REPORT ON THE NORTHERN AMERICAN GLACIERS

presented by

P. D. BAIRD

and prepared by W. O. FIELD for the U. S. and by the Water Resources Division for Canada

1. — American Rocky Mountains

Note : James L. Dyson's report, « Glaciers of the American Rocky Mountains » which is his annual report of the Subcommittee on the American Rocky mountains, of the Committee on Glaciers, Section of Hydrology, American Geophysical Union. Issued, April 1950. This summarizes existing information about the glaciers and their variations through the 1949 season.

a) *Glacier National Park, Montana*

An aerial survey was made by the National Park Service in 1950 to determine the condition of the glaciers in the area. Of the 64 former glaciers reported, the survey disclosed that at least 7 have disappeared and several others are in a doubtful state and may possibly be merely stagnant remnants of formerly active ice. Specific measurements with ground control were made of Grinnel, Jackson and Sperry Glaciers with these results :

Grinnell Glacier (measurements along 1 /2 mile of terminus)

1937-1945	average yearly recession	33.8 ft.
1945-1950	»	14.9 ft.
1947-1950	»	15.3 ft.

Jackson Glacier

No appreciable change, 1948-1950.

Sperry Glacier

Average annual recession along 2,000-ft. section of terminus.

1938-1948	47.2 ft.
1948-1949	43 ft.
1949-1950	25 ft.

Practically no change in elevation of glacier surface, 1949-1950.

Meteorological conditions in the Glacier Park area have been as follows :

1945-1950 Snowfall above normal. In 1950 it was 71 % above normal.
1947-1950 Average temperatures below normal.

b) *Wind River Range, Wyoming*

Regimen studies were initiated in 1950 by Mark Meier, State University of Iowa. The glaciers of this area have been receeding in recent decades, very rapidly from 1930 to 1940, and more slowly since then. Since 1945, the recession of some glaciers is « practically negligible », and there is abundant evidence of a « thickening of snowfields at high elevations in recent years ». (Quotes from Meier's unpublished report).

The winter snowfall in 1949-1950 was very heavy and was followed by a late spring and a summer which was shorter and cooler than normal. Measurements were made on Dinwoody Glacier which indicated an excess of accumulation over ablation for the 1949-1950 budget year.

c) *Rocky Mountain National Park, Colorado*

Observations by the National Park Service of Andrews and Tyndall Glaciers indicate that recession during the four or five years prior to 1950 has been relatively slow with possibly even an occasional advance.

d) *Front Range, south of Rocky Mountain National Park, Colorado*

It was reported by the National Park Service that in 1949, recession which

was pronounced from 1930 to 1942 has « definitely halted, and several of the glaciers show definite signs of enlargement ».

(Report from National Park Service).

2. — Cascades

a) *Nisqually Glacier* on Mt. Rainier is the only one which is measured regularly. This is being done by the National Park Service and the U. S. Geological Survey. The recession of its terminus was 65 feet from 1949 tot 1950. Since 1940 in only two years has there been less recession than this. There is an interesting record of recession dating back to 1857. The annual rates are as follows :

1857-1892	26 ft.	per year
1892-1918	50	»
1918-1940	72	»
1940-1950	84	»

Of perhaps greater interest than this terminal recession is the fact that an increase in the volume of the glacier is occurring between one and two miles above the terminus. Profiles were established in 1948 and an appreciable rise of the surface has been measured both in 1949 and 1950. A rise of as much as 52 feet occurred since 1948, and in one place, the change from 1949 to 1950 was 32 feet. The surface motion of the ice has also been measured and varies in the center of this part of the ice from an annual average of 60 feet to 262 feet. Thus, it seems that a sort of « wave » is moving down glacier and should be watched as it approaches the terminus in the years to come.

Measurements have been made of two other glaciers on Mt. Rainier. From September 1948-September 1950 Paradise Glacier receded 36 feet and South Takoma Glacier 168 feet.

b) *Eliot Glacier* on Mt. Hood.

The only measurement available is the lowering of the surface. About 500 feet above the terminus, this has averaged two feet per year from 1940 to 1950. At a point about 3,000 feet above the terminus, the yearly average is about four feet.

c) *White River Glacier* on Mt. Hood has become far more crevassed in recent years which suggests increased activity.

d) A report states that a glacier on Mt. Shuksan in the Northern Cascades has receded about 3/4 mile since 1906 and has been reduced in size in that period by about 75 %. The small glaciers occupying cirques on Mt. Shuksan are said to be disappearing.

e) *Coleman Glacier* on Mr. Baker.

The barren zone fronting the terminus indicates rapid recent recession, but no measurements are available. However, from 1949 to 1950, the center of the terminus advanced about 80 feet. About 1/4 mile above the terminus, the surface of the glacier rose 35 feet in that year, and at an elevation of 1200 feet higher, a rise of 15 ft. was measured.

3. — Sierra Nevada

Measurements made in 1949 indicated that the glaciers of the high Sierra are shrinkring fairly rapidly. Lyell Glacier, East Lobe, shows an average annual lowering of its surface at three stations of 1.4 to 2.9 feet from 1933-1949 ; at one station the total lowering in that period was 45.5 feet. Measurements on the West Lobe gave a 0.5 to 1.2 feet average. The terminus of Dana Glacier receded 140 feet from 1935 to 1949.

ALASKA

Measurements of glacier variations in Alaska are made in only certain localities and can be considered as no more than spot checks. Few figures are available for

a precise determination of the observed changes so that only an indication of shrinking or enlargement can be made. No detailed analysis should be attempted on the basis of our present information, but certain trends and characteristics are becoming discernible. Although most glaciers in Alaska seem to be shrinking, a significant number are advancing or have done so within the past decade. The advances which have been observed are both long and short term — the former measured in terms of decades and the latter in a matter of a few years. These last may be likened perhaps to a flash flood in a mountain stream or to a river in flood.

The glaciers will be considered in their geographical order proceeding up the coast of Southeastern Alaska from southeast to northwest.

Leconte Bay

LeConte Glacier (tidal). Observations by D. N. Brown in 1950 recorded a recession of about 1/4 mile on the south side diminishing to about 100 feet on the north between 1946 and 1950;

Endicott Arm

Dawes Glacier (tidal). After a period of virtually no change in the position of the terminus from 1923 to 1941, recession of an average of about 1500 feet occurred by 1949, followed by little change to June, 1949. From that date to July, 1950, this tidal ice front receded an estimated 2500 feet.

North Dawes Glacier (land terminus). Steady recession has occurred since about 1923 amounting to about 2000 feet between 1935 and 1950.

Tracy Arm

South Sawyer Glacier (tidal). There occcurred no appreciable change from 1923 to 1941, then an average recession of about 3000 feet between 1941 and 1948, followed by relatively stable conditions from 1948 to 1950.

Sawyer Glacier (tidal). This terminus was slightly farther forward in 1950 than in 1941.

Taku Inlet and West Side of Juneau Ice Field

Taku Glacier (formerly, tidal, now no longer so). Since 1899 the terminus has advanced about 3 1/2 miles. From 1941 to 1948 this advance averaged 500-800 yards; from 1948 to 1950 there was an average advance of about 100 yards along most of the terminus, ranging from no appreciable advance at one point to about 300 yards at another.

Hole-in-the-Wall Glacier (land terminus). Since this is a distributary tongue of Taku Glacier, it quite naturally has also advanced — a matter of several hundred yards from 1941 to 1950.

Norris Glacier (land terminus). From 1941 to 1950 the whole lower part of the glacier has shrunk in volume, and the terminus has receded in the order of 100 to 200 feet.

Mendenhall Glacier (terminates on land and in lake). There has been steady recession for many decades; from 1931 tot 1948 the amount of retreat in the lake terminus has been about 3000 feet, and where the terminus rests on land about 800 feet.

Herbert Glacier (terminates in lake). Recession of about one mile, 1910 to 1948.

Eagle Glacier (terminates in lake). Recession of from 1/2 to two thirds of a mile from 1910 to 1948.

Glacier Bay

Muir Inlet

Adams Plateau Glacier which formerly filled the valley disappeared between 1941 and 1950.

Adams Glacier (land terminus). Recession and shrinkage 1941-1950.

Girdled Glacier (land terminus). Recession and shrinkage 1941-1950.

Casement Glacier (land terminus). Slow recession and shrinkage 1941-1950.

McBride Glacier (tidal). Since it became a separate glacier with its own terminus about 1945, due to the recession of Muir Glacier, the terminus has not changed appreciably and has even advanced slightly. This however, may well be due to

shallowing by outwash at the terminus, so that the ice is more protected from the melting effects of tidewater.

Muir Glacier (tidal). The long recession since 1899 continued with a further recession of 1–7 /8 miles between 1941 and 1946. From 1946 to 1950 there was no further recession and in fact, the west end of the terminus advanced slightly.

Plateau Glacier (tidal). Recession between 1941 and 1948 amounted to 1 1 /4 miles and from 1948 to 1950 7 /8 mile. This glacier is shrinking rapidly as it is a remnant mass almost entirely below the level of the neve line.

Morse Glacier (land terminus). Rapid recession and shrinkage is continuing. Various remnant glaciers in Muir Inlet, which have been left stranded by the recession of the valley glaciers, are shrinking rapidly especially at elevations of less than 1000 feet.

Queen Inlet

Carroll Glacier (land terminus), has experienced net recession of about 1600 feet since 1919. There was a slight advance in 1943-1944 following which recession has amounted to about 500 feet.

Rendu Inlet

Rendu Glacier (land terminus). The terminus in 1950 was about in the same position as in 1916 and some 400 yards in advance of its position in 1926. Recession occurred between 1935 and 1948 following which an advance has set in accompanied by a thickening of the whole lower end of the glacier.

One hanging glacier on the east side advanced conspicuously between 1948 and 1950.

Romer Glacier (land terminus). There was a slight advance of the terminus from 1941 to 1950.

Tarr Inlet

Grand Pacific Glacier (tidal). Between 1941 and 1948 there was a net advance of about 1500 feet and a further advance of 1200 to 2000 feet between 1948 and 1950.

Margerie Glacier (tidal). More advanced in 1950 than in 1926 and the surface of the glacier a mile above the terminus is noticeably higher. This glacier has not changed very much since 1913.

Reid Inlet

Johns Hopkins Glacier (tidal). To understand and evaluate the current trends of the glaciers in this inlet, one must bear in mind their general behaviour since 1900. At that time, the Johns Hopkins Glacier occupied the whole valley and the hanging glaciers which are now independent were tributaries. The Johns Hopkins receded about four miles from 1892 to 1911 or at an average rate of .2 miles per year. From 1911 tot 1929 recession amounted to 7 1 /2 miles or an average of .4 miles per year. Most of this probably occurred in the few years prior to 1926. The volume change is indicated by the fact that at the position of the 1929 terminus the surface of the glacier in 1894 was at 2250 feet. Three miles below that point, as late as 1907, the ice surface was at 1750 feet. Since the depth of the fiord is known to be 1380 feet at that point, the ice was approximately 3130 feet thick.

After the very rapid recession from 1892 to 1929, the terminus began to advance as mapped in 1935, 1941. 1948, and 1950. The total measured in the center is approximately 4750 feet, of which nearly 2000 feet has occurred since 1941. The advance between 1948 and 1950 has been uneven, varying from almost none in the center to several hundred feet on the southeast side. The glacier above the terminus has also thickened appreciably. The nine hanging glaciers for which there is any data have shown very little net change since first observed between 1929 and 1935. However, some rather startling variations have taken place, in the form of spasmodic advances lasting over a period of a few years followed by a return to the former condition.

Taken in order in a counter-clockwise direction, the behaviour of these glaciers from 1941 to 1950 may be summarized as follows :

Topeka Glacier (land terminus). Little change discernible 1941-1950.

Toyatte Glacier (land and tidal terminus). In 1935, the terminus was at the water's edge, but in 1940, it was far up the valley at an elevation of about 750 feet

and perhaps 1/2 mile back of the shore line. It was progressively more advanced in 1941, 1946, and 1948 when it reached the water's edge. The lower end of the glacier began to shrink between 1948 and 1950.

Tyeen Glacier (land and tidal terminus). Between the time the Johns Hopkins Glacier receded past Tyeen Glacier and 1929 (presumably in the interval 1920-1926), the terminus of Tyeen was at the water's adge. By 1929 it had receded about 5000 feet to an elevation of about 1800 feet. An advance then occurred which by 1935 brought the terminus to about 1700 feet from the shore line at an elevation of about 700 feet. Recession then occurred which by 1946 placed it back almost to the 1939 position. A rapid advance took place between 1946 and 1948 during which the terminus moved forward 4700 feet from an elevation of about 1500 feet to the water's edge. The impetus of the advance was quickly spent and by 1950 the whole lower end of the glacier below an elevation of 700 feet was virtually stagnant and cut off from the ice above. (The 1946 and 1949 data is taken from vertical aerial photographs made in those two years by the U. S. Coast and Geodetic Survey and the U. S. Navy respectively, some 22 months apart).

Charley Glacier (land terminus). Little data exists on this glacier except that there was a net advance between 1948 and 1950.

Clark Glacier (land terminus). This small glacier had a net advance between 1941 and 1946 with no appreciable net change from 1946 to 1950. The 1950 and 1935 positions are about the same.

Gilman Glacier (tidal). There has been little noticeable net change in the position of the terminus, but the volume of ice in the lower part of the glacier has changed as follows: 1931 to 1935 thickening; 1935 to 1941 shrinkage; 1941 to 1946 thickening; and 1946 to 1950 thickening.

Hoonah Glacier (tidal and land terminus). The changes in the position of the terminus have not been very great, but appreciable changes have occurred in the volume of ice in the lower glacier. The two factors combined may be summarized as follows: 1929 to 1931 — advance and thickening; 1931 to 1935 — back to condition of 1929; 1935 to 1940 — recession and thinning; 1940 to 1941 — advance; 1941 to 1946 — no appreciable net change; 1946 to 1948 — advance and thickening; 1948 to 1950 — recession, but still more advanced compared to 1941.

Kashoto Glacier (land and tidal terminus). The terminus has varied in position from several hundred feet above tidewater to the water's edge. The volume of the lower glacier has varied accordingly. It may be summarized as follows: — 1929 to 1935 — recession; 1935 to 1941 — no appreciable net change; 1941 to 1946 — advance; 1946 to 1948 — no appreciable net change; 1948 to 1950 — slight recession.

There are several other small hanging glaciers in Reid Inlet for which quantitative data is not available. However, it is believed that they have not varied very much during this period, 1929 to 1950.

Lamplugh Glacier (tidal). This glacier became independent of the Johns Hopkins Glacier between 1894 and 1899. There was little change in the position of its terminus until the period 1935 to 1941 when there was a recession measured in the middle of the terminus of about 900 yards followed in 1941 to 1946 by an advance of about 340 yards, and from 1936 to 1948 by about 150 yards. This recent advance may be largely due to the shallowing of the water of the inlet which has caused the terminus to become increasingly protected from the melting effects of tidewater.

Upper Glacier Bay

Reid Glacier (tidal). The rapid recession which occurred between 1926 and 1941 has not continued. From 1941 to 1950 there has been no appreciable change in the position of the tidewater terminus, but shrinkage has occurred on the east side where the terminus rests on land.

Hugh Miller Inlet

Scidmore Glacier (land terminus). No specific data is available, but it appears to be shrinking.

High Miller Glacier (Land and lake terminus). Rapid recession has occurred during the past decades. From 1941 to 1948 it amounted to about 3/4 mile with 100-200 feet additional from 1948 to 1950. The lowering of the ice surface from 1941 to 1950 at a point about 3/4 mile above the 1948 terminus amounts to about 275 feet.

Maynard Glacier. No precise data available but relatively rapid shrinkage and recession is indicated.

Charpentier Glacier. There has been a recession of at least several hundred feet from 1941 to 1950.

Geikie Inlet

Geikie Glacier. From 1892 to 1950 total recession has amounted to about 13,662 feet. A brief spasmodic advance occurred in the period 1919 to 1926 since which recession has amounted to about 7866 feet or an average of 328 feet per year. From 1941 to 1950 recession has been 2381 feet or an average of 265 feet per year.

Wood Glacier. This virtually ceased to exist as a glacier between 1931 and 1941 and it may be presumed that the remnant ice seen in the latter year has now disappeared.

As can be seen, Glacier Bay presents an extremely varied picture of glacier variations. The relationships are not obvious, but at least some generalizations can be made which may provide a better basis for understanding current behaviour than the study of any single glacier. The great recessions which began in the 18th Century, when the trunk glacier occupied the whole of Glacier Bay, proceeded with few known interruptions up each inlet as the trunk glacier disappeared and the tributaries became independent. Recession in these inlets continued until the second half of the 1920's when the main glaciers of the three northernmost inlets reached their minimum positions from which they have since advanced. In the four other inlets, recession is still continuing, but in one, at least, with diminished rapidity. The glaciers flowing from relatively low neves at elevations of 3000 to 4000 feet, such as on the west side of lower Glacier Bay in Geikie and Hugh Miller Inlets, are continuing to recede rapidly. Recession and shrinkage also dominate in Muir Inlet although the Muir and McBride Glaciers themselves have been relatively stable for the last five years. Carroll Glacier also seems to be shrinking but not very rapidly. The big exceptions are the Grand Pacific and Johns Hopkings Glaciers and to a lesser extent Rendu Glacier. These are now well in advance of their positions a quarter-century ago.

No general inference can be made, but it is possible that the higher neves in the Fairweather Range are getting more snow accumulation than formerly, and although some of the glaciers in the area are still shrinking, the main sources of supply in the high neves are building up toward an eventual return of the trunk glacier of Glacier Bay.

It is interesting to note that despite the very rapid recession which many of the glaciers have undergone, there have been a very considerable number of cases of spasmodic advances in which termini came forward from a few hundred feet to over a mile, following which the glaciers reverted to their previous condition.

The larger glaciers which had such advances, including current advances are as follows. (The advances which are unusually vigorous are underlined) :

Muir — 1890-1892 and 1926-1929
Carroll — *1916-1920* and 1943-1944
Rendu — *1907-1911*, 1926-1929, 1931-1935, 1948-1950
Grand Pacific — *1911-1913*, *1929-1931*, *1938-1950*
Johns Hopkins — *1929-1950*
Lamplugh — 1941-1950
Geikie — about 1919-1921

The advances which have been recorded of the smaller glaciers are as follows: two unnamed glaciers which occasionally become tributaries of the Rendu (1) *1907-1916*; (2) *1892-1907*; *1924-1929* and *1941-1950*; Romer Glacier, *1892-1911*, 1916-1924; unnamed tributary of Ferris Glacier, about 1908-1912, 1939-1940 Toyatte, *1926-1935*, *1940-1948*; Tyeen, about 1919-1921, 1929-1935, *1946-1948*; Charley, 1946-1948; Gilman, 1931-1935, 1941-1950; Hoonah, 1929-1931, 1940-1941, 1948-1950; Kashoto, *1941-1946*.

It is clear that advances are not uncommon and in some cases merely represent a normal waxing and waning in size of the glacier. Others, however, appear due to definite « waves » which come down the glacier and influence even the glaciers which are shrinking. Examples of the latter occurred at Muir, Carroll, and Geikie Glaciers.

The spasmodic advances of great intensity occurred to the Carroll, Rendu, Grand Pacific (1911-1923 and 1929-1931), the tributaries of the Rendu, Romer, Toyatte, Tyeen, and Kashoto Glaciers.

An effort to determine whether there is anything synchronous in these advances suggests that there may be, although this would not necessarily be readily apparent since different glaciers would respond at different times from the same impulse — perhaps ten or more years apart. An effort to compare the behaviour of four hanging glaciers in Reid Inlet show that three of them reached maximums from 1930 to 1935 and the four experienced maximums between 1945 and 1948. Thus the curves of advance and recession when plotted are sufficiently similar to suggest an important common causal factor. In Reid Inlet it can also be said that in general the glaciers were advanced in 1935, receded in 1940, and advanced again in 1948. Going back to the period 1905 to 1920, we find that the Grand Pacific, Rendu, Carroll and Geikie all had significant advances as did four widely separated smaller glaciers. From 1926 to 1935 at least five large and five small glaciers experienced advances; and in 1941 to 1950 six large and eight small advanced. The possible causes can only be conjectured — it may be earthquakes and /or a combination of meteorological factors which favor these variations and result in very noticeable effects in some glaciers, while others absorb the change with little change being recorded at their termini. In time, and with more correlation it may be possible to be more specific. There is obvious need of meteorological data in this area, but pending that, a closer study of the records from other stations in that part of Southeastern Alaska might reveal useful data.

So much emphasis is placed on Glacier Bay because of the relatively long record of study there and the complex behaviour of the glaciers. It would seem that an adequate understanding of the variations of these glaciers in particular would go far toward explaining some of the unknown factors and causal relationships of glacier variations in general.

Lituya Bay

La Perouse Glacier (tidal). Increased activity along the ice front was reported in 1950. An advance may be in progress.

Crillon and Lituya Glaciers (tidal). Both seem to be at maximums and in contact with mature forest. The have been advancing steadily for some decades and are two to three miles in advance of their positions in the 18th Century.

Alsek River Valley

The glaciers in this area appear in 1948 aerial photographs to be receding steadily.

Prince William Sound

These glaciers were visited in 1947 and 1949 by D. N. Brown who reported their condition as follows :

Columbia Bay

Columbia Glacier (tidal and land terminus). Net recession occurred between 1935 and 1947, followed by an advance from 1947 to 1949. On Heather Island near the center of the terminus, this advance was about 300 feet.

Unakwik Inlet

Meares Glacier (tidal). The slow advance which has been under way since 1906 continued between 1935 and 1949. On the northwest end of the terminus it is in the order of a few hundred feet.

College Fiord

Lafayette Glacier (land terminus). A measured recession of 280 feet occurred from 1947 tot 1949.

Yale Glacier (tidal). The northwest end and center of the terminus did not change position between 1935 and 1949 but some terminal thinning is apparent. The southeast end of the terminus receded several hundred yards.

Harvard Glacier (tidal). The slow advance, which has been going on since the first decade of the century, has continued with an additional several hundred feet

from 1947 to 1949. From 1935 to 1949 the advance amounted to about 1600 feet on the west and 800 feet on the east.

Smith Glacier (tidal). An increase in volume of the terminal section occurred from 1947 to 1949.

Bryn Mawr Glacier (tidal). A very considerable net advance occurred between 1935 and 1947 of which about 1500 feet took place after 1941. No appreciable change occurred between 1947 and 1949.

Vassar Glacier (Land terminus). No appreciable change is discernible from 1947 tot 1949.

Wellesley Glacier (tidal). No appreciable change is discernible from 1947 to 1949.

Barry Arm

Coxe Glacier (tidal). Terminal thickening has occurred between 1935 and 1949.

Barry Glacier (tidal). There bas been a slight advance from 1935 to 1949.

Cascade Glacier (tidal). Considerable advance occurred between 1935 and 1949.

Harriman Fiord

Serpentine Glacier (tidal). Ad advance of several hundred feet occurred between 1935 and 1949. Some advance is noticeable from 1947 to 1949.

Baker Glacier (land terminus). No great net change discernible from 1935 to 1949.

Surprise Glacier (tidal). There was a slight advance from 1935 to 1947 with no appreciable change from 1947 to 1949.

Cataract Glacier (land terminus). Net recession occurred from 1935 to 1949 followed by little change from 1947 to 1949.

Roaring Glacier (land terminus). There was an apparent slight net increase in volume from 1935 to 1949.

Harriman Glacier (tidal). A slow advance has been in progress for some decades. From 1935 to 1947 it amounted to about 400 feet on the west side. No appreciable change occurred from 1947 to 1949.

Toboggan Glacier (land terminus). There has been steady recession for some decades which was maintained up to 1949.

Blackstone Bay

The various glaciers of the bay show no appreciable net change between 1935 and 1949. There may even be slight advances in places.

The glaciers of Prince William Sound, particularly those from Columbia Bay to Harriman Fiord, are of special interest since several of the termini have established maximums of several hundred yards during the past five to six decades. Three of the glaciers, the Meares, Harvard and Harriman, are now in contact with forest or old vegetation several centuries in age. While some of the smaller glaciers flowing from relatively low level neves are receding, most of the larger glaciers or hanging glaciers flowing from high neves were of greater volume in 1949 than in 1935. Of all groups of glaciers on the continent, this one seems now most nearly in equilibrium. The conditions responsible for this should be studied.

Water Resources Division
Results of Glacier Observations
Years 1948, 1949 and 1950

Glacier	Year	Recession Feet	Rate of Ice Flow Feet	Decrease In Depth Feet	Observed Water Discharge c. f. s.
Coast Range					
Sentinel	1948	164	5	15	70
	1949	120	21	28	75
	1950	31	6	13	100
Helmut E. Tougue	1948	90	9	10	40
	1949	40	15	—	50
	1950	25	—	—	25
W. Tougue	1948	23	—	—	50
	1949	11	—	—	30
	1950	4	—	—	40
Franklin	1948	218	—	—	800
Selkirk Range					
Kokanee					
Joker Creek	1948	54	—	9	50
	1949	49	—	6	45
	1950	40	9	6	26
Coffee Creek	1948	18	—	15	8
	1949	104	—	11	12
	1950	27	10	17	—
Illecillewaet	1948	39	—	—	—
	1949	101	—	—	—
	1950	103	91	5	—
Rocky Mountain Range					
Victoria	1948	58	90	—	—
	1949	100	105	—	22
	1950	31	84	—	26
Peyto	1948	110	31	15	—
	1949	107	26	—	—
	1950	34	15	—	—
Freshfield	1948	150	40	10	—
	1949	145	50	—	—
	1950	96	34	—	—
Saskatchewan	1948	155	—	—	—
	1949	157	—	—	—
	1950	84	—	—	—
Athabaska	1948	100	49	—	—
	1949	106	50	—	190*
	1950	67	42	—	150*

* Mean run-off July-September inclusive.