

Table 3. Extremes and ranges of weights (in grams) of male Spotted Towhees trapped ten or more times.

Band No.	No. Records	Minimum		Maximum		Range
		Date	Wt.	Date	Wt.	
A 283061.....	10	Jan. 13	34.85	Jan. 9	42.90	8.05
A 283838.....	33	Feb. 10	34.70	Feb. 10	42.05	7.35
A 283839.....	20	Feb. 22	37.10	Mar. 14	42.05	4.95
A 283849.....	10	Mar. 20	34.30	Feb. 28	38.55	4.25

Table 4. Summary of weights (in grams) of male Spotted Towhees trapped during the winter of 1932-33 at Berkeley.

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
Number weight records.....	1	4	8	5	18	44	24	9	3
Average weight in morning.....	40.10	42.05	40.00	38.53	38.48	38.22	39.58	39.65	
Number birds.....	2	3	1	5	5	4	1	1	
Average weight at noon.....	38.10	37.65	39.90	40.37	39.18	39.32	38.16	35.58
Number birds.....	1	1	3	3	5	8	3	1
Average weight in afternoon.....	39.90	45.80	36.45	39.57	39.11	38.18	38.39	40.90	
Number birds.....	1	1	1	4	7	4	3	1	
Average all weights.....	38.10	39.44	41.66	39.51	39.06	39.03	38.19	38.07	40.28
Minimum weight.....	38.10	37.55	36.15	36.45	32.95	34.70	34.30	35.20	38.65
Maximum weight.....	38.10	42.65	45.80	42.10	44.30	43.80	42.05	41.05	40.90

In general, the 116 records of weight of male Spotted Towhees summarized in tables 1 to 4 show the same sort of variability already described for Golden-crowned and Fox sparrows. The male towhees, though, do not show the peak reached by the other, migratory species just before their migration in the spring.

Museum of Vertebrate Zoology, Berkeley, California, August 5, 1936.

STUDIES OF WATERFOWL IN THE CARIBOO REGION, BRITISH COLUMBIA

WITH TWO ILLUSTRATIONS

By J. A. MUNRO

The Cariboo region, comprising portions of the watersheds of the Fraser and north Thompson rivers, is probably the most important nesting ground for waterfowl in British Columbia. It is well supplied with water areas of every description, including large lakes with heavily wooded and rocky shores, small, deep lakes surrounded by willows and dogwood and covered by yellow pond lily, *Typha* and *Scirpus* marshes, open alkaline ponds, barren "soda" lakes, marsh-edged sloughs, and beaver meadows. Many of the smaller lakes, hidden away in the aspen and jack-pine forests, and known only to the few settlers, are difficult of access; others may be reached by motor road.

In the summer of 1936 I explored many of these waters by means of a light canoe. Canoe transport made possible an intensive examination of areas which in previous years had been viewed from the shore only and provided opportunities for close observation of waterfowl behavior. The program included an inquiry as to a possible correlation between the presence of loons, Holboell Grebes and coots and the mortality among young ducks. A report of this investigation, together with other observations on the behavior and life history of certain species, is submitted in the following pages.

In 1936, waterfowl populations in certain particularly favorable localities were probably at a saturation point; in other, "marginal" areas the numbers of breeding

birds were much less than could have been maintained by the amount of food and cover available, a condition that has been observed elsewhere when waterfowl were much more abundant than they are now.

103 MILE LAKE.—This shallow lake, less than a mile long, contained a waterfowl population sufficiently unusual to justify detailed description. It is surrounded on three sides by open range dotted here and there with clumps of lodge-pole pine and trembling aspen; the land on the south side rises steeply and is well wooded. The shores and bottom are hard clay, gravel and boulders; the only cover vegetation is an open growth of *Scirpus* extending outward from the shore's edge on the east side of the lake and elsewhere established in small clumps twenty to fifty yards out from the beach. Around the circumference of the lake to a width of forty to sixty yards is a heavy growth of aquatic plants chiefly *Myriophyllum*, with a lesser amount of *Potamogeton pectinatus*. The surface of this weed bed was covered with filamentous algae; the deeper water farther out was turbid with blue-green algae. Amphipods were not abundant, as was found to be the case in some other lakes of the region, and no evidence of the presence of any group of mollusca was obtained; the food supply was predominantly vegetable.

On August 8, 1936, this small lake was inhabited by approximately 2000 ducks comprising (1) a population of non-breeding, post-breeding and young diving ducks with which were associated a few Baldpates (*Mareca americana*), American Coots (*Fulica americana*), Holboell Grebes (*Colymbus grisegena holboellii*), and Eared Grebes (*Colymbus nigricollis californicus*); (2) a concentration of surface-feeding ducks; and (3) a small population of female ducks accompanied by broods.

In population number one some of the ducks, principally Lesser Scaup Ducks (*Nyroca affinis*), were flightless; others were losing, or perhaps regaining, the power of flight. Buffle-heads (*Charitonetta albeola*) were principally females in worn, faded plumage (probably non-breeding yearlings) and flying young. In addition there were two males, thought to be yearlings, and at least two broods, of seven and eight, about three-quarters grown, each accompanied by an adult female. Half of the Barrow Golden-eyes (*Glaucionetta islandica*) were non-breeding yearling females; one was an adult male in eclipse plumage, the remainder adult females and young of various ages not all of which were in broods. Canvas-backs (*Nyroca valisineria*) and Ruddy Ducks (*Erismatura jamaicensis rubida*) were all adult males; the White-winged Scoters (*Melanitta deglandi*) comprised one adult male and three adult females. Baldpates were chiefly adult males in eclipse plumage, and the association of this species with the diving ducks was a parasitic one, identical with that commonly observed during autumn and winter when Baldpates attend the diving operations of coots and diving ducks.

These ducks, grebes and coots, without segregation of species, formed a close association, a "raft", which if dispersed came together again very quickly. As this raft was approached it spread out as many birds moved inshore and swam along close to the beach in a formation that rapidly lengthened. When the canoe drew nearer, those birds able to fly began to rise from the water, the different species usually rising together, and moved in short flights to another part of the lake where they reassembled. Meanwhile the flightless birds, for the most part unseen after an initial dive and momentary reappearance, travelled quickly in the same direction so that after an hour or so the association was much the same as it had been before. This breaking up and reassembling of the flock took place four times as the observers paddled from one end of the lake to the other. Exact counts of the various species under such condi-

tions proved impracticable so that it was necessary to rely on estimates which were checked and re-checked in the course of a period of four hours. The composition of population number one was as follows:

Baldpate	over 50	White-winged Scoter	4
Canvas-back	8	Ruddy Duck	17
Lesser Scaup Duck	150	Coot	23
Barrow Golden-eye	60	Holboell Grebe	5
Buffle-head	600	Eared Grebe	5

The population of surface-feeding ducks (2) comprised flocks of Common Mallards (*Anas platyrhynchos*), Green-winged Teal (*Nettion carolinense*), and Blue-winged Teal (*Querquedula discors*) which were made up of females and flying young. In addition there were a number of adult male Mallards, chiefly solitary, and a few Shovellers (*Spatula clypeata*). All these ducks frequented the lake shore, more particularly at the marshy east end, and although they were flushed numerous times they did not leave the vicinity. Both species of teal were found in one flock and it was common to find mallards and Blue-winged Teal together, one such flock comprising seventy-five teal and eighteen mallards. This population contained:

Common Mallard	100	Blue-winged Teal	230
Gadwall	1	Shoveller	10
Green-winged Teal	60		

It was impossible to identify the breeding population (3) so late in the season. Very likely some of the young Mallards, Blue-winged Teal, Barrow Golden-eyes and Buffle-heads included in population (1) and (2) had been raised on the lake. Two broods did not, during the times they were under observation, join the mixed assemblage forming population (1); these were Blue-winged Teal with brood of four, and White-winged Scoter with brood of nine.

Lesser Loon. *Gavia immer elasson*. In the course of the summer's investigations forty-eight adult loons, comprising twenty-two pairs and four solitary and apparently unmated individuals, were under review. According to careful observations this total of twenty-two pairs had produced nine young. It might be suggested that many small young, because of their wariness and the readiness with which they can conceal themselves, might have escaped attention. I do not believe this to be the case because in the first place the season was far advanced and the young well grown, and in the second place the young birds which did come under observation were detected without difficulty. Furthermore, several pairs of loons under daily observation for periods of ten days or longer, at no time were accompanied by young, although time and again they made elaborate demonstrations which usually would be interpreted as indicating vigilance in defense of young. It was, of course, too late in the season for loons to be incubating eggs. Possibly this behavior is a mechanical reaction, indicative of a particular physiological stage in the breeding process and produced automatically when the nesting territory is invaded by enemies.

Thus on August 15, at Horse Lake, when I approached an open bed of *Scirpus* growing on a shallow reef near the entrance to a marshy bay, a pair of loons showed great excitement. One of them standing upright with neck curved back, chest out-thrust and half-opened wings curved forward, called again and again with various modifications of the familiar laughing call. After this demonstration the bird made a series of short dives, swimming just below the surface for only a short distance, then emerging and diving again. The previous evening this same pair had been seen racing over the water, half-flying and half-swimming as they commonly do during the courtship period.

These two, under observation from July 23 to July 30 and from August 13 to August 23, spent much of their time in the vicinity of the open *Scirpus* bed referred to, which appeared to be their chief feeding ground. Squawfish and lake shiners were plentiful in this shallow portion of the lake and so also were snails, *Planorbis*, which are known to be a food eaten by loons. At various times they were joined by a second pair, also without young, whose territory centered around a half-mile stretch of *Scirpus* situated about a mile to the east; occasionally also a fifth, unmated bird joined them. Thus on August 19, while I was watching the local pair from a canoe distant from them about thirty to fifty feet, the single bird was seen approaching. It travelled slowly down the lake, peering below the surface with head submerged in much the same manner in which a merganser searches for fish. As it neared the two others, one of the pair gave a short, single note repeated at regular intervals—a note of recognition or of welcome.

In the case of a pair with two half-grown young, one young bird accompanied each parent. The parents were swimming about 200 yards apart when first they came into view. One of this pair showed more excitement than did the other, calling and diving repeatedly, close to my canoe. Meanwhile the two young birds commenced diving, and as they showed only their heads above water when emerging, it soon became difficult and finally impossible to locate them. The parents finally swam close together and allowed the canoe to approach within thirty yards or so before they dived.

It was noted several times in watching loons with young that one of the parents defended the territory while the other remained with the young. For example, in the case of a pair with one half-grown young on a small lake near Horse Lake, one of the parents with neck outstretched surged across the water toward my canoe and when 25 yards or so distant stood upright, churned the water with rapid wing-beats and gave the laughing cry a number of times. The second parent, some distance away and accompanied by the young bird, was less vocal and made no demonstration suggestive of anger or alarm.

Again, on another somewhat larger lake which was occupied by three pairs of loons, similar behavior was noted. One parent remained with the young bird while the other approached the canoe with noisy cries and demonstrations of anger. In one case the bird approached by a series of movements which threw the body forward so that it cleared the water by perhaps a foot; then dropping with a splash it repeated the movement. This forward thrust and subsequent splash into the water was made four or five times while the bird approached directly toward the canoe. In other cases one of the birds would swim toward the canoe for a certain distance, then would turn with a surging rush that preceded a dive.

One of the most noticeable characteristics of the loons in the Cariboo district was their unusual tameness, perhaps indicating a freedom from molestation that not everywhere is the case. It was a common occurrence on many lakes, while travelling by canoe, to approach within fifty feet or less before the birds would begin slowly to sink in the water.

Holboell Grebe. *Colymbus grisegena holboellii*. At Horse Lake a pair of these grebes had nested in a bulrush bed near the entrance to a marshy bay. The activities of these birds appeared to be closely confined within a definite area comprising the waters along about one-quarter mile of shore. On July 23 two young about three-quarters grown accompanied them; shortly afterwards one young disappeared, and the parents and the remaining young bird were observed in the same territory until the investigation was concluded on August 23.

On one occasion an adult rose to the surface with a small sculpin held crossways

in the bill. This was swallowed almost immediately. Another time an adult was seen holding a fish about four inches long by the head. Hoping to make the bird drop the fish so that it might be collected and identified, I paddled rapidly toward it. The grebe dived and reappeared with the fish still grasped by the head; held thus, the bulk of the fish kept the bird's mandibles some little distance apart, and with the bill partly open in this way the bird called several times, then suddenly threw back its head and swallowed the fish head first.

Several times the voice of a half-grown Holboell Grebe was heard as it swam along behind one of its parents. The sounds, described at the time as trills and soft whistles, were sustained and musical—a true "bird song". Their origin, not at first traced to the grebe, was sought among the trees and brush at the water's edge. Finally the performance was heard at such close range as to leave no doubt that the young bird was responsible.

Baldpate. *Mareca americana*. This was the commonest nesting duck on Bridge Creek below Horse Lake; elsewhere it was less common. On Bridge Creek it was observed that female Baldpates when approached usually left their broods and proceeded upstream ahead of the canoe, flying a short distance, then swimming, and calling almost continuously. After having travelled several hundred yards in this manner the duck usually circled back down stream, again passing about thirty or forty yards above, and a short distance to one side of, the canoe. In the meantime the young scampered over the water, or swam directly but less hurriedly, toward the marginal growth into which they disappeared.

At Horse Lake on July 26, a female, which when first detected was several hundred yards or so from her brood of eight ten-day-old young, rose from the edge of a rush bed and circled the canoe several times before dropping again to the water. As the canoe continued to advance, the duck again rose and flew directly to her brood where she alighted and led the young birds into the rushes.

Green-winged Teal. *Nettion carolinense*. Young of this species sometimes are concealed in marsh growth or other cover while the female acts in a manner which clearly indicates the presence of young. These actions include short circular flights toward and away from the observer, dropping onto the water or into the marsh growth, and continuous quacking. Two females at Bridge Creek acted thus on July 27; so also at Horse Lake similar behavior was observed on two occasions. In none of these cases were the young found.

At Horse Lake on August 23 a Green-winged Teal's nest was located in a sedge meadow about 100 yards from water. The cup of the nest was six inches in diameter, deep and well lined with down. In and beside it were remains of six eggs, all broken in at the side as if the contents had been removed by crows.

Blue-winged Teal. *Querquedula discors*. During the period from July 24 to August 10 single, or sometimes two or three, eclipse plumaged males, in some cases accompanied by probably non-breeding females, were met with. Later in the season the birds associated in flocks of various sizes which apparently comprised females and flying young. Probably at this time the adult males had moved south. At any rate none was satisfactorily identified.

Females were observed to show great anxiety for the welfare of their young. For example, at 103 Mile Lake a female with four young about two weeks old behaved in the following manner: When approached by canoe she remained with her brood, which first was detected near the center of the lake, until they swam inshore and had hidden themselves in matted filamentous algae. During the shoreward journey of the young

the female flapped over the water toward the canoe several times, and after the young were hidden she followed the canoe with short flights for several hundred yards.

Redhead. *Nyroca americana*. It was observed that female Redheads with broods usually do not remain with their young when disturbed by the presence of man. An exception to this was recorded on July 24, 1936, at Horse Lake where a female with a brood of six well-grown young were under observation. In this case the young scattered into an open growth of rushes while the female flew to open water and preceded the canoe.

Canvas-back. *Nyroca valisineria*. It was common during August to see broods of young, or large bands of young not accompanied by adult females. At this time the females are probably flightless and for this reason less conspicuous, so that in some cases they may have been overlooked. Nevertheless, many cases of unattended young were definitely noted. Thus, at Williams Lake on August 11, one band of forty-two nearly full-grown young, strung out along the edge of the marsh, were examined carefully at close range through binoculars. No females were with, or close to, these young birds.

The relative lack of care shown by females for their young in the case of the Redhead and Canvas-back, as compared with some other species, such as the Lesser Scaup, may have been a factor in the reduction in numbers of these species.

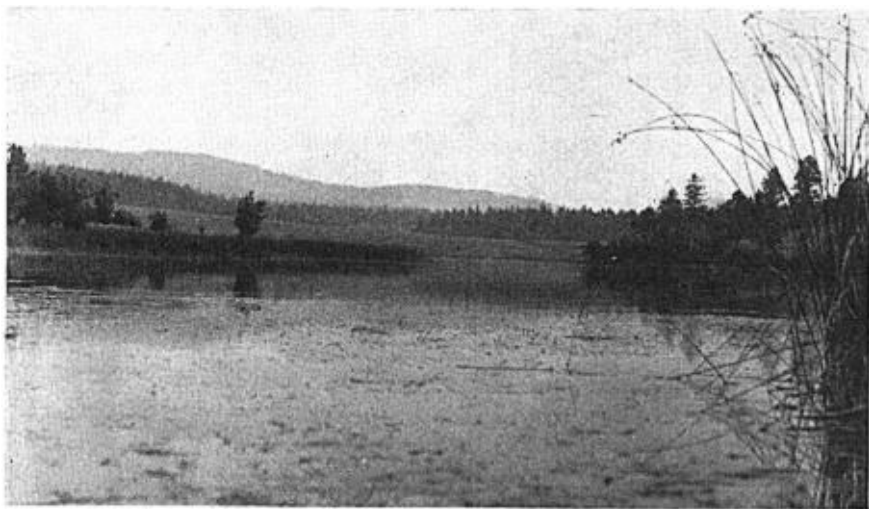


Fig. 48. 105 Mile Lake, Cariboo region, British Columbia.

Lesser Scaup. *Nyroca affinis*. This species proved to be the most common nesting duck in the region adjacent to the Cariboo road, where broods of various ages were met with on all suitable lakes. Concentration of eclipse-plumaged males and non-breeding females also were encountered, 105 Mile Lake being notable in this respect.

This lake is shallow and very rich in animal and vegetable food. There is one small island which is covered with a thick growth of potentillas and vetches. At the west end the lake terminates in a *Scirpus* marsh of about twenty acres extent, in which are channels navigable by canoe. On August 4 and August 8, 1937, the water was clouded with an algal efflorescence and filamentous algae covered parts of the surface. Almost half of the total duck population, which numbered 465 counting adults and young,

were Lesser Scaup. These consisted of eight females with a total of sixty-three young, one-quarter to one-half grown, and a flock of 200 (plus) eclipse-plumaged males and non-breeding females. In addition, on August 4 and 6 a female was flushed from a nest containing eight eggs. As she rose this bird splashed the eggs with excrement of an orange-brown color composed chiefly of the undigested parts of amphipods. Five feet from the occupied nest was a deserted nest containing five addled eggs, and six feet in another direction were three egg shells from each of which the contents had been removed through a ragged hole about three-quarters of an inch wide—evidently the work of crows. Both nests were well concealed by a heavy growth of vetch. The majority in the flock of 200 referred to were males; the remainder probably included both non-breeding adult females and yearling females. By actual count 140 were flightless or nearly so and fifty-two had normal powers of flight. It is of interest to note that at this time (August 4), while most of the non-breeding females were flightless, none of the females with broods had lost the power of flight. At Fawn Lake about two weeks later (August 17), females with broods apparently were incapable of flight.

When the flock at 105 Mile Lake first was seen, the birds were strung along the shore in the shadow of a timbered hillside; visibility was good and it was remarked that many females were in a curious condition of plumage brought about partly by fading and wear. Some had all brown heads, others white cheek patches and a white patch behind either side of the bill; others again had only the latter marking. Some were oddly piebald, both on head and flanks, and some were faded all over the upper surface to the color of tow. One eclipse male and a female, flying and swimming close together, were apparently still mated. Scattered among this raft of birds were adult or yearling female Buffle-heads, Barrow Golden-eyes and broods of Canvas-backs and Lesser Scaups. As the canoe slowly drew nearer to the moving birds, those capable of flight took wing and moved to another part of the lake while the flightless ones dived. In a few minutes these began to break water, some only a few yards away from the canoe. In most cases, after the first dive and reappearance, the birds showed only head or bill above water. For a little time birds were coming to the surface on all sides of the canoe; the number of rings on the water and the faint splashings might have been made by trout. It was remarkable how soon all had disappeared; in a few minutes none save the females with broods could be seen; the molting birds had vanished. This same performance, slightly varied in detail, was again witnessed two days later.

With other species of diving ducks it is common to find young broods unaccompanied by females, but with the Lesser Scaup this appears to be unusual. In nearly every instance where broods were observed, the female remained with her young even when followed closely by a canoe, and in some cases, under these circumstances, she showed lively concern. Thus, at 105 Mile Lake, a female with sixteen young rushed across the water toward the canoe and when close-by turned on her side showing her white underparts and dragging one wing; the bill was held open and a gentle purring note was made continuously.

Two females on a small marshy lake, with broods of seven and eight respectively, showed quite different temperaments. One led her brood along the marshy edge of the lake and made no demonstration of anxiety; the other rapidly approached the canoe, paddling with the feet, beating the water with her wings, and giving the "purring" note repeatedly with the bill held open during and after the sound was made. When twenty yards distant this duck described a circle behind and to one side of the canoe, sometimes surging over the surface with neck outstretched and in a position that brought the white belly into prominence. After this she dived and upon emerging

flapped over the surface as if badly wounded; in the meantime her brood made rapid progress toward the marshy shore.

It is common for several females and their broods to associate in bands which may attract non-breeding females as well. This sometimes takes place even when the young are quite small. Thus at 150 Mile Lake on July 31 a band of seventy young, one-third to one-half grown, and accompanied by seven adult females was under observation. Again at Fawn Lake on August 17 a raft of thirty-nine well grown young and seven females, representing the entire population of this small lake, was sighted at the lake side of a cattail marsh. In close formation they moved along the edge of the marsh and continued thus along the wooded shore of the lake where they were approached by canoe. When only a dozen yards or so intervened, the birds rushed across the surface and then all, including the old females, dived. Apparently at this time the adult females were flightless.

White-winged Scoter. *Melanitta deglandi*. At 105 Mile Lake, on August 4, two broods, and on August 6, a third brood, of this species were examined. In one brood there were fourteen young about one week old, in another, ten slightly older, and in the third, eleven about one-quarter grown. A fourth brood, comprising eleven large downy young, was observed on 103 Mile Lake on August 8. In each case the brood was accompanied by a female.

When the broods were approached close enough to alarm them, the family of ten and the one of eleven were led off in single file, while the family of fourteen followed the female in a closely packed group. Suddenly this entire brood dived almost simultaneously. They reappeared widely separated, paused a moment on the surface, then quickly dived again, so that in a few minutes the brood was scattered over an area approximating an acre in extent. The female showed little alarm and remained close



Fig. 49. Longbow Lake, British Columbia. Bird in the center is a displaying Loon.

to the canoe, swinging her head slowly from side to side and at intervals repeating a soft, tremulous, creaking call. This procedure was observed on two occasions and the female and brood observed at 103 Mile Lake acted in a similar manner. This species hitherto has not been recorded as nesting in British Columbia.

American Coot. *Fulica americana*. Coots were less abundant than was the case during the past few years. A reduction in the numbers of breeding birds was noted in the Cariboo region in the summer of 1934, and it seems probable that any increase which might have taken place subsequently was offset by a reduction which occurred in the early winter of 1935 when in southern British Columbia many coots were frozen in the ice.

RELATION OF LOONS, COOTS AND HOLBOELL GREBE TO DUCK POPULATIONS.—There is evidence, some definite but mostly circumstantial, that loons attack and sometimes kill the young of other waterfowl. Also it has been observed that loons are sometimes in sole possession of certain small lakes, although conditions there may fulfill the nesting requirements of other water birds. The inference is that in such cases loons, in defense of their nesting territories, have driven other species away. This would appear to be supported by the following observations made in Alberta.

On June 18, 1932, a small lake north of Lacombe, on the Calgary-Edmonton Highway, was occupied by a pair of loons, the only other waterfowl present being a female Mallard, apparently without a brood, and one Holboell Grebe. On May 23, 1933, the loons were absent and the pond was occupied by two pairs of Lesser Scaup Ducks and one pair of Buffle-heads. Another lake close by was, on June 18, 1932, and on May 23, 1933, occupied solely by a pair of loons. A third adjacent slough in the sole possession of one pair of loons on June 18, 1932, and on May 23, 1933, contained a population of nine Lesser Scaup Ducks, one pair of American Golden-eyes, three pairs of coots, two pairs of Holboell Grebes and fourteen Black Terns.

The association between loons and other waterfowl in the Cariboo was watched at every opportunity, with results that are entirely negative. On no occasion was a loon observed to pay attention to any other species of water bird; neither did any of the species under observation show any concern at the presence of loons. At Horse Lake, on July 26, one of a pair of loons which had two young about half grown was kept under observation for some time while it swam toward a female Baldpate and her downy young. The loon was excited by the presence of the observers in a canoe and previously had been diving and splashing on the surface. At this time it continued swimming in a straight line and calling at intervals. The loon and the Baldpate at the head of her brood passed each other at a distance of about ten yards, neither deviating from its course or paying any attention to the other. It may be stated that the Baldpate brood was apparently reduced by three on August 18, when this section of the lake was again visited. There is no evidence, however, that the loons were responsible.

A sharp watch was kept for dead or wounded young ducks which might have been killed by loons or by any other of the species under review, with little result, the only instance being a one-quarter grown Ring-necked Duck (*Nyroca collaris*) on 130 Mile Lake. Evidently wounded, this bird was by itself and after some little difficulty was captured. There proved to be a puncture in the belly close to the anus which may have been made by a loon, although the position of the wound might suggest otherwise. No other young birds, either dead or injured, were found during a careful search in a considerable number of marshes and lakes which were inspected by means of a canoe during the height of the breeding season.

The populations of Holboell Grebes are recorded on the accompanying table. Statements that this grebe attacks young ducks are based, so far as I am aware, merely on the fact of the common use of marsh nesting areas. Observations suggest that a greater mortality takes place in the young of this species than among other waterfowl. They are usually slow-moving, strictly sedentary birds while on their nesting ground, remain-

ing within a definitely limited territory even after the young are fully grown. No evidence of interference with other species was observed.

Unlike Holboell Grebes, coots are pugnacious in the nesting season and sometimes vigorously resent intrusion on their nesting territories by other species. One instance of coots killing young Ruddy Ducks has been reported to me and it seems probable that the destruction of young ducks, or at any rate the dispersal of broods with consequent wandering and loss, does occur on crowded nesting grounds. No instances of this, however, were noted during the course of this study.

In the accompanying table are set forth the populations of young ducks and the numbers of loons, Holboell Grebes and coots occupying the same nesting grounds.

TABULATION OF DUCK BROODS AND ADULT LOONS, HOLBOELL GREBES AND COOTS

Locality	Date Visited	Duck broods	Average in broods	Holboell			Remarks
				Loons	Grebes	Coots	
Pond	July 22	1	3	0	0	2	1 acre slough, rushes
Pond	July 22	4	5	0	0	0	5 acres
Clinton Lake	July 22	11	4.2	0	0	0	50 acres, open shores
Horse Lake	July 23-28	11	6.1	11	10	2	7 by $\frac{1}{4}$ miles
Unnamed Lake	July 29	7	7.3	0	0	2	50 acres
Pond	July 31	1	7	0	0	4	1 acre, marshy
Pond	July 31	2	6	0	0	2	$\frac{1}{4}$ acre
149 Mile Lake	July 31	22	7.1	0	0	20	10 acres
150 Mile Lake	July 31	10	6.1	0	1	4	25 acres
130 Mile Lake	Aug. 3	8	6.6	2	4	7	$1\frac{1}{4}$ by $\frac{1}{4}$ miles
105 Mile Lake	Aug. 4	20	8.5	1	14	20	$1\frac{1}{4}$ by $\frac{1}{2}$ miles
108 Mile Lake	Aug. 4	1	3	8	4	4	Unattractive to waterfowl
McKinley Lake	Aug. 6	3	6.1	0	2	12	$\frac{3}{4}$ by $\frac{1}{8}$ miles
103 Mile Lake	Aug. 8	6	6.5	0	10	0	$\frac{3}{4}$ by $\frac{1}{4}$ miles
Elliott Lake	Aug. 8	6	6	0	2	1	$\frac{1}{8}$ by $\frac{1}{8}$ miles
Tatton Lake	Aug. 10	0	1	1	8	50 acres, chiefly marsh
Williams Lake	Aug. 11	10	5.5	0	2	30	5 by $\frac{1}{4}$ to $\frac{1}{2}$ miles
Fawn Lake	Aug. 17	8	6.1	4	0	0	$1\frac{1}{4}$ by $\frac{1}{4}$ miles
Longbow Lake	Aug. 17	2	2	4	0	0	$1\frac{1}{4}$ by $\frac{1}{4}$ miles

Correlation of the presence of loons and the mortality among duck broods is suggested by conditions at Longbow Lake ($\frac{1}{4}$ by $1\frac{1}{4}$ miles) where, with two pairs of loons present, the survival among duck broods (August 17) was four young from two broods. Two other adult female ducks present were not accompanied by young and may have lost entire broods. This lake was relatively poor in duck feed.

Contrasted with this is another smaller lake (50 acres) about two miles distant which was occupied by one pair of loons with one young. There the survival (July 29) was fifty-one young ducks from seven broods. This lake was rich in duck food. The data presented do not indicate a relation between the presence of large grebes and the size of duck broods.

The size of duck broods is not conspicuously influenced by the presence of coots. One of two small marshy lakes (Tatton Lake) was occupied solely by coots and their young except for an adult male Canvas-back. This lake is suitable for ducks, so that the absence of broods and the relatively large number of coots may be significant.

The almost entire monopoly of 108 Mile Lake by loons and grebes is explained by the fact that its waters supply plenty of food for fish-eating birds but very little vegetable food. This applies also to many other Cariboo lakes of the same type.

On any nesting ground even where food and nesting cover are adequate, broods of young ducks, irrespective of their species, are subject to loss. Usually the average of

survival is not greater when loons are absent than when loons are present. The same remarks apply also to the presence or absence of large grebes and coots.

It seems logical to conclude on the basis of these data that the destruction of young waterfowl by loons, Holboell Grebes, or coots does not reach serious proportions. It might be expected that if such destruction commonly took place the evidence would be more decisive. At present such destruction does not appear to be an important factor in the mortality among duck populations, but further investigation of the problem is desirable. There can be no question that the young of waterfowl, including coots and grebes, are subject to reducing factors about which little or nothing is known. The mortality seems to occur more often in the first week or so of life than it does later on. The ability to keep the brood together, and to use hiding places of relative safety during stormy weather, which is possessed in various degrees by ducks of different species and apparently also by different individuals of the same species, probably has an important bearing on the question.

Okanagan Landing, British Columbia, May 5, 1937.