# OBSERVATIONS ON THE LIFE HISTORY OF THE DIPPER IN MONTANA

BY GERALD J. BAKUS

Aside from incidental notes, relatively little has been published on the American Dipper (*Cinclus mexicanus*). Grinnell and Storer (1924), Ehinger (1930), Bent (1948) and others have contributed valuable material in the past. More recently Hann (1950) published a thorough study of the nesting behavior of the Dipper in Colorado. An attempt was made in the present study to stress those aspects of life history for which reported observations have been lacking.

The study area was defined as Rattlesnake Creek, Missoula County, Montana, extending from its outlet (into the Clark Fork River) to the upper end of the canyon road near the stream (fig. 1). This is 13 miles by road. All the stream bank area plus nearby tributaries and beaver ponds were considered in the study, if these were occupied by Dippers. The study was carried out from January, 1956 through August, 1957.

I am indebted to many persons for help in connection with this study, especially to Dr. Robert S. Hoffmann for assistance during this study and in the preparation of this paper, to Dr. Ludvig G. Browman for information on the topography of the Rattlesnake drainage, to Harold Knapp for participation in the field work and for advice, and to my wife, Grace Bakus, who aided in preparing this report.

## Description of the Study Area

The entire Rattlesnake Creek drainage is located within Missoula County, Montana. The outlet of Rattlesnake Creek is in the city of Missoula at an elevation of 3200 feet, approximately 100 miles west of the continental divide, in west central Montana (fig. 1). The city of Missoula and the first few miles of Rattlesnake Creek are located within a broad, flat valley utilized for farming. The stream passes through a riparian deciduous forest community of cottonwoods (*Populus trichocarpa*) which higher up is replaced by a coniferous forest of intermixed yellow pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menz*), and the deciduous western larch (*Larix occidentalis*). At yet higher elevations, Engelmann spruce (*Picea engelmanni*) is present along with Douglas fir. The bank is lined with willow (*Salix* sp.), alder (*Alnus tenuifolia*), wild rose (*Rosa* sp.), hawthorn (*Crataegus douglasii*), and dogwood (*Cornus stolonifera*), which frequently form dense thickets. The width of the stream within this area varied from 10 to about 50 feet. Juvenile and adult birds were trapped with a

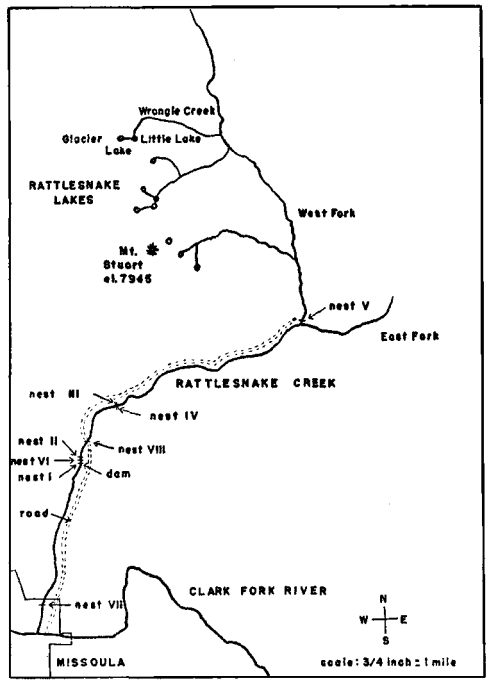


FIGURE 1. Map of Rattlesnake Creek drainage.

Japanese mist net and color-banded within the study area, and nestlings were similarly marked.

## DISTRIBUTION

The species *Cinclus mexicanus* is found in western North America from the Aleutian Islands, north-central Alaska, and central Yukon, southward in mountainous country, east to Alberta, Montana and southwestern South Dakota, and south to southern California and through the highlands of Mexico and Central America to western Panama (A. O. U. Check-list, 1957: 405).

Many authors (Skinner, 1922; Johnston, 1943; Packard, 1945) have reported the altitudinal distribution of the Dipper as extending from the Upper Sonoran or Transition Life zones up to or near timberline. However, they have been found even in the lower Sonoran zone in Arizona by Hargrave (1939: 122). In western Montana, Dippers are found on some parts of the valley rivers, such as the upper Bitterroot River, throughout the year (Harold Knapp, unpublished field notes). During the summer they are most commonly found in the Upper Transition and Canadian zones, where they

breed (Saunders, 1921: 154). In this study they were found on Little Lake (6500 feet) and on Glacier Lake (7000 feet) at the headwaters of Rattlesnake Creek. Ludvig Browman (unpublished field notes) on a number of journeys to high lakes in the mountains of western Montana has seen the birds along the shores. L. Richard Mewaldt collected an immature female Dipper in post-juvenal molt, at an elevation of 8100 feet, from the McCalla Lakes in the Bitterroot Mountains of Montana on August 10, 1947 (specimen in the Montana State University Zoological Museum). These observations are suggestive of nesting at this elevation.

During the cold periods in the fall and winter Dippers are found in open water of streams and rivers in lower valleys (Lundwall, 1915; Skinner, 1922; Bergtold, 1924). Nelson (in Bent, 1948: 111) indicates that some Dippers endure temperatures of −50 to −60°F., and possibly lower, in the Yukon. The temperature along Rattlesnake Creek has fallen as low as −33 to −40°F. without noticeable effect on the birds, except for an increase in the period of inactivity and their restriction to unfrozen stretches of stream where food is available.

## General Behavior

*Swimming and diving.*—Various authors have reported that the Dipper uses its wings when underwater (Bryant and Bryant, 1915; Bond, 1938; Hann, 1950). Michael (1938: 185), however, says that the bird uses only its feet underwater. My observations have been that Dippers may walk submerged along the stream bottom in shallow, relatively quiet, water with no apparent wing assistance. However, in most instances, they actively use their wings underwater. Recently Goodge (1959: 7-12) has determined through photography that a captive Dipper used the wings in swimming under water.

When diving from the surface the wings are thrown out and slightly to the rear and with a quick dip the bird enters the water head first. Frequently the birds swim on the surface against the current, or often with the current in shallow water, feeding as they move from one rock to another or stopping near the bank. When swimming the legs are used in a paddling motion.

The time the Dipper spends underwater may be exaggerated, as reported by Muir (1894: 284) and Surber (in Bailey, 1928: 533). On many occasions I have watched Dippers dive, and have occasionally timed such dives, which usually were only 5 to 10 seconds in duration, but sometimes were as much as 15 to 20 seconds.

Deep dives as recorded by Henderson (1908: 2) and Bent (1948:

97) are probably uncommon. Dippers that fed in water 15 to 18 feet deep behind the Montana Power Dam in the Rattlesnake Creek made no attempt to dive to the bottom. They picked off grubs from the concrete sides just at or slightly below the water level or skimmed food from the water surface. On May 4, 9, and 20, 1956, parent birds were seen diving almost directly below their nests into the torrential currents. It was estimated that three feet was about the maximum depth reached by the birds. On November 9, 1956, one of two feeding birds was observed diving to the stream bottom behind the dam where the water measured four feet in depth. The dive took 15 seconds, and with its buoyancy the bird bobbed up onto the surface of the water at the end of the dive. This was the deepest dive recorded, but ordinarily the birds dive to a depth of from one-half to two feet.

*Flight.*—Hann (1950: 52) has reported that the Dipper usually follows a stream closely, only a few feet above the water, although Skinner (1922: 19) saw one bird flying at a maximum of 30 feet above the surface. I have found that they commonly fly within two or three feet of the water. On July 18, 1956, two birds were found drowned, tangled in the bottom of a mist net left up overnight. Because the net bottom was set at the water level this may indicate that the birds fly very close to the water under natural conditions, *i.e.,* when not being chased by man. However, when a bird is driven from its territory it will frequently turn back and fly up and over the observer's head, if he is standing in the stream. On longer journeys down the stream Dippers may fly between three and six feet above the water. When a bird accidentally hits a mist net without being trapped it will usually fly over or around the net on the second or third attempt. At this time it may fly ten feet above the water.

The Dipper is rarely seen over land. On April 14, 1956, two birds displayed courtship behavior, the male pursuing the female. They both flew inland 30 feet and about 15 feet over my head. On another occasion a bird flew across about 10 feet of land from one stream branch to another. However, Skinner (1922: 18) saw one Dipper flying across a quarter-mile stretch between two streams.

*Grooming and resting.*—On many occasions Dippers have been observed preening and grooming their feathers. This was especially true after trapped birds were released. It is almost inevitable that in their attempts to escape from the mist net or hand, their feathers get displaced; after release they quickly fly to a rock and spend from five to ten minutes preening themselves after which they may rest or resume foraging. One behavior pattern observed in the Dipper is

the stretching of one wing fully above the head. This was seen only during the summer. It may be connected with juvenile feather development and with post-juvenile molting.

In the early part of this study it was noticed that the birds had more frequent periods of inactivity during very cold weather. The longest observed resting period during the winter of 1955-56 was ten minutes. On January 16, 1957, the temperature was between zero and 5°F. throughout the day and a study was made on the activity of the birds. Extensive areas of the stream were frozen over. Three out of four birds observed were standing motionless in shallow water when approached. I was able to move within 15 feet of the three birds before they became active. In contrast, on warmer days the birds generally became aware of the observer when about 30 yards from him. This cold temperature behavior was also observed by Robert Hoffmann (unpublished field notes) on March 9, 1956 (temperature 10-15°F.). I have observed the Dipper resting on a rock or occasionally a piece of driftwood, on one leg on six different occasions. At this time the other leg is well hidden among the breast and wing feathers and cannot be seen. They were timed in this position for ten minutes.

*Food habits.*—On Rattlesnake Creek small fish apparently supplement the diet of the Dipper. On six occasions predation on fish ranging from two to three inches in length was observed. There are no salmon in this part of Montana and the birds prey instead on small cottids or trout. The total effect of this predation is probably economically insignificant in this area.

A gross survey of available food was made on one small portion of the stream 0.25 mile below the Montana Power Company dam in May, 1956 (fig. 1). Numerous Plecoptera and Ephemeroptera nymphs and Tricoptera casings were found attached to the rocks. The sandy substratum contained mostly Tipulidae larvae and some Tricoptera. Often the food particles on which the Dipper is feeding are too small to be identified, but frequently a bird has been observed foraging upon both Plecoptera and Ephemeroptera nymphs, which they pick from submerged rocks with great rapidity. On September 13, 1956, a bird was seen with a Tricoptera casing in its bill. It picked off the outer shell and ate the larva. This was the only observed instance of Tricoptera in the diet.

An analysis of the digestive tract of two birds trapped on July 18 was made (see p. 193). No recognizable food was found in the female. In the male, one unidentified, intact, adult beetle was found in the

cloaca. The remaining food was located only in the gizzard. This contained sand grains, 2-3 mm. diameter, which constituted roughly two per cent of the total volume, and eight pieces of oligochaetes (fresh-water segmented worms) 4-5 mm. long. The bulk of the food included adult Plecoptera or portions of them, such as wings, legs, and body segments. Some legs found with no claws were presumed to be Plecoptera. No larvae of any kind were found. The large percentage of adult forms is correlated with the abundance of flying insects found on the stream during July. These are obtained either by skimming them from the water surface or by "fly-catching."

On October 13, 1956, a bird was observed eating what appeared to be moss off of a rock, and leaves from an unidentified monocotyledonous plant at the stream edge. It is not known whether this bird was a juvenile or adult as the two are almost identical after the post-juvenile molt. Bryant and Bryant (1915: 99) observed a juvenile pecking at lichens and moss in rock crevices shortly after leaving the nest. My observations indicate that fledged birds will peck at many miscellaneous objects during the first few days.

*Feeding behavior.*—Typically a Dipper picks up an aquatic nymph, crushes it, doing this sometimes with an up and down motion of its bill, and then swallows it. On three occasions birds were seen catching fry and swallowing them whole. One of these swallowed the fish immediately, another picked some scales off and then swallowed it, and the third pounded the fish on a rock for about five minutes, picking bits of muscle off intermittently, and then swallowed the remainder. Three other birds were observed to repeatedly slam their fish against a rock, pull muscle and intestinal contents out, and discard the remainder.

Dippers have been observed rapidly plunging their bills and the anterior part of their heads, including the eyes, into the water. For some time it was not known what the birds were doing, but on October 24, 1956, a Dipper was seen lowering its head in this manner and picking nymphs from the rocks. At other times they may be looking underwater for food as suggested by Burcham (1904: 50). On two separate dates, January 2 and February 19, 1956, birds were observed picking litter off the rock they were standing on and tossing it into the water. The litter consisted primarily of dead leaves. This may be related in some way to their habit of feeding on rock-clinging nymphs.

Another method of obtaining food is by "fly-catching." The bird commonly stands on a rock above the water, suddenly flies into the

air, snatches an insect, and returns to a rock (not necessarily the same one). The flight into the air is low, being well under ten feet above the stream. Birds were observed "fly-catching" on July 19, July 21, and August 17 in 1956. During these times there was a profusion of insects over the stream.

*Defecation.*—The presence of an observer at first causes a dipping action in the bird. This is followed by a quick defecation on the rock on which the bird stands and a rapid flight from the source of disturbance. Defecation in flight was observed only after banding; three birds defecating immediately after their release. On one occasion a banded bird defecated while being held.

Another stimulus which causes occasional defecation is the territorial fight. Several defending birds were seen to defecate on rocks. Other evidence for deposit on rocks can be seen on the rocks themselves, which in the territory of the bird are splattered with excreta.

*Dipping.*—One of the fundamental behavior patterns of *Cinclus mexicanus* is the dipping habit. Because dipping is so evident the name "Dipper" has been used recently to a greater extent in the literature than "Water Ouzel," which is a common name also used for the European species (*Cinclus cinclus*). Many people of western Montana use the name "Teeter-bird," etc. This name may be misleading, as the bird does not teeter or wave the tail up and down like the Spotted Sandpiper (*Actitis macularia*), but conspicuously bends the legs so that the entire body moves up and down in about the same horizontal plane.

Steiger (1940: 12) makes the suggestion that dipping is a device for communication. This is, however, unsupported. He also mentions that old birds do not dip as frequently as the young. I find no evidence of this, but there is, in general, much variation in the habit. Dipping begins at a very early age. It was not seen in nestlings 13 days old but by the 17th day the bird dipped slowly after being handled. Observations indicate that dipping is most frequent when the birds have been disturbed and is rare when they are feeding or resting. It is apparent that by the time most people get close enough to observe the bird it has already become aware of their presence and dips frequently.

*Perching.*—The Dipper is seldom seen perching. Drew (1881: 87) reported that he saw a Dipper perching in a bush. Occasionally they may be seen perching on driftwood or sharp angled rocks, but on September 11, 1956, the opportunity occurred to observe three birds perching simultaneously. A large tree had fallen and this exposed

the intricate root system over the water. Three birds were feeding together. They gradually moved near the base of the tree. One climbed up some roots which were hanging in the water and stopped about three feet above the water balancing precariously for several seconds. Then it fell directly into the water. A second attempt was made and the other two birds followed. This time the first bird climbed only a foot over the water, the other two nearby. For the following two or three minutes they would fall occasionally and climb again. Then they terminated this activity and resumed feeding.

*Mortality.*—One observation indicates that older nestlings may be able to avoid being dashed to death in torrents when they leave the nest. On May 15, 1957, nest I was checked for nestlings which were expected to fledge that day or the next. Upon seeing the observer's hand three nestlings flew out of the nest. One flew across the stream, another upstream and then entered the water. The third dropped into the water near the dam spillway (fig. 1). It paddled vigorously, but exhausted itself after one-half minute and was swept over the dam in the large volume of the overflow. After being tossed about in the stream at the base of the dam for about 20 yards, it quickly swam to some rocks at the stream edge, apparently unharmed. Just after leaving the nest, fledglings seem to allow closer approach than adults; this could be advantageous to a predator.

On September 7, 1956, an adult bushy-tailed woodrat (*Neotoma cinerea*) was found in nest IV (fig. 1). It had constructed a cup-like nest out of the moss and grasses of the old Dipper nest. The animal had remarkable climbing ability and experienced little difficulty in scrambling over a slight overhang after being chased from the nest. There is no evidence that the woodrat is a predator. They can, however, be considered as a potential threat.

## BREEDING BEHAVIOR

*Singing.*—The Dipper is one of the most colorful singers in the whole array of Oscines. The bird characteristically has two main types of vocalization, the "alarm" or "disturbed" call note and the winter or spring song. These have been described (Ehinger, 1930; Peterson, 1941).

Throughout 1956, the alarm note was most frequently heard. Fairly close approach to the bird by the observer can be expected to elicit this call. This is especially true if the bird has been previously flushed. On several occasions a parent bird with young was seen to be quite disturbed after noticing the observer in the vicinity. In one instance the parent, after being chased, settled on a rock and gave

repeated alarm notes for a period of five minutes, waning until it observed movement, and then recommencing. This was probably due to the presence of a fledgling which was only 20 yards from the parent.

Dippers were most often heard singing while on a rock in the stream. Skinner (1922: 19) says that the birds prefer to sing on warm days but will sing on the coldest. However, I have detected no preference with respect to temperature. In 1956, songs were heard on 27 different occasions. These ranged from a few disconnected sounds to very brilliant, vociferous singing that continued for a full 10 minute period and could be heard for several hundred yards. In 1957, from January through April, songs were heard on 22 different occasions. Singing was intense during this period and on March 17 a bird sang repeatedly for at least 20 minutes.

Singing was strong during January, 1956, increased in intensity through February and March and reached a peak in April. From December through February both males and females sang so similarly as to be indistinguishable. The male sang very loudly when in the presence of a female during the pairing stage. No singing was heard during the incubation period but it was resumed by the male parent during the nestling and fledgling stages. However, the observer's whistle elicited a short song by a male Dipper on one occasion during the incubation period in 1957. No singing was heard from June 6 to September 11, 1956. From this latter date on, the number of songs heard and their intensity slowly increased until the latter part of November at which time a more rapid increase in singing was noticed. The winter and early spring seasons of 1957 were very similar to those of 1956.

*Pairing, courtship, and copulation.*—The first observed pairing of birds in the spring of 1957 occurred on March 9. An unbanded male Dipper was heard singing loudly for 10 minutes. Bird #7, a male, approached him and both assumed a territorial defense posture (see below). Then the unbanded male, with wings bent downward, shook them rapidly, reminiscent of involuntary shivering in man when cold. A third Dipper approached and all three birds walked in a two-foot circle while maintaining territorial defense postures. The third bird, presumably a female, had been observed with #7 before he approached the singing male. Next, #7 chased the male 50 yards upstream, the female following behind. All three birds returned downstream several minutes later. The unbanded male sang very loudly and shook his wings. Number 7 then shook his wings and gave a

repeated alarm call. The female stood off to one side and watched the display. The chase resumed again as #7 pursued the male upstream and the female followed them. This behavior continued for another 30 minutes. The unmarked male and female were banded (#23 and #24) but their sex could not be determined at the time of marking. Number 7 flew over the mist net and on downstream to the vicinity of nest II (fig. 1).

It seems evident that #7 and the unbanded female were already paired before the engagement with the unbanded male. Territorial defense was very strong with even the female taking a defense posture on one occasion. This would indicate that there is a period of time during the early spring when a transitional change occurs from strong winter defense behavior (see below) to the paired condition. During this time, even the birds of the same pair may show a defense behavior toward each other on occasion. This particular behavior between two males in the presence of a female not only shows territoriality but is highly suggestive of the occurrence of a courtship display.

*Sex determination.*—The only method of determining sex in the wild is to observe the distinctive nesting behavior of the sexes. However, Richter (1953: 70) has successfully sexed the European Dipper or Water Ouzel (*Cinclus cinclus*) by measurements of wing lengths. He found that all birds with wings measuring under 89 mm. in length were female, all those 90 mm. and above were males. This method was checked for accuracy by observing the breeding behavior of measured and banded birds and could be first used on six to eight week-old juveniles. This system has not been employed in determining sex in the American Dipper (*Cinclus mexicanus*) so far as is known.

On April 14, 1956, a pair of birds from the vicinity of nest I (fig. 1) was seen in a courtship display in the stream area behind the Montana Power Company dam. The male chased the female for a total period of about 10 minutes. The male flew repeatedly from a small concrete block near the shore, where he would take brief rests of about 5 to 10 seconds, to the female which was in shallow water near the stream bank. Occasionally, when he would rest for 15 to 20 seconds, the female would fly past the male on the concrete block, apparently stimulating the male quickly to resume his chase. Flying at high speed, for Dippers, they would twist and turn while maintaining a fairly straight overall flight path. The male was singing loudly while pursuing the female. Often when the male was in pursuit, the female would drop into the stream with the male flying on rapidly over her. This behavior occurred within a 50-yard length of stream.

From my observations copulation in the Dipper is an event which

usually takes place from two to four weeks after the birds have formed paired associations. This interesting behavior is not frequently seen or reported. The mating behavior observed resembles that noted by Ehinger (1930: 494). The pair of birds observed on April 14, 1956, occasionally met in midair during the courtship flight, the male's breast and female's back in close contact. This behavior suggests copulation in flight; however, it may have been a type of courtship activity. On one occasion they thus met in air about 15 feet above the water and then fell in a free drop together into the water.

On May 23, 1956, two birds were seen copulating in the vicinity of nest IV (fig. 1). One was in shallow water on a sand bar and the other was standing on its back performing an up and down patting motion with its feet. The cloacal regions came in contact for about 15 seconds. This was repeated three or four times within about two minutes. Before alighting on the sand bar both birds were seen flying at high speed. This suggests that some chasing had taken place before copulation.

*Nesting.*—In the present study, all nests had an outer shell constructed of moss with small amounts of interwoven grass stalks and roots. The inner lining consisted largely of dry grass stems arranged into a cup-shaped structure. Several dry cottonwood leaves were found in the inner bowl just before eggs were laid in nest I on April 1, 1957. The entrances measured about three inches wide and two inches high during the early stages of nesting but became four inches wide and four inches high by the end of the nesting period. On several occasions one of a pair of birds was observed with moss in its bill. On March 6, 1957, at nest III and on April 20, 1957, at nest VII, both male and female repaired or constructed the nest. Bent (1948: 100) was told by Aretas Saunders that, in Montana, some Dipper nests are built on rocks without a bottom or lining and the eggs are then deposited on the rocks.

Hann (1950: 52) describes two common characteristics of Dipper nests, saying that they are placed over or nearly over the edge of a stream and are mostly inaccessible. I am in full agreement with Johnston (1943: 65), who states that the location of the Dipper nest "is determined solely by habitat conditions." The Dipper will construct nests on a large variety of supports providing that they simulate the conditions as outlined by Hann. The length of time that the nests are usable is indicated by observations of Towne (1904: 109) who photographed a nest in 1897 and found it intact in 1904, a period of seven years. If this nest was used each year then it was probably

repaired annually. On the Rattlesnake Creek usable nests are repaired each spring by the addition of moss and grass before being utilized once again. The most obvious repair is to make the nest opening smaller and to add a new inner lining.

Six nests were located during the pre-nesting period of 1956. On April 5, 1957, another nest was discovered in the process of being newly constructed. In July, 1957, a trapper informed me of an eighth nest (table 1). The nests were numbered in the order they were found (fig. 1). Three of the nests remained green during the breeding period.

TABLE 1

NESTS WITHIN THE STUDY AREA

| *Nest* | *Location* | *Height above water in feet* | *Miscellaneous Comments* |
|---|---|---|---|
| I | 4.3-mile point. On wood shelf above dam spillway. | 7 | Used for several years prior to and including 1956-57. |
| II | 4.4-mile point. Rocky niche. | 15 | Used in 1956-57. |
| III | 6.0-mile point. Rocky niche. | 5 | Used in 1956-57. |
| IV | 6.0-mile point. Rock ledge in a dark recess. | 7 | Used only in 1956. Atypical shape with opening from the top. |
| V | 13.0-mile point. Crossbeam under bridge. | 8 | Used once but no eggs were laid. Missing in May, 1957. |
| VI | 4.35-mile point. Rocky niche. | 8 | Collapsed. Not used. |
| VII | 0.9-mile point. Crossbeam under bridge | 8 | Newly constructed in 1957. Found collapsed on May 4, 1957. |
| VIII | 4.7-mile point. On bridge. | 15 | Newly constructed and used in 1957. |

Six additional nests were found in the eight miles beyond the study area in steep granite canyons in September of 1956. Five of these were placed in exposed granite niches. One was behind a waterfall. The nests were placed about 8, 8, 14, 6, 20, and 10 feet above the water, respectively. Five of the nests would be accessible only by rope from above. The depth of water under the nests was estimated to vary from 4 to 10 feet or more and at this time the water level was very low. Three of the nests were green. Four appeared to be in use.

Nesting begins in April (Grinnell and Storer, 1924: 546) or May (Saunders, 1914: 142) and extends through June and July or sometimes even up to August in Montana (Saunders, 1921: 154). In 1956, the first egg was laid on April 15 in nest I, about April 17 in nest II (calculated), and about April 12 for nest III (calculated). In 1957, nest I had an egg laid in it on April 1. Nests II and III had eggs laid in them between April 8 and 20 in 1957.

In 1956, an inner lining was placed in nest III at least 15 days prior to egg laying. Bird #6, in 1957, was observed placing an inner lining in nest I seven days prior to the laying of the first egg. In 1957, eggs were found about two weeks after the inner lining was placed within nest III. Because young juveniles were observed in September above the study area the nesting season must have extended into July at the higher altitudes (see p. 192). Henderson (1908: 2) says that this variation in the time of nesting is partly due to differences in altitude. Young juveniles were seen as late as September 5, 1956. They were found upstream above the study area, on the West Fork of Rattlesnake Creek.

A Cliff Swallow (*Petrochelidon albifrons*) was observed in nest II on July 25, 27, and 29, 1956. She had constructed an inner lining of what appeared to be white remiges (at least around the nest opening) and may have laid eggs, although no further observations were made to determine this. This was the only instance in which a Dipper's nest was occupied by another species of bird.

*Incubation and care of nestlings.*—Most of the observations on nesting behavior in 1956 were made at nest III. Some additional information was gathered at nests I and II. During and after the inner lining was placed in nest III the male sang loudly in 1956 and 1957. In 1956, the male of nest III was not seen for a period of 22 days after the calculated egg-laying date. Again in 1957, the males were not observed around nest I or III during the incubation period. However, after incubation in 1956, the male parent of nest III was heard singing loudly near the nest while the female fed the nestlings. The males do not incubate.

During the first few days of incubation the inattentive periods vary from 8 to 22 minutes, according to Hann (1950: 54). In 1956-57, at nests I and III, the female was observed in the nest on the majority of days when checks were made during the incubation period.

The feeding of the nestlings is done primarily by the female parent, but the male (#7) alone was observed performing this task at nest II after the female had disappeared. A similar situation is reported by Hann (1950: 51). During one observation the shortest time required by the adult to obtain food was 20 to 30 seconds, and 5 to 10 seconds to feed the nestlings.

When the Dipper nestlings were 12 to 13 days old they would cry every time the parent approached the nest. The same reaction was elicited when a hand was placed over the nest entrance. While nestlings were being marked the parents did not seem to be overly dis-

turbed, but if the young cried the parents would suddenly act greatly alarmed. At about 20 days of age, two or three nestlings would stick their heads out of the nest opening until the parent arrived with food, at which time they would cry. The nestlings defecated out over the rim of the nest, as reported by Cordier (1927: 171).

Hann (1950: 53) concludes that the incubation period of the Dipper is 16 plus or minus one day. In April-May, 1956, the female (#6) of nest I incubated eggs for at least 14 days. On April 1, 1957, the same female laid her first egg in nest I, two days later her second, then one per day until four were laid. Incubation began after the fourth egg was laid and extended over a period of 16 days. In 1956, nestlings remained in nest I at least 20 days but not more than 29 days, and at least 19 days in nest III. In 1957, nestlings remained in nest I for 24 and 25 days.

*Productivity.*—Numerous authors (Mitchell, 1898; Saunders, 1921; Dawson, 1923; etc.) mention that some Dippers raise two broods per season. Drew (1881: 86) provides the only observation on this point. He found a nest with four young, the female parent of which was building another nest while the male fed the young brood. The second brood had two eggs. More recent evidence by Hann (1950: 59) and the present study show that only one brood is raised ordinarily. Table 2 is a summary of productivity observed on the study area in 1956 and 1957. No broods were raised in nests IV and V in 1956. On May 16, 1957, nest III was checked but no nestlings nor remnants of shells were found. The inner lining was still within, and no birds were observed in the area. The cause of these nesting failures is unknown.

TABLE 2

SUMMARY OF PRODUCTIVITY

| *1956* | *Nest I* | *Nest II* | *Nest III* | |
|---|---|---|---|---|
| No. of eggs | 5 | ? | 5 | |
| Nestlings observed | 5 | 3 | 5 | |
| No. of nestlings that disappeared | 3 | ? | 0 | |
| No. of nestlings banded | 2 | 0 | 5 | |
| Fledglings observed | 2 | 4 | 4 | |
| *1957* | *Nest I* | *Nest II* | *Nest III* | *Nest VIII* |
| No. of eggs | 4 | ? | 5 | ? |
| Nestlings observed | 4 | 3 | 0 | 4* |
| No. of nestlings that disappeared | 0 | ? | – | – |
| No. of nestlings banded | 4 | 0 | 0 | 0 |
| Fledglings observed | 3 | 0 | 0 | 0 |

* Reported by a trapper. Nest observed; information considered reliable.

It may be that breeding Dippers return to their previous nesting site over a period of several years. Bird #6 nested in nest I in 1956 and 1957 but had different mates each year. Bird #7 (male) remained in the area of nest II in 1956 and 1957 and may have had different mates each year, however, no proof of this exists as neither of the females were marked. It is not known whether the same birds returned to nest III in 1957 as they were not banded.

*Fledgling behavior.*—The period of time that the fledglings remain with the parent is usually short. Near nest I in 1956, the male parent (#4) was observed feeding the two fledglings, #13 and #14, 12 days after they had been fledged. At nest II the family unit, composed of the male parent (#7) and four fledglings (see p. 202), remained intact for at least 12 days. At nest III the family unit remained in the nesting area for only four days.

The fledglings were usually observed within 50 yards of the parent, who repeatedly obtained food for them. In typical behavior, each time the parent flew by they would cry, some fluttering their wings. Male #7 at nest II fed the fledglings at intervals of one to two minutes during one observation. Burcham (1904: 50) has observed parents feeding fledglings until October 7.

In addition to being fed by the parent, the fledglings spend many hours resting and grooming. They were observed standing motionless on one leg for 10 minute periods, and would also spend some time in pecking at various objects in a type of trial and error behavior. On one occasion two fledglings were observed pecking on a rock immersed two to five inches under water. Several times they were seen diving into deeper water but they made no attempt to enter the swifter portions of the current.

## IMMATURE PLUMAGES

One-day-old nestlings (four observed) have sparsely scattered down on the crown and rump regions.

Two nests were observed (1956-57) with a total of 11 approximately 12-day-old nestlings. The nestlings had well defined pterylae. Each primary and secondary was extruded at least one-fourth inch from the sheath. The young still had a downy appearance, especially on the top of the head and rump. The incipient juvenal plumage was blue-gray. Their bodies were smaller than those of an adult, and the oral cavity and portions of the bill and legs were yellow. The legs appeared to be as long and thick as those of adults. The combined tarsus-middle toe length of the nestlings and adults alike varied be-

tween 50 and 60 mm. Their claws were well developed and quite sharp.

At 17 days of age the grey juvenal plumage was completely developed. A circlet, three fourths of an inch in diameter, of about 10 down feathers was seen on the crown and the rectrices were very short. The breast was pale white and grey, and the flank and crissum were a mixture of pale white and buff. Their oral cavities, commissural line along the bills, and portions of the legs were yellow, and the primaries and secondaries were tipped with pale white.

Newly fledged birds, 27 days old, were observed near their nesting site (nest III). They were generally of a slate-gray color with lighter undersides. The oral cavity was entirely, and bill and legs each partly, yellow. The juvenal plumage was well developed but retained a slight downy appearance.

Observations of three banded juveniles indicate that the post-juvenal molt takes place within about six weeks after fledgling dispersal.

## SUMMARY

The general life history of the Dipper (*Cinclus mexicanus*) was studied on Rattlesnake Creek, Missoula County, Montana. Nestling birds were color-banded, juveniles and adults trapped and marked.

When diving Dippers used the wings to a considerable extent. The maximum time spent submerged was between 15 and 20 seconds. The deepest measured dive was four feet.

Dippers commonly flew within two or three feet of the water but on longer journeys this was increased to between three and six feet above water. Only on two occasions did a bird fly overland.

Dippers appear to feed upon Plecoptera and Ephemeroptera found on the rocks within the stream. Trichoptera larvae, fish fry, and plant food were occasionally eaten.

Defecation was frequently caused by the observer's presence and rarely occurred in flight.

The frequently heard alarm note was usually elicited by the observer's presence, but was also heard in connection with territorial defense behavior. Singing was strongest from December through early April. No song was heard from June 6 to September 11, 1956.

Pairing occurred throughout March. An intensive shaking of wings accompanied by loud singing was perhaps indicative of courtship behavior. Copulation took place from two to four weeks after the birds paired. Chasing appeared to precede copulation.

Of eight nests located, two were newly constructed, others were old

repaired nests. Some Dippers may return to the same nesting site over a period of several years. Nesting may sometimes begin in late March, and extend into July.

Observed clutch size was four to five. The incubation period was 16 days, the nestling period 24 to 25 days. There was no evidence that more than one brood was raised during a breeding season.

Fledglings remained around the nesting site from 4 to 14 days.

The post-juvenal molt took place within about six weeks after fledgling dispersal.

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*Department of Zoology, Montana State University, Missoula, Montana. (Present address, Department of Zoology, University of Washington, Seattle 5, Washington.)*