AERIAL BEAVER SURVEYS--MACKENZIE DISTRICT

SEPTEMBER AND OCTOBER--1952

by
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INTRODUCTION

This report deals with the first attempt to survey the beaver population of the entire Mackenzie District systematically from the air. The objectives of this survey are as follows:

1. To evaluate all parts of the district with respect to quality of beaver habitat.
2. To count a large enough sample of beaver colonies in each area to provide a reliable basis for following the trends in population over a period of years.
3. To estimate the absolute abundance of beaver in certain critical areas as and when necessary.
4. To establish permanent transects to be re-flown at regular intervals.

METHODS

The methods used are still open to modification. The chief difficulty is to locate a flight line which can be followed with certainty by the pilot. This can be done relatively easily when rivers and streams constitute the most important beaver habitat. A course can be planned up one river, over the divide and down another river, then over to a different drainage, and so on for several hundred miles with only very brief "portages" between watersheds. Even in this kind of country, however, because the smaller tributaries are often inaccurately mapped, the planned course may be lost now and then.

To record the observations, a table similar to the one used last year in the Fort Providence area (Fuller & Flook, 1951) was prepared. This eliminates the need for detailed map reading and thus allows more freedom for observing. The observations are easily converted into colonies per unit of time or colonies per unit distance.

In 1952 a new system was tested for lake country which gives promise of being more suitable for this type of terrain. Each lake which could be clearly seen from the aircraft was searched for the presence of beaver sign, and then was recorded simply as being occupied or unoccupied, as the case might be. This system permits the results to be expressed as the proportion of lakes occupied, and has one very great advantage, namely, that the altitude and width of the strip, both variables, would not be considered. The width of the strip, and thus the number of lakes which are visible, varies with the elevation, but the proportion of occupied lakes should be constant. Also, in repeating the survey of a given group of lakes in order to study population trends it is not essential that the transects be located identically to those flown on the previous survey, provided that they be either representative or randomly selected, and of sufficient length to provide adequate sampling. It has been found that below about 1,500 feet the lakes go by too fast to permit a thorough search of the shoreline to be made. In the type of country surveyed beaver sign can be seen easily at 3,000 feet with a little practice. The optimum height

is probably about 2,500 feet on a clear day. All altitudes mentioned are actual heights above the ground.

SOURCES OF ERROR

When surveying creeks, there are two main sources of error. One is that the smaller streams particularly, twist and turn more rapidly than the aircraft can manoeuvre, and thus, there are many bends which are not seen from the aircraft. The other is overhanging trees which frequently occur when the stream runs through heavy spruce. Both these factors result in a count which is lower than it should be; thus our population estimates must be considered conservative.

In lake country, the chief source of error is considered to be the difficulty in adequately searching the larger lakes. Usually some parts of the highly irregular shorelines are not visible to the observer, and frequently a portion of the lake may be out of sight beneath the aircraft. Reliable persons have also reported that there are lakes in which beavers put up no feed beds, because they are able to live through the winter on water lily roots. This type of lake has an abrupt shoreline, so that the lodges are hidden under the marginal vegetation, and there is little evidence of canals, trails, or cutting visible from the air. These lakes are not common in the Mackenzie basin, so this source of error is considered to be minor.

GENERAL CONDITIONS ATTENDING SURVEY

The survey required a much longer time than was anticipated and the results are not as good as hoped for. Two circumstances beyond our control were responsible.

In the first place, the weather was the worst in the memory of many old-timers around Fort Smith and elsewhere. Between September 11 and 27 we had only three clear days. A certain amount of poor flying weather is to be expected in the autumn, but so much poor flying weather was certainly unusual.

The second difficulty was the lack of gasoline between Norman Wells and Aklavik. Associated Airways had not made gasoline caches anywhere between these points which are three hours flying time apart on a direct course. Since the flying range of the Beaver aircraft is only four hours, it was necessary to carry gasoline in the cabin in order to have sufficient for surveying. The oil problem was even more serious, since oil was unavailable even at Norman Wells. The engine of the aircraft was due for an overhaul and was using two to three gallons of oil per day. In order to do the flying we did, we had to carry 50 gallons of gasoline and 10 gallons of oil out of Aklavik; buy a barrel of gasoline available by pure luck from the Mission at Fort McPherson; and have the pilot ferry back 90 gallons of gasoline from Norman Wells to Fort Good Hope. Adding to the strain, two members of the Education Office at Fort Smith were sharing the charter and our movements had to be correlated with theirs. This would not have been difficult if gasoline had been available at each stop. It is considered that Associated Airways did not give us the service to which we were entitled, although a word of praise is due the pilot, Pat Carey, who did the best he could to make good the shortcomings of the company.

RESULTS

(A) NORTHERN REGION

This region is normally the responsibility of E.H. McEwen, Mammalogist at Aklavik, but as he was to be absent until about December 1 on field work in the Anderson River Country, it was agreed that the writer should prepare the report.

The district now under discussion comprises the Fort Good Hope, Arctic Red River, and Fort MacPherson areas, and the Mackenzie Delta Beaver Sanctuary. The flight lines and a summary of observations are shown on Maps 1 and 2 and a more detailed breakdown of the results is shown in Tables 1 and 2.

(1) Fort MacPherson - Arctic Red River District

The first survey flight in this district was flown on September 19, under ideal conditions. The results are summarized in Table 1, and the conclusions drawn are set out below.

In the physiographic formation known as the Mackenzie Lowlands, occupying most of this district, the beaver population is in general satisfactory. North of the Mackenzie River there is a rugged plateau which does not now support many beaver, nor does it appear to be good beaver habitat (see G and I, Table 1). This plateau is not described in any published material available to me, and we do not have sufficient first hand information to describe its borders accurately. The line on Map 1 is based partly on observation and partly on the direction of flow of the creeks shown. The difference in beaver density between the Mackenzie Lowlands and the plateau north of the Mackenzie River was striking. Further work to map the boundaries of this plateau would be well worth while, since the entire plateau can be left out of any future plans for beaver management.

The upper portion of the Mackenzie Delta Beaver Sanctuary is fairly consistently the most densely populated part of the area surveyed. In 111 minutes of flying over the Sanctuary, 109 colonies were seen, an average of 1.0 colonies per minute. In the remainder of the area only 72 colonies were seen in 141 minutes, an average of 0.5 colonies per minute.

It should be pointed out that the best parts of the Fort McPherson-Arctic Red River area are nearly as good as the best parts of the Fort Providence area. Areas B, E, and K (Table 1), which have beaver populations large enough to compare favourably with those of the better streams surveyed last year, at Fort Providence, are all in the Sanctuary. Thus, it appears that the Fort McPherson-Arctic Red River area could be almost as productive as the more southerly Fort Providence area, but that the portions open for trapping are not populated to capacity.

There is other evidence that the population in the areas open for trapping is below carrying capacity. There are many lakes large enough, and with feed enough, for several colonies of beaver, but very few lakes in which there was evidence of more than one colony were seen.

(2) Fort Good Hope District

In this district chief attention was paid to the Ramparts area, the lake country lying between the Hume and Rampart Rivers and extending inland northwestward from the Mackenzie. The flight lines in the Ramparts area are shown in Map 2 and the observations made are summarized in Table 2.

Analysis of Table 2 discloses that the area carries a heavy beaver population. Using the number of colonies seen per minute as an index, it is one of the most densely populated areas surveyed to date. Also, it is interesting to note that there is a reasonable parallel between the colonies seen per minute and the proportion of lakes occupied on each strip. The data pertaining to Strip (2) may indicate that a figure of 50 per cent occupancy, as determined by the aerial method, means an extremely dense population.

The table also discloses some interesting peculiarities of distribution. The low count on Strip (1) is probably the result of heavy exploitation of beaver since the majority of the trappers do not go very far inland. The high figure for Strip (2) (significantly higher than the average) is probably correlated with some exceptionally fine habitat in the form of a zone of nearly pure aspen woods. Farther inland the effects of past fires are obvious. Burns were noted on all the intervals except the one between Strips (1) and (2). Strip (4) is severely burned. On Strip (5) the lakes seem to be of different character. They are shallower, with naked shorelines, and the whole country supports only scrubby timber. Still farther inland, conditions become progressively worse.

The rate of survey was from two to three lakes per minute, and at this speed it was not always practical to search for multiple colonies in any lake. The first objective was to decide whether or not the lake was occupied. If there was beaver sign, it was usually seen within a few seconds. If no sign was noted at once, 20 to 30 seconds was often not too long to devote to a lake to make sure that sign was absent. In other words, more time was necessary to pronounce a lake negative than the reverse, which seems like doing things backwards. Under these conditions perhaps it is not surprising that only three lakes were noted to have two colonies in them.

Another objective of the strip method of survey was to try to arrive at a population estimate for this area. When discussing this aspect, McEwen and I independently estimated that our width of strip was about one mile on each side of the flight line. Using this estimate, we surveyed 20 per cent of the area sampled by the five strips, and on this basis, arrived at an estimate of 380 colonies. This estimate can be cross-checked another way. Assuming that the strips were two miles wide and the linear distance 75 miles (45 minutes at 100 miles per hour) then the density of beaver colonies is 0.506 colonies per square mile. The size of the Ramparts area outlined on Map 2 was determined by planimeter to be 796 square miles giving a population of 404 colonies. This estimate includes the area to the west of our last strip. Allowing for colonies not seen, and the possibility that our strip was in reality less than one mile wide, it is believed that there are probably 500 colonies in the area.

In addition to the survey in the Ramparts area, notes were also kept during the flight from Fort Good Hope to the Anderson River. The country traversed on this flight is high and rugged and is probably part of the plateau seen north of the Mackenzie at Arctic Red River. Its beaver potential is low. During the flight 19 colonies were observed in 123 minutes flying time, an average of 0.15 colonies per minute or approximately one colony every 10 miles.

(3) Conclusions and Recommendations for Northern Region

(a) The beaver population in general is satisfactory. All areas of suitable habitat contain adequate stocks which should build up under a trapping intensity of one beaver per colony. Generally speaking the areas open to trapping are not as well populated as the upper portion of the Mackenzie Delta Sanctuary, where beaver have been protected for 12 years. This would seem to indicate that through careful management the population can be increased. For this reason, it is recommended that no increase in the quotas be made until the trappers are able to bring in sketch maps showing the location of all beaver colonies, which will, in effect, give a complete census of the region.

(b) The Ramparts area probably contains more beaver than any area of comparable size anywhere in the Northwest Territories. However, the indications are that its carrying capacity has not been reached. The importance of this area would seem to justify a ground study to verify, if possible, the aerial findings. For the present it is considered advisable to put a quota on this area, which should not exceed 500 beavers per year. This quota should be subject to revision as new information is obtained.

(c) The Ramparts area should be re-surveyed in 1953, using the aircraft based at Aklavik. If the survey could be combined with an administrative trip to Fort Good Hope it could be carried out in about three hours flying time. The sample strips should be spaced more closely and should be more numerous in order to give a more reliable result.

(d) If the Mackenzie Delta Beaver Sanctuary is abolished, it will be necessary to protect the area between the Peel and Arctic Red Rivers. Probably this could best be done by setting a quota and limiting the number of trappers allowed to harvest beaver in the area. In both the Sanctuary and the Ramparts areas this may be an inducement to the trappers to divide a registered area which is now unmanageable into two or more smaller and therefore more manageable units.

(e) On all flights in this area, observations of the boundary of the plateau which lies to the east and north of Mackenzie River should be made. Management will eventually be practiced according to physiographic provinces and drainage basins, but it is likely that we shall have to accumulate the topographic and physiographic data ourselves.

(b) CENTRAL REGION

The Central Region is large. It was inadequately surveyed this year. Unfavourable weather forced cancellation of the first attempt to conduct the Liard survey. The aircraft returned a week later with Chief Warden McCall and again the weather was unfavourable. A final attempt was considered when Col. Richards reached Fort Simpson, but this, too, had to be abandoned because of poor flying conditions.

The only surveying in this district was done out of Fort Franklin and covered the area shown on Map 3. The observations are summarized in Table 3.

As will be seen from the table, the area surveyed was generally poor beaver country. The average was about one colony for each six miles of flight. Most of the country south of Great Bear Lake is of low relief and apparently forms a part of the Mackenzie Lowlands. Some fairly good beaver habitat was seen although the present beaver population is low. The Precambrian country was touched between Tache and Grandin Lakes (C, Table 3), and is considered to have a low potential for beaver. From Grandin Lake to Hardisty Lake was again a country of low relief, but with shallow lakes having boulder-strewn shores. From Hardisty Lake north a very rugged part of the Laurentian Plateau was sampled. The beaver potential here was very low. Leith peninsula is a flat muskeg area with lakes which appear to be too shallow for beaver and a generally scanty forest cover with little deciduous growth. Surprisingly, the north slope of the Grizzly Bear Mountain contained several beaver lakes.

The best country seen on the entire Fort Franklin survey was due north of Fort Franklin, although an Indian at the post had informed us that there were no beavers in that direction. Our flight line took us along a creek flanked by many favourable-looking lakes with a moderately dense beaver population. The map indicates a continuation of this type of terrain for a considerable distance to the west and north. It is interesting to note that Preble (1908) concluded that the best beaver country around Great Bear Lake was to the northward of Fort Franklin.

Conclusions and Recommendations - Central Region.

(a) The beaver potential south of Great Bear Lake is low although there are areas in the Mackenzie Lowlands section (west of the Laurentian Plateau) which appear to be fair habitat which are underpopulated at the present time.

(b) The country between the Franklin Mountains and Great Bear Lake, from Bear River an unknown distance north, may be classed as good beaver habitat, carrying a large, but by no means maximum beaver population.

(c) The Precambrian country (Laurentian Plateau) is poor beaver country in the Central Region. There are several recognizable sections of this plateau with whose boundaries the writer is unfamiliar. However, as a general rule, the western edge of the plateau is a country of low relief with considerable soil accumulated in the valleys. Farther east there is a higher, more rugged type of country with little soil anywhere, and deep lakes with almost continuously granite shorelines. This is the type of Precambrian encountered on this survey. It is obviously poor beaver country and it seems foolish to waste time and effort in the future in re-surveying it. Therefore, it is recommended that the survey lines in this area be re-drawn in future to leave out the high Precambrian and devote more time to the Mackenzie Lowlands along the south shore of Great Bear Lake.

(d) The Johnny Hoe River is also unsuited for beaver and it is considered that time could be spent more profitably in surveying some of its tributaries.

(e) Beaver are fairly well distributed over the Fort Franklin area as a whole, though in low numbers. It is thought that the population can be increased by careful management.

(C) SOUTHERN REGION

The southern region is the largest subdivision of all, but its importance is not in direct proportion to its size. Much of it lies within the Laurentian Plateau and is only fair to poor beaver habitat. All surveying done this year was in this type of country.

(1) Rae District

The flight lines in the Rae district are shown on Map 4. Beaver sign was seen at only one point on this entire flight, namely on the unnamed stream at a point due west of Clive Lake. Along this stream six colonies were seen in ten minutes. It is believed that the beaver potential of this stream is fair to good.

From information accumulated by Flook it was known before the survey began that there were very few beaver in the Rae district. The prime object of the survey, therefore, was to map areas suitable for beaver production. The following areas are considered to be most favourable:

(a) The James River drainage from Raccon Lake to Slave Lake.

(b) The Windflower Lake drainage.

(c) The unnamed stream on which beaver sign was seen.

(d) The low-relief country from and including the north fork of Staff River southeast of Yellowknife Bay.
This undoubtedly should read "Stagg River, S.E. of Fort Rae"
E. Kuyt

(e) Marion River in the vicinity of Shoti Lake.

(2) The Southeastern District

The survey in this district was curtailed by poor flying conditions. We left Stoney Rapids under a 2,000-foot ceiling which gradually lowered as we flew north. At Selwyn Lake we broke into the clear and so began the survey under ideal conditions. In just over 30 minutes, however, we flew back into the overcast which was now "right on the deck". We were forced to leave the flight line to seek a large, unfrozen lake on which to land. This we were able to do on Smalltree Lake, where we waited for 2½ hours for the weather to clear. Again about 20 minutes after take off we flew into the overcast and again landed. However, we were now over an area covered by a four mile to one inch map sheet just north of Ivanhoe Lake, so decided to try and pick our way out to Goldfields. This called for low altitude flying over frozen lakes and required the full attention of two people to map read successfully. The Ena river was followed on this leg and the beaver signs noted. The observations are summarized in Table 4, and the flight lines are shown on Map 5.

It is obvious from the table that the beaver potential of most of the area surveyed is low. In 50 minutes of flying over lake country only five colonies of beaver were seen, which accounts for about one colony per 15 miles. A trapper would therefore require a line about 75 miles long in order to have five colonies of beaver which is about the average number requested by the Stoney Rapids Indians. This seems like a reasonable figure.

On May 18 and 19, 1951 a survey was flown in the same general area. On that flight an average of one beaver "sign" was seen for each 14 miles of survey. Although seasons and conditions were very different on the two surveys, the results seem to agree very well.

Since the beavers in this area have received seven years of protection, it may be assumed that we are dealing with approximately peak numbers of beaver in this area. It would seem, therefore, that the average take of the trappers in the area should not exceed five beaver per season.

(3) Fort Smith District

The Fort Smith district is of interest for two reasons. First, because a survey in 1949 by Mr. Kelsall may be compared with the 1952 survey. Second because geographically and ecologically speaking this district strongly resembles the Rae District and it gives a clue to the potential productivity of that district.

Broadly speaking there are three ecological types in the Fort Smith District. The first is an extension of the Mackenzie Lowlands which occupies a narrow belt between the Slave River and the Tethul-Taltson system. This is a level plain, a former lake bed, with poorly developed drainage and consequently much muskeg. At its northern end are the ancient and recent parts of the delta of the Slave River. In the past, much of this lowland has produced fair numbers of beavers. At present, however, there is a rapid drying-up in progress. Geologically this is presumed to be a natural and irreversible trend representing the final stages in the disappearance of the post-glacial southern extension of Great Slave Lake. In recent years the trend has been hastened by numerous destructive forest fires. Under present conditions, therefore, the lowlands constitute poor beaver habitat, nor is there any chance for improvement, barring a major geological upheaval.

To the east of the lowlands, merging gradually into it and occasionally pinching it off, lies the Laurentian Plateau, which may be subdivided into an area of low relief (the western edge) and a rugged plateau known as the Tazin Highlands to the east. The boundary of the Tazin Highlands is not shown on any map known to the writer, nor has it been fixed with absolute accuracy by personal observation. However, the low-relief country in general occupies a zone about 40 to 60 miles in width, running from the boundary at 60°N. to the south shore of Great Slave Lake. The Tazin Highlands are also said to slope gently from south to north (Camsell 1916) so that the transition is sharper at 60°N. than at the shore of the lake at 61° 30' N. An example of the difference in elevation of these two subdivisions is that Lady Grey Lake is 1,100 feet above sea level while Tsu Lake, 50 miles to the west, is only 580 feet and Great Slave Lake, 495 feet above sea level.

On Halliday's map (1937), three subdivisions of the boreal forest are shown in this region. They correspond roughly with the divisions just made, although the boundaries shown do not quite agree with the writer's conception of what they should be.

It is interesting to note that several Fort Smith trappers have informed the writer that the litter size of beaver decreases to the eastward from an average of four or five close to Fort Smith, to three around Hill Island Lake, which is definitely in the Tazin Highlands. Whether or not this is so, the higher country is certainly less favourable for beaver and carries a smaller population.

The flight lines in the Fort Smith District are shown on Map 6 and the observations are summarized in Table 5.

From Table 5 it will be seen that the low-relief country (A and B) carries a moderately dense beaver population. For A and B combined there were 0.6 colonies per mile. The potential may be higher than this since area B, probably the best habitat in the district, contains 1.3 colonies per mile. This compares favourably with the best beaver population sampled anywhere in the Mackenzie District. This figure is almost exactly double that for the strip from Methleka Lake to Thubun Lakes (C, D, and E) which lies mostly if not entirely in the Tazin Highlands.

The only part of the lowlands section which was sampled was two streams in the Slave Delta. The lower delta is absolutely unproductive of beaver while the Rûis Pierrot, a ponded channel of a more ancient part of the delta, contains a surprisingly good population, 0.75 colonies per mile.

A large part of the route followed was surveyed by Kelsall in 1949. Table 6 has been constructed to show some comparisions in beaver populations from 1949 to 1952. Since observers, seasons and methods all differed, no statistical analyses have been attempted, but the differences shown are quite striking and probably reliable.

It will be seen that on the first, second, and fourth sections of the route, compared in Table 6, there were marked increases. The total number of houses on these three sections increased from 15 to 43 which is nearer tripling than doubling. However, rapid increase is to be expected in a thriving beaver population and the trapping in the spring of 1951 was not extensive and so would have had only small effect on the total number of colonies in 1952. As trapping increases the rate of increase in the population may be expected to decline.

In the third section compared, from Methleka Lake to Fork Lake, there was no apparent change. It should be pointed out that different routes were followed in the two surveys from Methleka Lake to a hook-shaped lake at 60° 38' N., 110° 53' W. From this point to Fork Lake the routes were the same and since colonies were plotted directly on four mile to one inch maps, it is possible to make a close comparison. A sketch map, Map 7, has been prepared to show this comparison. The boundary lines of registered areas which cross the flight line are superimposed.

Reading from south to north, on Map 7 it will be noted that the first and third colonies are apparently new since 1949, while the second and fourth were seen on both surveys. The fifth lodge was dead in 1952 although recorded as active in 1949. A sixth lodge, although inactive, was tallied in 1952 but not in 1949. Immediately north of Fork Lake, lodges 7 and 8 were recorded as active in 1949. In 1952 one of these must have been overlooked while the other was considered inactive.

The southern part of this strip is registered in the name of Theodore Mercredi who has not trapped for several years. The northern part belongs to Rene Mercredi who has trapped consistently. The central portion was not registered until 1951-52. The three dead lodges are on the boundaries of the previously unregistered country and indicate to the writer either that poaching has gone on in the past, or destructive trapping practices were used during the 1952 open season.

(4) Conclusion and Recommendations for Southern Region

(a) The Fort Rae District is practically devoid of beaver at present, but indications are that there is considerable suitable habitat. A discussion of the feasability of reintroducing beaver is presented in a later section.

(b) The southeastern portion of the region is a generally rugged type of country in the transition zone between the northern confierous forest and the Arctic tundra. Such critical species as aspen either do not occur at all, or are an uncommon element in the flora. Two surveys in this part of the region, although both were carried out under unfavourable conditions, point to the conclusion that the beaver population is thinly distributed. The Indian trappers in this region have not yet been taught to report their beaver colonies accurately or show them on a map. Until they are capable of doing this, and by this method show that a larger beaver population exists, it would be unwise to allow more than five beavers per trapper per season.

(c) From all the information that the writer has been able to gather, the principle of trapping one beaver per colony seems to be best understood in the Fort Smith District. Considering that last spring was the first time the scheme was put in practice in this district, it is thought to have been a success.

At this rate of exploitation elsewhere beaver populations have continued to increase, and it will be interesting to follow the trends in the beaver population as revealed by the house counts of the trappers and by the aerial samples.

(d) One instance of apparent poaching or at lest, destructive trapping methods, has been uncovered. This could well be investigated quietly on the ground by the local warden. There may be some other explanation, but further investigation should either prove aerial observations unreliable or demonstrate that they have a certain usefulness in enforcement work.

GENERAL DISCUSSION

(1) Fulfilment of Objectives

Returning to the general introduction, it may be recalled that four objectives were set out for the present survey. It is pertinent here to review the results with a view to determining how well these objectives have been fulfilled.

In the first place it is believed that aerial surveys have disclosed trends in the beaver population. In the Fort Providence District, an approximate doubling was noted on some streams in the two years from 1949 to 1951. Other streams apparently were saturated in 1949 and showed no further increase in the interval. Still others showed explosive population increases. In the Fort Smith District, the population seems to have increased by a factor of two or three in three years -(two years in which beaver were protected and a third in which there was an open season). These trends are in line with the theoretical capabilities of the beaver to increase under favourable conditions. Where there have been exceptions to the general trend of increase, reasonable assumptions have been made to account for the variations.

An index of abundance has also been obtained (colonies per mile of survey) which allows comparisons between different areas. At present these comparisons are somewhat crude, but refinement may be possible in future years. As an example of the type of conclusion which may be drawn, we have the following argument. First, we believe certain streams in the Fort Providence District to be saturated with beaver because they showed no increase from 1949 to 1951. Second, the upper portion of the Mackenzie Delta Beaver Sanctuary has about as dense a population as these heavily populated streams in the Fort Providence District. Third, the remainder of the Arctic Red River Group Area, which is equally favourable beaver habitat, has only about one-half the density of the Sanctuary. Therefore, we conclude that the Arctic Red River Group Area is understocked at the present time.

The second objective was to set up permanent flight lines to be reflown at regular intervals. Most of the flights carried out this year were suitable for this purpose, but it has been recommended in the body of the report that certain lines be discontinued and others substituted. More intelligent planning of flight lines will be possible when there is more topographic information available and as personal acquaintance with various sections of the country is obtained by the investigators. Ideally it is believed that surveys and management should be based on watersheds or natural topographic provinces. A start was made on this for the Fort Smith District where the major topographic units are fairly well known, but the information is still inadequate for our purposes.

The third objective was to derive a method for making an accurate total census of critical areas when and if necessary. The Ramparts area was chosen for the experiment. The results are far from conclusive but it is felt that with greater coverage and a stricter attempt at determining the width of the sample strip, a more refined technique can be worked out. It is recommended that the Ramparts Area be surveyed again in a similar way next autumn (1953) using the Aklavik Flying Services aircraft. As a general conclusion it may be stated that lake areas lend themselves to total census, while streams do not. There will, therefore, be relatively few areas, outside the Ramparts, where the technique could be used. However, it is hoped that the indices to abundance which are being developed, and comparisons between different areas and different years will prove satisfactory substitutes for the total census.

The final stated objective was an attempt to evaluate the beaver habitat sampled. General information in this connection has been collected, but the boundaries of zones of habitat types require more accurate delineation than is possible at present.

(2) AREAS FOR TRANSPLANTS

The only area surveyed this year in which transplanting might be considered is the Rae District. A strong case for re-introduction can be made for this district. Some considerations are:

(1) The area formerly had a substantial beaver population. Preble (1908) speaks of "a large number of skins seen at Fort Rae", and also quotes Hearne to the effect that beaver were abundant to the north of Great Slave Lake. Overtrapping is given as the cause of the decline.

(2) Geographically and ecologically the country resembles very much the country north and east of Fort Smith, in that it lies astride the boundary of the Precambrian formation. The Fort Smith District carries a moderately abundant beaver population and it is considered that an equally dense population could be supported in the Rae area. Although the latter area is farther north, it is also farther west (i.e. away from timber-line) and generally lower in elevation which compensates for the increased latitude. It might also be mentioned that the north-south relationship was shown to have little effect when the Providence area was compared with the Mackenzie Delta Beaver Sanctuary. In the Fort Smith district conditions deteriorate faster from west to east than from south to north.

(3) At present the plant succession is largely in a phase suited to the needs of the beaver. Large fires devastated the Precambrian country during the prospecting boom in the late 1930's and 1940's. In many of these old burns there is now sufficient aspen and birch to support beaver.

(4) The area is now practically devoid of beavers.

The details of any transplant program are beyond the scope of this report. However, several ideas which may prove of value will be briefly mentioned.

First, the project should be explained in detail to the trappers, with pictures if necessary, and the idea given time to "sink in" and work in their minds. The co-operation of the Indian Affairs Branch is essential in this.

Second, it should be pointed out beforehand that there will be no trapping allowed for a period of five years following the transplant.

Third, the institution of a token system or bonus for each live lodge on a trapper's line might be considered. If each trapper was paid $5.00 per year for each colony which he could mark on a map, it would help tide him over the closed years, instil a sense of ownership, and teach the practice of counting and mapping lodges; and the cost probably would not exceed $500.00 in any year or $2,000 for the five closed years. This expenditure should be considered part of the cost of the re-introduction.

Fourth, it may prove to be cheaper and more efficient to secure the beavers at a national park, where there is a surplus, than to try and obtain them in the Territories. They might then be flown in one trip in a suitable large aircraft to Yellowknife from where dispersal could be carried on by means of a float-equipped aeroplane.

In conclusion I would like to re-emphasize the need for working slowly and planning at least one year in advance.

ACKNOWLEDGEMENTS

The entire project was a co-operative venture involving Mr. McEwen in the Northern Region and Mr. Flook in the Central and parts of the Southern Regions. Although the responsibility for writing up the results has fallen on the writer, the ideas presented have been developed by discussions involving all three men. Chief Warden McCall gave valuable assistance on the flight in the south-western Mackenzie District. Pat Carey of Associated Airways gave willing and skillful service as our pilot and added much to our success.

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Table 1. Observations of Beaver Abundance in the MacPherson - Arctic Red River Area.

Area	Time in Minutes	STREAMS F	L	D	Colonies	LAKES F	L	R	Colonies	TOTALS Total Colonies	Colonies/ Minute	Colonies/ Mile	REMARKS
A	30	0	9	3	11	3	1	0	4	15	0.5	0.3	
B	23	11	3	18	25	1	5	0	6	31	1.3	0.8	
C	34	8	9	12	20	5	6	0	6	26	0.7	0.4	Tree River only - 16 colonies in 17 minutes
D	10	0	0	0	0	1	0	1?	1	1	0.1		
E	17	5	11	4	8	7	11	2	13	21	1.2	0.7	
F	15	1	3	0	3	4	8	0	8	11	0.7	0.4	
G	45	0	0	1	1	3	4	2	5	6	0.1		
H	16	0	0	0	0	11	15	0	16	16	1.0	0.6	Also 3 dead houses. Two lakes with 2 colonies
I	23	0	0	1	1	4	6	0	6	7	0.3	0.2	Also 2 dead houses. One lake with 2 colonies
J	23	2	2	3	3	6	9	1	10	13	0.6	0.4	Also five dead houses
K	16	0	0	0	0	18	23	10	30	30	1.9	1.1	Also 2 probably dead lodges. Four lakes with 2 colonies
TOTAL	252	27	37	42	72	63	88	15	105	177	0.7	0.42	

- - Dam
- - Feed Bed
- - Lodge
- - Runway
- - Mackenzie Delta Beaver Sanctuary

Area	Description
A	MacPherson to Yukon Boundary
B	Yukon Boundary to Arctic Red River
C	Tree River to Fishing Lakes
D	Fishing Lakes
E	Fishing Lakes to Mackenzie River
F	Mackenzie River to height of land
G	High country to 67° 40' W, 131° 05' W.

Area	Description
H	Height of land to Lake south of Travaillant Lake
I	Lake south of Travaillant Lake to Pierre River drainage
J	Pierre River drainage
K	MacPherson to Arctic Red settlement.

Table 2. Observations of Beaver Abundance in the Ramparts River Area.

STRIP	TIME IN MINUTES	LAKES OCCUPIED	LAKES UNOCCUPIED	TOTAL LAKES	PER CENT OCCUPIED	COLONIES PER MINUTE
1	13	17	52	69	24.6	1.3
2	9	21	24	45	46.7	2.3
3	9	15	30	45	33.3	1.7
4	7	13	23	36	36.1	2.1
5	7	10	25	35	28.6	1.4
Subtotals	45	76	154	230	33.1	1.7
Intervals	20	16	116	132	12.2	0.8
TOTAL	65	92	270	362	25.4	1.4

Table 3. Observations of Beaver in Franklin District

AREA	TIME IN MINUTES	STREAMS F	L	D	COLONIES	LAKES F	L	R	COLONIES	TOTALS COLONIES	C/MINUTE	C/MILE	REMARKS
A	41	5	14	9	13	1	4	0	3	16	0.4	0.2	Generally low country. Only fair beaver habitat.
B	47	4	1	0	7 (1)	0	1	1	1	8	0.2	0.1	4 dead houses in lakes. River fast, shallow, gravel bars & shore becoming more favourable upstream.
C	16	0	0	0	0	0	0	0	0	0	0.0	0.0	Precambrian with rocky shores, deep clear water. Mature spruce & brulé.
D	39	0	0	0	0	0	0	4	4	4	0.1	0.06	Flat country of shallow lakes, boulder-strewn shores.
E	50	0	0	0	0	1	1	3	3	3	0.06	0.03	High, rugged Precambrian, rocky shores no soil, no deciduous growth.
F	15	0	0	0	0	0	0	0	0	0	0.0	0.0	Lakes shallow, muskeg, separated by parallel strips of scrub spruce.
G	14	0	0	0	0	6	5	6	6	6	0.4	0.3	Many favourable lakes on north slope of mountain.
H	41	2	3	14	13	3	6	12	17	30	0.8	0.5	Flat country with good lakes & interconnecting streams. Also three dead lodges.
TOTAL	263				33				34	67	0.25	0.15	

(1) Four places where runways seen on river indicating beaver colony

(KEY) A. Bear River to Johnny Hoe River
B. Johnny Hoe River to Lac Taché
C. Lac Taché to Grandin Lake
D. Grandin Lake to Hardisty Lake
F. Hardisty Lake to Cunjuror Bay
) Leith Peninsula
G. Grizzly Bear Mountain
H. North Shore of Keith Arm

Table 4. Summary of Observations in Southeastern District

COURSE	TIME IN MINUTES	LAKES			COLONIES		
		OCCUPIED	UNOCCUPIED	PROPORTION OCCUPIED	TOTAL	PER MINUTE	PER MILE
West side Selwyn Lake	8	0	25	0	0	0.0	0.0
Selwyn Lake to Rowley Lake	9	3	21	.14	3	0.3	0.2
Rowley Lake to Smalltree Lake ✱	7	0	4	0	0	0.0	0.0
Smalltree Lake to Woodruff Lake	18	1	20	.05	1	0.05	0.03
Woodruff Lake to Insula Lake ✱	8	1	2	.50	1	0.1	0.06
Ena River	8				5	0.6	0.04
TOTALS	58	5	72	.07	10	0.17	0.10

✱ Discontinued due to bad weather before reaching objective.

Table 5. Summary of Observations in the Fort Smith District

AREA	TIME IN MINUTES	STREAMS				LAKES				COLONIES			REMARKS
		F	L	D	COLONIES	F	L	R	COLONIES	TOTAL	PER MINUTE	PER MILE	
A	32	2	2	6	6	9	9	10	19	25	0.8	0.5	Plus 3 dead lodges. One lake with 2 colonies. Three beaver ponds counted as colonies.
B	8	9	6	8	12	2	3	1	5	17	2.1	1.3	
C	25	3	7	6	10	2	2	2	4	14	0.6	0.3	Plus 6 dead lodges, 3 unused dams.
D	12	3	4	3	6	0	1	0	1	7	0.6	0.4	Plus 1 dead lodge.
E	24	1	1	1	2	3	6	2	8	10	0.4	0.2	Plus 3 dead lodges and 1 abandoned dam.
F	42	9	7	6	10	6	6	7	14	24	0.6	0.3	Plus 3 dead lodges and 1 abandoned dam.
G	31	8	7	0	9	0	0	0	0	9	0.3	0.2	All signs on Ruis Pierrot, during last 12 minutes. One dead lodge.
TOTAL	174				55				51	106	0.6	0.40	

(KEY)
A. Tsu Lake to Jack Lake
B. Jack Lake to Methleka Lake
C. Methleka Lake to Fork Lake
D. Fork Lake to Rutledge River
E. Rutledge River to Thubun Lakes
F. Thubun Lakes to Taltson River
G. Taltson River to Rat River.

Table 6. Comparison of Beaver Populations in Portions of Fort Smith District in 1949 and 1952

Course	1949		1952		
	Houses	Dames	Houses	Dams	Change
[illegible] Lake to Jack Lake	3	1	12	9	X4
Jack Lake to Methleka Lake	8	4	16	8	X2
Methleka Lake to Fork Lake *	9	4	9	8	No change
Thubun Lake to Rocher River	4	5	15	6	X4
TOTALS	24	14	52	31	X2

* Course different near Methleka Lake in 1952

MAP 3. FLIGHT LINES IN FRANKLIN DISTRICT

GREAT BEAR LAKE

GREAT BEAR LAKE

Deerpass Bay

Lac des Maringouins

Cabin

Hills rising to 1500 feet

Kokeragi Pt.

Reef

Point Leith

LEITH PENINSULA

McTavish Arm

St. Paul Pt.

RICHARDSON ISLAND

Charlton Bay

King L.

Moody L.

Contact L.

Thompson L.

Sawmill Bay

Conjuror Bay

Gunbarrel Inlet

Rainy Lake

Eagle Falls

Fishtrap

Grouard Lake

Camsell R.

Satairil R.

Cabin

George Is.

Russel Bay

Preble Bay

Bear R.

McVicar Arm

Lionel I.

GRIZZLY BEAR MOUNTAIN

1500

Jupiter Bay

Alcyone Bay

Cloud Bay

Fort Franklin

KEITH ARM

MCVICAR ARM

Manitou I.

Cabins

Reef

Hottah Lake

640

Lebulon L.

BELL ISLAND

CAMSELL

Waite Bay

Rainy

Beaverlodge Lake

Lac Malfait

HARDISTY LAKE

64° 30'

124° W.

123° W.

122° W.

121° W.

65° N.

124°00′ 50′ 40′ 30′ 20′ 10′ 123°00′ 50′ 40′ 30′ 20′ 10′ 122°00′ 50′ 40′ 30′ 20′ 10′ 121°00′ 50′ 40′ 30′ 20′ 10′ 120°00′

30′ 119°00′ 30′ 118°00′

MACKENZIE RIVER

MACKENZIE MOUNTAINS

Lac Ste. Thérèse

JOHNNY HOE RIVER

Johnny Hoe River

Tache L.

Grandin L.

Keller Lake

Blackwater Lake

Twin Peaks

3600

3700

3200

3500

3050

750

To Grimshaw

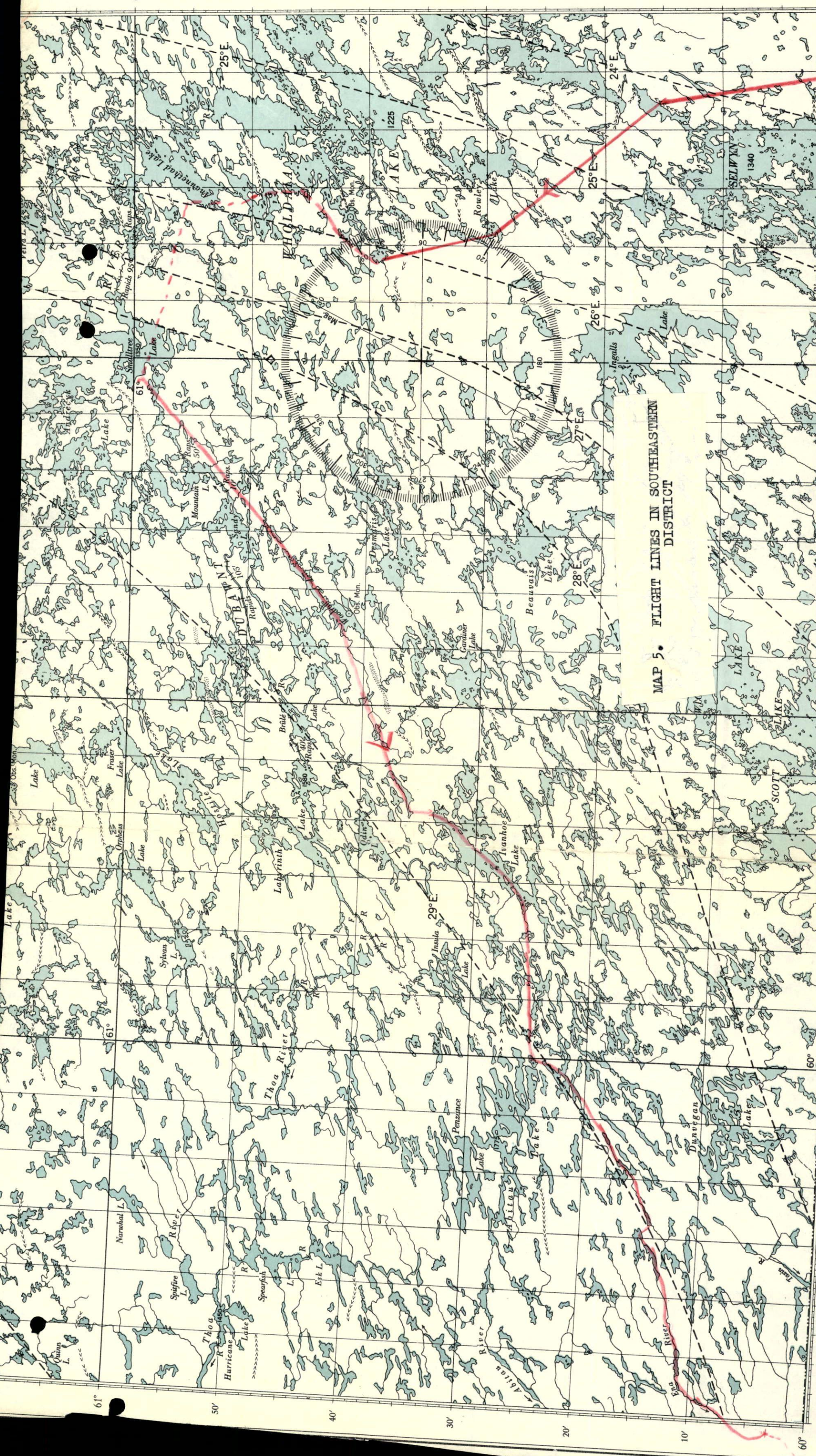
Winter Road

MAP 1. FLIGHT LINES IN McPHERSON-ARCTIC
RED RIVER DISTRICT

Map 2. FLIGHT LINES IN RAMPARTS AREA

MAP 4. FLIGHT LINES IN RAE DISTRICT

MAP 5. FLIGHT LINES IN SOUTHEASTERN
DISTRICT



MAP 6. FLIGHT LINES IN FORT SMITH DISTRICT

10′ 113° 50′ 40′ 30′ 20′ 10′ 11°00′ 30′ 111°00′ 30′

62°

61°

60°

GREAT SLAVE LAKE

Hornby Channel

Union I.

Simpson Chan.

Seton

Keith I.

Westhead Islands

BLANCHET I

ISLANDS

Jackson Islands

Harris I.

WILSON ISLAND

PREBLE ISLAND

Petitot Islands

Les Iles Terribles

Grant Pt

Willow Pt

William Pt

Driftwood I.

Talson Bay

Gaudet Bay

Rocher River

Tr

Channel

Indian Village

Rat River

Pierrot

Ruin

McConnell

Oracha Falls

TALTSON

Deskenatlata Lake

Iche Rapids

Pte Ennuyeuse

Long I.

SLAVE RIVER

Brûlé Pt

Le Grand Detour

Tethul R.

Salt River

Salt R.

Cunningham Landing

Bell Rock

Boundary surveyed

WINTER TRACTOR ROAD

ARK

Thubun River

Thubun Lakes

Thubun Lakes

Riviere

La Loche R.

Doucet Lake

LaLoche Lakes

LaLoche R.

Rutledge Lake

Rutledge River

O'Connor Lake

Thubun R.

Fork Lake

Jack Lake

King Lake

Champagne Lakes

Konth R.

Naylor Lakes River

Natla Raps. 15′

Shethko Falls 8′

Tsu Lake

580′

Nende Raps. 45′

TALTSON

Naili Falls 20′

Methleka Lake

Twin Gorges

Elsie Falls 30′

90′

Gertrude L.

Trudel L.

Trudel L. Cr.

Mabel L.

Powell Cr.

Kenneth L.

Kenneth River

Tethul R.

Schaefer Lakes

Donovan L.

Leland Lakes

Charles L.

Pilot Lake

Hanging Ice L.

Star L.

Berens Lakes

Ithikethe Rapid 20′

Natalkai Falls 15′

Tazin River

Tsannaequ L.

Napie Falls 20′

Kozo L.

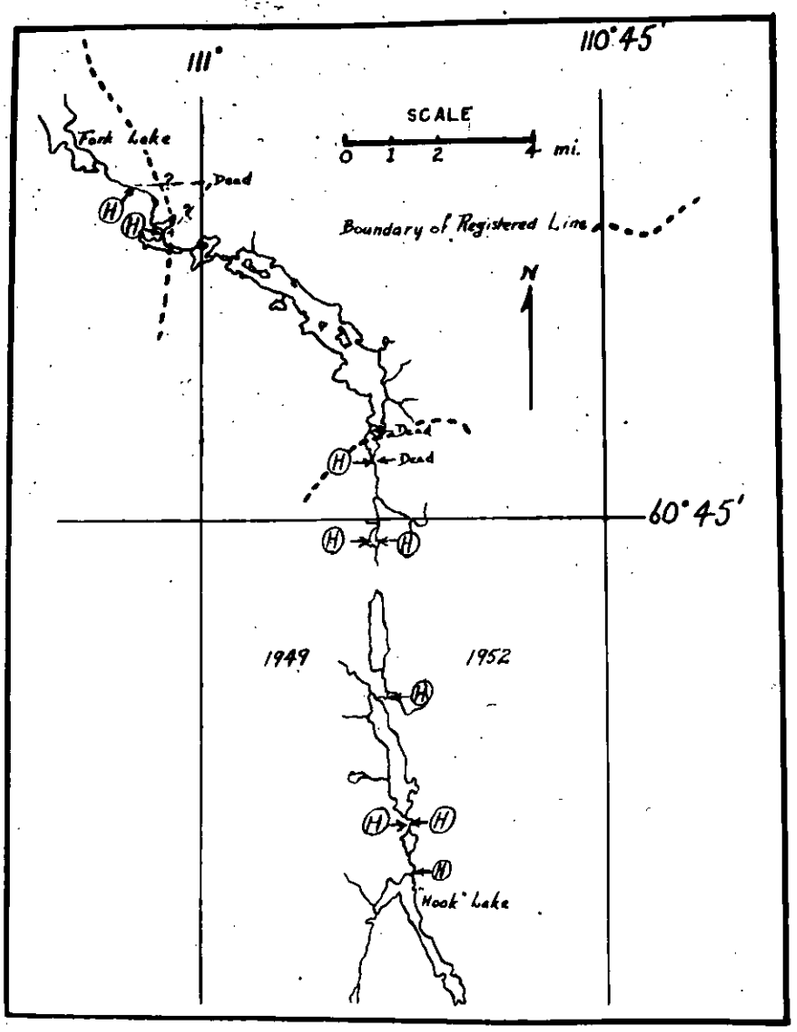
Falls F 20′

Slave R.

Rapids of the Drowned

Fort Smith

PROVINCE OF ALBERTA



MAP 7. SECTION OF FLIGHT LINE IN
FORT SMITH DISTRICT

Fuller, W. A.

Aerial beaver surveys Mackenzie District, September and, ...

TITLE

DATE LOANED	BORROWER'S NAME