

MONITORING OF COMMON LOONS
IN THE BULL RUN WATERSHED, OREGON
APRIL - JUNE, 1986 *

Charlotte C. Corkran
NORTHWEST ECOLOGICAL RESEARCH INSTITUTE
13640 N. W. Laidlaw Road
Portland, Oregon 97229
(503)643-1349

* NERI REPORT # 86-01

ABSTRACT

Common Loons (Gavia immer) were monitored in the Bull Run Watershed, Mt. Hood National Forest, Oregon, April through June, 1986. From 3 to 6 loons were present from early April through mid-May, with a higher peak in mid-April. The Upper Reservoir, and to a lesser extent the Lower Reservoir, received consistent use. Loons were only observed once at Bull Run Lake, and not on any of the smaller lakes visited. A pair of loons appeared to establish territory at the North Fork on the Upper Reservoir, as in the past several years. Both courtship and aggressive behavior were observed, but no nesting was observed. Several opportunities were noted for habitat improvements that could encourage loon nesting in the watershed in the future.

ACKNOWLEDGEMENTS

The author wishes to express her appreciation to the City of Portland Water Bureau, not only for its funding of the present study, but also for its continuing cooperation and interest in the wildlife resources of the Bull Run Watershed. Special mention must be made of Bill Stotts, whose good observations of loons and background information on the watershed were very helpful.

Rick Kneeland, Wildlife Biologist for the Columbia Gorge Ranger District of the Mt. Hood National Forest, initiated and supervised the study, as well as giving frequent advice and assisting with observations on several occasions. The study would not have occurred without his commitment and enthusiasm.

Advice and encouragement were readily available from Bill Haight, State Coordinator for the Nongame Wildlife Program of the Oregon Department of Fish and Wildlife, Dave Marshall, author of the Oregon Nongame Wildlife Management Plan, and Philip Gaddis, President of the Northwest Ecological Research Institute.

Data on recent loon nesting in Washington were graciously supplied by Susan Tank, Nongame Data Systems Biologist with the Washington Department of Game, and Alan Richards, co-author of "Report: Breeding Status of the Common Loon in Washington, 1985."

Finally, the encouragement and patience of Dave Corkran were vastly appreciated, as well as his and student David Bailey's assistance with observations.

HISTORY OF OCCURRENCE IN OREGON AND THE NORTHWEST

While there are numerous early accounts of the Common Loon (Gavia immer) in Oregon during the winter and both fall and spring migrations, historical records of its breeding in the state are rare. Several observers in the late 1800s noted probable breeding on lakes in the Great Basin. Newberry (1857) found loons using lakes in the Cascade Range. His survey party heard them calling from many of the lakes as they crossed the mountains in summer several times. Gabrielson and Jewett (1970) have summer records of apparent breeding at Devil's Lake, Lincoln County, during the early 1930s. The Oregon Natural Heritage Data Base has unpublished accounts of breeding loons at Siltcoos Lake, Lane County, in the 1960s.

Historical records of loons summering in Washington are more numerous than for Oregon. Jewett et al. (1953) list many lakes on both sides of the Cascade Range as nesting grounds. A few lakes in northern California were also used (Bent, 1919, Newberry, 1857).

Although recreational shooting and water pollution have been implicated as other factors in drastic reductions of loon populations in New England, it is believed that direct disturbance near nest sites by human activity accounted for the withdrawal of western loon populations from the southern limit of their breeding range (Oregon Natural Heritage Data Base, and McIntyre, 1986).

There are no known early records of Common Loons in what is now the Bull Run Watershed. However, one can assume their original presence in Bull Run Lake from its Native American name, Gohabedikt, which translates to "Loon Lake" (Rick Kneeland, USFS, pers. comm.) Since this lake is at 3200 feet elevation and frozen much of the winter, one can infer summer occurrence and probable breeding there.

CURRENT STATUS IN OREGON AND THE PACIFIC NORTHWEST

Large numbers of Common Loons continue to winter along the Oregon coast, with lesser numbers on major rivers and lakes elsewhere in the state. Significant flocks pass through Oregon in migration, mostly along the coast. More birds are observed inland in the spring than the fall migration (Oregon Natural Heritage Data Base). There are no recent confirmed records of loons breeding anywhere in the state.

Washington still has a small residual breeding population on several lakes in the northeast corner (Richards and Musche, 1985). Other parts of the state have had recent unconfirmed reports of nesting, and many areas have not been recently inventoried (Susan Tank, pers. comm.). Loons still nest on many lakes in western Canada and Alaska, where population trend studies are just beginning. Much less is known about loons in the west than in either the midwest or the east (McIntyre, 1986).

The Oregon Natural Heritage Data Base classifies the Common Loon as having been extirpated from Oregon as a breeding bird. The Nongame Wildlife Management Plan classifies the Common Loon as a non-breeding species, and therefore it is not included on the Oregon Department of Fish and Wildlife's proposed list of Sensitive, Threatened, and Endangered Species. It is listed as a Sensitive Species by the U. S. Fish and Wildlife Service, Region 1. The U. S. Forest Service Region 6 list has not yet been finalized, but the Common Loon is a candidate for Sensitive status (Kathy Johnson, pers. comm.). The Washington Department of Game has proposed that the Common Loon be classed as Threatened on its state list.

REASONS FOR THE PRESENT STUDY

Incidental to other work in the Bull Run Watershed, there were several sightings of Common Loons during the spring and early summer in each year from 1980 to 1985. Interest in the possibility of loons nesting in the watershed has grown, but there had been no methodical monitoring. Several other factors were also significant in the initiation of the present study.

1. The Portland Water Bureau, by construction of Dams #1 and 2 on the Bull Run River, has created good habitat for Common Loons and several other species (see Appendix II). Resident fish populations are currently utilized as a prey base by osprey and several other species of birds and mammals. The same fish population also supports loons at the present time for at least a brief period in the spring, and potentially could support more utilization by loons.

2. Recent efforts in New England and elsewhere indicate that it is possible to increase Common Loon numbers and even to repopulate formerly occupied breeding grounds. Since the Bull Run Watershed is closed to public entry and is largely undisturbed by human activity, the potential exists for successful loon nesting to occur. Loon nesting habitat conditions in the watershed were largely unknown.

3. The Portland Water Bureau, under its Special Use Permit from the USFS, requested permission for management activities in the reservoirs, particularly debris removal from the Upper Reservoir and algicide application. These activities were thought to have the potential to disturb loon breeding, if it were occurring.

The current study was initiated to establish baseline field data and to attempt to answer questions regarding use by loons of the lakes and reservoirs in the Bull Run. The primary objectives of the study were:

- To authenticate the period of Common Loon occurrence,

- To identify the primary areas of use,

- To determine whether reproductive activity occurs, and

- To assess the opportunities for maintenance and improvement of habitat for potential breeding in the future.

METHODS

Visits to the watershed to monitor loons were made on the average every three to four days during the study period, from early April through June. Ten observation points were used on the Upper Reservoir and nine on the Lower. Most of the points on the Upper Reservoir were stops along Road 10. Observations were generally made from a vehicle. On the Lower Reservoir, several observation points were reached by driving and walking on gravel roads or paths. Most observations were made from outside a vehicle. Bull Run Lake was visited generally once a week, although snow prevented several visits. Goodfellow Lakes were only visited once before late May.

Rick Kneeland, USFS, made several visits during late March and early April. His data are included in this report. All other observations were made by the author, occasionally accompanied by other individuals.

At each observation point, all visible water areas were scanned with 7X binoculars, and distant vistas searched with 20X spotting scope. Scanning was repeated at least twice due to the likelihood of missing loons when they were under water, either foraging or hiding. All sightings of Common Loons and of most other wildlife were recorded in field notebooks and plotted on aerial photos for later transfer to outline maps. (Daily maps of observations on both reservoirs and Bull Run Lake are in Appendix I).

Loons sighted were observed for a few minutes to determine activity. If several loons were sighted in the same vicinity, observation continued and any significant behavior or interactions were also recorded. In moving from one point to another, every effort was made to avoid counting the same loon twice.

On the evening of 4/21, recording equipment was set up at the North Fork in an effort to analyze vocalizations to determine reproductive activity (Barklow, 1980). No loon vocalizations were heard or recorded.

Toward the end of the study, more time was spent examining available habitat and analyzing potential for improvements. In addition, visits were made to Blue Lake and Palmer Lake, and Hickman Lake was checked from the summit of Hickman Butte.

Records of Common Loon sightings from recent years were also analyzed. USFS files were examined, and several individuals from both the USFS and the Portland Water Bureau were interviewed.

OBJECTIVE 1 - TO AUTHENTICATE THE PERIOD OF COMMON LOON OCCURRENCE

On visits to the Bull Run Watershed in late March and on 4/2/86, Rick Kneeland, USFS, observed no Common Loons on the Upper or Lower Reservoir. On 4/5, six loons were seen on these reservoirs, so their date of arrival can be closely estimated.

The numbers of loons observed peaked on 4/16, when at least eight, and possibly as many as eleven, loons were sighted. Aside from that peak, however, the total number observed remained fairly constant at four to six from 4/5 through 5/11 (see Figure 1). Although the regularity could be coincidental, it probably indicates that the same individuals stayed in the Bull Run during that period. This is perhaps corroborated by sightings of a pair of loons consistently using one area of the watershed throughout that same period. During the week of 5/5, considerable movement of loons was observed within the watershed. The following week, two visits yielded no loon sightings, so it is possible that all the loons present earlier had moved out of the area by 5/14.

On 5/21, three loons were observed closely together, a situation not noted previously. As discussed under Objective 3, it is possible that they were not the same individuals observed in April and early May, but represent a final wave of northward migrants. No Common Loons were observed in the watershed from 5/21 through the end of the study period. The last visit was on 7/3/86.

Most records from recent years previous to the current study are sporadic spring and early summer sightings on the Upper Reservoir beginning in 1980. The most complete data are from 1984 when loons were first noted the first week of April and seen regularly through mid-May. This period correlates well with data from 1986. However on 6/26/84, a loon was seen at Bull Run Lake (Barbara Kennedy, USFS, pers. comm.). In late summer, 1984, two probable immature loons were seen on the debris behind the North Fork logboom (Rick Kneeland, pers. comm.). In spring of 1985, two loons were regularly seen until the Upper Reservoir was drawn down for repairs to the intake. During one summer in the late 1970s, in approximately six visits to Bull Run Lake throughout the summer, a pair of loons was seen and heard on each visit (Clyde Shaver, USFS, pers. comm.).

NUMBER OF COMMON LOONS OBSERVED IN THE BULL RUN WATERSHED
 SPRING, 1986

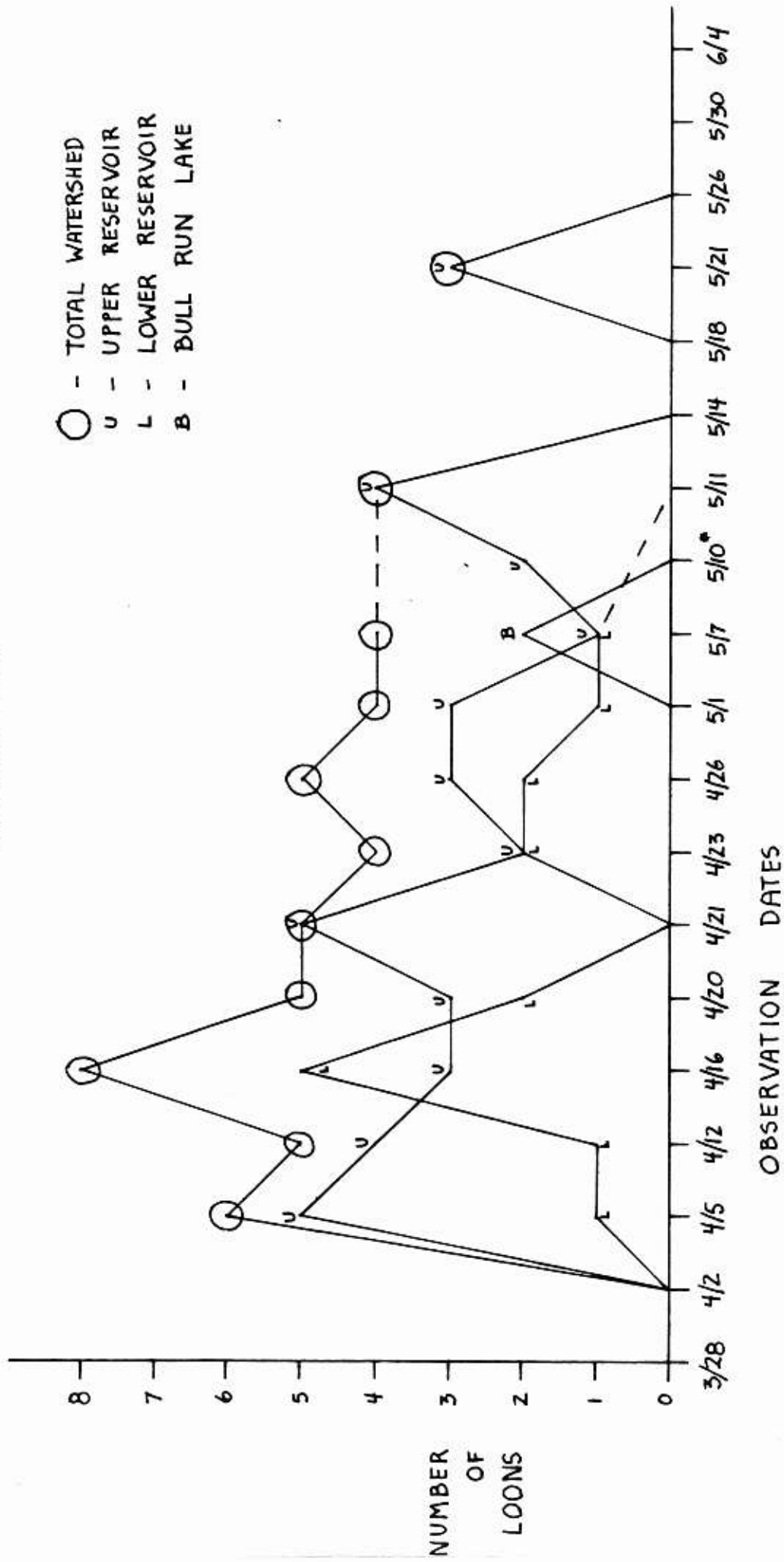


FIGURE 1

* UPPER RESERVOIR ONLY

OBJECTIVE 2 - TO IDENTIFY THE PRIMARY AREAS OF USE

Both the Upper and Lower Reservoirs and Bull Run Lake were utilized by Common Loons during the study period in 1986. Sightings were consistently most frequent on the Upper Reservoir (Figures 1, 2, 3, and 4). Although observation is more difficult on the Lower, that factor is not considered to be significant, nor is disturbance by observation from outside a vehicle.

If the loons observed on successive visits during most of the study period were the same individuals, it appears that they wandered extensively within the watershed. Figure 1 shows that while the total number of loons in the watershed appeared to remain fairly constant (except for the peak on 4/16), the numbers on the reservoirs fluctuated in an inverse relationship. On most visits numbers were higher on the Upper Reservoir and very low on the Lower Reservoir. On 4/21 all loons seen were on the Upper, with none on the Lower. But when numbers on the Upper Reservoir decreased, there was a corresponding increase in numbers seen on the Lower (4/11, 20, and 23). On 5/7, when only one loon was seen on each of the main reservoirs, a pair was seen at Bull Run Lake. It is tempting to speculate that the pair at Bull Run Lake was the same pair that had been observed on the Upper Reservoir throughout April.

Figures 2, 3, and 4 are compilations of all direct loon sightings for the two main reservoirs and Bull Run Lake.

Figure 2 shows a fairly random pattern, except for slight clustering of observations near the dam and southeast of the boathouse (site #7). There is also a marked avoidance of the length of the reservoir above the South Fork. The only loon sightings above the South Fork were of 2 loons seen on 4/16.

Figure 3 may indicate that every inch of the Upper Reservoir was utilized by loons at some time during the spring of 1986. The most conspicuous clustering of sightings is around the North Fork where a pair of loons was consistently seen. Employees of both the Water Bureau and the USFS reported seeing "the North Fork pair" not only in 1986, but also occasionally in April of 1985 (before the reservoir was drawn down), and regularly in April and early May of 1984. It is difficult to escape the interpretation that all these sightings were of the same birds. If so, they represent not only a significant preference, but quite possibly also a traditional use established over several years (McIntyre, 1974). The other slight clustering of sightings is around the shallow areas southeast of and opposite Deer Creek.

Figure 4 shows the only sighting of loons at Bull Run Lake in spring of 1986. Several earlier visits were made with no loons

seen. On 4/12 the upper and lower ends of the lake were still frozen, with three-quarters of the surface open. On 4/20 the major ice had receded further, but a fresh skim of ice had formed during cold, still weather. By 5/7, when the loons were sighted, the lake was free of ice, although snowbanks still extended to the waterline at several points around the lake. The average ice-free date for Bull Run Lake is unknown.

LOWER RESERVOIR
 COMPOSITE OF ALL DIRECT COMMON LOON SIGHTINGS
 APRIL - JUNE, 1986

- - First sighting
- - Direction of movement
- ⊗ - Interaction between loons

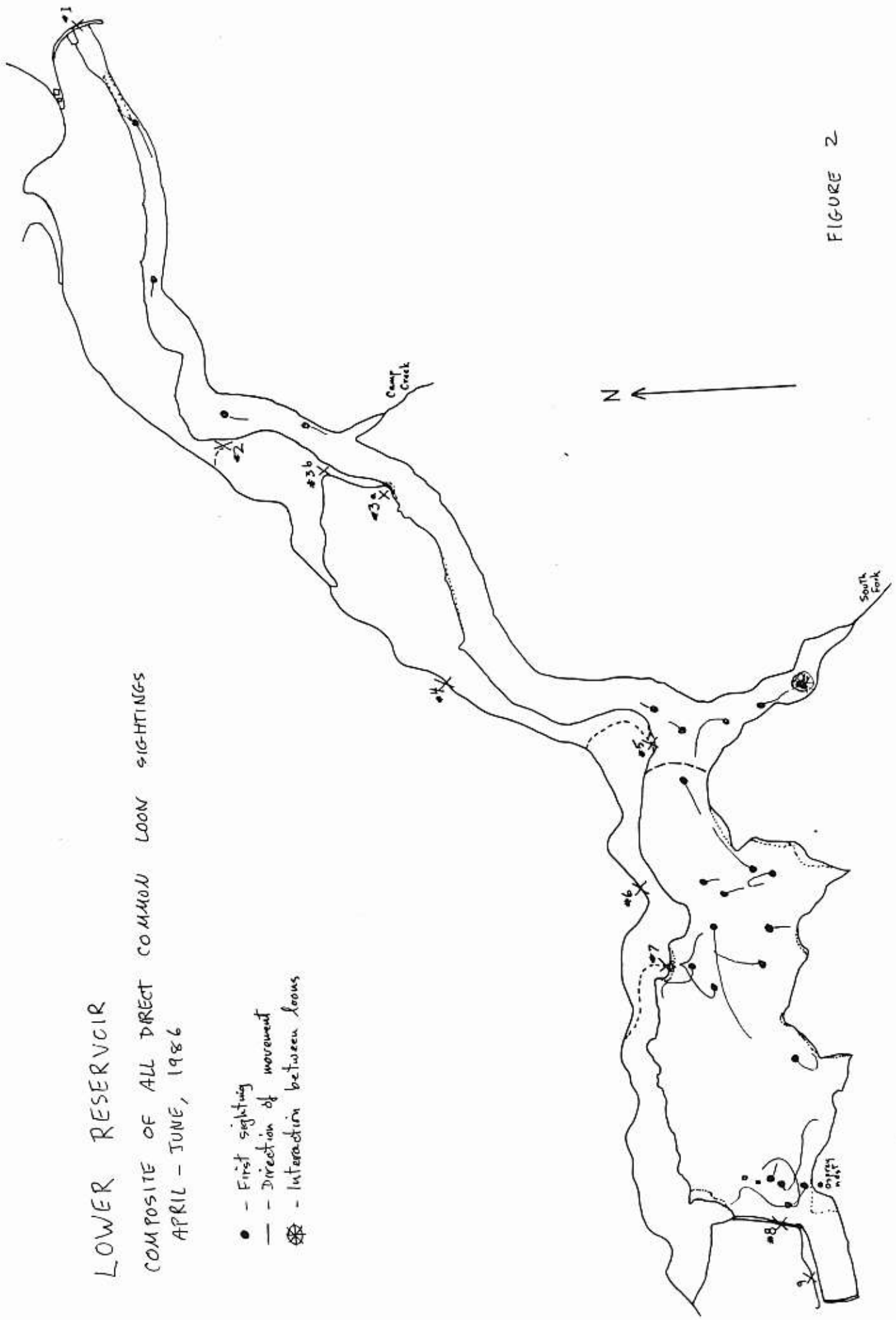


FIGURE 2

UPPER RESERVOIR
 COMPOSITE OF ALL DIRECT COMMON LOON SIGHTINGS
 APRIL - JUNE, 1986

- - First sighting
- - - Direction of movement
- ⊗ - Interaction between loons

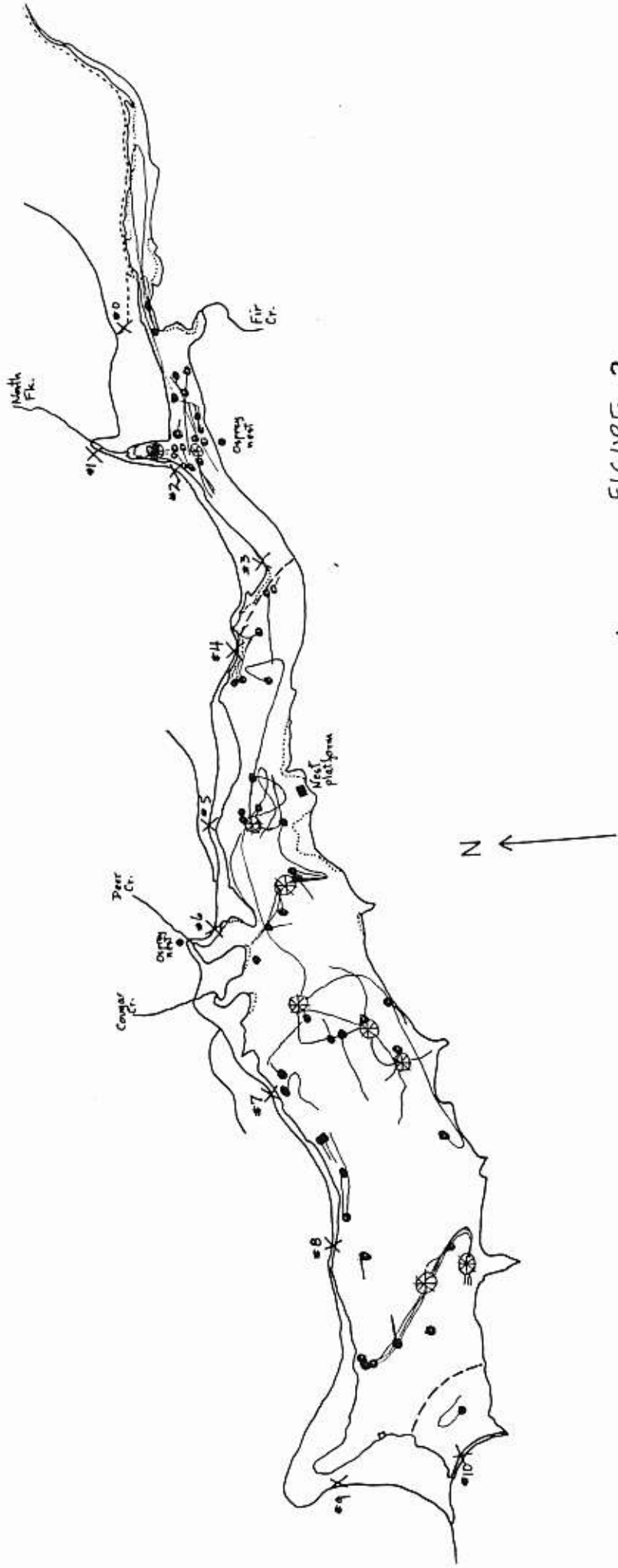


FIGURE 3

BULL RUN LAKE

COMMON LOONS SEEN 5/7/86

- First sighting
- Direction of movement
- ⊗ Interaction

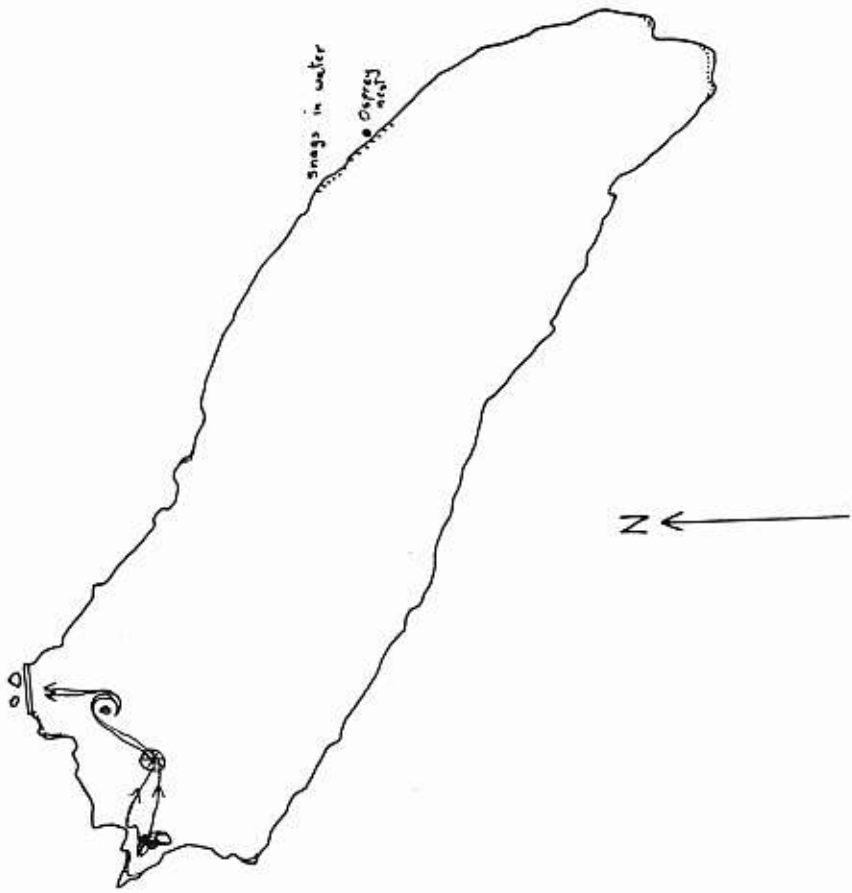


FIGURE 4

OBJECTIVE 3 - TO DETERMINE WHETHER REPRODUCTIVE ACTIVITY OCCURS

OBSERVATIONS

All of the loons observed in the watershed during the study were in breeding plumage. All individuals seen closely enough to note also had black bills and red eyes.

The majority of sightings were of single loons fishing, resting, or preening, but a significant number of other activities were also observed.

Ten instances of two loons swimming parallel, less than three meters apart, were noted. Seven of the ten observations were at or below the North Fork on the Upper Reservoir. On four occasions two loons were observed synchronizing their motions, including dipping their bills in the water, preening, and making shallow dives. These motions were accompanied by occasional short hoots. One of these observations was at the North Fork on 4/12, another just below it on 4/5. The others were at the South Fork on 4/16, and at Bull Run Lake on 5/7. On two occasions, both at the North Fork, a loon was observed swimming with breast nearly underwater, head and neck low along the surface, a posture this author terms "low stretch." On 4/12, the bird in "low stretch" was approaching another loon and they then swam parallel, preened, and bill dipped in synchrony. On 4/20, the two loons were seen swimming parallel, with the bird in "low stretch" about a half length ahead.

Several other encounters between loons were also observed during the study period, all on the Upper Reservoir. On 4/16 and again on 4/21, two loons were seen in brief bouts of circling, diving in such a way as to make a noticeable splash, and shaking the head from side to side. Just prior to the 4/16 sighting, a loon may have been seen flying down reservoir from the North Fork where two loons swimming parallel had been seen earlier. On 4/26 only one loon was seen at the North Fork shortly after watching an extended period of interaction on the Upper Reservoir. The loons involved were at first more than half a mile apart. One loon preened vigorously, rolling over and exposing the white belly, occasionally stood up on the water and flapped its wings, and made several short rushes across the water, splashing violently with wings and feet. Slightly later this loon gave a series of Type 1 tremolo calls (as described in Barklow, 1980) and then, with its breast high on the water showing much white, cruised down to meet the other loon which had been fishing further down the reservoir. The two loons had three rounds of circling, splash diving, and one made several brief rushes across the water. It was not possible to keep track of the two individuals. In between rounds, one followed the other at a distance of five to ten meters, both bill

dipping frequently, and always moving down reservoir. Several times one tipped its head back, pointing the bill straight up. During most of the observation, one loon kept its breast higher out of the water, showing more white. At several points, the other loon was so low in the water that only the head and neck showed above the surface. After the third round the two loons swam off in separate directions. On 4/20 a loon was seen splash diving, wing flapping, rushing, and vigorously preening, quite far down the Upper Reservoir. No other loon was seen at the time, but one could have been out of the observer's view.

On 5/21, three loons were observed closely together. It was not always possible to keep the identity of the individuals straight. Two of the loons swam parallel and gave occasional hoots. One of the two gave two Type 1 wailing calls, and both gave Type 1 tremolo calls. During one fifteen second period, the two loons took turns calling, one giving the Type 1 tremolo, the other the Type 2 tremolo. The third loon followed, two to ten meters back. Twice the three loons came together, circled, and two of the birds splash dived. One loon was frequently noted with its breast high out of the water.

The data available from previous years includes many sightings of two loons swimming parallel near the North Fork, during spring of 1984 and 1985. In late summer of 1984, two birds that were seen resting on debris and then flying were tentatively identified as immature Common Loons (Rick Kneeland, pers. comm.). The sightings at Bull Run Lake one summer in the late 1970s were regularly of two loons close together. Wailing calls were regularly heard.

INTERPRETATION

Common Loons do not develop the full adult characteristics until the second (Bent, 1933) or third (Roberts, 1936) year. No loons were seen with the greyish bills and brown eyes of immatures (Roberts, 1936). All loons observed during the study appeared to be breeding age adults.

Published descriptions of loon behavior were used to interpret observations made during the present study (Sjolander and Agren, 1972; Tate and Tate, 1970; Barklow, 1979; Barklow, 1980; Rummel and Goetzinger, 1975; Munro, 1945; Alvo, 1986; McIntyre, 1974). Although there are some discrepancies about the significance of certain behavioral elements, there is enough consistency to permit interpretation.

The ten observations of two loons swimming parallel closely together are interpreted as sightings of breeding pairs, since that behavior has been reported in no other context, and is common in water birds. The synchronized actions seen on four occasions match descriptions of courtship or pre-copulation displays in Tate and Tate (1970) and Sjolander and Agren (1972). The "low stretch"

posture observed twice could correspond to descriptions in the same two papers of postures observed after courtship displays, during the search swimming in which the female leads the male to an easy place to slide up on land where copulation occurs. All observations interpreted as courtship or possible search swimming ended when the loons swam out of view. Copulation was not observed in the present study.

Because of the regularity of sightings of a pair of loons near or above the North Fork logboom on the Upper Reservoir, it is very likely that all such sightings between 4/5 and 5/1 were the same individuals, the North Fork pair. There is the possibility that the pair seen on Bull Run Lake on 5/7 were also the same loons, since on that date no pairs were seen elsewhere.

All references cited that discuss loon behavior describe aggressive defense of breeding territory (by the male whenever known) from intrusion by other loons (particularly Sjolander and Agren, 1972; Barklow, 1979; Munro, 1945; and Rummel and Goetzinger, 1975). Descriptions vary, but generally include high breast or raised neck displays, rushing across the water at the intruder, circling in which the aggressor orients its body at right angles to the intruder, splash diving, standing upright in the water with wings open or folded, and a crouching posture during which a yodelling vocalization is given. The intruding loon may respond with some of these actions, but eventually makes quick dives, gives tremolo calls, bill dips frequently, and escapes by either swimming away, running across the water, or diving and swimming off underwater. Since many of these actions were noted during the encounters seen on 4/16, 4/21, and 4/26, those observations are interpreted as defense of territory. Since they all occurred in the same area below the North Fork, they are tentatively interpreted as involving one member (most likely the male) of the North Fork pair. The fact that the yodel call was never heard may possibly be explained by the fact that most vocalizations are given at night (Barklow, 1980), but only one evening visit to the watershed was made.

The literature reviewed has no mention of aggressive behavior being performed by single loons. Because on 4/26 the loon observed splash diving, etc. by itself did shortly afterwards interact aggressively with another loon, the single loon actions at the beginning of the 4/26 observation, and on 4/20, are also tentatively interpreted as aggressive. It seems likely that they were displays of aggression in response to distant loon (not seen on the 20th). They may have represented ambivalent situations in which the motivation to evict the intruding loon and to avoid a close confrontation were in conflict. Supporting this idea is the fact that frequent bill dipping was seen and tremolo calls were given on the 26th. Both are interpreted as non-aggressive, signs of agitation or fear, and as often occurring in approach avoidance situations (Barklow, 1979; Sjolander and Agren, 1972; Rummel and Goetzinger, 1975). Barklow (1979) further notes that the tremolo call may itself reflect "the flight component of an ambivalent

aggressive motivation." An alternative interpretation of the observations of solo aggressive behavior is that they were of juveniles practicing the actions in the absence of an external stimulus.

The behavior of the three loons observed together on 5/21 could be interpreted in several different ways, because it included elements of courtship, aggression, and agitation. It is possible that two of the loons were the North Fork pair in a confrontation with an intruder near their breeding territory. The part of the encounter observed did not include many aggressive actions, however, and the third loon followed the pair, rather than retreating from them. It was the pair and not the possible intruder that gave the tremolo calls. Barklow (1979) feels that the Type 2 tremolo is indicative of a higher intensity stimulus than the Type 1. Being watched by four people standing beside a van could have intensified the agitation of the pair and disrupted a territorial conflict. An alternative interpretation is that the observation was of a just-formed pair with a third loon attempting to displace one member and claim the other as a mate. Since this would seem to represent an earlier stage in pair formation than the other observations, it probably could not have included the North Fork pair, which could have left the Bull Run soon after they were last seen on 5/11. There are no descriptions of pair formation in the literature reviewed, although Rummel and Goetzinger (1975) record "threesomes" that "may represent courtship parties or pair formation encounters." All authors state that loons arrive on the breeding grounds already paired. There are no known studies of loons in late winter or early spring when pair formation might be expected to occur, although observations have been made of aggressive interactions between loons wintering off the Oregon coast (Harry Nehls, pers. comm.).

It is possible that the frequent sightings of a pair of loons at the North Fork during 1984 and 1985 involved the same individuals as in 1986. Most authors assume "life-long pairing" (Sjolander and Agren, 1972) and traditional use of specific nesting territories (Sjolander and Agren, 1972; Munro, 1945; Barklow, 1980; Alvo, 1986; Bent, 1919). So far, McIntyre's 1974 report of a banded loon returning to the same part of the same lake is the only proof found in the literature. Whether or not the sighting of two probable immature loons in 1984 means that loons were fledged from a lake in the watershed is open to conjecture. The wailing calls given by the two loons at Bull Run Lake in the 1970s could be indicative of nesting. Sjolander and Agren (1972) interpret the wail as a low intensity territorial marking behavior, which could have been stimulated by the human intruder. Barklow (1980) finds the wail more commonly given by a loon to reestablish contact when separated from its mate or from its chick.

POSSIBLE EXPLANATIONS FOR NO LOONS BEING SEEN AFTER MAY

There are several possible explanations for the fact that no loons were seen in the watershed after the end of May in 1986.

1. The loons observed in the Bull Run may use traditional nesting areas further north. That is likely for the loons that only appeared to stay a brief time. It could also explain a pair formation interpretation of the 5/21 sighting of three loons. However, this would not explain what appeared to be courtship and defense of territory by the North Fork pair for a period of five weeks, unless such activity is in fact a pair bond strengthening behavior, rather than an actual nesting attempt. There are no known publications that describe this early stage in the Common Loon reproductive cycle.

2. Disturbance by frequent observation or by reservoir management activities could have caused loons to move out of the watershed, but is unlikely. The observer frequently became the subject of curious observation by the loons. On 4/23 a motorboat was observed cruising through the territory of the North Fork pair. The only loon in sight dove, crossed the reservoir underwater, watched the disappearing boat for several minutes, and then resumed fishing. The water treading distraction display and surface running, described by Munro (1945), Barklow (1979), and others as associated with human disturbance were never seen. However, the high breast display, quick dives, frequent bill dipping, and tremolo calls apparently can be responses to intrusion of breeding territory by loons or humans (Barklow, 1979; Munro, 1945; Alvo, 1986). Some of these actions were noted on 4/23, 4/26, 5/7, and 5/21. Except on 5/7, another loon, rather than the observer, always appeared to elicit the response. Debris removal activities from the Upper Reservoir did not begin until after the loons appeared to have left the watershed, and therefore cannot be accountable.

3. One or more habitat components required for loon nesting may not be available in the watershed. Loons have remained in at least two other summers, although it is not certain that they nested. There could have been recent changes that precluded nesting in 1986. Erosion of edges of islands on Bull Run Lake by wave action could be one such change. These possible habitat limitations are discussed in Objective 4.

4. Fluctuations in water level could have made suitable habitat unavailable, but would not explain loons leaving Bull Run Lake. A floating nest platform was placed in the Upper Reservoir on 4/12 to provide a nest site that would not be inundated as the reservoir was filled, but it was never seen being used.

CONCLUSIONS

In summary, both aggressive and courtship activities were observed in the Bull Run in 1986. Several single loons and at least one pair utilized the reservoirs briefly (4/16 sightings), resting before continuing to migrate to other breeding grounds. It is likely that the fairly consistent number of single loons present between 4/5 and 5/11 represents the same individuals remaining during that period. Whether they were non-breeding birds in 1986 or did establish pairs later in the spring is open to conjecture. The infrequency of interactions observed would tend to indicate the former. Several behavioral elements not described in the literature reviewed were observed, including aggressive displays by unaccompanied loons, and a trio of loons exhibiting both courtship and aggression. These may represent previously undescribed early stages in the Common Loon reproductive cycle. A pair of loons appeared to establish and defend a breeding territory at the North Fork on the Upper Reservoir. They may have attempted to nest there. They may possibly have moved briefly to Bull Run Lake before leaving. They were probably the same pair seen in the same area in both 1984 and 1985.

OBJECTIVE 4 - TO ASSESS THE OPPORTUNITIES FOR MAINTENANCE AND IMPROVEMENT OF HABITAT FOR POTENTIAL BREEDING IN THE FUTURE

Several of the publications reviewed describe habitat chosen by loons for nesting (Ream, 1976; Jewett et al., 1953; McIntyre, 1983; Munro, 1945; Vermeer, 1973, etc.). The following components are considered important.

A. Lake selection - Common Loons prefer large, deep lakes, avoiding shallow ponds and sloughs. The lower size limit that loons use is not known. McIntyre studied loon nests on lakes as small as 25 acres. A study in Montana found loons nesting in lakes not much larger than 10 acres (Alan Richards, pers. comm.). Munro (1945) recorded single loons, but not pairs, on lakes as small as 4 acres. Human disturbance would certainly be a more important factor on very small lakes. Shorelines of lakes used for loon nesting may be either forested or rocky, but at least part and frequently all of the shoreline is marshy.

B. Prey base - Munro (1945) found both single loons and breeding pairs using lakes in British Columbia that were devoid of fish, and several authors report a limited percentage of invertebrates and vegetation in the diet. Most authors find that fish are the major food source, particularly of breeding loons. Studies of fish populations in relation to loon nesting were not found, but it is inferred that populations need to be high. Loons feed small fish to young chicks, so presumably fish spawning and rearing habitat are important components of loon nesting habitat. Analyzing fish populations was outside the scope of the present study,

C. Nest site selection - Most authors reviewed agree that small islands are the preferred nest site if available, but points of land are also frequently used. The site is generally either directly on a very narrow beach within 4 feet of water and hidden by overhanging trees or shrubs, or floating within a few feet of open water but obscured and protected by cattails or bulrushes. Frequently nests are on top of old muskrat houses. Jewett et al. describe nest sites in Washington as most frequently being either on tree stumps broken off slightly above the water level (similar to cut stumps) or in the weeds and grass growing on floating logs (which could be simulated by logbooms). In all studies, the preponderance of loon nests are immediately accessible to deep, open water, or are readily accessible by a shallow channel.

D. Chick rearing nurseries - McIntyre studied the selected sites to which newly hatched loon chicks are led or carried by the parent birds. These areas must be close to the nest site. Nurseries were most commonly in bays protected from wind and wave

action, and were characterized by shallow water, gentle slopes, generally abundant emergent vegetation, and usually soft, mucky bottoms.

With these loon breeding habitat factors in mind, both reservoirs and several lakes in the watershed were examined to evaluate the existing habitat and to identify the potential for maintaining and improving habitat conditions for breeding loons (Figures 5 through 13).

UPPER RESERVOIR - Construction of the #1 Dam created good habitat for Common Loons and many other species of wildlife. The head of the Upper Reservoir currently has the best combination of loon breeding habitat requirements found in the watershed. However, many of the existing components are dependent on the water level in the reservoir, and water level requirements differ for several habitat features. Since it has consistently been used by a pair of loons, it probably has the best potential for improvements that might allow nesting to occur in the future.

A. The long and deep lake has a generally forested or rocky shoreline. Near the head, the shore is occasionally gentle with small marshy areas.

B. Fish were observed frequently, but little is known about the age/size structure of the population. Limited spawning beds may be available in several streams emptying into the reservoir. The 1984 Bull Run Stream Survey (USFS) analyzed the mainstem but did not include information of side streams.

C. Several types of potential loon nest sites exist. Although there are numerous stumps, most are available only at water levels several feet below the normal high water line. The large number of stumps on the south side, east of Deer Creek, as well as those around Cougar and Deer Creeks on the north side, are exposed to winds from the southwest and resultant wave action. Stumps above the North Fork logboom are mostly in well sheltered positions. The logbooms have some vegetation growing on them, which could provide nest sites similar to the floating logs mentioned by Jewett *et al.*, but are easily accessible to terrestrial predators, and exposed to wind and waves. The debris that was built up behind the logboom was too fresh to have vegetation. There are no islands, but several rocky points, at the confluences of Cougar, Deer, and Fir Creeks and the North Fork with the reservoir, and in several places near the head of the lake. These nest sites are also dependent on the water level, being available only when it is several feet below full.

D. The best existing nursery areas found on the Upper Reservoir are above the North Fork on both sides of the lake. They are limited in area and are not available when the water level is down more than about 5 feet below full. Good combinations of nest sites close to nursery habitat presently occur only at Fir Creek, several points on both the north and south sides between Fir Creek and the head of the lake, and possibly in several small bays on the south side opposite Cougar and Deer Creeks. The water level best for nest sites, however, is different from that best for nursery habitat.

Suggestions for maintenance and improvement of breeding habitat

1. Fish populations could be investigated. Cougar, Deer, and Fir Creeks and the North Fork, as well as other small streams, could be investigated for existence of spawning beds or opportunities to develop them.

2. The existing floating nest platform should be maintained, and the vegetation on it changed or augmented as needed. Since it is beached and dry in late summer, annual fall maintenance of vegetation is probably necessary. It is probably in a fairly good position, although nursery habitat is limited in that area.

3. Opportunities for placing other nest platforms occur at several sites around Fir Creek and on both the north and south sides near the head of the reservoir.

4. If nesting attempts do occur on stumps, perhaps the most readily available ones could be sawed lower or at a steep angle.

5. There are several opportunities for improving potential nursery habitat. In the bay behind the existing nest platform, around Fir Creek, and on both sides of the reservoir above Fir Creek, cattails or bulrushes could be planted. A very few cattails are growing there now, but could be supplemented.

6. Predator baffles could be put on the North Fork logboom, but since it is exposed to wind and waves, and since there is not good nursery habitat nearby, it is not recommended. Moreover, the logboom is the only available reservoir crossing for terrestrial predators, which use may be a higher priority.

LOWER RESERVOIR - Construction of the #2 Dam created habitat for Common Loons and other wildlife. Loon numbers seen during the study were smaller than on the Upper, and good breeding habitat is sparser, but improvements could encourage increased use by loons.

A. The Lower Reservoir is very large and deep. In comparison to the Upper, it is bounded by cliffs for extensive sections, the remainder of the shoreline being forested or rocky.

B. Fish were frequently seen, but numbers and population structure are unknown, and spawning beds appear very limited. Few streams enter the reservoir at a gentle grade, except the South Fork and nearby streams.

C. Potential nest sites are varied, but many are dependent on the water level. An extensive area of stumps occurs on the south side, just west of the South Fork. Some of the stump areas are not fully exposed to the prevailing up reservoir winds, but many are. The logboom below the South Fork is exposed to both wind and land predators. The only island is just below the #1 Dam and is frequently above slack water and therefore not appropriate. Several points of land are available, especially on the south side, west of the South Fork.

D. Potential nursery sites occur only in the two large bays on the south side between the spillway and the South Fork. The marshy shallows in them are very small. These same two bays currently provide the only combination of loon breeding habitat components on the Lower Reservoir.

SUGGESTIONS FOR MAINTENANCE AND IMPROVEMENT OF BREEDING HABITAT

1. Fish populations could be investigated, as well as potential for development of spawning beds on several small streams entering the reservoir up the South Fork and between the South Fork and the dam on the north and south sides.

2. There are opportunities for placing floating nest platforms at several locations, particularly near the two large bays on the south side between the spillway and the South Fork.

3. If loons attempt to use stumps for nest sites, the stumps should be cut lower or at a steep angle.

4. Nursery habitat could be improved at several sites, especially the heads of the two bays on the south side. These bays were only checked with a spotting scope, but there appear to already be some cattails present. Additional cattails or bulrushes could be planted.

5. Predator baffles could be put on the upper logboom, but are not recommended, for the same reasons as on the Upper Reservoir.

BULL RUN LAKE - This natural lake has probably always provided good habitat for Common Loons. Construction of the earth dam probably created the island near the outlet by raising the water level, but probably also reduced the availability of protected shallows. On the other hand, the deeper water may have flooded both a shallow area near the outlet and more gentle shorelines than currently exist. The dam also blocked access to what may have been fairly extensive shallows that could have provided chick-rearing habitat in the part of the lake most sheltered from wind and waves. At present there are only a few parts of Bull Run Lake that appear to be suitable for loon nesting, but it has great potential with some improvements.

A. The lake is at 3200 feet elevation, is about 450 acres in surface, and is mostly very deep. Because of the oval shape of the lake, with few indentations or protected bays, the majority of the shoreline is exposed to the full force of winds from several directions.

B. Fish numbers and population structure are unknown. Potential spawning beds appear limited to several streams at the head, and possibly several on the north side. Other streams enter the lake in a precipitous fashion.

C. There are stumps scattered around the margin of the lake, but few were noted at the normal water level. There are log jams in the two bays at the head of the lake and one small one on the north side. Willows are beginning to grow out onto them. There are two small islands which appear to be suitable for nest sites, although wave action has eroded the shores and perhaps made them too steep for use. They each have several stumps on them. The only points of land are on the north side where they are very exposed to wind, or rise precipitously from the water.

D. Potential nursery sites are almost non-existent at present, and are probably the limiting factor in loon breeding habitat at Bull Run Lake. Because the sides are so steep and the wind so prevalent, the only currently shallow marshy area on the lake is in the outlet bay, and it is very small. Other shallows occur west of the earth dam and in the bays at the head of the lake. Possibly wind and wave action have prevented the growth of emergent vegetation in these places.

SUGGESTIONS FOR MAINTENANCE AND IMPROVEMENT OF BREEDING HABITAT

1. Fish populations could be investigated. Several streams, especially at the head of the lake, appear to have the potential for improved fish spawning beds.

2. The two islands could be protected from further erosion, and rebuilt to provide gentler slopes, by bracing logs around part of their perimeters. These could also be placed to act as jetties to break the wave action and encourage deposition on the lee side. Some reworking of currently steep slopes may also be advisable.

3. Floating nest platforms could also be placed in several positions. The best potential may be near the islands, on the point of land west of the earth dam, and near the bays at the head of the lake.

4. Logbooms could be constructed and placed across the bays at the head of the lake and near the earth dam. These would have several functions. They would act as wind and wave breaks, particularly after a few years if vegetation had started to grow on them. The barriers, besides protecting the Water Bureau's earth dam from further wave action and subsequent erosion, would shelter the water behind them, which could allow emergent vegetation to grow. Protected from wind and waves, and with more vegetation present, they would be suitable for use as chick rearing nurseries. They would also maintain hiding cover for small fishes. The logbooms should have some form of predator baffles, since they might also be used for loon nest sites.

5. The bays at the head of the lake, near the earth dam, and perhaps at the outlet, would be appropriate places for planting cattails or other emergent vegetation, to improve conditions for use as nurseries.

LOWER GOODFELLOW LAKE - Although small, the western or Lower Goodfellow Lake currently appears to have some good loon breeding habitat, improved by construction of the dam. Several additional improvements could make it even better. Loons have not been seen at any of these smaller lakes.

A. It is approximately 15 acres in surface and comparatively shallow, although the actual depth was not checked. It is possibly too small and shallow to attract loons, although loons apparently have nested in smaller lakes if undisturbed. The lake margin is marshy except around the south end which is mostly open rocky shore.

B. Many fish were seen, although numbers and population structure are unknown. One of the recent volunteer work projects by the Catlin Gabel School created experimental spawning beds in several sections of streams with gravel donated by the ODFW, brought in by the Water Bureau, and with supervision and advice from the USFS and the ODFW Nongame staff.

C. Available nest sites are limited, although the marsh at the upper end could provide a site for a natural floating nest. There is also a beaver lodge, but it appears to be too steep for use, and it may still be occupied. Most of the shore does not have overhanging brush to obscure a nest, although willow slips have been planted and may eventually provide such cover. The volunteer group constructed a floating nest platform and anchored it near the beaver lodge.

D. The entire north and east margins of the lake appear to offer suitable habitat for use as chick rearing nursery.

SUGGESTIONS FOR MAINTENANCE AND IMPROVEMENT OF BREEDING HABITAT

1. The new fish spawning areas should be monitored for use. There may be additional opportunities to develop spawning beds. Other logs or floating platforms could help to provide hiding cover for small fishes.

2. The loon nest platform should be maintained. Vegetation on it should be monitored, and additions or changes made if appropriate.

3. At least one more nest platform could be placed here, perhaps back in the marsh a short way up one of the small channels, or along the east side.

MIDDLE GOODFELLOW LAKE - Since this lake is only about 8 surface acres and probably not very deep, it may be too small for use by loons, although there are reports of loons gathering on large lakes and then pairs moving back into very small ponds to actually nest, bringing young chicks back to the larger lake (Roberts, 1936).

A. The south and east margins are rocky, while the lower end and the north side are cattail marsh.

B. Fish numbers were not checked. Small spawning areas and some hiding cover for small fish were developed by a volunteer work crew.

C. The rocky shoreline is currently too exposed to provide good nest sites. No appropriate logs or stumps were seen, and the marsh may be too shallow for use because of logging debris. The small points on the west end are very exposed to predators. Two floating platforms were constructed, but it may not be possible for loons to climb up onto them.

D. The west end of the lake appears to be suitable for a nursery.

SUGGESTIONS FOR MAINTENANCE AND IMPROVEMENT OF BREEDING HABITAT

1. Fish numbers could be checked. There may be additional opportunities to develop spawning habitat.

2. The floating platforms should be examined and possibly modified. Vegetation should be monitored regularly and added or changed as needed.

UPPER GOODFELLOW LAKE - Although quite small, this lake seems to have some potential for loon breeding habitat.

A. It is about 18 surface acres, and appears to be fairly deep in the middle. The margin is gently sloping, the shoreline rocky, with some brush and forest.

B. Fish numbers were not checked. A volunteer work crew initiated development of spawning habitat at the outlet.

C. Overhanging alders could provide cover for nesting along the shore, although the lake edge may slope too gently for a good underwater escape route from a shore nest site. Logs at the east end are not old enough to support vegetation yet. There do not appear to be many stumps available.

D. There are fairly extensive shallows around the lake, especially the eastern half of its circumference, and at the west end near the landing, but no emergent vegetation was observed.

SUGGESTIONS FOR MAINTENANCE AND IMPROVEMENT OF BREEDING HABITAT

1. The fish population could be checked. Spawning areas could be developed further, and hiding cover for small fish provided.

2. One or two nest platforms could be placed in the lake.

3. Emergent vegetation could be planted in the shallows. Placement of a partial logboom could protect a portion of the shoreline from wind and allow the vegetation to establish.

PALMER LAKE - Another very small lake, Palmer is probably not usable by loons because it is also very shallow. It is only about 8 acres and may not be more than 5 or 6 feet deep. The margin is marshy with standing snags around much of it, apparently from a recent rise in the water level. Many fish were seen. Several points could provide nest sites, but none is protected from predators. The whole lake could provide nursery habitat. Lake depth and fish numbers could be checked. If use by loons appears possible, a nest platform could be placed.

HICKMAN LAKE - The precipitous sides and small surface area (around 10 acres) probably preclude use by loons. Fish are thought to be present, because of observations of Hooded Mergansers diving there, but numbers were not checked. The round shape and lack of stumps, old logs, or extensive marsh indicate an absence of nest sites, although there is overhanging vegetation around parts of the shore. There did not appear to be much emergent vegetation in the shallows that extend part way around the shore, although several patches of yellow pond lily were noted. The lake would have to be visited, rather than just observed from Hickman Butte before suggestions could be made for habitat maintenance or improvement. Potential for use by loons appears to be limited.

BLUE LAKE - At around 3800 feet elevation, this is the highest lake surveyed. It is probably about 12 surface acres and appears to be deep. The surrounding topography is very steep, which probably makes the lake inaccessible to loons. The margin is steep and gravelly, with forest above. Fish were not seen on one visit to the lake. The smooth, round shape and lack of tall vegetation, stumps, or logs leave no nest sites. There is no nursery habitat. Since the potential for use by loons seems remote, there are no suggestions for habitat improvements.

OTHER WILDLIFE - While not within the scope of the study, several situations were noted where opportunities exist to improve conditions for other wildlife in the Bull Run Watershed. Both Hooded and Common Mergansers were regularly observed and a few broods of ducklings of each species were also seen. Only one brood of Wood Ducks was noted. Very few suitable nesting cavities in snags along the lakes and reservoirs were found. Wood duck type nest boxes could encourage more of these and other cavity nesting ducks to use the watershed. There is potential, especially at Palmer Lake and surrounding ponds, to introduce native Western Pond Turtles, a Sensitive Species suffering predation of young by the introduced Bull Frog which was not observed in the watershed.

BIBLIOGRAPHY

- Alvo, Robert. 1986. Lost loons of the northern lakes. *Natural History* 9/86:58-65.
- Barklow, William E. 1980. Voices of the loon. Audiodisc, published by the North American Loon Fund and the National Audubon Society.
- Barklow, William E. 1979. Graded frequency variations of the tremolo call of the Common Loon (*Gavia immer*). *Condor* 81:53-64.
- Bent, Arthur Cleveland. 1919. *Life Histories of North American Diving Birds*. Dover Publications, New York.
- Gabrielson, Ira N. and Stanley G. Jewett. 1970. *Birds of the Pacific Northwest*. Dover Publications, New York.
- Jewett, Stanley G., Walter P. Taylor, William T. Shaw, and John W. Aldrich. 1953. *Birds of Washington State*. University of Washington Press.
- Marshall, David B. 1986. Oregon Nongame Wildlife Management Plan. Oregon Department of Fish and Wildlife.
- Mathisen, John E. 1969. Use of man-made islands as nesting sites of the Common Loon. *Wilson Bulletin* 81(3):331.
- McIntyre, Judith W. 1974. Territorial affinity of a Common Loon. *Bird Banding* 45:178.
- McIntyre, Judith W. and John E. Mathisen. 1977. Artificial islands as nest sites for Common Loons. *J. Wildlife Management* 41(2):317-319.
- McIntyre, Judith W. 1983. Nurseries: A consideration of habitat requirements during the early chick-rearing period in Common Loons. *J. Field Ornithology* 54(3):247-253.
- McIntyre, Judith W. 1986. Common Loon, in Roger L. Di Silvestro, ed. 1986 Audubon Wildlife Report. The National Audubon Society. New York, N. Y., pp. 678-695.
- Munro, J. A. 1945. Observations of the loon in the Cariboo Parklands, British Columbia. *Auk* 62:38-49.
- Newberry, John Strong. 1857. Reports of explorations and surveys, to ascertain...a route for a railroad. Vol. VI, Pt. IV, Zoological Report No. 2, Chapter II, 73-110.
- Ream, Catherine H. 1976. Loon Productivity, human disturbance, and pesticide residues in northern Minnesota. *The Wilson Bulletin* 88(3):427-432.
- Richards, Alan and Ann Musche. 1985. Report: Breeding status of the Common Loon in Washington, 1985. North American Loon Fund.
- Roberts, Thomas S. 1936. *The Birds of Minnesota*. University of Minnesota Press, Minneapolis.
- Rummel, Lynda and Charles Goetzinger. 1975. The communication of intraspecific aggression in the Common Loon. *The Auk* 92(2):333-346.
- Rummel, Lynda and Charles Goetzinger. 1978. Aggressive display in the Common Loon. *Auk* 95(1):183-6.
- Sjolander, Sverre and Greta Agren. 1972. Reproductive Behavior of the Common Loon. *The Wilson Bulletin* 84(3):296-308.
- Tate, D. Jean and James Tate, Jr. 1970. Mating behavior of the Common Loon. *The Auk* 87(1):125-130.
- Vermeer, Kees. 1973. Some aspects of the nesting requirements of Common Loons in Alberta. *The Wilson Bulletin* 85(4):429-435.

APPENDIX I

DAILY MAPS OF WILDLIFE OBSERVATIONS

(On file at Columbia Gorge Ranger District, Mt. Hood National
Forest office)

APPENDIX II

WILDLIFE SPECIES SEEN IN THE BULL RUN WATERSHED, APRIL-JUNE, 1986

BIRDS

Common Loon	Western Flycatcher
Horned Grebe	Olive-sided Flycatcher
Eared Grebe	Hammonds Flycatcher
Pied-billed Grebe	Violet-green Swallow
Great Blue Heron	Tree Swallow
Canada Goose	Rough-winged Swallow
Mallard	Barn Swallow
Green-winged Teal	Cliff Swallow
Cinnamon Teal	Steller's Jay
American Wigeon	Common Raven
Shoveler	Black-capped Chickadee
Wood Duck	Chestnut-backed Chickadee
Ring-necked Duck	Red-breasted Nuthatch
Bufflehead	Brown Creeper
Hooded Merganser	Winter Wren
Common Merganser	Bewick's Wren
Turkey Vulture	American Robin
Red-tailed Hawk	Varied Thrush
Osprey	Hermit Thrush
American Kestrel	Swainson's Thrush
Saw-whet Owl N. Pygmy-Owl	Townsend's Solitaire
Blue Grouse	Dipper
Ruffed Grouse	Golden-crowned Kinglet
Mountain Quail	Cedar Waxwing
Spotted Sandpiper	Warbling Vireo
Ring-billed Gull	Orange-crowned Warbler
Band-tailed Pigeon	McGillivray's Warbler
Mourning Dove	Yellowthroat
Common Nighthawk	Wilson's Warbler
Vaux's Swift	Hermit Warbler
Rufous Hummingbird	Red-winged Blackbird
Belted Kingfisher	Western Tanager
Common Flicker	Evening Grosbeak
Pileated Woodpecker	Pine Siskin
Hairy Woodpecker	Red Crossbill
Downy Woodpecker	Dark-eyed Junco
Red-breasted Sapsucker	White-crowned Sparrow
Willow Flycatcher	Song Sparrow

Bald Eagle
Pintail
Snipe
D-c Cormorant
Lesser Scaup

Yellow-rumped Warbler

MAMMALS

Brush rabbit
Snowshoe Hare
Townsend's Chipmunk
Chickaree Squirrel
California Ground Squirrel
Beaver

Black Bear
Coyote
Cougar
Bobcat
River Otter
Black-tailed Deer

REPTILES AND AMPHIBIANS

Rough-skinned newt
Boreal Western Toad
Cascade Frog

Northwestern Garter Snake
Red-spotted Garter Snake
Northern Alligator Lizard