

OBSERVATIONS OF THE LOON
IN THE CARIBOO PARKLANDS, BRITISH COLUMBIA

BY J. A. MUNRO

Plates 4, 5

THE Cariboo Parklands is a section of the interior plateau of British Columbia noted for the number and variety of its watered areas that together comprise the most productive waterfowl nesting grounds in the province. The present paper, a contribution to the life history of the Loon, *Gavia immer* (Brünnich), is based on observations made in this region during the summers of 1936 to 1943, inclusive, but includes other pertinent data acquired elsewhere, chiefly during earlier years.

Loons arrive in the Cariboo Parklands shortly after the ice has gone from the larger lakes, which usually takes place in late April. Farther south on Okanagan Lake, at this time, it is common to see loons in flocks sometimes containing as many as 40 individuals, and such flocks have been recorded as early as April 10 and as late as May 3. Whether these represent pre-nuptial associations or gatherings of sexually immature, non-breeding birds has not been determined. No such flocks have been observed on the Cariboo lakes. The loons that arrive there first would seem to be sexually mature, since very soon after arrival they become established on the territories they will occupy during the summer.

The population seems to be nearly stationary. The same small lakes are occupied each year by single pairs while other lakes, that to all appearances afford the same facilities of nesting sites and food, are avoided. Each year, also, the larger lakes, all of which support loon populations, have approximately the same number of occupied territories.

The use of certain small lakes as breeding grounds and the avoidance of others cannot be correlated with the presence or absence of fishes as is commonly believed. Reference to the table on page 39 will make this clear.

In this table, "trout" means Kamloops trout, *Salmo gairdneri kamloops*, or other Salmonidae; "other fishes" means the so-called coarse fishes and includes no species of Salmonidae nor any commercially valuable species.

It will be seen that twelve loon populations totalling 53 adults occupied lakes in which trout, or trout together with other fishes, was an element in the food potential; that ten populations totalling 26 adults occupied lakes in which species other than trout represented

| Locality | Date | No. of adult loons | Food Items | | | | | |
|----------------------|-------------|--------------------|------------|--------------|-----------|----------|-----------------|---|
| | | | Trout | Other fishes | Amphipods | Mollusks | Aquatic insects | |
| Deka Lake (part) | 9 × ¾ m. | July 28, 1936 | 5 | x | x | x | x | x |
| Disputed Lake | 50 acres | July 29, 1936 | 2 | | | x | x | x |
| Dempsey Lake | 1 × ½ m. | Aug. 10, 1936 | 2 | x | x | x | x | x |
| Longbow Lake | 1¼ × ¼ m. | Aug. 17, 1936 | 2 | | | x | x | x |
| Fawn Lake | 1¼ × ¼ m. | Aug. 17, 1936 | 4 | x | x | x | x | x |
| Slough, Clinton | 4 acres | July 13, 1937 | 1 | | | x | x | x |
| Horse Lake | 7 × 1¼ m. | July 22, 1937 | 17 | x | x | x | x | x |
| Williams Lake (part) | 5 × ½ m. | Aug. 2, 1937 | 3 | x | x | x | x | x |
| Lily Pad Lake | 1½ × ¼ m. | Aug. 7, 1937 | 2 | | x | | x | x |
| Langley Lake | ½ × ⅓ m. | May 1, 1938 | 2 | x | | | | x |
| Exeter Lake | 1 × ⅜ m. | July 7, 1938 | 1 | | x | x | x | x |
| Succour Lake | ⅝ × ¼ m. | July 13, 1938 | 2 | | x | | x | x |
| Straight Lake | 2 × ⅓ m. | July 15, 1938 | 2 | | | | x | x |
| Simon Lake | 1¾ × ½ m. | July 15, 1938 | 4 | | | x | x | x |
| Roundup Lake | 50 acres | July 15, 1938 | 2 | | | | x | x |
| Pete Kitchen Lake | 80 acres | July 18, 1938 | 1 | | | | x | x |
| Slough | 4 acres | July 20, 1938 | 1 | | | x | x | x |
| Abel Lake | 80 acres | July 22, 1938 | 2 | | x | x | x | x |
| Rail Lake | 2 × 1 m. | July 25, 1938 | 7 | x | x | x | x | x |
| White Horse Lake | 1¼ × ¼ m. | July 27, 1938 | 4 | | x | x | x | x |
| Shermer's Lake | 10 acres | July 27, 1938 | 2 | | | | x | x |
| Tad Lake | ¾ × ⅓ m. | Aug. 1, 1938 | 2 | x | x | | x | x |
| Beaver Dam Lake | 30 acres | Aug. 20, 1938 | 2 | x | x | | x | x |
| Tatton Lake | 1½ × ⅓ m. | June 11, 1940 | 4 | | | x | x | x |
| Boitano Lake | 1¼ × ⅓ m. | June 12, 1941 | 2 | | | x | | x |
| Alkali Lake | ¾ × ⅓ m. | July 9, 1941 | 2 | | x | | x | x |
| Indian Dam Lake | 80 acres | July 11, 1941 | 2 | | | x | x | x |
| 130 Mile Lake | 1¼ × ¼ m. | June 4, 1942 | 2 | x | x | x | x | x |
| Jones Lake | 75 acres | June 29, 1942 | 2 | | x | x | x | x |
| 103 Mile Lake | ¾ × ¼ m. | July 2, 1942 | 3 | | | x | x | x |
| Anthony Lake | 30 acres | July 5, 1942 | 1 | x | x | | x | x |
| 105 Mile Lake | 1¼ × ½ m. | July 13, 1942 | 2 | | | x | x | x |
| Lac La Hache (part) | 10½ × 1½ m. | July 10, 1943 | 6 | x | x | x | x | x |
| 108 Mile Lake | 1¼ × ¼ m. | July 24, 1943 | 7 | | x | | x | x |
| Sheridan Lake (part) | 5 × 2 m. | July 28, 1943 | 2 | | x | | | x |

the fish food element and thirteen populations totalling 28 adults occupied lakes from which fishes were absent.

Most of the lakes containing fishes are large and their total area is much greater than the total area of lakes without a fish population. Thus the fact that the largest population of loons inhabits the former is less significant than it would be if the totals of areas were of comparable size.

NESTING

The majority of nesting sites fall into three categories—namely, muskrat houses, shore sites and floating sites. The muskrat houses occupied by nesting loons are usually those situated some little dis-

tance from shore where the water is at least a foot in depth. It is commonly the case that marsh growth affords protective cover on three sides while the fourth side is open with direct access to fairly deep water. Often the muskrat runways fulfill this necessity. Shore sites may be on an open beach or a marsh-edged shore; in the latter the nest always is beside an escape-channel. Floating sites are at the edge of a cattail marsh or in a stand of round-stem bulrush. In the latter the nests may contain a very large amount of material, of which the greater part is submerged and resting upon the solid root system of the bulrush. One essential for all sites is direct access to open water so that a sitting bird after being alarmed may slide off the nest and escape under water.

When muskrat houses are occupied as nesting sites, the eggs are laid in a scraped-out depression, no nest material other than that provided by the house itself is used. Actually, in some instances, it is impossible to determine whether a site is an old muskrat house or a chance accumulation of marsh debris. Nests built on the two other types of site—*i. e.*, those referred to as shore sites and floating sites—vary only slightly in character and the material used is almost invariably bulrush and cattail. The descriptions that follow illustrate the degree of variation in nest site and nest construction.

Muskrat house sites

Horse Lake, May 30, 1937. Site an old muskrat house 100 feet from shore in *Equisetum* marsh (Plate 4, fig. 2).

130 Mile Lake, June 4, 1942. Site at outer edge of round-stem bulrush and cattail marsh fronting on water covered by pads of yellow pond lily, *Nuphar polysepala*. The muskrat house, made of rotted bulrush, rested upon a submerged bulrush root system with its exposed portion, approximately four feet in greatest diameter, ten inches above water at the highest point. A depression about twelve inches wide held the eggs (Plate 4, fig. 3).

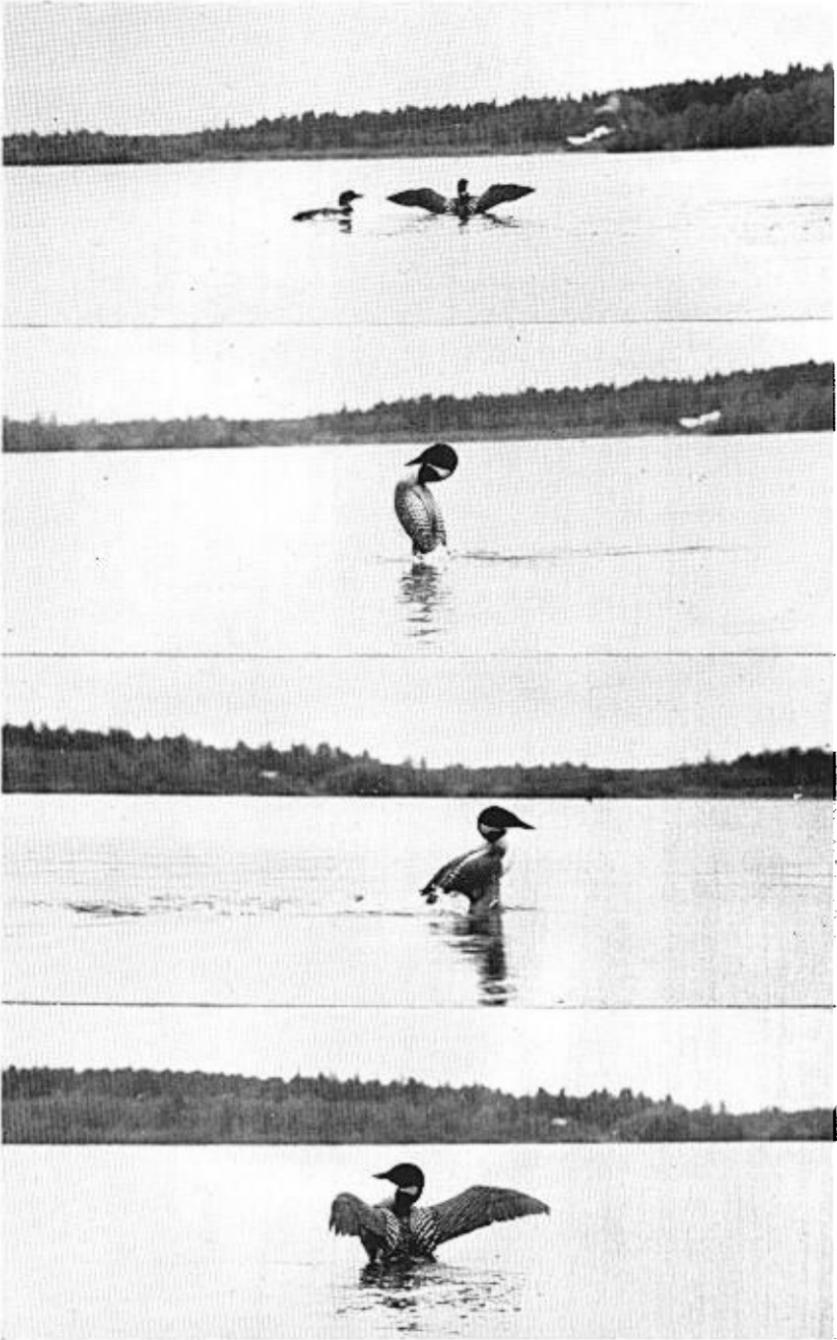
Shore sites

Williams Lake, June 2, 1942. Site under overhanging branches of dogwood between the base of a two-foot bank and the water's edge on a narrow, stony beach of a wooded island. The nest, two feet by three feet, was made of round-stem bulrush, all of which, except the upper surface, was sodden, apparently from wave action.

Lac La Hache, June 28, 1942. The site was on the outer edge of a narrow strip of shore-line marsh about five feet out from the hard shore of a marshy bay. The nest, measuring two feet across its widest



NESTS OF LOON.—FIGS. 1, 5, 6—FLOATING TYPE; FIGS. 2, 3—ON MUSKRAT HOUSE; FIG. 4—SHORE TYPE.



BEHAVIOR OF THE LOON NEAR THE NEST.

diameter, was made of bulrush built up from the lake bottom in water five inches deep. In front, a small clump of bulrush, probably grown tall since the nest was constructed, afforded some cover; to one side a well-marked trail through submerged vegetation led from the nest to open water; this was the entrance. On the opposite side of the nest, in front of and below what was identified as the usual place of exit, a space about six feet in circumference in the sandy lake bottom measured about eight inches lower than its surroundings. This extra depth undoubtedly facilitated the loon's departure from the nest. The excavation seemed of recent origin and possibly had been scraped out entirely, or at least deepened, by the continuing impact of the bird's body on the sand as it left the nest through the course of several weeks.

Floating sites

Lac La Hache at 121 Mile, May 31, 1942. At outer edge of open bulrush stand, *Scirpus acutus*, near entrance to marshy bay. The nest, two feet by three feet, was made of bulrush; the foundation rested on an invisible bulrush root-system in water three feet deep; the portion above water was entirely dry (Plate 4, fig. 2).

Tatton Lake, June 3, 1942. The site at edge of channel between two sections of a round-stem bulrush marsh. The nest, 18 inches in diameter, was made of bulrush resting on a submerged root-system^s with rim four inches above water; bulrush, *Scirpus acutus*, both old and new growth, provided cover on three sides (Plate 4, fig. 3).

Jones Lake, June 29, 1942. Site on the outer edge of a cattail marsh. The nest, a floating mass of cattail stems, was screened at the back by tall cattails and at the front by a small clump of bulrush. An escape-channel three feet long led through the cattails at the back to deep, open water.

There is much variation in color, shape, and size of eggs—and this is a fruitful field for enquiry. It would be of interest to know if such characters are fluid or static and whether or not a particular egg type is constant with a particular individual. One clutch examined in which one egg was darker and about one-third smaller than the other can be considered abnormal (Plate 4, fig. 4).

In regions south of the Cariboo Parklands, nests of quite different character have been examined. Thus at Lac Le Jeune, near Kamloops, June 5, 1922, a deeply concave nest on a small grassy island situated in a narrow channel that drained a beaver meadow, was 18 inches in diameter, and in its construction, sedge stems, leaves, and roots, and a little moss had been used—material that was available close at hand. Another at Echo Lake, near Lumby, May 13,

1940, consisted merely of a shallow depression on top of a mossy log, partly submerged and jutting out from the shore. The depression that was unlined had been made by removing the moss; the single egg rested on partly decayed wood.

From these observations, that have identified various types of nest sites and nest material, it may be adduced that the loon is most adaptable in nesting habits, using whatever site and material is available.

TERRITORY AND TERRITORIAL BEHAVIOR

An entire small lake will constitute a territory for one mated pair while larger lakes may contain two or more. Thus Tatton Lake, one and one-half miles long, supports two nesting pairs, whose territories are separated by intervening marsh growth. The population of Lac La Hache, 12 miles long, usually is three pairs, one near the west end of the lake, two others about five miles to the east. The territories of the latter center about two adjacent marshy bays separated one from the other by a long, narrow peninsula. On all large lakes, loons show a decided preference for marshy bays; these and their adjacent waters are occupied year after year. The yearly period of occupation by a pair, whether successful or not in raising young, lasts from early May until mid-August. During all this time the loons feed within a circumscribed area and show little tendency to extend the field of operation. Territories are often invaded by single birds, by couples or small bands engaged in the search for food; these are considered to be non-breeding individuals. Pairs with eggs or young and even pairs unsuccessful in nesting are definitely sedentary as has been suggested. Invasion of their territories by other loons may be resented or it may not; probably unsuccessful pairs are more tolerant of intrusion. Thus at Horse Lake in July, 1936, one of a pair without young took note of an intruder as it approached from a distance by repeating a short, single note at regular intervals but made no hostile demonstration. (Munro, *Condor*, 39: 163-173, 1937.)

At Tatton Lake, June 3, 1942, a pair on open water, about 200 yards distant from their nest in the shore marsh, was approached by a second male, and immediately the first male 'ran' over the water toward it. In this manner of travel it appeared as if the body were held above the water by slow wing-strokes that struck the surface with regular beats, causing a turmoil of spray that was added to by the 'running' feet. When about 200 yards from the intruding male he dived and upon emerging swam back to the female while the intruding male retreated. The first male called only once, the intruding male was silent.

The following behavior, observed on June 24, 1922, at Swan Lake, did not appear to represent defense of territory but rather a recrudescence of courtship display. The males of two pairs, swimming close together, simultaneously left the females and dashed away at a great rate of speed, in opposite directions, propelled by powerful wingbeats. The body was about two-thirds out of water, head and neck straight out six inches or so above the surface. Both called continuously with the laughing cry. In this swimming flight the birds followed the arc of a circle that brought them back to the females. At its conclusion, both stood upright with chest out and head back, then gave the laughing call several times in quick succession.

Loons become greatly excited by the appearance of a boat on their territories, an excitement that finds vent in behavior which varies somewhat with the individual and reaches the highest manifestation when the young are on the water.

It is the male that shows the greatest excitement and performs most of the somewhat grotesque actions that are a source of such interest to the beholder (See Plate 5). The performance may be given by a cruising male while its mate is incubating or by one that, accompanying female and young, remains close to the observer while the latter swim away. One common action is to surge over the surface half out of the water, then dive to reappear within a few yards and surge again. Another is to stand nearly upright with neck curved back, chest outthrust, the wings half-opened and curved forward. Sometimes one will approach a boat in a series of springs that takes the body clear of the water, which causes such disturbance on the surface that the mechanics of the movement are impossible to detect. These performances may be accompanied by one or another of the varied calls in the repertoire that is at the loon's command. More often than not they show little fear and may approach a boat within a few yards.

The reactions of nesting pairs and of pairs with young as observed under these circumstances are detailed in the following section.

Behavior of nesting pairs

At Lac La Hache, May 31, 1942, when a nest with two eggs was examined, the pair, at a distance of 50 yards and less from the site, swam back and forth and occasionally dived. Both birds were silent until the canoe was paddled from the vicinity, when one gave a single call. It is of interest to note here that this pair, accompanied by one young, was still on the territory on June 28, as was a second pair on an adjoining territory. The nest and eggs of this second pair also had been examined on May 31 and it, too, was accompanied by one young on June 28.

A female on a nest at 130 Mile Lake, June 4, 1943, allowed an approach within 50 yards. It had assumed a peculiar position with neck draped over the nest-rim and bill pointing down toward, and almost touching, the water. When approached closer she slid off, dived, and was not seen again amongst the expanse of lily pads that covered the water for 100 yards or more in front of the nest. Later the pair was heard calling half a mile away and later still, when a heavy rain squall came down the lake, the two birds flew past high in the air and called repeatedly.

Other nesting pairs under observation remained in the vicinity of the nest and were silent; on rare occasions only one of the pair was present.

Behavior of pairs with young

At Horse Lake on July 16, 1937, a female and her mate, accompanied by one young about a month old, were swimming close together not far from the nest site. It was observed that she accommodated her swimming speed to the slower progress of the young bird so that it was possible in a canoe to draw quickly toward them. Meanwhile, the male swam away in a different direction, sometimes surging over the surface with body half out of the water, chest outthrust, and head and neck retracted while he called repeatedly. When the canoe was about 30 yards from the female, she made a series of quick dives and sudden emergences, barely breaking the surface as she rose, so that the commotion on the water resembled that made by a rising trout. During this time the young bird swam off in a fairly straight course. The lake was perfectly calm so that the bird's progress could be detected by the regular appearance of the crown of its head or by a slight ripple on the glassy surface of the water. Gradually, as the bird tired, the time of submergence lessened until it was possible to paddle directly over its course. Then it could be seen, as it swam below the surface beside the canoe, that the rudimentary wings were held close to the sides and that motion was attained solely by vigorous thrusts of the feet. Finally the bird was captured and photographed. Upon being released, it immediately dived and swam under water for 20 yards or so before emerging. After a succession of such dives that carried it 100 yards or more, it was joined by both parents. A month later it was seen again on the territory accompanied by both parents. It was then about half-grown.

On the same territory, July 18, 1943, the male of a pair approached a moving canoe within 30 yards and accompanied it at this distance for five minutes, giving the laughing-call repeatedly. At the same time the female and one small young were swimming along the opposite

shore of the lake a quarter of a mile distant, and she answered the male's laughing-call with a long drawn-out, quavering *whooo*, or a short three-note sequence, *whoo ah wah*.

On June 27, 1941, at 130 Mile Lake, a pair was accompanied by two young about a week old, and both parents stayed with them and remained silent when the family was approached by canoe.

On Tatton Lake, July 2, 1941, the single large young remained with the female while the male, 50 to 100 yards away, made the characteristic demonstrations and called repeatedly.

At Jones Lake, June 29, 1942, a male swam 200 yards or so ahead of a female that was accompanied by two small young.

At Horse Lake, July 16, 1943, the male of a pair whose territory included a marshy bay was swimming across its wide entrance while the female with one quarter-grown young remained at the upper end of the bay, 500 yards distant. The former approached the observer's canoe until it was 60 feet or less from it, then turned and swam in a different direction, keeping about the same distance ahead. This continued for about ten minutes during which time the loon six times repeated the following performance, *viz.*, it rose in the water until it had assumed an almost vertical position with body turned slightly sideways (so that the white underparts were in full view) and, with head and neck retracted, it churned the water with its feet for several seconds, giving the laughing-call at the same time. In the intervals between these displays it swam slowly ahead on the surface, calling almost continuously. The female, out of sight near the head of the bay, answered with the laughing-call.

Pairs that have deserted or lost their eggs react in a similar manner to human presence even long after the desertion or loss has taken place. Thus at Horse Lake a pair was noted daily from May 26 to June 1, 1937, and again on July 14, on a territory comprising a marshy bay and adjacent waters that had been occupied each of the four years the lake was under observation. On July 14, the male was as demonstrative as it had been in May although the nest had been deserted for so long that the eggs were half-buried in the nest debris with their upper surface faded and the contents decomposed.

The behavior of these loons, unsuccessful in nesting, is possibly a mechanical reaction indicative of a particular physiological stage in the reproductive process and produced automatically when the nesting territory is invaded by enemies (Munro, *Condor*, 39: 165, 1937). On several lakes where nesting had not been successful, territory-defense has been observed as late as the first week of August.

On lakes where nesting has been uniformly unsuccessful, the entire population may at times associate in a flock and individuals may perform certain of the territory-defense actions. Thus, on Lac La Hache in 1937, none of the four pairs raised young and on several occasions in late summer the eight birds were seen together. On one such occasion a member of the flock swam in a straight line about 200 yards from shore for a distance of about half a mile, and at regular intervals struck the water sharply with partly-spread wings, sometimes a dozen or more times in quick succession, producing by this rapid movement a series of sharp reports that could be heard a quarter of a mile distant.

Survival of young

A large proportion of the nesting is successful in that the eggs hatch. In six instances where the history of a nest was followed through, both eggs hatched; in two others, one egg hatched and each of the others contained a small dead embryo; two other nests with eggs were deserted but both pairs remained on their territories for at least a month afterward. There is, however, a very considerable failure at some point in reproduction because invariably in late summer the greater part of the population consists of mated pairs without young; generally it is not possible to determine whether this is due to the loss of eggs or the loss of young. Furthermore, the number of pairs accompanied by one young is greater than the number of pairs accompanied by two young.

It seems, also, that some pairs remaining together for most of the summer do not lay eggs although they may construct rudimentary nests. Thus a pair on 105 Mile Lake, June 4, 1937, showed concern whenever I approached a small island near the center of the lake, and when I landed on it they swam back and forth close to what appeared to be their nest-site. This was the top of a newly-built muskrat house situated at the end of a stony point and constructed largely of sago pondweed, *Potamogeton pectinatus*. Later, as I paddled around the circumference of this small lake, the loons followed, swimming both on and below the surface. No loons were present when the lake was next visited on August 6 and again on August 16. It was observed on May 27, 1941, that a pair had established a territory at exactly the same place, and a muskrat's feeding place of dry rushes on the shore of the island showed indications of having been used by them. The pair was still on this territory on June 27 and was seen there later in the summer, but no eggs were laid so far as could be learned.

Some, at least, of these abortive pairings do not persist through the summer, and it frequently has been observed that a small lake may be occupied in June by a pair and by only one bird in July. Invariably a search for a nest in these circumstances was not successful and it was considered that none had been built. The breeding status of these birds is uncertain.

The yearly totals of adults and young with the number and size of broods as enumerated on various lakes in the Cariboo region, where the fact of nesting was established, are set forth in the tabulation below. It is not known what proportion of the adults represents non-breeding birds. What were actually identified as such have not been included in the tabulation. The variation in numbers is not an indication of changing numerical status.

LOON POPULATIONS IN CARIBOO REGION DURING JULY AND AUGUST

1936—40 adults and 9 young—2 pairs, each with 2 young; 3 pairs, each with 1 young.

1937—52 adults and 3 young—1 pair with 2 young; 1 pair with 1 young.

1938—40 adults and 6 young—1 pair with 2 young; 4 pairs, each with 1 young.

1939— 6 adults, no young

1941—12 adults and 3 young—1 pair with 2 young; 1 pair with 1 young.

There remain for consideration what definitely seem to be non-breeding populations. These consist of single birds or couples established on small lakes that often are occupied in successive years. This fact has been established many times at different places. Usually solitary birds are silent and difficult of approach. In the non-breeding category also are some members of the population frequenting larger lakes. They are not restricted to any particular territory but range over the entire lake, very often in small flocks as at Horse Lake which is seven miles long. A lake at 108 Mile ($1\frac{1}{4} \times \frac{3}{4}$ m.) is a resort of six to eight birds that, in five out of the six years the lake was visited, were identified as non-breeding. It has been observed that none exhibit the fearlessness or indulgence in the varied display that mated birds do on their territories.

FOOD

On some waters, fishes would seem to form a considerable part of the loons' diet. Thus 108 Mile Lake, which yearly supports a non-

breeding loon population usually numbering eight birds, as has been mentioned, contains lake shiners, *Richardsonius balteatus*, and suckers, *Catostomus* sp., but no amphipods nor mollusks and relatively few aquatic insect larvae. It can be assumed that the fishes mentioned form the chief food supply for the loons.

It seems remarkable how seldom visible evidence of the loons' fish diet is obtained. Mr. Sigurd Larum, a reliable observer who lives at Horse Lake, related the following incident. In July, 1943, two loons were seen swimming along the shore of Horse Lake, one with a fish about 14 inches long, either a sucker or a squawfish, *Ptychocheilus oregonensis*, that apparently was too large to be swallowed. The loon swam parallel with the shore, pulling the fish along the surface; several times the fish escaped but was seized quickly again. The second loon following behind did not take part in what seemed to be a struggle pursued with great effort and continued at least for half an hour or so until both birds passed out of sight behind a point on the shore.

Another quite dissimilar incident, but indicating a fish diet, has to do with a loon on Paul Lake, near Kamloops, May, 1936, that struck at an angler's trolling spoon and carried it away attached to a portion of the trolling line. A day or so later it was found along a tributary stream with the line entangled in a bush so that escape was made impossible. The person finding it broke the hook and released the bird. About two weeks later it was found dead with the barb of the hook still imbedded in the throat muscles.

That fishes are not essential, however, has been noted earlier; many lakes without fish life are used by both nesting and non-breeding loons. That a diet other than fishes is not unusual is testified to by the few stomachs that have been examined. All but one of these were taken in the interior of British Columbia but outside of the region covered by this paper. Nevertheless, as conditions at the places of capture approximate those of the Cariboo Parklands, this material is considered pertinent.

STOMACH CONTENTS OF FIVE LOONS

- Adult ♀. Mara Lake, May 18, 1922. Shell fragments of mollusca, including *Planorbis* sp., 100%.
- Adult ♀. Lac La Jeune, June 5, 1922. Small quantity of caddis debris, 100%.
- Adult ♀. Lac La Jeune, June 6, 1922. Small quantity of amphipod debris, 100%.
- Adult ♀. McGlashan Lake, April 23, 1940. Fragments of at least 150 amphipods many, if not all, *Gammarus limnaeus*, 70%;

10 whole corixids *Arctocorixa sutilus* Uhl, and fragments of at least 50 other corixids, 30%.

Downy young. 130 Mile Lake, June 26, 1941, bones of small unidentified fishes, probably *Richardsonius balteatus*, 75%; fragments of dragonfly nymphs, 5%; vegetable debris, 20%.

All the adult stomachs contained gravel; in one specimen were 14 pieces up to 18 mm. in length.

Okanagan Landing
British Columbia

DISTRIBUTION AND TAXONOMY OF THE BLACK-CAPPED CHICKADEES OF NORTH AMERICA

BY ALLEN J. DUVALL

DURING the course of identifying specimens that have recently come to the Biological Survey collection, I have been impressed, as have some previous investigators, by the similarity of Black-capped Chickadees from eastern Washington to those of the eastern United States. Apparently much has been written on this supposed 'colony' or 'island' of eastern-type Black-capped Chickadees, which, according to Ridgway (1904: 398), are inseparable from *atricapillus*. After intensive study of a large number of specimens, taken at all seasons of the year, the writer feels that, although these birds appear much like the eastern population, they are readily separable when compared with specimens in comparable plumage. Further discussion of these birds will be taken up later.

In the course of this study, over 800 specimens were available, including the type series and the types of both *practicus* and *turneri*, as well as three cotypes of *occidentalis*; the other three specimens of *occidentalis* listed by Baird (U. S. National Museum Nos. 6768, 4538, and 9219) were sent to other individuals or museums. In addition, the writer also had available the type series (excluding the types) of *nevadensis*, *anamesus*, *aldrichi*, and most of *bartletti*; also the type of *albescens* was examined.

The writer wishes to express his appreciation and thanks to the following institutions and individuals for the loan of material which made this study possible: Museum of Vertebrate Zoology, University of California (Dr. Alden H. Miller); University of California (Donald R. Dickey collection), Los Angeles (A. J. van Rossem); Carnegie Museum (W. E. C. Todd); and the Cleveland Museum of Natural History (Dr. Harry C. Oberholser); also Dr. Ira N. Gabrielson, Allan