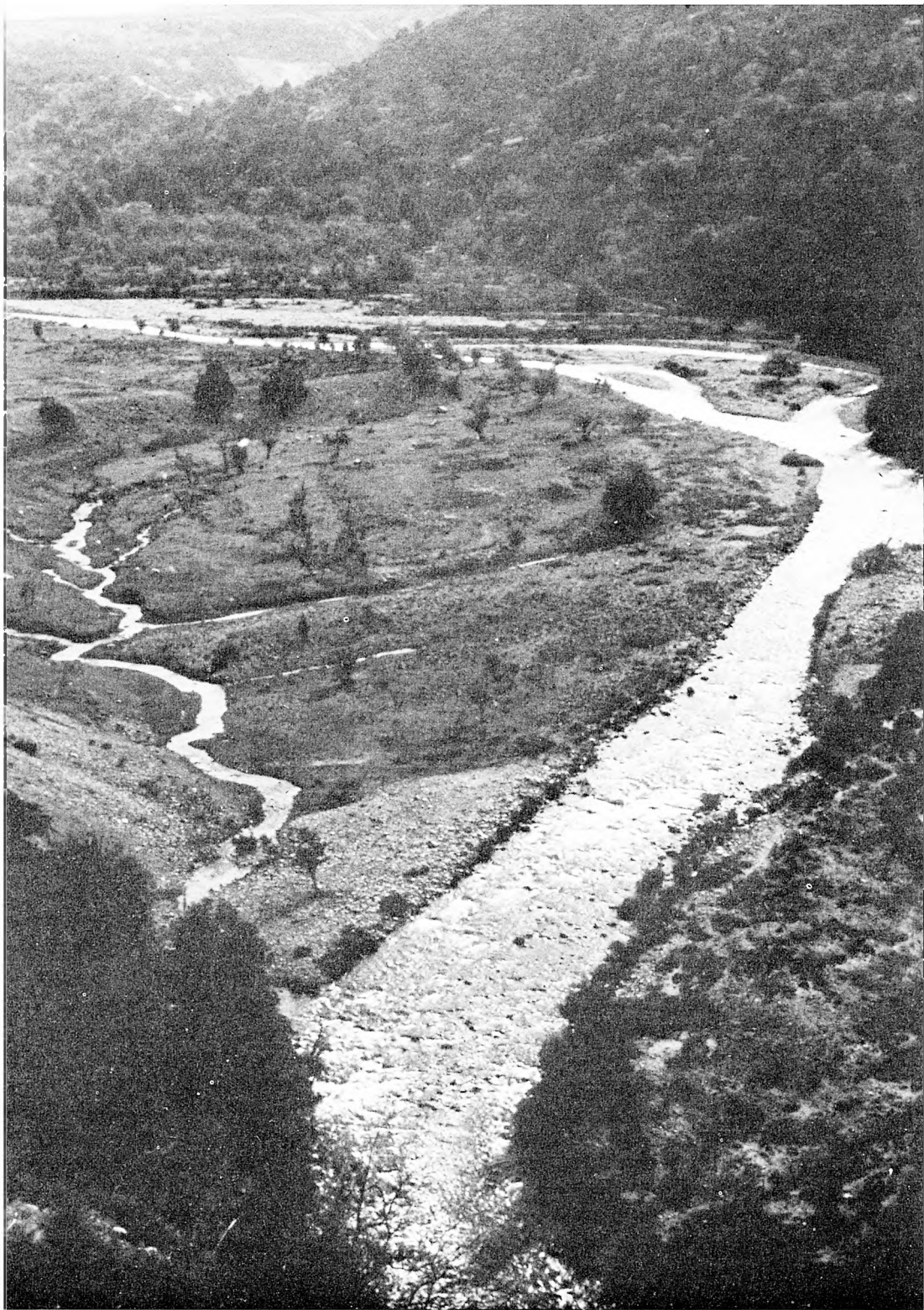


Figure 1. The Rio El Ternero, with its rushing waters, comprises a typical habitat for the Torrent Duck. Here, in Rio Negro Province, Argentina, pines and beech cover the mountain slopes and valleys, intermingled with treeless, scrubby plains between the rugged cordilleras.

Opinions differ about the taxonomic position of the Torrent Ducks. This species, with its six geographical races, warrants a separate taxonomic grouping according to Woolfenden (1961) who maintains that taxonomists should place it in a separate tribe. Others (Delacour, 1954; Niethammer, 1952) regard the Torrent Duck as an aberrant bird with clear affinities to the tribe of ducks that includes teal, pintails, mallards, and many others. Johnsgard (1966), on the other hand, believes that it might well be a member of the perching duck tribe (Cairinini).

Regardless of its relationships with other ducks, the Torrent Duck features a highly specialized way of living in its extremely restricted environment.

Few nests of these shy birds have been recorded. Johnson (1965) lists only four verified nests, two in Chile and two in Colombia. The most recent, in 1960, he discovered himself. Furthermore, no one has ever kept a Torrent Duck alive for any length of time outside its habitat. Peter Scott had one at the Wildfowl Trust the longest, I believe. He wrote me in April 1969: "We had a male Peruvian Torrent Duck here for about five months. He remained terribly wild and never really recovered the waterproofing of his feathers. Alas, he died last week." Marvin Cecil hoped to rear the young in Florida.

Our first job was to find a nest. For a month prior to our arrival in the El Ternero River area, a taxidermist, Andor Kovacs, and four of his sons, all guides and collectors, had been engaged to scout the rivers around El Bolson, where Torrent Ducks frequently occur.

On the first day after our arrival at El Bolson, the Kovacses took us to a lumber camp on the El Ternero, belonging to Senor Drago Milinkovic. He led us to a place a quarter of a mile upstream where the river, only 20 or 30 feet across, entered a gorge and raced in a fury of white water amid boulders and rocks, showing that its name, meaning the Young Bull, is most appropriate. From a steep bank a large, thick-trunked coihué tree (*Nothofagus dombeyi*) leaned out over the river. Andor Kovacs pointed to two cavities on the underside of the trunk, right over and about 15 feet above the surface of the water. He told us that there might be a nest in one of the cavities (Figure 3). After a struggle, Marvin Cecil roped himself up to one of the holes and found inside four eggs covered with down. We were elated, and yet we could not be sure it was the nest of a Torrent Duck. There was the possibility that the nest was occupied by a pair of Ringed Kingfishers (*Ceryle torquata*) because these two supposedly exchange nest burrows at times (Johnson, 1965). We had seen the beautiful kingfisher on our climb up the stream; we had not yet seen a Torrent Duck.

We returned to the lumber camp and set off again almost immediately in a drizzle to scout another possible nest three miles downstream. The drizzle soon turned to rain. We had only one fleeting glimpse of a Torrent Duck which, alerted by our presence, left his perch on a rock and floated off down the fast flowing river. The alleged nest site, a cavity in a coihué tree, was empty. An *asado*, beef grilled over log embers, in a coihué grove was the only respite in the long arduous trip back.

While the others hunted for nests, I spent the next few days, camera in hand, fruitlessly chasing after Torrent Ducks along the El Ternero. In covering some three miles of river during the course of a day, I usually sighted these

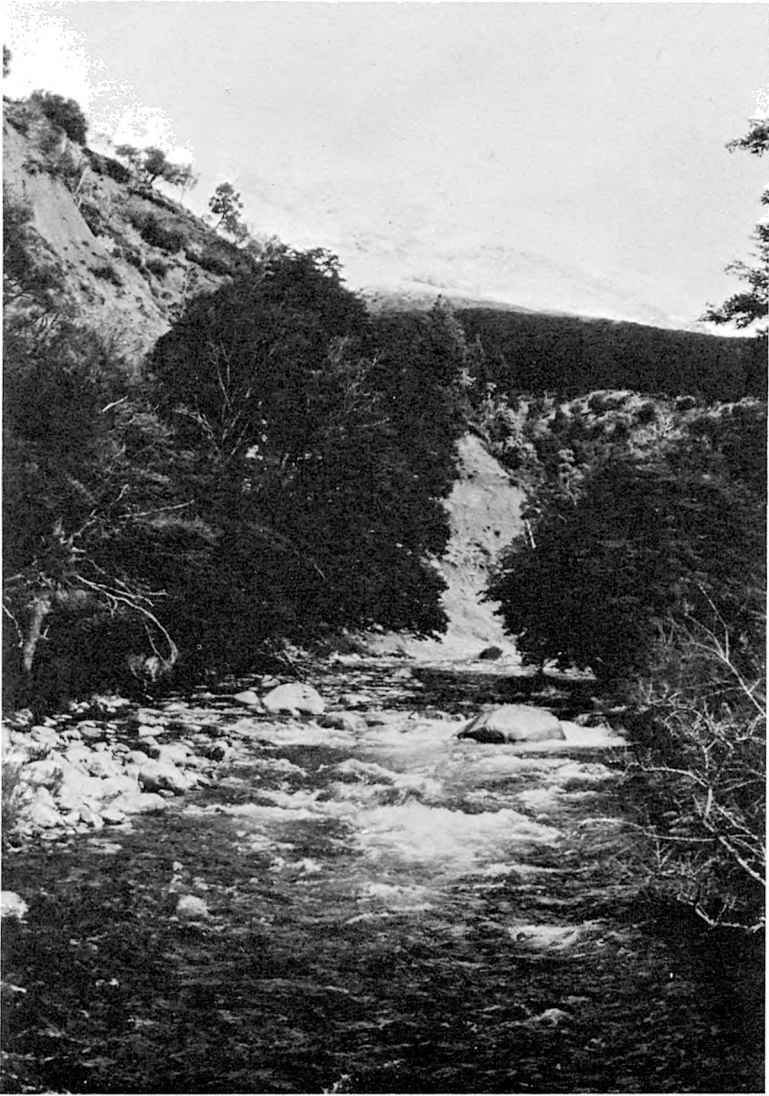


Figure 2. The Rio El Ternerero, site of the study of the Torrent Duck. The waters here run off the slopes of the Andes, still covered with snow in September at 6,000 feet.

wary birds about a dozen times and then only through binoculars at a distance. My best view occurred when I spotted a male moving upstream toward me, feeding mostly along the sides of the river where the water ran less swiftly. In half an hour of diving and surfacing he advanced about 100 yards. He spent an average of about seven seconds underwater and about half as much time on the surface.

Meanwhile the news that the Kovacses had located another nest far downstream led me to concentrate on hunting and forget the camera for the time being. Having noticed several boulders in a certain part of the river regularly favored by one pair of Torrent Ducks, I decided to map that portion of the

river and record each sighting of them. Using the sun as a compass and a camera range finder as a measuring rod, I made a reasonably accurate map of what appeared to be the pair's territory. I numbered all the boulders, shoals, overhanging trees, and other landmarks, and whenever I saw one of the pair in a particular spot, I noted the location and time and the direction in which it left or arrived at the spot.

My notes soon showed that their territory included about six-tenths of a mile of river where it flowed at an average rate of six feet per second. The

Figure 3. Locating a Torrent Duck nest in the cavity of a coihué tree beside the El Ternerero. This one contained four down-covered eggs.



elevation was about 1,980 feet, and the water temperature about 5°C. Working along this section I gradually narrowed the territory to 1,750 feet of river where I most frequently saw the pair. Then I built a blind, pitched a tent as refuge from rain and snow, and waited.

The pair spent much of the time along a stretch of river where the boulders were numerous and where trees from the heavily wooded banks overhanging the water. One day I followed the female to this area, and as I watched from the opposite bank, she suddenly leaped up onto the dead limb of a coihué tree that slanted down toward the water, and moved up and down the limb sidewise in a nervous manner. She faced upstream and made frequent head-and-neck bobbing movements which both birds often did before taking off. But she did not take off. She made head-pumping movements as if to leap, then moved up the limb, made more head-pumping movements, moved down the limb, and then repeated the behavior. Finally, she jumped into the water, swam a few yards upstream, and then, all at once, leaped to the bank on the far side of a coihué—out of sight.

I dropped my camera, grabbed my binoculars, and made my way along the bank upstream until I was opposite the place where the female had disappeared. Soon I spotted her through the brush and leaves of the overhanging trees. She was right next to the coihué in a cavity between roots uncovered by the erosion of the river bank. I watched for half an hour. She never moved and neither did I. This nest was so much more exposed than I had expected.

After a while I spotted the male on a boulder downstream, asleep with his bill tucked under his right wing. I moved down the bank to a point halfway between the nest and the male and tried to watch them both. I was looking at the female when something whizzed by me, not five yards from my nose. It was the male in full flight, calling *wheek wheek* in a high-pitched, single-syllabic call. He flew fast and low and in seconds was around the bend of the river and out of sight.

The Torrent Ducks always flew low and followed the river. This I found to be true of all the Torrent Ducks I watched. They flew along the axis of the river no matter how circuitous its course.

Although I did not see the female leave the nest, she must have followed him. When I looked again, she was gone. I put on my waders and with difficulty forded the stream. Water dripped from the high embankment. Tiny, vermilion-colored flowers grew in the mossy crevices of the ledges. I found a foothold and, using the exposed roots as handholds, hoisted myself up to the level of the cavity, about nine feet above the river. Two eggs lay in a shallow scrape. They were buff in color and about the size of a large chicken egg. There was no down at all in the scrape.

This nest was new; the clutch was not complete. I could not believe my luck. Here was a chance to discover the incubation period. Although I had been told it was from 21 to 24 days, the incubation period was actually unknown. And I would have an opportunity to observe the behavior of the downy chicks when they first entered the raging river—this too was unknown. Although the Kovacses had already found two nests, each contained four eggs embedded in down. Both were too far along to help in determining the incubation period.

Habitat, Locomotion, and Feeding

On the following days I observed Torrent Ducks for many hours. Their most notable characteristic is their ability to swim against strong currents, either underwater or on the surface. The rivers and streams they usually inhabit flow at the rate of from six to eight feet per second, but they can make headway against water flowing at 10 feet per second (Johnsgard, 1966).

Torrent Ducks live in swift mountain streams that must contain submerged and partly submerged boulders, for only in such a stream is the water sufficiently oxygenated to support the stonefly larvae (*Rheophila*) on which the Torrent Ducks feed almost exclusively. They dive underwater and extract the larvae from the cracks and crannies among the rocks and stones on the bottom with their bills—narrow, flexible, and edged with serrations.

They expend considerable energy in feeding. I once observed a female Torrent Duck feed vigorously upstream for an hour and a half, where the surface velocity was over seven feet per second. In a stream of even greater velocity, ten feet per second, “. . . a bird simply maintaining its submerged position in the water for sixteen seconds would have to perform the equivalent effort of swimming 160 feet underwater!” (Johnsgard, 1966). While the El Ternero never flowed quite that swiftly, I saw both the male and female feeding underwater for 16 seconds, and sometimes much longer.

As is typical of any species whose habits are unusual yet little known, explanations, suggestions, and even myths abound around the Torrent Duck. Some authors have suggested that the carpal spurs, present in both male and female Torrent Ducks, function in anchoring the birds to the bottom during feeding. While it is difficult to watch them underwater, I did have some views and I never saw any evidence of this. Johnsgard (1966) cautiously stated that, “. . . the adults appeared to hold their wings open slightly when swimming underwater, probably for steering purposes rather than propulsion.” In the birds I observed swimming underwater the wings were always folded close to their bodies and played no part in underwater movement. Their bodies are narrow and elongated. They propel themselves through the water with a large powerful tail and with huge feet. One explanation for the size of the Torrent Duck egg, large in proportion to the body, is that it must accommodate the large webbed feet of the downy young which, as we shall see, needs them very early in life.

So much has been written about the Torrent Duck's ability to swim against strong currents that one might think the bird spends most of its waking hours performing this strenuous activity. Such is not the case. The Torrent Duck prefers to expend the least amount of energy possible when traveling along the river. Except for certain circumstances, I never saw the male or female swim upstream underwater very far—usually less than 10 feet. When underwater, it is mostly a question of the duck holding its own against the current. In their usual method of going upriver, they skitter across the surface, using their tails as a kind of skulling oar and the feet as paddles. If they want to cover long distances, they, of course, fly. While swimming upstream they usually keep to the sides of the river where the current is less swift. But their chief method of saving energy lies in their ability to take advantage of the reverse eddies and

still water behind rocks and boulders. The pair I watched closely commonly bobbed placidly about in the gentle swirl behind a boulder where the water piled three feet high in front of it from the force of the river. The male and female also spent considerable time standing on rocks partially or totally submerged. As I watched them standing on submerged rocks, it seemed remarkable that they could maintain their balance with apparent ease as the water piled up on their breasts. They used their strong tails for balance—as a counter weight, not for support as one leg of a tripod—and held on to the slippery rocks with their feet and sharp toenails.

After suitable rest periods, they went back to the river to continue their feeding, and it was amusing to see how differently the male and female entered the water from a rock perch. The male always stuck his neck out and teetered over the brink, as if coiling his springs for a mighty leap out into the torrent. His was the racing start, with the accompanying splash (Figure 4). The female, on the other hand, rarely jumped into the water. She slowly eased herself in without commotion or fuss.

When feeding, the pair almost always worked their way upstream from the nest area, sometimes almost as much as half a mile. After they had fed enough,



Figure 4. From his perch on a rock, a male Torrent Duck enters the water with a leap. By contrast, the mate of this bird always eased herself into the water.

they turned themselves over to the mercy of the river for a free, swift ride home, going down sideways or backward as the currents buffeted and twisted them about, often invisible in the rapids. They stopped with one quick motion of the powerful tail, skittered easily to the side of the stream, and climbed out on a rock. While perched on rocks, the pair usually dozed or preened.

During the first week after my discovery of the nest, I paid frequent visits to it, but never saw a sitting bird. I had the awful feeling that the pair had abandoned it. The nest, only a slight depression in the earth, contained no down and seemed so exposed and vulnerable. Then, seven days after the discovery of the first two eggs, a third egg appeared, but still no down.

Another seven days passed and from my blind I saw her now sitting on the nest with down fluffed out all around her and tail cocked up. I forded the river and waded down by the steep bank, holding on to exposed roots for balance. I was only 20 feet away when she jerked her head up. As I came closer, she got up, stood on the edge of the nest for a while, and then flew into the water and let it carry her downstream to where the male was loafing on a rock in the middle of the river. I inspected the nest and discovered a fourth egg. The female had thus laid her four eggs one week apart and incubation began with the laying of the final egg. It was raining hard and the whirling wind whipped most of the down off the eggs and into some briars nearby.

Territorial Behavior

The territory of this pair of Torrent Ducks consisted of a stretch of river with its boulders and adjacent banks. Border incidents with another pair downstream occurred frequently. The territorial behavior involved a display in which the male stood in an erect and stiff posture, stretched his neck with the bill pointed upward, and pumped his head up and down. This display was followed by several bows. The bow consisted of lowering the front part of the body, raising the rear, and cocking the head and tail. Males held the deep bow briefly and then assumed the erect posture. The birds performed in a like manner in the water as well.

The first time I watched this behavior, the pair stood on a rock in the stream. All at once the male started pumping and bowing; the female did not. Then another male appeared, climbed up on the same rock, and both males performed facing each other (Figures 5 and 6). After more bows the three went into the water and, from a distance, it appeared that they were fighting. The female disappeared. On the rock again the two males head-pumped continuously, both facing diagonally across the river and calling to each other in a soft plaintive *wheek*, quite unlike the bold assertive note the male delivered when he flew past me. After 20 minutes, the intensity of their display gradually subsided, and the intruding male jumped into the water and floated off downstream. The remaining male continued to call, bowed several times, and then flew upstream where I found him later foraging with his mate.

The second time I observed a territorial encounter I noted another display both on the rock and in the water. This is a "mule kick," a high-intensity bow accompanied by kicking the feet out behind them. I watched the mule-kick activity on the rock and the two feet actually did leave the ground. The activ-

ity in the river that I first mistook for a fight was simply the mule-kick display done in the water. On the second observation of the boundary dispute, the female floated downstream and joined the two males on their rock and bowed and called with them. This was the first time I heard a female Torrent Duck's call—a single-syllabic call, somewhat like the male's but lower in frequency and quite hoarse.

These border incidents took place two or three times a week, almost always in the afternoon and always at the same place in the river. Usually they involved only three birds but sometimes there was another female with them. The territorial boundary appeared to be well defined. I never saw either pair feed on the other's side of the boulder on which they displayed.

To test the fidelity of the pair to the territory and its boundary, I waited one day until they were very close to the downstream border of their territory. Then I walked into the stream and waded slowly along the bank toward them. I was between them and their nesting area upstream; behind them lay the territory of another male. When I was about 50 feet from the pair, the male flew off upstream, uttering a declamatory *wheek*. The female stayed behind. As I continued to approach, she showed anxiety and head-pumped continually. She had three alternatives: fly upstream, go to the opposite bank, or float down past the border into another's territory. She went to the opposite bank and began swimming up the stream. At that moment six cows came lumbering down to her side of the river, presenting too formidable an obstacle for the duck. She swam back and climbed upon the rock in the middle of the stream close to the border.

Again I approached her; again she jumped into the river; and, just as she did, the male came whizzing past my ear and made a belly landing right next to his mate. They swam around and around, trapped by the cows on one side, me on the other, and the territorial boundary behind them. For the second time the male flew in what appeared to be an attempt to lead me away. I continued my approach and, when I was about 15 feet from the female, she flew off upstream—and, to my amazement, flew very badly. Even though spurred on by fear, she could hardly get off the water. She flew only about 30 feet and then plopped back into the river where she was now free of danger. I had, meanwhile, found out that each pair remains faithful to a particular stretch of river and respects the well-defined boundary between territories.

Even though any landing on the surface of the water or boulders of another's territory was an infringement, it was all right for a Torrent Duck to fly *through* another's territory. The territorial male chased, or flew with, other males which entered his territory. Often two males, separated by no more than a couple of body lengths, flew low, following the bends of the river. They moved in perfect unison, dipping their wings and altering their course as if under a single control. Usually I did not see them coming because Torrent Ducks fly only from five to, at the most, 20 feet above the surface of the water and their bodies blend in with the background. They streaked past me and disappeared. Often they came back down the river again. Sometimes they splashed into the water together, mounted a rock, and performed the repertoire of bows and mule kicks. The intruding male always broke off the performance first and floated off down the river, out of the other's territory.



Figure 5 (*above*) and Figure 6 (*below*). Two males standing on boulders that mark their territorial boundaries. Males commonly face each other and display, standing in an erect posture and pumping the head up and down, finally bowing several times.



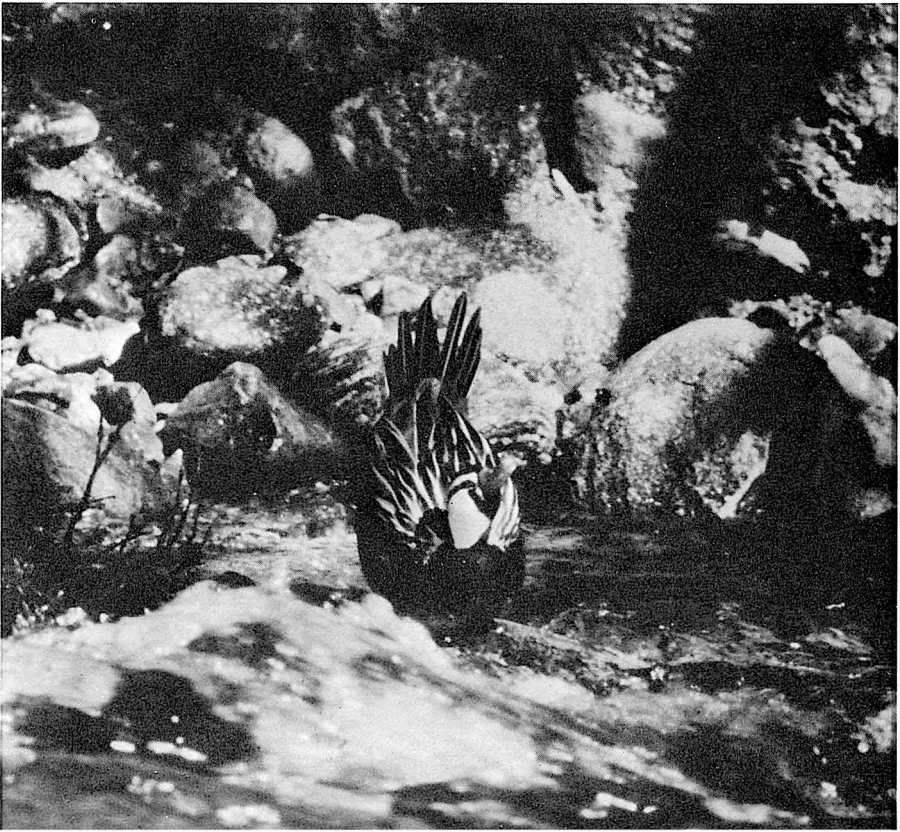


Figure 7. A female returns to the nest only in the male's presence. This male stood on a rock near the nest and bowed and called until the female joined him and made her flight to the nest.

Distraction Behavior

The territorial male used several methods in what appeared to be attempts to elude me and to lead me away from his mate's nesting area. The most common method was to fly swiftly out of the area in a direction that would lead him past me, calling as he flew and thus getting the maximum attention. One of his favorite stratagems was to fly off upstream and then come back downstream underwater. Many times I followed the male upstream only to find, after searching for an hour, that he was feeding placidly in the area whence he had flown.

Another stratagem, a variation of the above, was to jump off a rock and head upstream underwater. Since Torrent Ducks never stay underwater very long, I would watch for his head to bob up not far from where he had submerged, only to find it was a ruse—he had let himself be carried 50 yards downstream underwater.

Nesting Behavior

After the fourth egg arrived, the female spent all of her time either incubating or foraging in the river. The male did not incubate. Each morning,

after first light, I usually found the female sitting on the nest. But she soon left, first rising and then making a full circle of the nest as she poked the down about her eggs. This was rather a futile task because as soon as she left the nest, the wind funneling up the river scattered the down off the eggs onto the briars. Each day, when I checked the eggs, I found them uncovered and the briars around the nest full of down.

The female, upon leaving the nest, wasted no time. She fed in earnest for about two to three hours in the morning and for about the same time in the afternoon. The male's feeding habits, on the other hand, were irregular and desultory.

The male was rarely around when his mate flew off the nest, but they soon met for he usually foraged upstream and periodically floated down the river to the nest area. They then remained together until she returned to the nest. The female's foraging dives averaged 12 seconds; she spent about half as much time on the surface between each dive. She sometimes kept this pace up for half an hour before getting out on a rock. There she preened or just stood, but never slept. The male always remained nearby on a rock.

The male's movements were abrupt and positive, including the act of going to sleep. With a quick motion he turned his head over his right shoulder, sometimes closing his eyes, sometimes keeping them open. He often slept standing on one foot with his tail canted to one side for balance. When he was not sleeping, he spent a lot of time preening.

Behavior When Returning to Nest

Near the end of her inattentive period, the female usually fed a while longer in the nest area while the male remained nearby. The female's nest was, as I have said, about nine feet directly above the river. A flat rock, right next to the bank and slightly upriver from the nest, was the scene of the nest-returning activities.

Female Torrent Ducks do not return to the nest unless the male is present. After the female had foraged for a short while in the nest area, the male swam over to the flat rock and hopped up onto it. He began to call and bow (Figure 7). He usually bowed facing away from the bank, but sometimes he bowed in the direction of the nest. The female ignored him for a while, but eventually joined him on the rock. She spent several minutes there, usually looking up toward the nest and pumping her head. All the while the male continued with his bows and calls. If the female happened to get out on the rock so that the male was between her and the bank, the male slipped into the water and swam around her, thus allowing her a clear flight path to the nest. She never gained the nest in one shot. When at last she made the effort, she flew first to an exposed tree root and perched there hesitantly while her mate called intensively from below. Then she half flew and half scrambled to another branch or ledge before finally gaining the lip of the nest.

There were times when her attempts failed and she fluttered back into the river. The male then remained quietly on the rock while she foraged. After a short time, he began calling and bowing again, and they repeated the whole process until she attained her goal. At the nest she paused momentarily before

settling down on the four eggs. She went through the motions of placing the down around the margin of the nest, but it was mostly a ritual, for there was little down about. The male remained on the rock below the nest sometimes for as long as an hour. His calling and bowing continued, gradually subsiding in frequency and intensity. Eventually he went off to forage or to perch on another rock for a time.

I observed another behavior of unknown significance yet fascinating. The male, seldom nearby when the female flew down from her nest, invariably showed up within half an hour. If she was resting on a rock, he almost always climbed on the same rock and paused a moment beside her before one or the other of them jumped into the river. This sequence of activity happened so often that I felt it was some form of recognition or greeting. At other times the opposite occurred, the female clambering up on a rock where the male was resting and pausing before one or both of them returned to the water.

While waiting for this female's eggs to hatch, I sought other Torrent Ducks and nests farther downstream. Although I spent most of the next several weeks observing another pair with two young, I periodically checked the nest with four eggs. Actually, the events in the two nests rather paralleled each other (see Appendix), but, in order not to interrupt the sequence of the first nest, I shall continue with my discussion of it and reserve the second nest until later.

Hatching

The female, after 38 days of incubation, still sat on the eggs. However, on 5 November, one of the eggs was pipped. On 7 November, two days later, the pipping had not progressed.

On 8 November, in the afternoon, I found the parents foraging and immediately inspected the nest. Three of the eggs had not begun to pip; the hole was much bigger in the pipped egg. I saw the duckling move, faintly.

On 9 November, the opening in the pipped egg was no larger, but the chick inside was active—breathing. Moreover, two other eggs were pipped.

On 10 November, all four eggs were pipped. Of the weather that day, I wrote: "Rain followed by snow near blizzard proportions, followed by sunshine, then more rain, then sun and rain — all in the space of 45 minutes. Typical Andean weather!"

On 12 November, one week after the first egg had begun to pip, I checked the nest at 10:09 and discovered three downy chicks (Figure 8). A fourth was still in the egg. After 43 to 44 days, there they were, fuzzy gray ducklings. They were a sleepy looking bunch. Their eyes were closed most of the time and they moved about very little.

Incubation had lasted 43–44 days. If this nest was typical of Torrent Ducks, the species has a longer incubation period than has been recorded for any other species of the Anatidae.

I kept the nest under observation all day. The female remained with her brood until 19:05 when she finally flew down to the river. Twenty-five minutes later she returned. In the intervening time, I checked the nest and found four chicks. My record reads: "Very windy. Spitting rain. I crossed the river with

great difficulty. The water is rising—up two inches since this morning.”

On 13 November, the river raged. It was higher than at any time during my stay along El Ternero and flowed at 7.8 feet per second. In the early morning the female remained on the nest. She left at 09:05. The chicks stayed in the nest but were active. They moved around, climbed over each other, preened, stood up, stretched their wings, but never ventured beyond the cup of the nest.

Within an hour the female returned to the nest. At 11:25 the chicks wandered off the nest rim. During the afternoon the female made several forays to the river below. The young, however, stayed in the nest, except for one that was accidentally shoved out. He managed to scramble back again.

On 14 November, early in the morning—before 06:30—I found the parents and three chicks on a rock below the nest. The fourth chick was missing and may have been swept away by the current. The others clambered over the rocks and took their first foraging swims.

Locating Another Nest

Meanwhile I had been looking downstream in a deep, narrow gorge where I had previously seen a pair of Torrent Ducks. I was sure there was a nest. To find a nest by searching tree cavities in that somber gorge seemed a difficult and unpromising way to go about it, so I stationed myself in a blind on the edge of the cliff above the gorge, hoping that the ducks would lead me to it. After a week or so, I saw a male climb out on a huge boulder and make a couple of bows. The female soon appeared. This first sighting soon led to the discovery of their nest 60 feet above the water in a crevice in the cliff. This was a real cliff, all rock straight down, so high and steep that the female had to stop five times before reaching her nest while her mate called energetically from below.

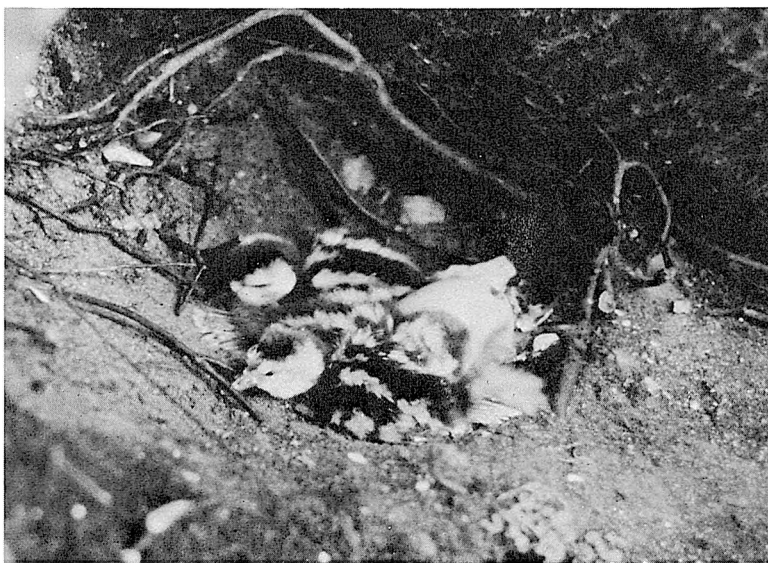


Figure 8. A nest with three downy chicks on 12 November, one week after the first egg had begun to pip. This nest was situated nine feet directly above the water.



Figure 9. A young Torrent Duck sits near the water's edge four hours after tumbling from its nest 60 feet above the water in the crevice of a cliff.

With this second pair I observed the same courtship bows, the same nest-return behavior, and heard the same calls. I was unable to determine the contents of their nest because the top of the cliff overhung it, hiding it completely from above.

Behavior on Departing from Nest

During the next days I sat in my blind on the cliff edge across the gorge from the nest site and kept a camera trained on the crevice. One day, the female appeared at the entrance to the crevice. She was in shadow, silhouetted against the sunlit face of the cliff behind her. I was photographing her when, to my astonishment, a duckling appeared on the ground glass beside her. A duckling, gray with a dark eyestreak, looking all fluffy and alert (Figure 9). Then out popped another ball of gray fluff. They all stood there together for several minutes. There should be two more, I thought. No more came.

Then the female flew off the ledge, fluttered down to the river, and swam about in a back eddy pool behind a boulder. As she swam, she called vigorously and continuously to the two ducklings that were standing on the ledge 60 feet above her. They made head thrusting movements just as the adults did.



Plate II. The brown and gray colors of the female Torrent Duck (*above*) contrast sharply with the striking black and white of the male (*below*).



The first one out of the nest made the first leap into the torrent. Only a matter of 30 seconds or so after the parent started calling from the river, the duckling toppled off the edge and, tumbling as it fell, bounced off a projection of the cliff, and then onto bare jagged rocks and stony debris at the base. It appeared on the stones at the edge of the pool where its mother was swimming, looking completely unperturbed by its hair-raising (for me) entrance into the world.

Without a moment's pause it went into the water and swam around easily in the eddy which revolved in a slow whirlpool behind the boulder. Almost immediately it made forays into the faster water of the river and had no difficulty getting back to the calmer water of the pool despite the buffeting it took in the turbulence at the edge of the river. It also dipped its head under to feed.

About two minutes after the fall of the first chick, the second, responding to the insistent calling of its parent, took the plunge. It, too, bounced and crashed onto the rocks at the base of the cliff and disappeared from view in a thicket of thorns and briars. Somehow, its plunge seemed more perilous than that of the first chick, and, because it did not appear for some time, I thought it had met its end. Eventually it showed up at the water's edge and, without hesitation, joined its sibling in the river.

This drop to the river was not as perilous as it first appeared. A Torrent Duck chick has very little weight for volume—very little density. A duckling just out of the egg weighs 1.25 ounces, and that miniscule weight is wrapped up in a ball of fluffy down. As the chick goes hurtling through the air, it does not pick up much speed. Actually the down slows its speed, as do the feathers on a shuttlecock, and also cushions its landing.

Locomotion and Feeding Behavior of Young

The downy chicks floated high on the water. Though at the mercy of the currents, it was soon obvious that they were masters of the art of propulsion and navigation in a torrent and showed to what a remarkable degree the species is adapted to its highly specialized environment (Figures 10 and 11).

In all the length of the El Ternero that I knew, this particular spot was the wildest, narrowest, and most rapid part of the river. The water was all white with turbulence and rapids, sluices and waterfalls, whirlpooling currents, and tumbling waves. If torrents were to be their natural element for life, their initiation was immediate and severe.

The male had been upstream and now appeared. With the second chick in the water the female no longer called continuously nor did she look up at the nest, so I knew that no more ducklings would issue forth. The parents, however, called at frequent intervals. Almost immediately they started escorting the chicks into faster water, yet usually preventing the chicks from getting too far out into the river by keeping them between themselves and the bank. Right off the chicks were able to do two maneuvers I often watched in adults: "skate" over the water against the current to make headway; and, when the current was too strong to overcome by direct assault, maneuver across it on the diagonal.



Figure 10 (*above*) and Figure 11 (*below*). This Torrent Duck chick swims with its parents in the rapids of the El Ternerio. It floats high in the water and navigates well in the strong currents, although it has been in its new environment for only two hours.





Figure 12. A Torrent Duck chick tries to climb a rock. It uses its wings to maintain balance, and beats them vigorously to assist the climb. It seldom remained on the rock for long, but usually plunged right back into the water.

They also started climbing rocks, but with some difficulty (Figure 12). They used their wings for balance, and beat them vigorously to assist the upward climb. They succeeded in most of their rock-climbing attempts. Climbing rocks represented an important part of their early learning, for it meant rest and refuge from the rigors and exertions of swimming in a torrent. Once on the top of a rock the chicks plunged right back into the water unless the rock was a particularly high one. Even then, they hesitated only for a short time.

Hating to leave them, yet desiring to cross to the other side of the river to watch them close at hand, I walked upstream for an hour before I found a place to ford the river. Another hour brought me to the pool where the two ducklings had taken their initial swim. As I approached, I heard the male and female calling loudly and soon discovered the reason—one chick was missing. It had obviously been swept downstream. I watched as the parents started to slide downstream. And then I saw it, the missing chick, on a high rock in the middle of the river downstream. It was head-pumping and calling frantically.

The parents swam to a back eddy on the opposite side of the river near the rock on which the downy was marooned, calling continuously. The duckling responded by jumping into the torrent and skittering across the top of the water toward the parents. Then, in close company, the three worked their way up along the edge of the river, judiciously using the eddies and counter currents until they arrived opposite the pool where the other duckling was

swimming about. The male and female, trying to get their errant chick back to the pool, alternately crossed the stream and called, thereby demonstrating the technique and direction for crossing. The duckling started across but the current was too strong for it and the swift water drew it downstream to the rock from where it had started. It climbed back on the rock and began calling again. The parents moved down and repeated their calls. Once again the chick jumped into the water. This time the current swept it away, around the bend of the river and out of sight. In a moment, the parents eased themselves into the current and allowed themselves to be swept in pursuit of their duckling, leaving the other chick in the pool upstream.

I walked around the bend and found the duckling swimming in a pool by the edge of the cliff, occasionally ducking its head into the water for food, and always making forays into the fast water. Then it climbed out of the pool and generally poked around, looking things over, curious and alert, unperturbed. Although it showed no fear of me as I approached with my camera, it managed to keep a certain distance between us by continually moving and jumping into the water and swimming about.

After taking a few pictures, I climbed up a grassy bank. It was getting late. I looked back for the chick and it was gone. Then I caught sight of the parents on a rock in the stream opposite the point where the chick had been. And although I had not seen the chick return to the parents, a small gray form with a black striped head popping out from beneath the female's feathers indicated that it had successfully made the trip across the stream.

Soon the three were in the water slowly working their way back up the stream along the bank. Finally they reached a rock opposite the pool where all this time the other duckling had been busy dunking its head underwater for food. The parents swam across to the pool, called to the chick they had retrieved, and crossed back and forth several times between the pool and the chick. Finally, the chick headed out across the river. The little duckling skittered across and seemed to ride, not on the water, but on the froth that hissed on top of it. The duckling reached the other side quite easily and the entire family was together.

They were together, but all was not over for the day. The parents then proceeded to lead their chicks out of the wildest part of the river to calmer waters upstream. At one point, where they encountered a waterfall and also a stretch of fast water running between steep banks with no eddies for safe havens, they climbed rocks along the bank as the only recourse. At another point they confronted tumbled rocks 15 feet high. The parents stood on top of the pile and called while the ducklings worked their way up. For every two rocks they climbed they fell back one. Several times one of them—the weaker, probably the chick that had been swept downstream—nearly reached the top only to fall all the way to the bottom again, bouncing off rock after rock and ending up in every position but upright, but always unscathed. By the time darkness fell, they had made it to smoother sailing and I lost them from view on the opposite side of the river.

On 1 November, I returned to the gorge area and spent the day with this pair and their two ducklings. Most of the time the male stood guard on a rock usually a bit upstream from where the family group happened to be feeding.



Plate III. *Above*, a young Torrent Duck with its female parent.
Below, two chicks forage under the watchful eyes of the parents.



The downy young fed most of the time in the shallows along the edge of the river. The female remained in constant attendance, either feeding or swimming alongside of them. The ducklings fed with their heads underwater and they attempted to dive—to get beneath the water. They upended and kicked wildly with their oversized feet, but, due to their buoyancy, they either failed to submerge entirely or, if they did submerge, they popped up immediately like corks. By the end of the day the chicks had foraged a total of 6 hours and 28 minutes in five periods with an average of one hour and 18 minutes per period. The longest foraging period was one hour and 42 minutes; the shortest, 55 minutes. They had rested or been brooded for a total of 2 hours and 33 minutes. Although they foraged and rested along a half-mile stretch of river, they spent most of the day along 300 yards of El Ternero.

On the sixth day of waterborne life I discovered that one of the ducklings had disappeared in the night. Since I know of no predators on Torrent Ducks except man, I assume that it was swept downstream. The remaining duckling dived quite regularly now, going to the bottom and staying as long as just under six seconds at a time. As it grew older, it spent much more time resting on rocks and much less time foraging.

Meanwhile, Marvin Cecil had collected 18 Torrent Duck eggs from five nests and, using a portable incubator, had transported them by jeep, jet, and motor car safely back to Florida. Seventeen of the eggs hatched. Unfortunately, the ducklings all died.

I have limited my discussion in this paper entirely to Torrent Ducks, their nests and various behaviors, and have done so, I might add, with difficulty. The area was alive with other birds. I often spent a day on the farm of a friend of mine, by a lake filled with waterfowl. I saw coots struggling to rise off the water and Ashy-headed Geese (*Chloephaga rubidiceps*) circling about. There were Ruddy Ducks (*Oxyura jamaicensis*) and grebes, and Brown Pintails (*Anas georgica*) all over the place, and more ibises than I had ever seen before. I found a White-throated Tree Runner (*Pygarrhichas albogularis*) busily pecking away at its hole in a tree, and two Southern Lapwings (*Belonopterus cayennensis*) calling incessantly and drinking at the same time. I listened to the haunting whistle of the Chiloe Widgeon (*Anas sibilatrix*) and watched the Yellow-headed Caracaras (*Milvago chimango*) ride the thermals. One of the greatest thrills occurred when I came upon two ducks grazing on a grassy bank beside the El Ternero. I thought they were widgeons until the late afternoon sun suddenly flashed on the iridescence of a pinkish speculum. They were a pair of Bronze-winged Ducks (*Anas specularis*) and as I approached, they barked, like dogs. All these other birds were very fascinating, yet not fascinating enough to keep me very long from the Torrent Ducks on the El Ternero.

Summary

This paper describes a study of the Torrent Duck (*Merganetta armata*), undertaken in Rio Negro Province of Argentina from September to November 1968. The birds, about whose natural history little has been recorded, live in rapid mountain streams of the Andes, where they feed almost exclusively upon the larvae of stoneflies (*Rheophila*). Their adaptations to life in these

rapid currents include a torpedo-shaped body, proportionally large feet, a long, stiff tail, and a narrow, flexible bill. They generally work upstream on feeding forays, and frequently remain underwater for 16 seconds or more. One female's foraging dives averaged 12 seconds. Upstream locomotion on the water includes skittering across the surface using their tail as a sculling oar and their feet as paddles. They tend also to move upstream along the banks where the current is not as swift, and effectively use the reverse eddies and still waters behind boulders. I found two nests, one in a cavity formed by the roots of a *Nothofagus* tree along the bank nine feet above water, the other in a crevice in a cliff 60 feet above the water. I kept the two pairs under close surveillance. The species is monogamous. Pairs maintained rather strict territories that encompassed about 0.6 mile of river for a pair, although most of their time was spent in a one-third-mile stretch of river. Territorial behavior consisted of calls, bowing displays, and "mule kicks" both in the water and on boulders. The female generally left the nest for several hours in the morning and several more in the late afternoon. The male did not incubate, but remained in the territory and usually in attendance with the female when off the nest. One week separated the laying of the last three eggs in one nest. In both pairs the male displayed to entice the female to return to her nest. The incubation period of one of the nests was 43 to 44 days. In one of the two nests, the two chicks that hatched jumped to the water sixty feet below, landing on rocks on the bank. Both, unharmed, plunged into the water and began swimming with the parents.

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APPENDIX

Chronology of Two Nests of Torrent Ducks

NEST I

- Sept. 3-10 Observed pair and mapped territory.
- Sept. 10 Set up blind.
- Sept. 16 Found nest with two eggs, no down.
- Sept. 23 Third egg in nest, no down.
- Sept. 30 Fourth egg in nest, lots of down.
- Nov. 5 Egg piped.
- Nov. 7 No progress in pipped egg.
- Nov. 8 Hole in pipped egg larger, duckling moved, faintly.
- Nov. 9 Hole no larger, duckling more active. Two other eggs piped.
- Nov. 10 All eggs piped.
- Nov. 11 No change.
- Nov. 12 Three downy chicks out by 10:09; one very active in egg. Chicks quiet. Four hatched at 19:05.
- Nov. 13 Chicks in nest all morning. More active and outside nest in afternoon, but back by night.
- Nov. 14 Parents and chicks all on rock below nest by 06:30.

NEST II

- Oct. 13 Discovered nest in crevice in cliff, 60 feet above river.
Oct. 29 Female and two downy chicks in crevice. Female flew to river; chicks dropped down, landed on rocks, and went to water.
Nov. 1 Male on guard on rock; downy young and female feeding or resting. Stayed most of day along 300 yards of river.
Nov. 4 Adults and one chick in usual place. Other chick missing.

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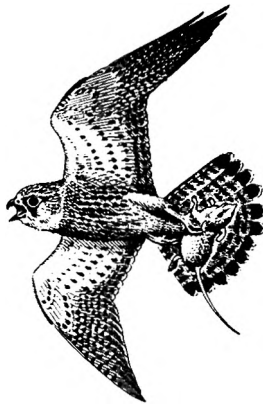
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