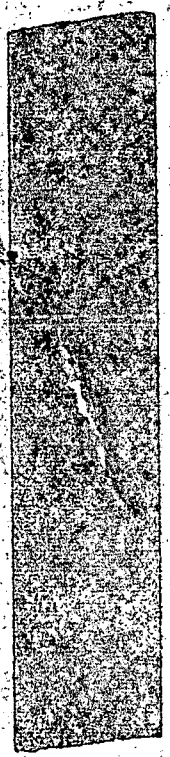

BEAVER STUDY

in

PRINCE ALBERT NATIONAL PARK

by

ANDREW RADVANYI

PRELIMINARY DATA
NOT FOR PUBLICATION

Fig. 1
An Adult beaver newly tagged in the left ear.

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BEAVER STUDY IN PRINCE ALBERT NATIONAL PARK
SUMMER 1956

INTRODUCTION

For as long as memory holds, beaver have been present in Prince Albert National Park, Saskatchewan. They were scarce during the early 1930's and were then found only in the southern part of the Park. During the years following the introduction of a second nucleus at Ajawaan Lake, about the middle of that decade, they began to spread over the whole park. They have increased in numbers during recent years so much that the removal of several hundred no longer appears to be adequate to keep the population down to carrying capacity. Following an aerial survey in October, 1954, J.G. Bonar estimated that there were at least 15,000 beaver in the Park, a calculation based upon Saskatchewan Government estimates of between 5 and 6 beaver per lodge.

During the summer of 1956 the writer was employed by the Canadian Wildlife Service to carry out a beaver study in the area. The present report is concerned with the results of the study.

ACKNOWLEDGMENTS

The writer is indebted to the personnel of Prince Albert National Park for wonderful co-operation offered in the completion of this study. Time and space do not permit a complete list of individuals. Particular mention however, ought to be made of Superintendent Dempster and Chief Warden Davies, who made possible the rapid co-ordination of each phase of the study by supplying transportation and equipment as well as personal assistance for brief periods at various times. Special thanks are due also to Park Warden D. Gregson for the use in this study of numerous items of equipment many of which were his personal property, such as his boat, rifles, and tools. Many after-work hours of assistance were freely accorded the writer at beaver hunting during the evenings by Messrs. Lee, Setest, and Bird, each of whom had other full-time employment in the park. Park Wardens H. Genge and C. Millard gave noteworthy assistance as second and third observers in the aerial survey in October.

PURPOSES OF THE BEAVER STUDY

1. To locate areas where beaver might be studied from year to year.
2. To determine, by live trapping and tagging, the average number of beaver inhabiting a lodge in the park.
3. To collect specimens to determine the health and reproductive potential.
4. To study the abandonment and recolonization of lodges after trapping.
5. Having established an average number of beaver per lodge, to carry out an aerial survey to determine the total population of beaver in the park.

PHASE ONE - TRAPPING

Trapping at Waskesiu

Several feet of snow, the remnant of a near-record fall during the previous winter, still covered the park when the writer arrived there on May 2. Temperatures rose only a little above freezing during the day, and Waskesiu Lake was still frozen solid, although unsafe for travel. It had been intended that the writer stay at the old warden's cabin on the north shore of Kingsmere Lake, but as that location could only be reached by walking 28 miles, to pack in provisions for almost a month was impractical. It was decided therefore, to stay at Waskesiu until after the break-up of the lake ice.

Nuisance beaver were reported to have plugged several road culverts near the townsite. Park wardens had authority to shoot such animals, but it appeared more advisable to live-trap them and transplant them to areas where they would not be likely to cause further nuisance.

Eight Bailey traps were available at the park during May. On May 7 one of these was set in front of a culvert in a beaver slough at the crossroads three miles south of Waskesiu townsite. At least two beaver had been observed in this slough, and there was a lodge near the centre of the pond. Two more traps were set at that location on May 8, one in front of another culvert and one at some clumps of dry grass near the lodge where beaver had been observed climbing out after swimming from the lodge. A beaver from the lodge was captured May 11. The traps were checked immediately after breakfast each morning and again after supper, often as late as 11 p.m. In addition the writer frequently spent two to three hours in observing the beaver pond during the evening for better places to set the traps. A second beaver known to inhabit the lodge was captured a week later, on May 18.

In the meantime, the other traps were set in sloughs along the road to First Narrows in an attempt to capture beaver within easy range of the road. Five sites were chosen along the stretch of road from Paignton Beach to approximately 1½ miles past the "Twin Culverts". Two of the five sites were at road culverts and three at drainage ditches that emptied directly into Waskesiu Lake. During the ten days between May 14 and 24 nine beaver were trapped at the Narrows road locations and two more were taken at the crossroads outside of Waskesiu.

Beaver captured in May were generally transported in the traps back to park headquarters where they were released in the specially-built beaver pens shown in Figure 2. An attempt was made to pair animals trapped in the same locations. Fresh-cut aspen was provided as food for the captive animals. A large washtub full of water in each pen permitted them to submerge themselves completely. Fresh food and water were provided each day and none of the animals appeared to suffer any ill effects in captivity. Of the 13 beaver trapped during May, one small one was tagged and released at the First Narrows on Waskesiu Lake; two large ones managed to escape from the same compartment of their cages before additional horizontal flat metal bars were welded on the door latches; two pairs were shipped to the zoological gardens, Edinburgh, Scotland; and the remaining

six were weighed, sexed, tagged, and marked before being released into Waskesiu River some five miles east of the town.

The beaver shipped to Scotland included two females weighing 27 pounds and 37 pounds respectively, and two males weighing 37 pounds and 32 pounds respectively.

The sex, weight, tag number and marking number of the six beaver released May 28 in Waskesiu River are listed in Table 1.

Table 1. Data on Six Beaver Tagged and Released in Waskesiu River, May, 1956

Tag No.	Marking No.	Sex	Weight (pounds)
1903	2	F	27
1904	3	F	30
1905	4	F	36
1906	5	F	25
1907	6	F	26
1908	7	M	29

Sex Determination

The sex of the captive beaver was determined before they were shipped or released. They were taken one at a time from the pens and transferred into a large canvas bag where they could be handled readily. Several Indians of a trail-cutting crew camped at park headquarters aided in handling the beaver during the weighing, tagging, and sexing. The presence of an os penis was taken as indication of maleness; its absence indicated that the animal was female. If present, it could be readily felt by inserting a finger approximately two inches into the false cloaca. In large male beaver it can be felt by external manipulation of the pelt just anterior to the cloaca, but this method is not reliable in younger animals. Neither general temperament nor size are characteristic of either sex in beaver and no reliable external features exist to aid in determining their sex.

Tagging and Marking

Serially numbered Ketchum clincher tamper-proof chick-wing tags were used to tag captive beaver. During the early part of the summer the tags were applied along the thinning margin of the tail an inch or two from the posterior edge. That procedure did not appear at the time to be entirely satisfactory because of the danger that the tags might be torn loose accidentally, or removed by the animals. Beaver frequently sit on their tails and then the tags are too conveniently within reach of the razor-sharp, powerful incisor teeth.

Ear tagging would have been more advisable but was thought too hazardous an undertaking for one person, until an improved technique was worked out later in the summer.

Pliers specially designed for applying the tags were used. Difficulty was encountered when some tags would not lock properly, particularly in cases where the tail was thick and fleshy. In such cases a new tag was used or the first one was remedied with sharp-nosed pliers. Once in the canvas bag and hidden the beaver generally remained still and made little or no effort to escape by backing out, even when left alone on the ground. If all but the head was uncovered, it would try to crawl back into the bag, hiding its head like the proverbial ostrich.

Because of the danger of losing the tags, it appeared desirable to have a second means of identification. Branding, as outlined by Bradt (1947), is impractical for one person alone in a remote area and it was not desirable to deface the pelts by staining or clipping, thereby lowering their value. Toe-clipping, a method commonly used in numbering small mammals, is impractical for marking beaver as they occasionally lose a paw in a steel trap. It was decided to paint a number on the upper surface of the tail while the animal was still in the canvas bag. A fast-drying aluminum paint was used. The paint was applied with a small wad of cotton wrapped around the tip of a stick. The beaver was then allowed to rest quietly with the tail extended from the bag and turned to the sun to dry the paint. On bright days the painted number became perfectly dry within ten minutes; on cloudy days it took longer. The method was not practical when it was raining but there were few rainy days. The tail number was not expected to stay readable for any great length of time, but it did prove a useful precaution in the few instances where it was later found that the metal tag had been torn off. In most such cases of recapture the small particles of paint lodged between the scales of the tail were adequate to indicate the number, even up to a month and a half later.

Weighing

All weights of beaver given in this report were obtained on a 100-pound capacity Hanson spring scale, Model 6910 Viking. The canvas bag used in weighing was of a very close mesh sail-cloth material and measured 36 inches in length. This was tied to a circular hoop of three-quarter inch piping bent to form an 18-inch hoop, to which a 40-inch handle of the same piping had been welded. A cord was looped around the bag below the metal hoop and above the animal, and the bag was hoisted with both hands to the scale. Ten pounds was deducted from the total weight to allow for the weight of the bag and the metal hoop and handle. If the canvas became wet from exposure to rain, its weight was determined at each use.

Arrival at Kingsmere

The ice broke up in Waskesiu Lake on May 25 and three days later in Kingsmere Lake. On June 2, the writer accompanied Park Warden E. Gregson to Kingsmere and became established in the old warden's cabin located a short distance from the new cabin on the north shore of the lake. During the first weeks at Kingsmere numerous reconnaissance trips were made to become familiar with the area, to locate and map dead and active beaver lodges, and to follow up streams in search of beaver activity and potential trapping sites. The eight Bailey traps were brought up from Waskesiu and six more were received from Ottawa. The snow had all disappeared by that time and travel was possible on both land and water.

Trapping Locations

The Bagwa-Lily Lake area had been suggested for trapping to determine the average number of beaver per lodge. Examination of the area at first hand, however, revealed some unfavourable factors. Beaver lodges were plentiful, particularly along both shores of Bagwa and Lily channels; but from a practical point of view, too plentiful. Beaver transgress frequently on one another's territories - if they may be said to have territories - and it would have been extremely difficult to determine what lodge a trapped beaver belonged to. Discrete colonies which could be trapped without likely intermingling would better fulfil the purpose. Then, too, the marshy, soft, mud bottom characteristic of the channels there would have made it difficult to set traps in water deep enough to submerge them properly. They could only have been set from a canoe - a rather awkward procedure. Stakes could have been sunk to fasten the traps to after setting, but there was always a possibility that a trapped animal would drown when the trap worked deep into the mud.

For these reasons, the Bagwa-Lily Lake area was considered unsuitable for the trapping project. Several more suitable locations were available and were used. These may be listed as follows:

1. Near the lake shore approximately 200 yards west of Kingsmere Cabin.
2. Along the fire tower trail one-quarter mile northwest of Kingsmere Cabin.
3. On the southwest shore of Bladebone Bay, the large circular bay in the northwest corner of Kingsmere Lake.
4. One-quarter mile north of northwest corner of Bladebone Bay.
5. Near the shore of Kingsmere Lake at Chipewyan Portage.
6. At Ajawaan Lake, one mile northwest of Kingsmere Cabin.
7. At an unnamed creek one-half mile east of Kingsmere Cabin.

Locations 1 and 2 listed above are along the same stream. On the former there was an active lodge and an escape lodge on opposite banks of a pond measuring approximately 50 by 75 feet. The pond was held back by a short dam 5 feet high, and was 30 feet or more from the north shore of Kingsmere Lake. Fairly dense stands of spruce and aspen overshadowed the whole pond. The active lodge was on the north shore of the pond, farthest from the lake and the escape lodge was on the west bank just inside the dam. A tunnel led from the escape lodge 100 feet or

more back into the woods and came to the surface as a water-filled circular hole about a foot in diameter from which a footpath led toward the lake.

The beaver pond at Location 2 is just south of the point where the fire tower trail crosses the stream that flows between Ajawaan Lake and Kingsmere Lake but does not connect them. The pond, held by a dam approximately 6 feet high and 50 feet long, extends back some 300 feet in a triangular shape. The apex of the triangle is crossed by the trail and phone line. There was only one active lodge, on the east shore of the pond.

Location 3, on the southwest shore of Bladebone Bay is a two-level pond separated from the lake by a long, narrow, low ridge, supplemented by segmentary dams. An 8 - to 10-foot beaver dam approximately 100 feet long separates the two levels of the pond. The upper and lower levels are of nearly equal size and each measures approximately 100 feet square. The lower level had one lodge along the east bank, which was occupied by muskrats only; a lodge similarly situated on the upper level appeared to have been occupied by beaver earlier in the summer but abandoned later. The ponds are void of vegetation, but aspen is plentiful all around the shore. A small stream flows in from a southerly direction. The stream was checked for a mile and a half up, but there were no dams on it.

Location 4 was an ideal colony unit, a single lodge on the northwest shore of a natural pond measuring approximately 400 feet in an east-west direction and 300 feet in a north-south direction. The pond is practically surrounded by steep, aspen-covered hills and is separated from Bladebone Bay by a 70 - to 80-foot elevation cut through by a dry, wooded ravine. The southwest corner of the pond is a muskeg area traversed by one well-defined, branching channel cleared out by beaver. Well-worn paths lead from the ends of the marsh channel up over the hill and down to Bladebone Bay. The margin of the pond is rich in waterlily growth.

The Chipewyan Portage trapping site (Location 5) is on the stream connecting Chipewyan Lake and Kingsmere Lake. A 50-foot beaver dam separates the pond from Kingsmere Lake. The pond extends back approximately 100 feet. It is shallow, there are many fallen tree trunks and roots showing above water. A lodge in rather poor repair was found along the middle of the north shore. Little aquatic vegetation grows along that shore. The surrounding woods are largely spruce and much of the beaver feed is brought in from up and down the shore of Kingsmere Lake, where aspen, willow, and alder are more plentiful.

Ajawaan Lake (Location 6), measuring approximately one mile by one-half mile, lies in a north-south direction one-half mile north of Kingsmere Lake. There is a spruce-covered island in the southern part of the lake. Spruce is the predominant tree species around the greater part of the lake, and aspen is plentiful farther up the slopes, particularly along the northern shore. Two active lodges and one bank beaver colony were located along the west and north shores.

The unnamed creek one-half mile east of Kingsmere Cabin (Location 7) once had beaver activity but two full weeks of trapping at this location in midsummer did not not even a sprung trap. It was concluded that the area was abandoned, and the traps were lifted.

A stream entering Kingsmere Lake half way between the cabin and Chipewyan Portage had on it a large beaver pond retained by an eight-foot dam approximately 60 feet long. There were two smaller dams between the main dam and the lake edge. Two large lodges were found, one on each side of the main pond. A common feed bed was built midway between the lodges. This location was not trapped during the present study but would be ideal for future studies.

Trapping at the Locations

The problem arose whether to concentrate all 14 Bailey traps in one or two locations to capture all the beaver in them quickly and then move the traps to new sites, or to distribute the available traps over several sites and trap each site for a longer period. It was believed that each site accorded only two to four main routes frequented by beaver in their rambling. The second method, therefore, was decided on as it would give a greater potential use of each trap. The site, the number of traps, and the duration of trapping at each site are listed in Table 8.

TABLE 8. Duration and Number of Traps Used at Seven Trapping Locations

Trapping Location	Date	Number of traps used
1. West of Kingsmere Cabin	June 7 - July 19	4
	July 19 - Sept. 20	3
2. Fire tower trail	June 7 - July 23	4
3. Bladebone Bay, south shore	June 11 - July 2	6
	July 2 - July 18	5
	July 18 - July 31	3
4. Bladebone Bay, north shore	July 31 - Sept. 13	3
5. Chipewyan Portage	July 19 - Sept. 14	4

Trapping Location	Date	Number of traps used
6. Ajawaan Lake	July 23 - Sept. 13	4
	Sept. 13 - Sept. 14	7
	Sept. 14 - Sept. 20	11
	Sept. 20 - Sept. 24	14
7. Unnamed creek east of Kingsmere Cabin	July 2 - July 19	3

Traps were generally visited only once a day, during the morning. Occasionally it would have been advisable to make an evening check as well, but this did not prove practical because of the distances involved and because another phase of the study occupied the greater part of the afternoon and evening. The round trip from the Kingsmere Cabin to the traps involved travelling 20 miles by boat on Kingsmere Lake, almost two miles walking to Ajawaan Lake and back, and two miles of canoe paddling on Ajawaan. The daily trips generally took up the greater part of the morning and longer if the lakes were very rough, if more than one beaver was captured and tagged, or if traps had to be rebaited. In travelling the trap routes and in connection with other phases of this study, the writer had the use of a 21-foot freighter-type boat driven by a new 10 h.p. Johnston outboard motor. This craft, although somewhat slow, was particularly useful on the many days when Kingsmere Lake rolled up four to six-foot waves. Park Warden Gregson also made available to him his own Flash-model speedboat. This lighter craft not only shortened considerably the time needed in travelling across the lakes, but also almost halved the amount of gas used in travelling up to 1,300 miles a month.

Several experiments were tried during the summer with different types of bait. Leafy willow twigs, leafy sprigs of aspen, apples, celery, strips of aspen bark, and fresh lily rhizomes like the one shown in Figure 3, were all tried in turn. Leafy aspen twigs and strips of freshly-peeled aspen bark proved most successful. Aspen bait was readily obtained from trees which the beaver had cut down along the shore of Kingsmere Lake. Generally traps were freshly rebaited every three or four days, and whenever a capture was made or the leaves had been removed by muskrats without setting off the trap.

Careful preliminary observation of the location aided in choosing the best possible trap site. Freshly used runways, fresh mudpacks on the banks, underwater channels or fresh tracks in the sand or mud proved valuable indicators. The traps were set at depths allowing only two to three inches of water above the trigger mechanism. Fresh twigs tied to the trigger were allowed to project above the water. Unnecessary trampling of the trapping area was avoided, and where it was necessary the footprints were watered down to minimize the traces of human scent. Beaver captured at two large mudpiles along the west shore of Ajawaan Lake were left in the traps and placed in the canoe to be taken half a mile away before removal. This left the mudpiles untrampled to serve as beaver-made signposts luring other beaver. A mudpile of the same kind is shown in Figure 4. Frequently it was

necessary to place a supporting structure under a trap to prevent too deep submersion and the danger of drowning the captured animal. Where the bottom was very soft, the supporting structure helped prevent the animal from working the trap deeper and deeper into the mud while trying to escape.

Several difficulties were encountered in trapping. Bailey traps were never designed for transporting over a great distance, much less to be carried through dense underbrush and bogs, and a helper could have been used to good advantage. Several of the traps gave frequent mechanical trouble, such as one or both clasps failing to lock when the trap was sprung. In some, only one side would spring shut; this frightened the beaver without capturing it. In others, the trap failed to shut even after the trigger mechanism had been completely unhooked from the central spring. The rusty condition of the centre spring may have accounted for that difficulty, and the others may have been attributable to the traps having been raked over by bears or to faulty reconditioning. When the safety catch slid back into catch-position after the trap had been set, thereby preventing closure of the trap when sprung, the incident was accepted as resulting from negligence on the part of the trapper even though it might have been brought about in trying to set the trap in muddy water.

Tagging Beaver

A set of tools was carried on all rounds for checking and tagging beaver. All the items except for the canvas bag were carried in a small army-type canvas shoulder bag. They included the spring scales, a heavy cord to tie around the canvas bag when weighing beaver, a leather strap 3/8 inch wide and 4 feet long with a half-inch metal ring riveted to one end, a supply of tags, the pliers for the tags, an extra pair of sharp-pointed pliers, marking paint and brush, and a notebook and pencil.

Beaver were found to react in widely different ways to being handled for tagging, and the procedure depended largely on the size and temperament of the animal at hand. When first approached, a captive beaver generally dives below the water-line and lies as low as possible in the trap. It keeps its eyes open and emits no air bubbles in as long as ten minutes submersion. When the trap is lifted slightly, it keeps trying to get below water level. If pulled from the water, it first attempts to escape. After that, individuals differ considerably. Some are quiet and resigned but others make repeated sham attacks and do not hesitate to bite any part of the trapper's anatomy within reach. Neither size nor sex indicated how the animal could be expected to behave. A nasty bite in the thigh was received while carrying a trapped beaver away from the water's edge early in the summer. The beaver reached out to bite from within the trap as it rested momentarily on my knee while I was taking a better grasp on the ends. The kits were generally found easy to tame and could be handled with bare hands as illustrated in Figure 5. However, not all young beaver act alike; and one at least had not read this report. It left a black and blue mark as a token of its lack of gratitude. Repeated capture did not necessarily make the animals more resigned.

Before an attempt was made to tag or weigh a trapped beaver, it was carried in the trap well back from the water's edge to allow a better chance for recapture in case of accidental escape. Transferring the animal from the trap to the canvas bag was difficult at first without help. The trap was opened just enough to allow shoving the hoop and canvas bag partly inside. When the animal tried to escape at that end the trap was opened completely on one side by pressing down on it with the foot while trying to keep the bag in front of the animal. Generally the beaver tried to escape by running into the bag, but occasionally it turned about and escaped from the other end, and had to be recaptured while running toward the water. One beaver was lost in this manner, but it was recaptured at the same location a week later. It was as hard to handle as ever but by then the writer's techniques had been improved.

The use of the length of a 3/8-inch wide leather strap prevented further loss in transferring the beaver from trap to canvas bag. The free end of the strap was first inserted an inch or two through the metal ring at the other end to form a sliding loop. The strap was then folded flat and the mid-portion of the loop was inserted through the wire mesh as near as possible to the top centre of the trap. The two ends of the strap were held and the loop was worked under the tail of the beaver. It was tightened, moved to the base of the tail, and held tight enough to prevent slipping. The free end of the strap was then worked up between the jaws of the trap which were opened just enough to allow it through. Once the beaver was secured in this fashion, the trap could be opened on one side by pressing down on the jaw with the foot. The animal would then walk out, still held securely by the leather strap about the base of its tail. It immediately tried to escape. If small enough to be lifted easily with one hand, it was lifted off the ground away from anything it could grasp and held until the canvas bag and metal hoop could be brought under it with the other hand. When the beaver was too heavy to list with one hand, the strap was held tight and the canvas bag was held open in front of the beaver until it sought refuge in it. Once in the bag, the beaver soon became quiet and could be handled at leisure.

As mentioned before, lack of help presented serious disadvantages during the earlier part of the summer. This was felt all the more when it came to tagging. The beaver could be depended on to stay quiet as long as its head was covered, but if the bag was turned back to expose its ears and eyes there was risk of its biting or escaping, especially when it began to struggle against the pain of having its ears pierced by the tags. The only alternative was to tag the beaver along the thin edge of the tail. This was supplemented by painting a number on the upper surface of the tail as described in a previous section.

With further experience gained during the course of the summer, a one-man method of ear-tagging was mastered, and beaver trapped after that were all ear-tagged before removal from the traps for weighing or sexing. As before, the trap was carried back from the water's edge. The swinging bar at the bottom of the trap was turned to fold in line and the trap was laid on its side. By stepping on the wire mesh of the basket, the animal was forced into one corner. Care was taken to press on the beaver just enough to prevent it from turning

its head more than an inch. The pliers could then be inserted through the wire mesh of the trap and the ear pierced by a tag. Special care was taken in placing the tags not to obstruct the valvular action of the ear flaps. Little or no bleeding occurred when the ear was pierced. An ear-tagged beaver is shown as the frontispiece of the report, Figure 1.

Painting a number on the tail was left until after all the data had been recorded. By then the animal had become completely quiet. When the number had been applied it could be safely left unguarded for the ten to fifteen minutes needed for the paint to dry. During the interval, the tools were collected and the trap was rebaited and set at the same or another location. Tagged beaver, when first released, appeared somewhat disoriented and often tried to crawl back into the bag. Eventually, they would move cautiously away, stopping periodically to see whether they were being followed and hastening their meandering gait to a rolling gallop if they were. Care was taken in directing the animal back to the water to prevent it diving into the newly-set trap.

The results of the trapping, the location, number of captures, recaptures, sex, weight, tag numbers used and numbers painted on the tails are outlined in later sections.

PHASE TWO - SHOOTING

The second phase of the study was concerned with collecting data on the health and reproductive potential of beaver from post mortem examination of freshly killed animals.

Shooting Locations

As it was intended that the shooting should not interfere with trapping, areas were selected for shooting which were, with three exceptions, far enough removed from the trapping locations not to overlap them . Considerable effort had been expended in the past by park wardens in trying to keep Kingsmere River free of beaver, as this waterway is used each summer by large numbers of fishing parties travelling up to fish in Kingsmere, Kingwa, Lily and Bladebone Lakes. To help with the eradicating process and at the same time obtain beaver for examination, the Kingsmere River area was selected as the primary location for shooting. Several dams in the river had been cleared away by the warden during the early spring and the previous autumn, but several colonies still persisted along the river. These included both lodge and bank beaver.

To keep beaver out of Kingsmere River, it appeared imperative that they be removed from adjacent waters as well, i.e. from the south end of Kingsmere Lake and the north end of Meakesiu Lake. No beaver lodges, old or new, were found along the southern shore of Kingsmere Lake. Lodges were abundant along the six-mile section of Meakesiu Lake from the First Narrows to Kingsmere River. Although it was distant from the Kingsmere cabin most of the beaver

shot during the summer were from that strip of lake.

Less frequently hunted was the Hagwa-Lily lake system. This area was reserved for times when bad weather made travel on the larger lakes unpleasant and dangerous and completely unfavourable for hunting from a small boat.

The three exceptions referred to above where shooting overlapped trapping were: at Chipewyan Portage where one female was shot in the summer before it was decided to use this area for trapping; at the pond along the Fire Tower trail west of Kingsmere Cabin where a beaver was shot at the end of the summer; and at the large pond emptying into Kingsmere Lake half-way between the Kingsmere cabin and Chipewyan Portage where one young beaver was shot.

Time of Hunting

Because of the nocturnal habit of the beaver, the writer had to extend his working hours often far into the night to get the number of specimens he eventually did. Although beaver become active somewhat earlier on cloudy or rainy days, this deviation is slight. Like many other nocturnal and crepuscular animals, beaver usually appear first in the evening outside the lodge during the hour before sunset. The period when they may be seen is somewhat extended during mid-summer and there may be as much as three or four hours of hunting before it is too dark to shoot effectively. During September, however, there was only about an hour and a half of sufficient light each evening.

Equipment

During the early part of the summer, the freighter-type canoe was used in all lake travel in connection with hunting and trapping. The use of the speedboat during the latter half of the summer made it possible to reach more beaver before they sank after shooting.

A .22 caliber rifle was found inadequate for shooting all but young beaver of the year. A more effective weapon was a 30-30 Winchester rifle, also the personal property of Warden Gregson.

Whether shot beaver have an instinctive compulsion to dive even after their mental capacities are lost, or are directed downward in floundering is not known to the writer. However, they must be retrieved within a few seconds or they sink. To aid in retrieving them a 10-foot pole with a sharply filed hook of No. 9 wire securely fastened to the end of it was carried in the boat on all hunting trips.

During some evening hours of beaver hunting Robert Lee and Jim Setoet, both employed as caretakers along the Kingsmere River and portage, Towerman Allan Bird and, on two occasions, Warden Gregson, gave valuable assistance.

Hunting was generally more successful when two people participated, one operating the outboard motor and the other shooting from the bow.

The trapping difficulties were gradually overcome in the course of the summer, but the hunting difficulties remained throughout and in some respects increased. One was to keep the outboard at the desired speed and direction while trying to shoot beaver in poor light. Rough water, wind, and sudden storms made effective marksmanship even harder. When a shot beaver was retrieved on Waskesiu Lake it was dissected there or taken back to Kingsmere for dissection. In either case the return trip up Kingsmere River, over the light railway portage, and across the nearly seven miles of open water of Kingsmere Lake was almost always made after dark. Often it was later than 1 a.m. before the cabin was reached. During August and September the water-level in Kingsmere River continued to fall, and this made it increasingly difficult to travel. Four or five extra shearpins no longer afforded a save margin to assure the completion of the return trip. At the same time a wide two-to-three foot sandbar formed across the south exit of Kingsmere Lake and the boat had to be pulled across it.

Preserving Viscera

For beaver tissue to be satisfactory for later examination, the animal had to be dissected and the viscera removed and preserved within two hours after the animal was shot. During June, July and August, when there were almost two hours of daylight after the first beaver of the evening had been shot, it was necessary to do the dissecting before starting back to the cabin, and preservative and containers were carried in the boat. Later in the summer that work was done at the cabin. The following data were recorded: date, locality, weight, sex, and four anatomical measurements. Note was made also of whether the entire viscera was saved or only portions of organs. When only portions were saved, they included parts of liver, lungs, heart, spleen, pancreas, kidney, and reproductive tract. Portion tissues were preserved in 1½-gallon glass jars; entire viscera in 5-gallon metal containers with whole top-clip-on lids. A 10 per cent formaldehyde solution to which a small quantity of salt had been added, about one ounce in 6,000 cc., was used as the preservative.

The retrieved beaver were inverted into the five-gallon metal containers. By the time they were weighed the fur had largely lost its excess water. The weight was taken to the nearest pound, and no attempt was made to correct it for the weight of moisture on the fur or for weight lost in bleeding.

Measurements taken on each animal before dissection included:

1. Total length from the tip of the snout along the back to the tip of the tail, with the animal stretched out flat on its stomach.

2. Tail length from the slight depression at the base to the tip. The depression can be felt approximately one inch anterior to where the tail scales commence.

3. Tail width measured at the widest point.
4. Hind foot measured from the heel to the tip of the longest toenail.

All of the above measurements were made with a steel measuring tape to the nearest quarter inch.

From six specimens, mainly taken at the beginning of the summer, only portions of viscera were preserved. Seven young of the year which were shot were preserved whole, a small cut being made into the body cavity to allow the entrance of the formaldehyde solution. From all the other specimens, the entire viscera were preserved. As the pelts of beaver are not prime in summer, they were not saved but buried with the carcasses the following morning.

Beaver not retrieved before they sank, were generally searched for in the same locality the following day. In rare instances the dead animal was buoyed to the surface when at least two hours had elapsed after shooting. The weight, sex, measurements, location and date were recorded for these recoveries but no tissues were saved. Approximately 20 beaver were shot and never recovered.

Shipment of Specimens for Disease Studies

A cursory examination of the beaver was made at the time of dissection. Because of the lack of proper facilities in the field and the limited experience of the writer in making such examinations, the preserved tissues were sealed and shipped to government pathology laboratories. Dr. Robert Connell, Veterinary Research Laboratory, Department of Agriculture, Lethbridge, Alberta, who had examined numerous beaver from the park in previous years, agreed to examine 50 specimens. Actually 52 were shipped to him. An additional 29 specimens were later shipped to Dr. A.H. Corner, Associate Superintendent, Elk Island National Park, Lamont, Alberta, who had agreed to examine the remainder of the summer's total. Except in the case of young of the year, a separate container was used for the shipment of the viscera of each specimen. Besides the address, a tissue lot number (the viscera of each beaver represented a tissue lot and the lots were numbered in the order of date of shooting), the sex and weight of the animal, the location and date of shooting, and the preservative used, were shown on the label. If the specimen was a female a request was made for confirmation of the number of young it might have had in 1956. Placental scars were fairly evident during the early months of the summer, but later on the number of young born became increasingly difficult to determine.

On October 6, the writer returned to Waskesiu to prepare a report of the summer's work and make arrangements for the third phase of the study, the aerial survey.

Abandonment and Recolonization of Lodges

Little new was learned in the course of this study on the abandonment and recolonization of lodges by beaver. It is believed that a study of several years duration extending over a greater area is needed before conclusive data

can be obtained. Only fragmentary evidence is here reported.

Only two beaver were seen during a week of nightly observations at the slough three miles south of Waskesiu in early May. These were live-trapped and removed. During the week following their removal, the road culverts were not plugged by other beaver and the water level fell. Within ten days, however, beaver were again inhabiting the lodge and the culverts were once more being plugged. Two more beaver were live-trapped at the culverts shortly afterwards. Whether or not the second pair had occupied the lodge at the same time as the original pair was not proved; more likely they had moved in when it became vacant. Had all four animals been present at first, the chances are that more than two would have been noted then.

Recolonization appears most rapid during spring about the time the kits are born. It declines during the summer and rises to a second and lesser peak in the autumn when lodges and food beds are being prepared for winter. During early August all the beaver occupying a large lodge along the west shore of Kapun Lake were shot. That lodge was in favourable beaver habitat, but no attempt was made to occupy it during the remainder of the summer or early autumn.

During September, several lodges along Bagwa Channel, which had been considered abandoned during the summer, began to show evidence of occupancy. Several in very poor state were repaired and provided with feed beds. More abandoned lodges were found repaired than new lodges built. A new lodge built along Bagwa Channel is shown in Figure 6.

Occupied lodges damaged during the summer were repaired within hours after damage. A hole was made in the peak of one lodge (Fig. 7) to check on how soon it would be repaired. It was filled in that night. It was opened repeatedly by the author during the following weeks, and each time was promptly repaired. By the end of the summer three feet more of mud, sticks and weeds had been added to the top of the former lodge to close the recurring hole. In no instance was it found that experimental damage to lodges or dams caused the beaver to abandon their home site.

RESULTS OF TRAPPING AND SHOOTING

The account of methods and procedures in this report has been lengthy and detailed but the results lend themselves well to tabulation.

Table 3 lists the results of the beaver trapping, including the tag numbers and tail numbers, and other data.

Table 4 lists the beaver tissue lot numbers, dates, sexes, weights, four measurements, locations of shooting, and tissues submitted for examination of 91 beaver shot during the course of the study.

Table 5 gives data on beaver which were shot but not retrieved until the following day or acquired in other ways. Measurements were taken for these beaver but no tissues saved from them for examination.

Table 3. Results of Trapping Beaver at Kingsmere Lake, Summer, 1956

Location	Date	Sex	Weight (pounds)	Tag No.	Tail No.		Remarks
1	June 12	F	28	1910	9	Tagged in tail.	
	June 18	F	29	1918	11	" " "	Recaptured June 28. Tail tag gone. Retagged in tail with Tag No. 1916.
	July 25	M	31	1923	18	" " "	
	August 3	Kit (undet.)	6	1926	21	" " "	
	August 24	M	42	1945	-	Tagged in left ear.	
	Sept. 6	M	8	--	-	Dead in trap.	Not tagged or marked before.
2	June 8	F	28	1909	8	Tagged in tail.	
	June 17	F	30	1911	10	" " "	
	June 19	F	27	1914	12	" " "	Has slit along left rear edge of tail.
3	June 15	F	45	--	-	Dead in trap.	
	June 18	F	38	--	-	" " "	
	June 28	Kit (undet)	15	1915	13	Tagged in tail.	Recent cut along left rear edge of tail.
	July 19	M	25	1918	14	" " "	
5	July 20	M	13	1910	15	" " "	Recaptured July 21 at same trap. Found dead at water's edge Sept. 13, tail tag intact.
	July 20	M	16	1921	11	" " "	Recaptured Sept. 9th. Tag and tail numbers gone. Tagged right ear (No. 1960) and left ear (No. 1961). Printed No. 31 on tail.
	July 22	Baby	5	--	--	Died ½ hour after removal from trap.	
	July 23	F	34	1922	17	Tagged in tail.	
	August 20	M	35	1922,1930	24	2 tags in tail.	
	July 12	F	39	--	--	Shot.	

Location	Date	Sex	Weight	Tag No.	Tail No.		Remarks
4	August 2	M	24	1924	19	Tagged in tail.	
	August 3	F	24	1925	20	" " "	Recaptured Sept. 8, tail tag torn out. Retagged in right (1955) left ear (1957).
	August 4	Kit (undet.)	7	1927	22	Tagged in tail.	Recaptured August 17 - dead in trap.
	August 14	M	35	1928	23	" " "	Recaptured August 26, tag torn out. Retagged in ears. 1946 - left, 1947 - right. Tail No. still visible. Recaptured again Sept. 5, ear tags intact, tail No. still visible.
	August 23	F	39	1934	25	Tag in right ear.	
				1936		Tag in tail.	
	August 29	M	10	--	--	Dead in trap.	
	Sept. 7	Kit (undet.)	10	1952 right	28	Tagged in ears.	
				1953 left			
6	August 21	M	42	1933	--	Tagged in tail.	
	August 23	M	45	1937 right	--	Tagged in ears.	
				1938 left			
	August 24	F	29	1939 - right	--	Tagged in ears, at lodge Sept. 22, both tags intact.	
				1940 - left			
	August 29	M	54	1948 left	26	" " "	
				1949 right			
	Sept. 6	F	25	1950 right	27	" " "	
				1951 left.			
	Sept. 8	M	24	1958 right	30	" " "	Recaptured Sept. 15 at same mud p'le. Ear tag intact. Tail No. still visible.
				1959 left			

Location	Date	Sex	Weight	Tag No.	Tail No.		Remarks
North end	Sept. 17	Baby	15	1962 right 1963 left	33	Tagged in ears.	Recaptured Sept. 18 at same trap. Ear tags intact. Tail No. still visible.
	Sept. 18	"	15	1964 right 1965 left	34	" " "	
	Sept. 19	"	11	1966 left 1967 right	35	" " "	
	Sept. 23	"	14	1968 right 1969 left	36	" " "	
	Aug. 28	"	1951	1951 right	--	" " "	

Table 4. Data on 81 Shot Beaver From Which Tissues Were Prepared, 1956, for Laboratory Examination

Tissue Lot. No.	Date Shot 1956	Sex	Wt. (lbs.)	Total Length (ins.)	Tail Length (ins.)	Tail Width (ins.)	Hind Foot (ins.)	Where Shot	Tissues Submitted
1	May 28	F	35	41½	16	5	7	Dr. Martin's boathouse - Waskesiu	Parts of liver, pancreas, spleen, lung, kidney, heart, ovaries.
2	June 9	M	18	34	14½	5⅜	5½	Kingsmere R., upper end of portage	"
3	" 12	F	50	45	14½	6½	7	Outlet Kingsmere R., at Waskesiu L.	"
4	" 18	F	48	43	14½	6	7	N. Waskesiu L., southwest shore	"
5	" 18	M	27	35	12	4⅝	6⅛	At lodge, s. end Kingsmere	"
6	" 21	M	22	34	10½	4	6	In old course of Kingsmere R.	Entire viscera.
7	" 21	M	21	33	10⅜	3⅝	6	" " " " " "	" "
8	" 22	F	42	42	13	5⅜	7	In large pond, N. end Waskesiu L.	" "
9	" 26	M	36	39½	15½	5	7	N. shore Waskesiu L.	" "
10	" 26	F	26	36⅛	12	4⅛	6⅛	" " " "	" "
11	" 28	M	34	40	13⅜	5⅛	7⅛	" " " "	" "
12	July 2	M	31	35	10⅝	5	7	" " " "	" "
13	" 2	F	45	44⅛	13⅜	6	7⅛	Upper end Kingsmere R. portage	" "
14	" 2	F	46	44	14	6	7⅛	N.W. shore upper Waskesiu L.	" "
15	" 3	F	33	39½	13	4⅝	7	Lower Kingsmere R.	Portions of viscera
16	" 3	M	36	41	13⅛	5	7⅛	N. shore Waskesiu L.	Entire viscera
17	" 11	M	43	42½	13⅛	5⅛	7	N.W. Shore upper Waskesiu L.	" "
18	" 11	Undet.	4	17	5	1⅝	3⅛	N.W. shore upper Waskesiu L.	Whole animal
19	" 11	F	39	43⅛	13½	5	7½	E. shore Kingsmere L.	Entire viscera
20	" 18	F	20	33	10½	3⅛	6	Waskesiu L., ⅓ way to narrows on w. shore	" "

Data on --- (etc.), cont'd.

Tissue Lot. No.	Date Shot 1956	Sex	Wt. (lbs.)	Total Length (ins.)	Tail Length (ins.)	Tail Width (ins.)	Hind Foot (ins.)	Where Shot	Tissues Submitted
21	July 18	M	20	32⅛	11	4	6⅛	Waskesiu L., ⅓ way to Narrows w. shore.	Entire viscera
22	" 19	M	54	47	13⅛	5⅛	7⅛	Waskesiu L., w. shore near Narrows	" "
23	" 19	F	46	44⅛	13	5⅛	7⅛	Waskesiu L., e. shore across from Narrows	" "
24	" 19	M	54	46½	14	6	7⅛	Waskesiu L., e. shore ½ m. n. of Narrows	" "
25	" 20	M	52	43½	13	6	7⅛	Waskesiu L., e. shore 3 m. n. of Narrows	" "
26	" 20	F	46	43⅛	12⅛	6⅛	7	Waskesiu L., e. shore 3 m. n. of Narrows	" "
27	" 20	M	26	36½	11	4⅛	6⅛	Waskesiu L., e. shore 3 m. n. of Narrows	" "
28	" 20	F	22	33	9⅛	4	6⅛	Waskesiu L. e. shore 3 m. n. of Narrows	" "
29	" 20	M	24	36⅛	11	4⅛	6⅛	Waskesiu L., e. shore 3 m. n. of Narrows	" "
30	" 22	Undet.	5	20	6	2	3⅛	Kingsmere L., Chippewan Portage (location 5)	Whole animal
31a	" 26	M	40	42	12⅛	5⅛	7⅛	Waskesiu L., e. shore 3 m. n. of Narrows	Entire Viscera
32a	" 26	F	43	43⅛	13⅛	5⅛	7⅛	Waskesiu L., e. shore 3 m. n. of Narrows	" "
33	Aug. 2	M	22	34⅛	10½	3⅛	6½	Waskesiu L., e. shore 3 m. n. of Narrows	" "

Tissue Lot. No. 666	Date Shot 1956	Sex	Wt. (lbs.)	Total Length (ins.)	Tail Length (ins.)	Tail Width (ins.)	Hind Foot (ins.)	Where Shot	Tissues Submitted
34	Aug. 2	F	33	39½	11½	4½	7	Waskesiu L., s. shore 3 m. n. of Narrows	Entire Viscera
35	" 4	F	33	38	11½	5	7	Waskesiu L. e. shore 3 m. n. of Narrows	" "
36	" 7	M	4	17½	4¾	1½	3¾	Old course of Kingsmere R.	Whole animal
37	" 8	F	28	37½	11½	4	6½	Bagwa L. w. shore lodge	Entire Viscera
38	" 9	M	30	37½	10¾	4	6½	" " " " "	" "
39	" 9	M	8	25½	8	2½	4½	" " " " "	Whole animal
40	" 11	F	47	44	13½	5½	7½	Bagwa L. n. shore lodge	Entire Viscera
41	" 11	F	39	41½	13	5¼	7	Bagwa L. w. shore lodge	" "
42	" 11	F	46½	43½	12¾	5½	7½	Bagwa L. s.w. shore	" "
43	" 11	M	26	35½	10½	4¼	6¾	Bagwa Channel	" "
44	" 14	F	48	45½	14¼	5½	7½	Lily L., w. shore	" "
45	" 15	M	42	41	12	5¾	7½	Lily L., n.w. corner	" "
46	" 15	M	56	47¼	13¾	5½	7¾	Lily L., e. shore	" "
47	" 15	M	10	26½	8¼	3	5	Bagwa L., w. shore lodge	Whole animal
48	" 16	M	9	25½	7½	2¾	4¾	" " " " "	" "
49	" 16	M	9	26	8	2¾	5¼	" " " " "	" "
50	" 16	F	54	45	12¾	5¼	7½	Bagwa Channel	Entire Viscera
51	" 16	F	14	30	9½	3½	5½	" "	Whole animal
52	" 23	M	13	29½	9	3	5¼	" "	" "
53	" 25	F	13	29½	10	3¼	5½	" "	" "
54	" 25	F	24	36	10	3½	6½	" "	Entire Viscera
55	" 25	F	47	45	13½	6	7¾	" "	" "
56	" 28	M	47	45½	14	6	7½	Waskesiu L. w. shore 1 mile n. of Narrows	" "
57	" 29	F	10	25½	9	3	5	Waskesiu L. w. shore 1 mile n. of Narrows	Entire animal
58	" 29	M	10	25	8½	2¾	5	Waskesiu L. w. shore 1 mile n. of Narrows	" "
59	" 29	M	9	25½	8	2½	5	Waskesiu L. w. shore 1 mile n. of Narrows.	" "

Tissue Lot. No.	Date Shot 1956	Sex	Wt. (lbs.)	Total Length (ins.)	Tail Length (ins.)	Tail Width (ins.)	Hind Foot (ins.)	Where Shot	b Tissues Submitted	
60	Aug. 29	F	27	34	11	4½	6¼	Waskesiu L. w. shore 1 mile n. of Narrows	Entire viscera	
61	" 29	M	26	35	10	4½	6⅛	Waskesiu L. w. shore 1 m. n. of Narrows	"	"
62	" 29	M	33	40⅛	11⅝	4⅝	7¼	Kingsmere R. n. end	"	"
63	Sept. 3	F	54	46½	13½	5⅛	7⅛	Bagwa L. n. end lodge	"	"
64	" 4	M	12	29	9½	3	5⅛	Lily L. n.e. shore	"	"
65	" 6	F	35	40	12	4⅜	7⅛	Waskesiu L. e. shore 1 m. s. of Kingsmere R.	"	"
66	" 6	M	41	41⅝	12⅛	5	7½	Waskesiu L., e. shore 1 m. s. of Kingsmere R.	"	"
67	" 8	F	46	45¼	13	5¼	7¼	Lily Channel	"	"
68	" 15	M	16	28⅜	8⅛	2⅝	5½	Kingsmere L. e. shore pond ⅛ m. old fire tower	"	"
69	" 16	M	36	39⅛	11⅛	4⅛	7	¼m. n.w. of Kingsmere Cabin along Fire Tower trail	"	"
70	" 18	M	57	46	12⅛	6⅛	7¼	Waskesiu L. e. shore 2 m. s. of Kingsmere R.	"	"
71	" 18	F	46	42½	13⅜	5¾	8	Waskesiu L. e. shore 3 m. s. of Kingsmere R.	"	"
72	" 18	F	38	43	13⅜	5½	7½	Waskesiu L. e. shore 3 m. s. of Kingsmere R.	"	"
73	" 22	M	29	36	10½	5	6⅜	Waskesiu L. e. shore 3 m. s. of Kingsmere R.	"	"
74	" 23	F	54	44	12	5¼	7½	Waskesiu L. e. shore 1½ m. n. of Narrows	"	"
75	" 26	F	26	38⅛	12	4½	6⅜	Kingsmere R. just s. of Portage rly.	"	"
76	" 29	F	44	46	12⅜	6	7½	Waskesiu L. e. shore ½ m. n. of Narrows	"	"
77	Oct. 2	M	42	42⅜	11¼	5½	7½	Lily L. n.e. corner	"	"
78	" 2	M	38	42¾	12⅛	5	7⅛	Lily L. n. entrance	"	"
79	" 2	F	49	47⅜	14	6	7⅛	Bagwa Channel	"	"
80 (31b)	July 31	F	53	46½	14⅛	5¼	7⅛	Waskesiu L. e. shore 3 m. s. of Kingsmere	"	"
81 (32b)	Aug. 2	M	33	39½	12⅜	4⅛	7	Waskesiu L. n. shore of postage tent	"	"

Table 5. Data on Beaver from Which No Tissues Were Saved

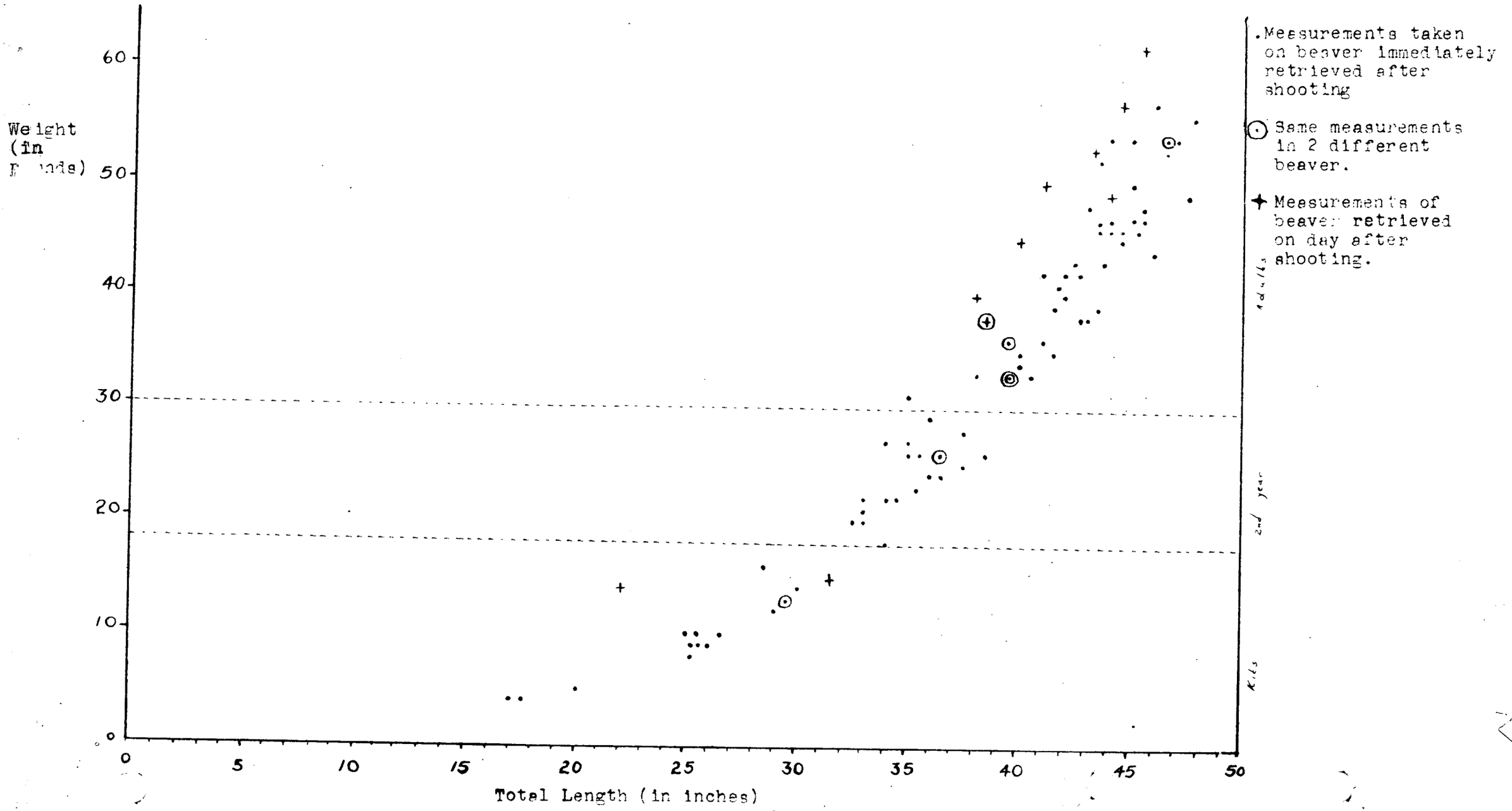
Beaver No.	Date 1956	Sex	Weight (pounds)	Total length (ins.)	Tail Length (ins.)	Tail Width (ins.)	Hind foot (inches)	Location	Remarks
i	June 1	F	15	31½	10½	3¼	6	Hanging Heart L. ¼ Waskesiu Road	Struck by car.
ii	" 15	F	45	40	14	6¾	7⅛	Bladebone Bay, ¼ s. shore slough	Dead in trap.
iii	" 18	F	38	38½	15	5½	7	Bladebone Bay, s. shore beaver pond	" " "
iv	July 4	M	40	38	13½	5	7	Waskesiu L. extreme n. end of pond	Shot, retrieved next day.
v	" 30	F	57	44½	14	6¼	8	Waskesiu L. e. shore 3 mi. n. of Narrows.	" "
vi	Aug. 7	M	50	41	12½	6	7½	Lily L. mid-w. shore	" "
vii	" 9	F	49	44	15⅛	5¾	7⅛	Bagwa L. w. shore lodge	" "
viii	" 11	F	38	38½	11¼	4¾	7¼	Bagwa L. w. shore lodge	" "
ix	" 14	M	62	45⅝	14⅜	5¾	8	Bagwa Channel	" "
x	" 14	M	53	43¼	13⅝	5½	8	Lily L. mid-w. shore	" "
xi	Sept. 19	M	14	22	9	3	5½	Ajawaan L. extreme n. end	Dead in trap

Table 6. Data on Beaver Shot at Large Beaver Lodge on Mid-West Shore of Bagwa Lake

Number	Date 1956	Sex	Weight (pounds)	Total Length (inches)	Tail Length (inches)	Tail Width (inches)	Hind Foot (inches)
1	Aug. 8	F	28	37½	11½	4	6½
2	" 9	F	49	44	13½	5⅝	7
3	" 9	M	50	37½	10⅝	4	6½
4	" 9	M	8	25¼	8	2⅝	4½
5	" 11	F	39	41½	13	5⅛	7
6	" 11	F	46½	43½	12⅜	5	7⅛
7	" 11	F	38	38½	11½	4⅝	7⅛
8	" 15	M	10	26½	8¼	3	5
9	" 16	M	9	25¾	7½	3	5
10	" 16	M	9	26	8	2⅝	4⅝

4 2 2 2

GRAPH I. WEIGHT - TOTAL LENGTH - RELATIONSHIP (Based on measurements of 92 beaver shot in 1956 beaver study, Prince Albert National Park)



Similar data on the ten beaver shot at or near the single lodge along the west shore of Bagwa Lake are given in Table 6.

Graph 1 shows the length-weight relationships of 92 beaver shot in the course of the study. Point positions on the graph represent measurements of animals shot and retrieved within two hours. Crosses represent measurements of beaver retrieved on the day after shooting.

No precise method was employed in aging the beaver handled, but the graph suggests three age groups by weight and total length measurements: kits, up to 16 pounds; yearlings, between 16 and 30 pounds; and adults, 30 pounds and more.

At the time of writing, no reply has been received concerning the examination of the beaver viscera shipped to Dr. Connell and Dr. Cowan.

PHASE THREE -- THE AERIAL SURVEY

As stated in the introduction the object of the aerial survey was to obtain a representative count of lodges and, using the average number of beaver per lodge as an index, to estimate the total beaver population of the park.

The 1954 Aerial Beaver Survey

An aerial survey for the same purpose was carried out by J.F. Tener assisted by Park Warden Gange, on October 15 and 16, 1954. In that survey a Cessna 180 aircraft was used in flying a total of 637 linear miles along the 25 transects shown on the map at the back of this report. The transects were two miles apart and ran in an east-west direction. As accurately as could be determined, a quarter-mile observation ground strip was used on each side of the aircraft, giving one-half mile total coverage. All the flights were made at an altitude of about 600 feet above ground level and an airspeed of 100 miles per hour. A count was kept of the number of active and inactive lodges and dams, of cuttings not associated with lodges, and of large game animals seen. A lodge was counted active if it had a fresh feed bed, which is easily seen from the air. When there was no feed bed and the lodge appeared old, without freshly peeled logs or sticks, and with the dam in disrepair, it was counted inactive.

The 1956 Aerial Beaver Survey

The 25 transect flight lines established in 1954 were used by the writer in the present study carried out on October 16 and 17, 1956. This gave not only an estimate of the present beaver population, but also a useful indication of the trend since 1954.

The 1956 survey, however, differed from the previous one in the number of observers, the altitude flown, and the airspeed. Three observers were used in the 1956 survey, Radvanyi, seated beside the pilot, Park Warden Millard seated behind the pilot observing to the left of the aircraft, and Park Warden Gange

seated behind the writer, observing to the right. The whole of the 1956 survey was flown at an altitude of 300 feet or less instead of 500 feet and at 75 to 80 m.p.h. instead of 100 m.p.h. This slower speed - actually only 5 to 7 m.p.h. above the stalling speed of the aircraft admittedly presented an element of danger, but permitted time for a better look at lodges hard to see or classify.

To establish in the minds of the observers the angle necessary to give a quarter-mile coverage on either side of the aircraft at the 300-foot altitude, practice runs were made before the actual survey. Three large Union Jacks were staked out in a horizontal plane along straight piece of highway east of the townsite of Waskesiu. The flags were spaced one-quarter mile apart. The pilot was asked to fly the aircraft at 300 feet altitude directly over the centre flag, approaching from a direction at right angles to the line of the three flags. As the aircraft passed over the center flag, the observers used the two distant flags to gauge mentally the point on the wing strut which would give a line of vision extending out one-quarter mile from the aircraft. This observation angle was rechecked by two more runs across the flag markers at the same altitude and in the same direction.

Only the five northernmost transects were flown during the morning of October 16. Upon landing at Waskesiu to refuel, it was found that the lake waters had become too rough to permit a second take-off. On October 17 fine weather prevailed and the survey was continued from transect 6 beginning at 7 a.m. The last transect was finished at 2:30 p.m.

As on the 1954 survey, active and dead lodges, cuttings not associated with lodges, and functional dams were recorded. Dams in such disrepair that they could no longer hold back an appreciable amount of water, were not recorded. A separate page in the record book of each observer was used for each transect. To record more precisely the distribution of the lodges the mid-point of each transect was marked on the pilot's map. As the mid-point was crossed in flight, he called out, and the observers turned to mark appropriately the page being used for that transect. Thus there was a record not only of the number of active and dead lodges observed along each transect, but also of the number of lodges on each half of the transect.

The abbreviations used in the recording of the various features were as follows:

A.L. - active lodge - one in good repair and with a feed bed evident.

D.L. - dead lodge - one in poor repair, generally overgrown in part or whole with weeds or grass, not freshly covered with mud, and having no feed bed evident.

D. - dam in good repair - one holding back an appreciable pond of water.

F.B. - a feed bed or a quantity of fresh cuttings in the water, (counted even though no lodge could be seen beside it.)

Results

Table 7 taken from Tener's report, lists the number of live and dead lodges counted by him and Gange along the 25 transects.

Table 8 lists the corresponding figures obtained in 1956.

Table 9 lists by transects the number of live and dead lodges counted in each quarter of the park. Transects 1 to 12 inclusive were considered to lie in the northern half of the park, and the remaining 13 transects in the southern half. The extra flight line compensated roughly for the tapering at the southwest corner of the park.

In tabulating the results of the 1956 beaver lodge count, a feed bed observed alone was interpreted and counted as an active lodge on the presumption that a lodge existed near by but was overshadowed by trees or that the feed bed belonged to bank beaver. An example of such a feed bed beside a bank lodge is very difficult to see even from the ground as shown in Figure 8.

Similarly, when one, two, or even three dams in good repair were close together on a stream this was taken to indicate the presence of an active lodge not noted from the aircraft on account of obscuring vegetation and rapid airspeed.

As far as known to the writer, no aerial survey technique has been devised which fulfils all the desired functions without any disadvantages. A flight at high altitude enables a wide effective observation strip on either side of the aircraft but this is offset by inaccuracy of detail. Feed beds in the open can be seen clearly at either 600 feet or 300 feet altitude, and if feed beds only were to be counted, there would be little advantage in risking flight at the lower altitude. However, many active lodges are not readily observed from an aircraft particularly when the lodge is overshadowed by tall trees or poorly indicated by a feed bed. Feed lodges, particularly if grown over by weeds, are often difficult to discern even at low levels of flight. Many such lodges must be missed in a survey carried out at a high altitude.

The altitude of 300 feet was considered high enough to permit adequate visability of the outer margin of the observational strip, and combined the important advantages of closer examination of the lodges and greater exactness in counting. At that height the aircraft does appear to pass more quickly over the lodges but with the reduced airspeed none of the three observers found himself hard pressed to record the count quickly enough. Pre-arranged abbreviations, agreement before the flight as to what was to be recorded, and the use of specially prepared record books all aided in making the mechanics of recording efficient.

Two other factors ought to be mentioned which might be considered to have at least a potential influence on the accuracy of the survey count. The first of these is the weather at the time of the flight. The increase in the velocity of the wind during the afternoon of October 16 that made Muskeeiu Lake too rough to permit a take-off, forced postponement of the other 20 transects until next morning. Had a take-off been possible, a higher altitude would have had to be flown because of the air turbulence. That would have meant a change in

Table 7. Results of the Prince Albert National Park 1954 Beaver Survey Lodge Count

J. S. Tener		H. Genge		Total Lodge Count		Transects
Live	Dead	Live	Dead	Live	Dead	
3	0	2	0	5	0	1
6	3	8	0	14	3	2
5	2	9	0	14	2	3
5	7	8	0	13	7	4
6	4	18	0	24	4	5
5	0	10	0	15	0	6
11	2	13	2	24	4	7
6	0	4	1	10	1	8
6	2	8	0	14	2	9
8	1	9	2	17	3	10
5	4	9	0	14	4	11
10	4	8	1	18	5	12
9 (76)	2	23	2	32 (182)	4	13
7	5	15	0	23	5	14
16	8	26	1	42	9	15
11	16	24	3	35	19	16
31	10	16	2	47	12	17
16	4	10	1	26	2	18
10	1	7	1	17	2	19
4	8	9	1	13	9	20
3	3	6	0	9	3	21
8	1	5	1	13	2	22
9	8	5	1	14	9	23
8	8	5	2	13	10	24
4 (136)	2	5	1	9 (293)	3	25
212	105	263	22	475	127	.....Totals.....

Totals 1-12

13-25

Table 8. Results of the 1956 Prince Albert National Park Beaver Survey Lodge Count

(1)		(2)		(3)			
A. Radvanyi		C. Millard		H. Gange		(1) - (2) Total Lodge Counts	
Live	Dead	Live	Dead	Live	Dead	Live	Dead
6	2	4	0	5	1	10	2
4	9	6	1	6	3	10	10
8	3	11	6	6	2	19	9
6	3	10	4	4	3	16	7
8	8	6	2	6	4	14	10
5	1	4	1	4	3	9	2
14	1	9	0	8	2	23	1
5	3	5	0	3	0	10	3
5	2	9	5	5	2	14	7
13	3	13	1	10	4	26	4
7	3	10	3	9	4	17	6
9	5	9	7	9	4	18	12
17	5	12	5	18	4	29	10
19	3	22	8	19	3	41	11
15	2	17	8	21	4	32	10
25	6	22	12	23	5	47	18
33	13	24	8	31	12	57	21
28	3	28	7	17	3	56	10
14	10	22	4	19	7	36	14
19	3	20	3	20	2	39	6
23	4	12	1	18	4	35	5
14	4	15	6	17	0	29	10
17	3	22	7	16	4	39	10
9	1	12	3	11	2	21	6
6	3	14	1	6	2	20	4
329	103	338	105	311	83	667	208

Table 9. Distribution of Active and Dead Beaver Lodges Counted During the 1956 Aerial Survey

	Eastern Half						Western Half					
Transect	Radvanyi		Millard		Total		Radvanyi		Millard		Total	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
1	3	1	1	0	3	1	4	1	3	0	7	1
2	3	3	0	0	3	3	2	6	6	1	8	7
3	4	3	5	3	9	6	4	1	6	3	10	4
4	3	2	4	1	6	3	4	2	6	3	10	5
5	3	4	3	0	6	4	6	4	3	2	9	6
6	0	0	1	0	1	0	5	1	3	1	8	3
7	9	0	3	0	11	0	8	1	7	0	12	1
8	1	1	3	0	3	1	4	3	3	0	7	3
9	0	0	3	0	3	0	5	2	7	5	12	7
10	6	1	6	0	12	1	7	3	7	1	14	3
11	3	1	1	2	3	3	5	3	9	1	14	3
12	3	1	0	1	3	3	7	4	9	6	16	10
	32						58					
Northeast quarter totals					59	32	Northwest quarter				107	51
13	3	0	3	3	6	3	14	5	9	3	23	8
14	9	1	14	6	23	7	10	3	8	3	18	4
15	7	0	11	5	18	5	8	3	6	3	14	5
16	12	3	15	5	27	7	13	4	7	7	30	11
17	13	3	12	4	25	12	20	5	12	4	32	9
18	11	0	16	4	27	4	17	3	12	3	29	6
19	10	7	11	3	21	10	4	3	11	1	15	4
20	9	2	10	3	19	5	10	1	10	0	20	1
21	12	4	4	1	16	5	11	0	8	0	19	0
22	8	4	7	3	15	7	6	0	8	3	14	3
23	13	3	20	7	33	10	4	0	2	0	6	0
24	7	1	9	4	16	5	2	0	3	1	5	1
25	4	3	10	1	14	4	2	0	4	0	6	0
	113						121					
Southeast quarter totals					260	83	Southwest quarter totals				231	52

procedure part way through the survey. Brilliant sunshine can cause temporary blind spots for an observer facing southward along an east-west flight line, from rays reflected off the numerous small bodies of water. The blind spots can be rechecked by backward glances but the glare intensifies and hastens fatigue, thus affecting the accuracy of the count. In that respect the 1956 survey was fortunate, as a thin layer of cirrus cloud covered the greater part of the sky during practically all the flying time.

The second factor to be considered is the blind spot directly underneath the aircraft. The width of the obscured strip depends on the altitude of the aircraft, the nature of the undercarriage, and the position of the observer. The blind spot exists for both observers in the rear seat but not for the observer seated beside the pilot in the Cessna 170 aircraft used. From that position it was relatively easy to observe lodges the other observers could not see, by glancing over the front of the engine. The writer's counts are therefore used in the calculations of beaver numbers appearing in this report, and no allowance is made for a blind spot. Its significance was clearly demonstrable, however, for the writer often recorded a lodge which the observer seated directly behind him, through no fault of his own, failed to observe. It also explains at least in part, the smaller number of animals and lodges recorded from the rear seat positions.

Analysis and Discussion

Dividing the park area into four approximately equal areas (Table 9) permits comparisons based on the number of active and dead beaver lodges counted in each.

The percentage of active and inactive lodges in each quarter of the park was as follows:

Quarter	Active Per Cent	Inactive Per Cent
Northeast	72.8	27.2
Southeast	75.8	24.2
Northwest	71.4	28.6
Southwest	80.9	19.1

From these figures it appears that the ratio of active to inactive was approximately 3:1 in each quarter. This may indicate that the general health of the beaver in the park is more or less uniform. Dead and sick beaver have been found in the park in recent years, but the sickness does not appear to have been serious enough to cause an extraordinary number of abandoned lodges in any quarter.

Of the total number of active lodges counted (667), 8.8 per cent were in the northeast quarter and 39.0 per cent in the south east quarter, making a total for the east half of 47.8 per cent. Similarly in the west half, 19.1 per cent were in the northeast quarter and 33.1 per cent in the southwest quarter, a total for that half of 52.2 per cent.

The corresponding percentages for the inactive lodges were: northeast quarter 10.6 per cent, southeast quarter 39.9 per cent, east half 50.5 per cent; northwest quarter 24.5 per cent, southwest quarter 25.0 per cent, west half 49.5 per cent.

In the northern and southern halves were 27.9 per cent and 72.1 per cent respectively of active lodges, and 35.1 and 64.9 per cent respectively of inactive lodges.

The above percentages may serve a useful purpose as population indices and for comparison with data from future aerial surveys, but several factors must be taken into account in interpreting them. The topography of the park is not uniform in nature. A much greater number of streams and small lakes as well as a greater availability of preferred food in the southern part of the park makes it more suitable as a beaver habitat than the northern part. Far more of the area of the four largest lakes in the park - Waskesiu, Kingsmere, Crean, and Lavallee - falls within the northern half than within the southern. The actual water surface of the northern half may be equalled by the total area of the numerous potholes in the southern half but the significance is not the same. Even if the topography and vegetation surrounding all the water bodies were uniform, small lakes, ponds and streams are important and inducive elements of a favourable beaver habitat. Only the narrow margins of large lakes can be considered at all comparable and even then but to a limited extent.

Large bodies of water act as deserts for beaver. In travelling as much as 1,500 miles a month on the lakes during the summer, the writer never met beaver more than 400 feet out from shore. The narrow marginal areas surrounding large bodies of water are not always suitable beaver habitat. Often steep embankments and rough water on such lakes make the establishment of lodges difficult except in sheltered inlets or where large reed beds off shore serve to lessen the pounding of surf. More frequently, small streams emptying into such large bodies of water are utilized as colonial habitat. A dam may be built only a few feet back from the lake. The lake may be used in travel to distant areas to collect preferred food and the lodge enjoys the quietness of small streams and ponds.

No attempt is made here to correlate the relative abundance of active and dead lodges counted with a vegetation map of the area. However, the generalization may be made that the greater tracts of spruce and treeless bogs in the northern half of the park make for a less suitable beaver habitat than that of the southern half.

Composition of Colonies

Considerable variation has been recorded in the number, age, and sex of the animals in the familial unit of the beaver. "A typical beaver colony", states Bradt (1947), "consists of an individual family, including the parents, the kits, and often the yearlings born the previous year". He further suggests that the rising two-year-olds leave or are driven out of the family in the spring before the birth of the new litter. The work of Townsend (1953) corroborates this observation. The male is driven from the lodge before the birth of the young and

lives separately until late summer. It is readily apparent that the membership of a beaver colony depends in part on the time of the year.

As previously described six locations were trapped successfully for varying lengths of time in the 1956 study. In addition, all the known members inhabiting a solitary lodge along the west shore of Bagwa Lake were shot out and retrieved for examination. The weights and sexes of the animals taken are listed below. The same animals are listed in Tables 3 and 6.

Location 1. West of Kingsmere cabin

42-lb male
31-lb. "
29-lb. female
23-lb. "
8-lb. kit
6-lb. "

Location 2. Fire tower trail

30-lb. female
28-lb. "
27-lb. "

Location 3. Bladebone Bay, south shore

45-lb. female
33-lb. "
25-lb. male
15-lb. "

Location 4. Bladebone Bay, north shore

39-lb. female
35-lb. male
24-lb. "
24-lb. female
10-lb. kit
10-lb. "
7-lb. "

Location 5. Chipewyan Portage

39-lb. female
34-lb. "
35-lb. male
16-lb. kit
13-lb. "
5-lb. "

Location 6. Alawaan Lake, Midwest shore

54-lb. female
43-lb. "
42-lb. "
39-lb. male
35-lb. "
24-lb. "

Bagwa Lake, west shore lodge

43-lb. female
46½-lb. "
39-lb. "
38-lb. "
30-lb. male
28-lb. female
10-lb. male
9-lb. "
9-lb. "
8-lb. "

South shore

9-lb. kit

North end

15-lb. kit
15-lb. "
14-lb. "
14-lb. "
11-lb. "

Average Number of Beaver Per Lodge

Only three locations are believed to have been trapped adequately and long enough to capture at least once most, if not all, the beaver there. These were west of Kingsmere cabin, Chipewyan Portage, and Bladebone Bay - north shore. No kits were captured at the trapping site on the west shore of Ajawaan Lake and no adults were trapped at the north end of that lake where five kits were captured. Ten beaver were shot at or near the large lodge along the west shore of Bagwa Lake. No other active lodge was found along the whole west shore of that lake, and, as most of the beaver had been shot close to the lodge, each was believed to be an inhabitant of the lodge and not a migrant. An additional adult male was looked for but not seen.

Two averages may be deduced from the above list - an "actual" average, and a "corrected" average. In the former are included the number trapped at Locations 1, 4, 5, and 6, (midwest shore and north end) and those shot at Bagwa Lake. A total of 40 individuals were taken in those locations, giving an actual average of 6.7 beaver per lodge.

In obtaining the corrected average, it was considered that a kit was observed but not captured at the Kingsmere Cabin trapping site. Thus seven individuals, instead of six are considered to have inhabited that lodge. Also as no kits were captured along the west shore of Ajawaan Lake, and no adults at the north end site of the same lake, the numbers for the two locations are combined, and the average is then based on five rather than six lodges. Using these corrections, a total of 41 was encountered, giving a corrected average of 8.2 beaver per lodge.

Beaver Population Estimates

A total of 637 miles are represented in the flight lines used by Toner and followed in the present survey. An observational strip one-quarter mile wide gives an area of 159.25 square miles observed on either side of the aircraft in the course of the flight. Using my total of 329 active lodges counted, it is estimated that there were at least 3,104 active lodges in the park. If the actual average number of beaver per lodge is used (6.7) then it is estimated that there were at least 20,795 beaver in the park. If the "corrected" average is used, then the population of beaver in the park area was at least 25,451.

The estimates must be considered in the light of several important influences. First, the trapping results upon which the averages in the calculations are based were obtained in the course of several months of trapping in a comparatively small area. Several extensive trapping programs carried out in the past to reduce the excessive number of beaver were mainly limited to the southern part of the park where roads could be used in travelling to the traplines. Beaver in the Kingsmere area have not been left entirely unmolested but nevertheless have been protected somewhat by the inaccessability of that area in winter. An average obtained there for the number of beaver per lodge may not be fully applicable to the whole park. It would be of great comparative value if an average could be obtained for each quarter.

If it were found that the average determined in 1956 was too high to be applied to the whole park, another factor ought to be considered compensatory. That factor is the number of bank beaver lodges which easily pass unnoticed in both ground and aerial surveys. What percentage of beaver live in bank lodges was not determined by the writer, nor does he know of anyone who has established a usable figure of this kind. Some bank lodges are accounted for in aerial surveys in the count of feed beds, but not all bank beaver may build feed beds and if they do the feed bed is not always evident above the water level. Some beaver are reported to continue feeding on aquatic rhizomes during the winter and not to build feed beds; others build extensive feed beds in deep water.

An example of the latter was found at the north end of Ajawnen Lake where fragmentary portions of freshly-cut feed-bed material had been well anchored under logs in 10 to 15 feet of water. Such food reserves generally consist of heavier pieces of aspen 6 to 8 inches in diameter and approximately 10 feet long. They may be left up to 100 feet from the lodge and may or may not supplement a feed bed near the lodge.

An example of a very large beaver lodge inhabited but with no visible feed bed near it even as late as mid-October, was found along the east shore of Waskesiu Lake approximately two miles south of Kingsmere River. During the latter part of September the writer travelled on one occasion to Waskesiu with Park Warden Gregson from Kingsmere Cabin. On the return trip, the warden was requested to follow the east shoreline from First Narrows to the north end of Waskesiu Lake plotting the location of all active and dead beaver lodges, while the writer did the same from another canoe along the west shoreline. The warden recorded the large beaver lodge in question as dead and it was understandable that he did so. No mud had been carried up on the lodge by beaver, nor was there a visible feed bed. Yet during late evening of the night before, the writer had sat for more than half an hour in a canoe less than 20 feet from the lodge and had observed as many as four large beaver swim out from the lodge at a time. The muted cries of several young could be heard from inside the lodge. Whether the large size of the lodge permitted the establishment of a feed bed inside it was not determined. Some colonies of beaver may delay considerably before laying a feed bed, even until just before freeze-up. An aerial survey carried out at a later date than that of the present one, might aid to minimize possible error. Such lodges may represent only a minor element in any beaver population. The amount of the possible error can only be learned through further extensive studies covering a fairly large area.

Game Animals Observed in 1956 Aerial Survey

No special attempt was made during the summer to study the habits or populations of other game in the park, but moose, elk, and other animals seen during the aerial survey were recorded, to provide figures to compare with those obtained by Tener in 1954. No deer were seen in the present study. The number of moose, elk, and bears observed are listed below.

TABLE 10. Numbers of Moose, Elk, and Bears Observed During the 1956 Aerial Beaver Survey

	Observer	Moose	Elk	Bears
	Madvanyi (1)	51	11	3
	Millard (2)	35	5	
	Gange (3)	33	6	3
Total	(1) and (2)	86	16	3

Using the figures of the writer and second observer, Millard, a total of 86 moose were observed in the aerial survey. This indicates a substantial increase in the moose population from 1954, when 79 moose were counted. Almost half the cows encountered during the summer were accompanied by twin calves. Moose are distributed fairly evenly throughout the park with only a slightly greater number in the southern half than in the northern.

Tener recorded 51 elk. Only 16 were recorded by the writer and Millard, and these were all seen on the five southernmost transects. One was seen along transect 14.

A black bear with two cubs was seen on transect 1.

SUMMARY

An excessively large beaver population has developed during recent years in Prince Albert National Park. An aerial survey of the park in October, 1954, gave an estimate of at least 15,000 beaver inhabiting the park area. Extensive trapping programs in the past have not appreciably reduced the population.

During the summer of 1956, the writer was employed by the Canadian Wildlife Service to carry out a beaver study in the park. Several areas were established for purposes of future study.

One hundred and forty-eight beaver were handled by the writer during the course of the summer. Of these, 51 were trapped at least once and 9 recaptured a total of 11 times. Eighty-one were shot in areas distant from where trapping was being carried out, and their entire viscera, or portions thereof, were preserved and submitted for pathological examination. Seven more beaver were shot and retrieved but no tissues from them were saved. Approximately 15 were shot and not retrieved.

An average of 6.7 beaver per lodge was established by trapping in selected localities. When corrected to compensate for animals observed but not trapped and parents taken into account where only kits were captured, the average was 8.2.

An aerial survey of the park was carried out on October 16 and 17, 1956. The 25 transects flown by Tener in 1954 were again followed, but at an altitude of 300 feet and an airspeed of 75 to 80 m.p.h. instead of 600 feet altitude and 100 m.p.h. airspeed in the 1954 survey. Also three observers instead of two participated.

A strip of one-quarter mile in width was surveyed on either side of the aircraft and a total of 637 miles were flown.

A total of 329 live beaver lodges was recorded in the 159 square miles surveyed. This gave an estimate of 3,104 live lodges in the park area. Using the average of 6.7 beaver per lodge, these figures give an estimate of 20,795 beaver in the park.

If the corrected average is used, the estimate is 25,451 beaver. The actual number is possibly midway between these figures.

RECOMMENDATIONS

1. That a more extensive trapping and tagging beaver study be initiated early next spring. The main object should be to repeat in each quarter of the park the essential part of Phase 1 of the present study, i.e. to determine by live-trapping and ear-tagging whether the average number of beaver per lodge is the same in each quarter or varies significantly in the north as compared with the south. This program could be carried out by five persons, working simultaneously one in each of the four quarters and following, as nearly as possible identical procedures. The fifth ought to be a biologist in charge - one experienced in trapping beaver - who could travel among the other four members and co-ordinate their work.

2. Unless there is evidence of a more than minor pathological condition in the beaver viscera specimens submitted during the past summer or new outbreaks of disease are encountered, less time, effort, and expenditure ought to be spent on disease studies in future beaver programs.

3. At a date as late in the autumn as practical, the five-man party ought to combine efforts to carry out a ground survey along several of the established flight transects. Such a study should establish a correction factor to be applied to counts of beaver lodges made in a later aerial survey. The five men could cover in short stages the width of the observational strip at least on one side of the aircraft over the length of several of the flight lines in each quarter of the park.

The correction factor established may be applicable only to the topography and vegetation of the park, and ought not to be considered a constant entity. It would, nevertheless, serve to indicate whether or not a very important consideration ought to be included in the calculations for all aerial beavery surveys.

4. More information is needed on the following subjects:

   1) The age classes of beaver found in representative lodges.

   2) The exact time of year the two-year-olds are forced to leave the parental lodge. Do they ever leave it in summer or autumn?

   3) Whether one adult female will tolerate another in a lodge.

   4) Exactly when the males return to the familial lodge.

   5) How long beaver take in establishing a feed bed. Are some lodges which appear dead, say in mid-October, actually occupied, and is the feed bed laid much later, in a very few days time? If so, more lodges may have been occupied than were counted in aerial beaver surveys carried out in mid-October in the past.

5. If it is intended that beaver management be carried on in the park, at least 1,000 beaver ought to be removed annually for as many years as required to bring the population down to carrying capacity.

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Toner, J.G. 1954 Aerial survey, Prince Albert National Park, 1954. Canadian Wildlife Service Report.

Townsend, J.E. 1953 Beaver ecology in eastern Montana, with special reference to movements. J. Mamm. 34(4):459-479.

Figure 2. Beaver pens at Waskesiu in Prince Albert National Park.

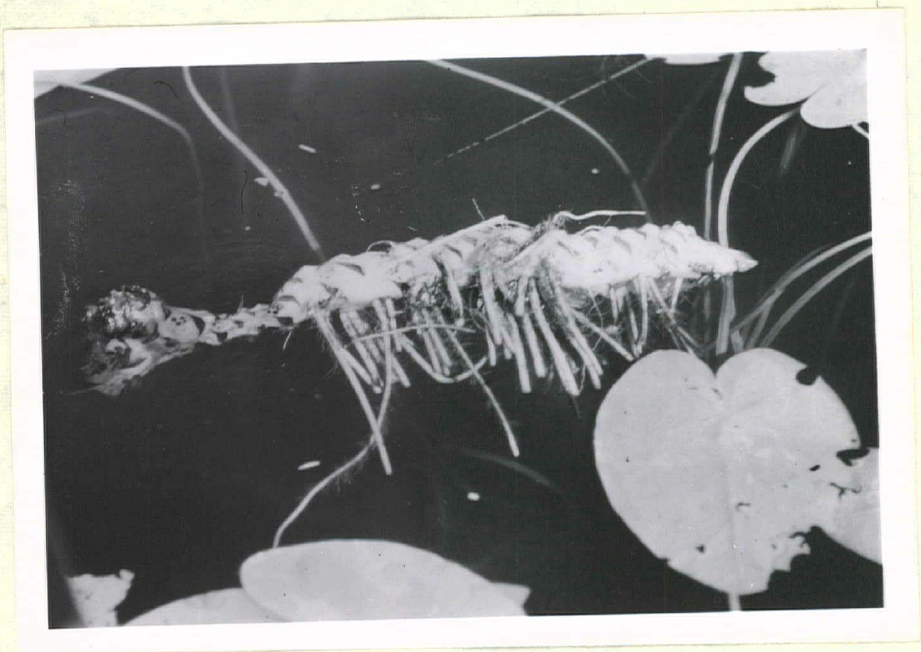

Figure 3. A floating piece of lily rhizome such as beaver often feed on.

Figure 4. A beaver taken in a Bailey trap set in front of one of two mud piles built by beaver along the west shore of Ajawaan Lake. Five other beaver were trapped at this "signpost".

Figure 5. A beaver kit, just tagged in the ear, handled with ease by the author.

Figure 6. A newly-constructed beaver lodge along the marshy shore of Bagwa Channel. No feed bed had been started at the time the photo was taken.

Figure 7. A beaver lodge into the peak of which the writer had repeatedly poked a hole. Each night, more sticks and mud were carried up by the beaver and used to close the hole. The final result was that three feet of material were added to the top of the lodge. A portion of the feed bed is seen to the left of the lodge.

Figure 8. An extensive beaver feed bed along the north shore of Ajawaan Lake. A bank lodge is barely visible just to the left of centre of the photo. Such lodges are very difficult to see in aerial surveys but their presence is indicated by the feed bed near by.

INSERT

LARGE

FORMAT

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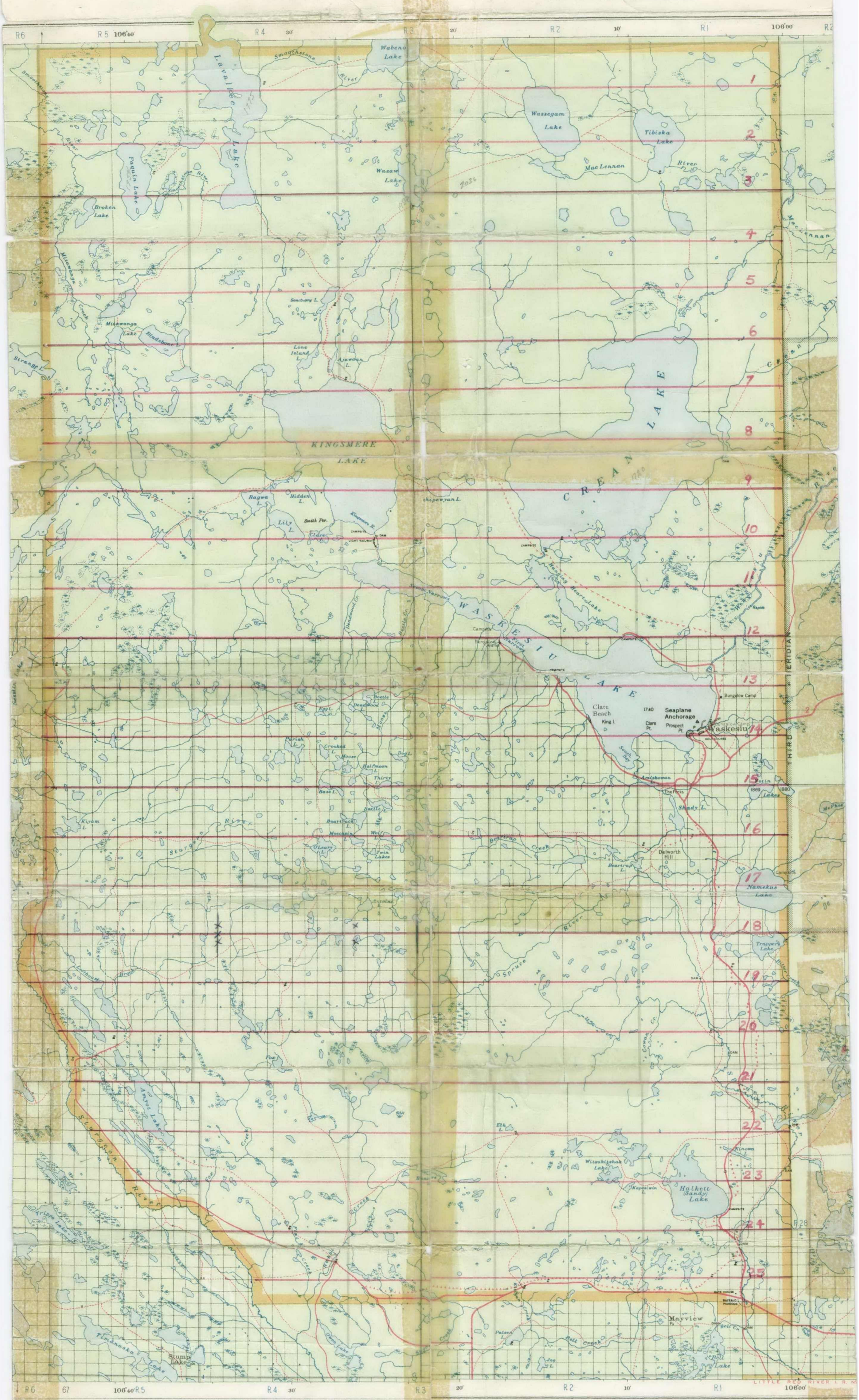
Canada
DEPARTMENT OF
Mines and Technical Surveys
SURVEYS AND MAPPING BRANCH



Copies may be obtained from the Map Distribution Office, Department of Mines and Technical Surveys, Ottawa.

THE DECLINATION OF THE COMPASS NEEDLE
JULY, 1930

...tion of the compass needle at any place along a red line is the declina... ...n that red line. At other places the declination is between those given ...bouring red lines; thus at the place marked A, because it is halfway ... two red lines marked N.21°E., and N.22°E., the declination of the ...edle is N.21°30'E.
...tion of the compass needle is decreasing 9 minutes annually.

Reference

Boundary, park	
" Indian Reserve	
" township	
Surveyed line	
Motor road	
Wagon or fire road	
Trail or portage	
Telephone	
Marsh, bog or open muskeg	
Woods	
Building	
Post office	P.
Warden's cabin with telephone	
" " without telephone	
Lookout tower	
Height in feet	1740

NATIONAL PARKS OF CANADA

PRINCE ALBERT PARK

SASKATCHEWAN

Scale 1:150,000 or 2.37 miles to 1 inch

Miles 2 1 ½ 0 2 4 6 8 10 Miles

Datum is mean sea level.

NOTE: The location of the grid lines is shown by small ticks in the margin of the map. The numbers of the grid squares which are four miles to a side, increase to the north and to the east; those for the square at the southwest corner of the sheet are given.

Price 15 cents

PERMANENT FLIGHT TRANSECTS
W. ———————— E.

Radvanyi, Andrew
Beaver studies in Prince Albert National Park, summer.

TITLE	
DATE LOANED	BORROWER'S NAME