

Peace-Athabasca Delta Flood History

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Documentary Information

This research was undertaken in response to a request from Wood Buffalo National Park for information related to historic water levels on the Peace-Athabasca delta. Since 1967, when construction of the W.A.C. Bennett Dam was completed on the Peace River, water levels in both Lake Athabasca and on the delta have been low. This has allowed willow to encroach upon marshes that have historically been an important habitat for a variety of wildlife.

For several years, WBNP has been examining solutions to this problem. Any reconstruction of past water levels requires an understanding of the frequency and extent of past flooding on the delta. Since water has historically been a crucial factor in transportation throughout the fur trade, it seemed probable that information on water levels would be present in daily journals kept at a number of Hudson's Bay Company trading posts in the vicinity of the delta. The bulk of information pertaining to Hudson's Bay Company posts is housed at the Hudson's Bay Archives in Winnipeg, and is comprised of post journals and accounts of fur returns. Information relevant to this study was derived from several different posts, with the bulk taken from daily journals kept at Fort Vermilion (covering the period 1826 to 1906) and Fort Chipewyan (covering the years 1803 to 1923). Supplementary information was obtained from post journals kept at Red River and Colville House, from recorded fur returns for the Athabasca District, Governor George Simpson's Correspondence Inward, and Annual District Reports. Information derived from the above sources was also compared with a delta flood analysis conducted by Gerard and Karpuk¹ and with a dendrochronological study conducted by The Peace-Athabasca Delta Project Group.²

An index of the complete holdings of the Glenbow-Alberta Archives on microfiche are located at Prairie and Northern Regional Office in Winnipeg. As the Glenbow contains post journals from several Hudson's Bay Company posts, such as Fort Resolution, the index was consulted as a possible source of documents pertaining to Fort Vermilion which are missing from the Hudson's Bay Company collection. Unfortunately, the only documents pertaining to Fort Vermilion at the Glenbow Archives consist of account balances for 1888, no post journals being present.³

¹ Probability Analysis of Historical Flood Data. *Journal of the Hydraulics Division: Proceedings of the American Society of Civil Engineers*. Vol. 105, no. HY9, September 1979.

² The Peace-Athabasca Delta: A Canadian Resource. *Summary Report* (1972), prepared by The Peace-Athabasca Delta Project Group.

³ An incomplete selection of Wood Buffalo National Park warden's reports has also been located at the National Archives of Canada and summarized by Parks historian Robert Burns

In examining the daily post journals noted above, the following information, where present, was noted: journal entries pertaining to water levels in Lake Athabasca, the rivers entering Lake Athabasca or in the smaller lakes on the delta; precipitation both at the time of spring breakup and throughout the summer months; and duration and intensity of spring thaw. Observations recorded at the forts were then compared with yearly fur returns from Fort Chipewyan in an attempt to identify any correlation between the number of muskrats harvested and water conditions on the delta.⁴ Yearly muskrat returns for the entire district are also provided for comparison with Fort Chipewyan, but should not be considered reflective of muskrat populations on the delta.⁵ Where yearly fur returns fluctuated significantly, District Reports were consulted in order to identify causal factors. Relevant quotes from post journals for Forts Vermilion and Chipewyan were summarized in tabular form (see Appendix 1). Supporting information from Red River and Colville House is supplied separately in Appendix 2. Finally, Fort Chipewyan and Athabasca District muskrat returns are summarized in Figure 1.

It should be noted that most of the information found in Fort Chipewyan post journals pertains to water levels on Lake Athabasca, the surrounding lakes on the delta and the Peace, Rochers and Quatre Fourches rivers. Very few references to water levels on the Athabasca River were encountered. This is probably for several reasons: Fort Chipewyan was in closer proximity to the Quatre Fourches and Rochers rivers than the Athabasca, and the effects of yearly spring runoff from the Peace would have been more directly observable in increased discharge into Lake Athabasca from these rivers; and Brigades carrying fur returns from the more northerly posts made the outward voyage to Fort Chipewyan each spring immediately following spring breakup, and their arrival time depended entirely on the timing and course of breakup on the Peace. When scows began travelling on the Athabasca River sometime in the 1880s, water levels on the river became of more immediate concern to Fort Chipewyan, and references to high or low water on the river appear more frequently.

(1993). These reports contain sporadic accounts of flooding observed from Warden's Stations at several points along the Peace River covering the years 1922 to 1925, 1932 to 1933, 1935, 1937 to 1938, 1940 to 1945, and 1947 to 1953.

⁴ Although muskrat populations are directly influenced by water levels, it is inadvisable to rely upon historic fur returns as an indirect indicator of water levels on the Peace-Athabasca delta. Many other factors contributed to the number of muskrat furs harvested in any given year (see discussion, page 17). Other factors would have included the number of hunters reporting to the posts in question, competition from newly-established independent traders or other trading companies such as the North West Company, and illness in both animal and human populations.

⁵ Athabasca District included Fort Chipewyan, Dunvegan, Peace River, St. John's, Fort Vermilion, Hudson's Hope, Fond du Lac, Fort McMurray and, in the earlier part of the 19th century, Harrison's House, Beren's House, Colville House, Great Slave Lake and Fort Resolution (see Fig. 2). The area covered by the delta makes up only a very small portion of the entire district.

Water on the Delta in the 19th Century

Significant changes appear to have occurred in the water regime on the Peace-Athabasca delta since the 19th century. Recent interviews with local hunters have indicated that, prior to the construction of the W.A.C. Bennett dam in 1967, flooding of perched basins on the delta during the 20th century has occurred only as a result of spring ice jams on the Peace River⁶. While written historic accounts do not prove or disprove this assertion, there are ample indications that summer flooding also played a significant role in the recharging of delta waters. Frequent references occur in both daily post journals and District Reports throughout the 19th century to extremely high summer water levels on the delta that are unrelated to ice on the Peace River. In a report dated 1821, District Manager William Brown offered this explanation of increased summer discharge to the District Governor:

... Peace River runs past this Lake, and discharges itself into the Great Slave Lake, but when the water is very high }which generally is the case about the 15th of June from the effect of the sun upon the snow at the Rocky Mountains{ there are several branches which seperate [sic] from the Main body and fall into the west end of this Lake.⁷

At such times, rivers on the delta overflowed their banks without the impetus of spring ice jams on the Peace. Such was the case in 1832 and 1835, when hunts suffered greatly due to summer flooding. In a more extreme example, flooding on the Peace River in mid-July of 1826 inundated Fort Vermilion, forcing its inhabitants to move around in canoes.⁸

Haymaking and water levels

Soon after the establishment of Fort Chipewyan, references to livestock begin appearing in post journals. Horses and oxen were kept both for transportation and to haul goods, and also served as an emergency source of food in times of famine. During the summer months, the animals were turned loose to forage, but were fed throughout the winter with hay cut locally. Haymaking usually took place along the rivers Rochers, Quatre Fourches and, occasionally, on the Child's River⁹. The hay was likely cut in close proximity to the water's edge, as it was transported to

⁶ M. Peterson, "Water Restoration Attempt in the Peace Athabasca Delta". Internal Report on file, Parks Canada.

⁷ B39/e/3 fo. 4, Fort Chipewyan Post Journals.

⁸ B224/a/2 fo. 2, Fort Vermilion Post Journals.

⁹ J. Petitot, *Canadian Record of Science*, Vol. 1(1):37-38. During the 19th century, many of the rivers of the delta were referred to by names which have since fallen from common usage. Many of these rivers were previously known by their French names, hence, the Childs River was

the fort by boat and in only a few years is there any mention of having had to use horses to transport the hay any distance overland. Given the very flat topography of the delta, it seems likely that flooding of the meadows along these rivers would have been accompanied by flooding to some extent in other areas of the delta as well.

Synopsis

Taken independently, records from Fort Vermilion and Fort Chipewyan rarely give a definite indication of years in which flooding occurred. When considered together, however, a number of years can be identified in which floods -- not necessarily related only to spring ice jams -- definitely or likely occurred. Prior to 1826, no records for Fort Vermilion could be found. On Lake Athabasca, Nottingham House and Fort Wedderburn post journals are available for the period 1806 to 1821, although incomplete. It was the custom for the chief factor or chief trader of the post to accompany the post returns on the outward journey to York Factory each year. This trip commenced immediately after breakup, as soon as a channel down the Athabasca River was open. Until 1821, a late spring/summer journal was rarely kept, and breakup conditions and subsequent water levels were not recorded. In 1821, the Hudson's Bay Company and its' primary rival, the North West Company, amalgamated under the Hudson's Bay Company name. The HBC headquarters at Fort Wedderburn were abandoned in favour of the better-located North West post at Fort Chipewyan. After this date, post journals were kept year round.

1803 to 1819

In 1803, Peter Fidler, Chief Factor of Nottingham House, noted large amounts of ice and driftwood¹⁰ entering Lake Athabasca from the Peace River. In the absence of corroborating evidence from Fort Vermilion, the presence of great quantities of driftwood is not an indication of flooding on the Peace River, but it does suggest very high water levels.

called the "Rivière des Enfants". The Rivière des Rochers was also referred to as the "Rocky River" or the "Gros Rocher", while the modern Chenal des Quatre Fourches was called the "Aux", "Eufs" or, in English, the "Egg River".

¹⁰ A certain amount of driftwood regularly entered Lake Athabasca whenever water levels rose high enough to cause a reversal of normal drainage, so that water flowed from the Peace River into the lake. The collection of this wood seems to have provided an almost annual source of firewood for Fort Chipewyan. Using Gerard & Karpuk's (1979) perception levels theory, it seems probable that a "normal" amount of driftwood would likely not be cause for comment in the daily post journals. It could then be assumed that comments regarding large amounts of driftwood entering the lake are an indication of very high water levels on the Peace River.

In 1805, an unnamed arm of the Quatre Fourches River was blocked for over a week near the actual "Four Forks" of the river by ice. This may have caused localized flooding in the vicinity.¹¹

Fort Chipewyan records are sketchy until 1821, and no other possible flood years prior to 1820 could be identified.

1820 to 1829

The first part of the decade appears to have been characterized by low water levels on the delta rather than flooding. In 1821, the recorder at Fort Chipewyan notes that the water is very low in Lake Athabasca and in the region surrounding the lake throughout the breakup period, but then records great quantities of water and a strong current from the Peace River into the lake in mid-June. This corresponds with the usual timing of discharge from mountain streams. In 1824, water levels were also very low, and in the spring of 1825, the yearly muskrat hunt suffered greatly, in part due to the extremely low winter water levels which allowed foxes and wolverines to predate the muskrat population heavily while still in their winter burrows.¹² Although the usual rapid spring rise of water was experienced at Fort Vermilion, water on the Peace River appears to have been low throughout the summer season.

In the spring of 1826, summer flooding occurred at Fort Vermilion. Although no mention is made in the Fort Vermilion post journal of high water in May, when the Peace usually breaks up, an April 22 entry at Fort Chipewyan notes that the muskrat hunt has again been unsuccessful due to the sudden thaws and high water liberating the animals from their winter huts. Although breakup occurred at Fort Vermilion sometime prior to May 7, high water is not recorded at that post until June 15. This was likely the result of melting and increased discharge in the mountain streams. After this point, the water rose quickly to such a height that by June 19 the entire Fort (with the exception of the dwelling house) was under water, forcing the men to move about in canoes. The water remained at flood stage for 3 days before beginning to subside quickly on June 22, 1826.

Water levels appear to have remained lower than usual for the remainder of the decade. In 1827, the muskrat hunt was again disappointing due to the low winter water levels which exposed the muskrat huts to predation and froze thousands of the animals. The Peace River in front of Fort Vermilion was clear within four days of breakup, and a later notation in the Fort Vermilion journal reports that no inconvenience had been suffered from flooding that year. This is in direct

¹¹ A similar ice jam along the Quatre Fourches in 1832 caused the river to overflow its banks, leading to flooding of the surrounding plains and Lake Mamawe.

¹² Muskrat returns also suffered because many of the hunters did not reach Fort Chipewyan until after the Brigades had departed with the returns of Outfit 1824 (*Letter Edward Smith to Governor George Simpson, George Simpson Correspondence Inward D.5/1 fo. 161*).

contradiction of the PAD Project dendrograph, which indicates very high water from 1827 to 1829 (see discussion, page 16). Although the flow of water on the Rivière des Rochers near Fort Chipewyan reversed direction to drain into Lake Athabasca due to the high water and strong current from the Peace River in mid-May, it resumed its normal drainage by the end of the month.

On May 6, 1828, spring run-off from the Peace carried "great quantities of ice and driftwood" into Lake Athabasca, but flow quickly resumed its usual direction by the end of that day. By June, water at Quatre Fourches was again so low that navigation was difficult. Spring breakup appears to have occurred earlier than usual in 1929, with the Peace River having broken up on April 2 at Dunvegan and around April 10 at Fort Vermilion. Incoming traders at Fort Chipewyan reported the water on rivers and lakes in the area very low and navigation therefore difficult.¹³

1830-1839

In contrast with the 1820s, much of the 1830s seem to have been characterized by high water in the Peace-Athabasca region.

No records exist from Fort Vermilion from the period 1830 to 1833, or for 1831 at Fort Chipewyan. In 1832, no mention is made of high water during breakup at Fort Chipewyan, but July entries indicate that water along the Quatre Fourches is so high that the banks of the river are overflowing. This summer flooding appears to be due to a combination of heavy discharge from the mountains and frequent heavy rains, as a later entry in August indicates that the hunters are doubtful of "making provisions" due to the rain that has inundated the area and made animals impossible to track.

In 1833, the journal recorder at Fort Chipewyan remarks on the prolonged drought. In 1834, water at Fort Vermilion reached "the ordinary spring flood mark" but does not appear to have overflowed. The spring muskrat hunt at Fort Chipewyan was reported favorable.

In the spring of 1835, records describe hunts, notably beaver and marten, as "excellent" (no specific mention is made of muskrat).¹⁴ Breakup at Fort Vermilion began and ended quickly in

¹³ Then-district manager Alexander Stewart reported to Governor George Simpson that the muskrat population at Fort Chipewyan had failed completely "in consequence of the prevailling [sic] Droughts, and also to our having prohibited the future killing of Swans and other Summer Furs" (D.5/3 fo. 429, George Simpson Correspondence Inward, 28 December 1829).

¹⁴ Good returns were offset later in the season by an influenza epidemic which resulted in high mortality among Native hunters, especially the Beaver Indians at Fort Vermilion. District manager Edward Smith wrote that "all hopes of returns is banished for the season ... The

late April, with the river in front of the fort clearing within three days of breakup. However, water did not begin to rise on Lake Athabasca until three weeks later on May 10, and appears to have risen consistently after this date. Although no specific mention is made of flooding on the Peace River, evidence of flooding on the delta is abundant: on Lake Athabasca, the current from the Rochers is too strong to set fishing nets at English Island; water is reported very high in the Slave River, which is "choked with driftwood"; great amounts of driftwood are passing into Lake Athabasca from the Peace; water is too high on the Hay, Child's and Rochers rivers and "all lakes in that area" to take any fish; navigation between Fort Chipewyan and Slave Lake is extremely difficult owing to high water, and the fort hunters report that the animals have all been driven to high ground by the height of the water. In addition, the Arctic Land Expedition was able to cross from the Athabasca River to the Embarras River by dragging their heavily laden boats a very short distance, indicating that the land between the two rivers was all but flooded. In July, the haymakers report the grass in the meadows to be extremely thin, suggesting all the meadows around their usual haying areas -- along the Rochers or Quatre Fourches -- were inundated for most of the growing season.

In 1836, spring breakup at Fort Vermilion occurred on May 9 after a fairly rapid thaw. Water rose quickly on the Peace River and remained high until mid-June; journal entries at Vermilion record large quantities of driftwood on the river making transportation to Fort Chipewyan difficult. No mention is made of flooding at Fort Vermilion, and the boats carrying the fur returns of the fort departed for Fort Chipewyan on May 19 after an apparently unremarkable breakup. The Fort Chipewyan post journal for 1836 begins in July, when, on July 3, the recorder notes that ice is floating into the lake, presumably from the Rochers or Quatre Fourches, as the current has turned. As there was no mention of flooding at Fort Vermilion earlier in the spring and the boats had no difficulty reaching Fort Chipewyan, this must have been due to a very late thaw in the mountain streams. Furthermore, an entry at Fort Chipewyan dated July 8 records that the plains all around Lake Mamawe are flooded, that there was little likelihood of getting any hay because of the flooding, that the water from the Peace River was continuing to rise and that fish catches had suddenly declined due to the influx of muddy water from the Peace.¹⁵

In 1837, no mention was made of high water at Ft. Vermilion, where the Peace River broke up in front of the fort on May 5. At Fort Chipewyan, breakup occurred on the Athabasca River

distressing situation and loss of life among the indians is without parallel... In this situation We can only creep on inch by inch" (D5/4 fo. 149-150, George Simpson Correspondence Inward, December 1835).

¹⁵ Although 1836 muskrat returns for Fort Chipewyan are lower than would be expected after several years of wet conditions, this can be explained by the hunters' preference for the more valuable beaver or marten furs. In years such as this, when beaver and marten were plentiful, the less valuable muskrat were not hunted as heavily.

sometime between April 20 and May 22. Water in the Athabasca River appeared to rise steadily throughout the summer season, but no mention is made of flooding.

Post journals were not kept at Fort Vermilion in 1838. Records from Fort Chipewyan indicate a fairly rapid thaw, with water on the lake rising very quickly and to a greater height than normal. In early May, large amounts of ice were obstructing navigation on the Athabasca River, and fishing had to be suspended on the lake due to the volume of wood and weeds entering it from the Peace River and destroying the nets. An entry dated May 11 notes that "the flooding of the Peace River" had caused the water to attain an "extraordinary height", and that an unnamed arm of the Quatre Fourches was blocked by ice. With water levels on the lake so high to begin with, it seems likely that an ice jam on the Quatre Fourches could well have caused at least localized flooding, as was experienced in the summer of 1832. In support of this hypothesis, men sent to look for hay in July reported that all the meadows about the fort (and presumably along the Rochers and Quatre Fourches) were inundated with water and the grass very thin and short. Eventually, hay was cut somewhere along the Rochers, but the meadows remained wet throughout the season. Water levels on Lake Athabasca did not begin to drop until the end of July.

Records for the spring of 1839 at Fort Vermilion end on April 19 and therefore give little insight into the breakup period that year. However, they do indicate a very early thaw at the beginning of April. Records from Fort Chipewyan also indicate an early thaw, so that by April 24, water was entering the lake from both the Quatre Fourches and Rochers rivers, carrying large amounts of ice and driftwood. Breakup seems to have been quick and unexpected, as two young Cree men were thought to have drowned in "the sudden rise of the Water in Peace River" when the ice broke up. No specific mention of flooding occurs, however, and water on Lake Athabasca begins dropping by June 3.

1840 to 1849

Water levels through the first part of the decade continued high both at Fort Vermilion and Fort Chipewyan. Records for the 1840 spring breakup period are missing for Fort Vermilion, but events at Fort Chipewyan indicate summer flooding occurred. May entries record a rise in the water on Lake Athabasca after the Peace River was thought to have broken up sometime around May 11. The lake ice had begun to break up within a few days, and by May 15 water on the lake had begun to drop. An entry dated June 24, 1840, however, records that the water on the lake had once again begun to rise rapidly, with a great deal of driftwood passing into the lake from the Peace River. A concurrent journal entry for June 24 at Fort Vermilion states that, although the water in the Peace River has begun to subside greatly in that quarter, the fort's potato field has been flooded by the high water of the river (no mention is made of where this potato field was located, but the wording of the entry suggests that it may have been on the island directly across from the fort on which the free traders' house was also situated). Hayfields around Fort Vermilion were also flooded, as were the meadows along the Rivière des Rochers. By July 1, the water at Fort Vermilion had risen "to an amasing [sic] height", and the local

Natives had informed the recorder that the Peace River was uncommonly high. Similarly, by July 14, the water on Lake Athabasca had risen over "The big stone in front of the fort". Water remained high throughout the summer, and on August 23 the water was still too deep in the meadows along the Rochers to allow any hay to be cut.

Fort Vermilion records for 1841 are missing, but at Fort Chipewyan the May muskrat hunt had to be suspended "on account of the little Lakes & Rivers being inundated".¹⁶ It is not clear whether this was the result of flooding or just water derived from the melting of the ice, although the use of the word "inundated" suggests a greater magnitude than the usual "water on top of the ice". At any rate, water levels appear to have been high throughout the summer months as well, as Fort Chipewyan was unable to cut any hay along the Rochers in July due to the high state of the water.

There is some suggestion that an ice jam may have occurred on the Peace River above Fort Vermilion in 1842. A fast thaw caused ice breakup in the vicinity of Fort Vermilion very early, as noted in a post journal entry dated April 27. The ice cleared the river in front of the fort within a few days, but breakup doesn't appear to have taken place upstream for some time after. On May 22 -- almost a full month later -- the journal recorder noted that the river had that day risen very high and a great deal of driftwood was passing the fort. This episode lasted a few days, and the water then dropped back to usual levels. Again, almost a month later on June 17, the water rose greatly, with much driftwood passing down the river. Entries dated June 19 and June 22 respectively describe the river as "amazingly high" and "uncommonly high". No further mention is made of high water, but Fort Chipewyan journals record that the current on Lake Mamawe was so strong in early July that fishery nets had to be raised and that the hay in the meadows along the Rivière des Rochers was very scarce, usually a reliable indicator of very wet conditions.

Records are absent for the 1843 breakup period at Fort Vermilion, but Fort Chipewyan entries do not indicate any flooding around the fort. Water levels rose throughout May and early June, but hay along the Rochers was reportedly of good quality in July, suggesting that no notable flooding occurred.

In 1844, yet another early breakup and summer high water event occurred. At Fort Vermilion, the ice broke up on April 24 and the river in front of the fort was clear by April 26. By May 14, the river was as low as it had been the previous fall. An entry dated May 26, however, states "The River rose suddenly to an amazing height -- surely this cannot be the flood!" It is unclear whether any flooding resulted from this apparently early mountain discharge, as summer records for both Vermilion and Fort Chipewyan are incomplete. In July, however, a great scarcity of hay is reported in all meadows of the Quatre Fourches, the Rochers and "the Little

¹⁶ B39/a/40 fo. 76, Fort Chipewyan Post Journals.

River".¹⁷ The summer of 1844 may have been cool and wet, as reflected in periodic rises and falls in water levels both on the Peace River and in Lake Athabasca.¹⁸

No Fort Vermilion records are available for the spring and summer of 1845. At Fort Chipewyan no spring flooding is reported, although high water in many unspecified meadows in the area prevents haying later in the summer. The meadows behind the fort, however, remain dry.

1846 was a dry year in which no flooding was reported. No records are available from Fort Vermilion in 1847 and Fort Chipewyan journals make no mention of flooding, although entries dated May 14 and May 22 note that the Peace River is reported to be very high. No records are available from either fort for 1848.

Fort Vermilion journals are missing for 1849, but on May 27 two Peace River boats arrived at Fort Chipewyan after being "long detained by ice". It appears that some flooding may have occurred in consequence, as the hay meadows along the Rochers are reported flooded in July, with no grass. Hay was eventually cut at Child's River, which apparently escaped any serious flooding.

1850-1859

Records are absent at Fort Vermilion for the period 1850-1863, so any analysis of water levels must be based solely upon post journals from Fort Chipewyan. No mention is made of flooding in 1850 or 1851, but in 1852 an entry dated July 25 notes that the haymakers on the Rivière des Rochers are working in water up to their ankles, and that hay is very scarce.

No flooding occurred in 1853, but high water was a problem in the summer of 1854. There is no record of breakup conditions on the Peace River, but flooding seems to have taken place on the delta in late June. An entry dated July 1 records that "this is the eighth day we have heard from our fisherman the water has attained a most unusual height". On July 19, a group of men sent to look for hay returned to say that the "prairies" were entirely flooded, and that no hay was available to cut, except along the Rochers.

Post journals at Fort Chipewyan are missing for the spring and summer of 1855, and available entries begin in September of that year. Haying, however, was not finished until November 5.

¹⁷ The "Little River" referred to may be either the Revillion Coupé or one of the un-named arms of the Chenal des Quatre Fourches.

¹⁸ Apart from smaller fluctuations in lake levels noted in post journals, Lake Athabasca rises considerably on August 7, and the current on the Quatre Fourches and Rochers rivers reverse to carry Peace River discharge into the lake.

The reason for this unprecedented late finish is uncertain, but records indicate the cutting crew had difficulty finding enough grass to cut.

There is no indication of abnormally high water in 1856, but in May of 1857 the Peace River boats arrived at Fort Chipewyan after having been detained at the Four Forks for a few days by flooding which overflowed the banks of the Quatre Fourches River. The water along the Quatre Fourches continued to rise through the last half of May and at least until the second week in July.

In 1858, spring breakup appears to have progressed uneventfully and no summer flooding was reported. In July of 1859, however, water was reported to be too high for haymaking in all the usual haygrounds. An entry dated August 3 records "Old Jeanvenne in search of some spot not under water to begin hay making, says that water begins to fall or lower gradually expect to be able to commence mowing soon".¹⁹

1860-1869

No records are available for Fort Vermilion from 1860 to 1863 and 1866 to 1868, or for Fort Chipewyan from 1862 to 1864. There is no indication in the Fort Chipewyan journals of high water in 1860. In 1861, spring breakup took place on the Peace River sometime before May 13, and the Peace River boats arrived at Fort Chipewyan on May 23. Some difficulty was experienced later in the summer due to high water, however, when grass was reported to be very sparse and all the haygrounds flooded.²⁰

The 1864 Fort Vermilion post journal makes no mention of excessively high water, and the river in front of the fort was clear within a week after breakup. Journal entries for the spring of 1865 at Fort Vermilion are missing, but breakup on the Peace River appears to have taken place in early May. No mention is made of flooding at Fort Chipewyan. A protracted series of breakups may have taken place along the Peace River and into the mountains, as June entries at Fort Vermilion record a series of sharp rises and falls in water levels on the Peace, but make no mention of flooding.

There is no indication of flooding on the delta from 1866 to 1869. Although high water was reported in 1867, in general, water appears to have been lower than in the preceding years, causing high mortality in the muskrat population in 1866 when many were frozen to death.

¹⁹ B39/a/44b fo. 38, Fort Chipewyan Post Journals.

²⁰ B39/a/44b fo. 90, Fort Chipewyan Post Journals.

1870-1879

There is no evidence of an ice jam on the Peace River in 1870, but there does appear to have been some localized flooding along the Quatre Fourches which may have been exacerbated by the rapid spring thaw reported in the Fort Chipewyan post journal that year. An entry dated May 7 indicates that the water on the Peace River is reputed to be very high; later entries record that an unnamed channel leading to Quatre Fourches was blocked by ice and again that the Peace River boats were stranded for about a week in the "little river" by ice. In July, the Fort Chipewyan haymakers could not find any hay along the Quatre Fourches due to high water, but were able to find enough for livestock on the Rochers.

No flooding occurred in 1871, and, although Fort Vermilion records are absent for 1872 and 1873, no problems were reported at Fort Chipewyan in those years. There is the possibility that some flooding occurred in 1873, although its extent and cause remains uncertain. The ice on Lake Athabasca began to thaw a great deal in mid-April, and since the Peace River usually broke up at least two weeks prior to any significant melting on the lake, the Peace could reasonably have been expected to have broken up in early April. No mention is made specifically of the Peace River in the Fort Chipewyan accounts, but water levels on the lake rose steadily throughout the summer months, and water levels in the usual haying grounds along the Quatre Fourches and Rochers rivers remained "far too high" through July and August for any hay to be cut.

Again, Fort Vermilion records are absent for 1874 and 1875, but a quick spring thaw and an ice jam took place in 1874, when the recorder at Fort Chipewyan notes that the Peace River boats were delayed by ice, probably at the Vermilion chutes near Red River (Fig. 2). Another flood occurred at Fort Vermilion in 1876, when the free traders living on the island in front of the fort were forced to evacuate and move their possessions to the roof of their house. In an entry dated May 9, the recorder speculates that the cause of the flooding was probably "a jam up the river". Gerard and Karpuk (1979) state that the level of the Peace River during this event rose to 11 metres above "normal", or the zero discharge stage. Interestingly, there is no mention of the effects of this flooding being felt at Fort Chipewyan, and no problems were reported in obtaining hay.

In 1877, no problems with ice were reported on the Peace River, but August journal entries at Fort Chipewyan report that the men were blaming poor hay returns on the wet state of the hay and deep water in the hayfields. The summer of 1877 appears to have suffered greater than usual precipitation, and it is possible that this caused localized flooding along the Quatre Fourches and Rocher rivers. No flooding was reported at either fort in 1878 and 1879.

1880-1889

The Peace River does not seem to have flooded in 1880 and 1881, although high water was reported in the Athabasca River in 1880. In 1882, water on Lake Athabasca rose and fell several

times through June and July, and the hayfields along the Quatre Fourches and Rochers rivers were too wet to cut any hay. Notably, this seems to have been a windy season, and the lake often rose and fell in response to high winds from the east or northeast. It is possible that, if water levels during the 19th century were higher than present levels, an easterly wind piling up water in the northwestern part of the lake could have been sufficient to flood areas bordering the lake.

There is no indication of any flooding on the delta between 1883 and 1885. In 1886, however, there was an ice jam of unknown size at Vermilion chutes. Although the Peace River at Fort Vermilion was clear of ice by April 26, men returning from Red River were forced to leave their scow "above the chute" as it was rendered impassable by ice. There is no mention, however, of whether flooding resulted. Similarly, there is no mention of flooding in the spring and summer of 1887. However, there is some evidence for high water in the area around Peace Point. This was the location where the hay for Fort Vermilion livestock was traditionally stored, and an entry dated April 18 notes that the haystack was standing in about a foot of water.

According to Gerard and Karpuk (1979), heavy flooding occurred throughout the delta in 1888. No records are available for this year from Fort Vermilion, but the Fort Chipewyan post journals and District Reports record very high water on the rivers and lakes surrounding the fort throughout the spring and summer. By May 16, 1888, the level of Lake Athabasca was rising fast due to the great inflow of water from both the Quatre Fourches and Rochers rivers. Frequent mention is made of the strength of the current and the speed with which the water is rising. On May 18, the recorder notes that little ice is coming from the Rochers, but large amounts are entering from the Quatre Fourches, and the water level is beginning to drop quickly. By July, however, the water has begun to rise again, so that by July 10, Lake Athabasca was higher than the local Natives had ever seen it. It should be noted that this appears to have been a wet summer, with frequent rains. No flooding was reported in 1889, and the spring breakup seems to have been characterized by a protracted thaw. On May 20 the Athabasca River was reported to be very low, and the remainder of the spring and summer was warm and dry.

1890-1899

No mention of flooding is found in Fort Vermilion and Fort Chipewyan journals between 1890 and 1893. In 1894, an ice jam occurred near Fort Vermilion, but it does not appear any flooding resulted. Ice was forced up over the bank and water came within three feet of the top, but the ice began to move again before it could spill over.

From 1896 to 1899, water levels were generally high, although the degree of inconvenience or flooding suffered is unclear. In 1896, heavy spring discharge from the Peace River into Lake Athabasca appears to have turned into summer high water without the usual early July decrease in between. Water on the lake overtopped the pier at Fort Chipewyan, and some difficulty was encountered in finding a dry spot to cut hay. Similar difficulties were encountered in 1898 and 1899, but no specific mention of floods is made.

1900-1909

Flooding occurred over much of the delta in April of 1900, although it is not certain that an ice jam was involved. The ice broke up on April 14 at Fort Vermilion, but remained jammed until the 17th.²¹ It began to move again on the 18th, and drifted for about 5 days. Very heavy rain fell on April 24 and 25, but no further mention is made of high water at Fort Vermilion. Driftwood and ice entering Lake Athabasca from the Peace River was recorded at Fort Chipewyan on April 27, and water rose steadily. On the 29th, Natives coming to Fort Chipewyan reported that the Peace River was so high that water was passing over Pointe Providence and overflowing the Quatre Fourches River and Lake Mamawe.²² Water continued to rise throughout May, and on May 10 an incoming scow reported much damage from high water at Athabasca Landing and Grand Rapid.²³

Water appears to have continued high throughout the summer of 1901, but no mention of difficulty owing to high water appears in post journals for either Fort Vermilion or Fort Chipewyan in 1902. In 1903, water in Lake Athabasca and the Athabasca River is reported very low.

In 1904, flooding occurred on the upper Peace River. At Fort Vermilion, breakup occurred on April 17, although the ice soon stopped moving. By April 22, it was drifting thickly past the fort, and by the 23rd the Peace River was falling off. Large quantities of driftwood entered Lake Athabasca throughout May, although the very high water levels on Lake Athabasca began to decline early in the month. On June 7, however, the recorder notes "Piles of drift wood still floating past which means that somewhere up the Peace River there must have been an ice jamb [sic]."²⁴ Furthermore, the trader stationed at the Jackfish outpost had to leave the area in a hurry due to overflow of the river. The theory of an ice jam being responsible for the flooding is supported by the fact that water on the Athabasca River was reported to be very low at this time.²⁵ On June 13, the recorder notes that "Mr. John Sutherland arrived from Red River ... He reports that quite a bit [of] damage has been caused by Peace River overflowing its banks on the upper Peace. Houses and Animals has been swept away ...".²⁶ At Peace River Landing, most

²¹ Ice at Fort Vermilion often remained stationary for up to a week after initial breakup, with no resultant flooding reported.

²² B39/a/60 fo. 85, Fort Chipewyan Post Journals.

²³ B39/a/60 fo. 89, Fort Chipewyan Post Journals.

²⁴ B39/a/63 fo. 24 Fort Chipewyan Post Journals.

²⁵ B39/a/63 fo. 24, Fort Chipewyan Post Journals.

²⁶ B39/a/63 fo. 24, Fort Chipewyan Post Journals.

of the first consignment of fur returns for the westernmost posts in Athabasca district was "utterly lost".²⁷

Water levels on Lake Athabasca and the rivers entering it are generally low the rest of the decade, and frequent mention is made of difficulty navigating scows along the Athabasca River for this reason.

Historical Evidence & Dendrochronology

In an attempt to correlate written evidence with scientific data, historical records were compared to a dendrochronology established for trees on Lake Athabasca.²⁸

Prior to 1821, historical records are incomplete and no comparison could be made. Apart from the ice jam that occurred at Fort Vermilion in 1826, written evidence indicates that water levels on the delta were low. For the first part of this decade, the PAD dendrograph (Fig. 3) is in general agreement, showing water levels on Lake Athabasca to be below 690 feet above sea level. However, an upward trend on the graph from 1826 to 1829 is unsupported by historical data, which reports difficulty in navigating on some of the rivers surrounding the delta due to the low state of the water.

Historical evidence also contradicts dendrochronological evidence for much of the 1830s. The PAD graph indicates steadily declining water in Lake Athabasca throughout the decade, but post journals make frequent reference to both high spring and summer water levels and flooding on the prairies of the delta. Similarly, dendrochronology for the 1840s suggests that water levels on Lake Athabasca declined steadily until 1844, when they began to rise slowly again. Post journals do record a very dry year in 1846, but indicate that high water and summer flooding occurred in most other years throughout the decade.

A sharp peak on the dendrograph for the year 1853 may correspond with historical records which report deep water on the delta in 1852. Although records for the rest of the decade are incomplete, flooding along the Quatre Fourches River is also reflected in a peak on the dendrograph for 1857.

Historical accounts generally agree with the dendrochronology for the 1860s. Both indicate that the water on Lake Athabasca was high in 1862, but dropped steadily to extremely low levels by

²⁷ B39/a/63 fo. 25, Fort Chipewyan Post Journals.

²⁸ The Peace-Athabasca Delta: A Canadian Resource. *Summary Report* (1972), prepared by The Peace-Athabasca Delta Project Group. Annual growth rings were examined from trees growing on the levees of the major Delta rivers, although the report does not indicate which rivers specifically.

1867. However, high water events through much of the 1870s are not supported by the PAD dendrograph, which shows lower than usual water on Lake Athabasca for most of the decade.

Post journal reports of high water in 1882 are supported by sharp peaks on the dendrograph. However, high water in 1880 and heavy flooding documented in 1888 are not indicated on the graph.

Historical accounts agree closely with dendrochronological data for much of the period from 1890 to 1909. Both suggest low water levels on the delta from 1890 to 1895. On the graph, a summer peak in the level of Lake Athabasca to approximately 692 feet above sea level corresponds with historical accounts of heavy spring runoff and high water all summer. Sharp drops on the graph from 1897 to 1899, however, are unsupported by historical journals.

In 1900, high water is indicated both by a sharp peak on the PAD dendrograph to about 695 feet ASL and by historical accounts of flooding over much of the delta. Both also indicate high water in 1901, and the 1904 ice jam floods which caused so much damage on the upper Peace River are also indicated by a rise on the graph. In 1908 and 1909, however, the graph indicates high water in Lake Athabasca, while post journals record lower than usual water on the major rivers of the delta and corresponding difficulty in navigation.

19th Century Muskrat Returns

The number of muskrat furs returned each year to HBC headquarters in London are illustrated in Figure 1. As previously noted, although returns for both Fort Chipewyan and the entire district are given, district returns are provided for comparison only and should not be considered reflective in any way of muskrat populations on the Peace-Athabasca delta. The delta makes up only a very small portion of Athabasca District and muskrat fluctuations on the delta would not necessarily be reflected in the rest of the district.

A great many factors affected 19th century muskrat returns, many of which were not related to the actual size of the muskrat population on the delta, and any conclusions should therefore be drawn cautiously. The most significant of these mitigating factors are summarized as follows:

a. Yearly supply of trade goods (indent)

At each trading post, furs could only be obtained in exchange for goods desired by the hunter. Each year, the chief trader at the post requested an allocation or *indent* of goods to be supplied by the London office of the HBC for use in trade. The request was sent out at least a year in advance with the fur returns from each post, with the expectation that the goods would be received the following year. Obviously, the difficulties imposed by the geography of the region, the harsh climate (and correspondingly short transportation season) and the distances that had to be travelled were considerable, and chief traders often complained that their outfit was

insufficient or had arrived late in the season, adversely affecting their ability to obtain furs in trade. In such cases, Native hunters would simply take their furs to another post. Such shortages of trade goods were more problematic prior to the amalgamation of the Hudson's Bay and North West companies in 1821, as there was no way to ensure that the furs would not be taken to the competing company. In general, when trade goods were scarce, the number of furs taken in -- including muskrat -- suffered.

b. Overhunting

Many species of fur-bearing animals appear to have suffered greatly from overhunting. This was less a problem for muskrat than beaver, whose numbers declined steadily throughout the 19th and 20th centuries. However, the intensive hunting that decimated the beaver population can also be demonstrated to have had an indirect effect upon the number of muskrat harvested each year.

It appears that hunting practices on the Peace-Athabasca delta in general became more intensive in the early 19th century. In 1821, District Manager William Brown blamed the overhunting that had occurred on Iroquois hunters brought into the region by the North West Company in the years 1790 to 1795.²⁹ The Beaver Indians, previously the primary group of hunters occupying the area, had been careful to maintain a breeding population of beaver by always leaving two young in each lodge and by never killing pregnant females. The Iroquois, however, practiced no such restraint, and according to Brown, the beaver population in the entire district was largely extirpated in the space of 30 years.³⁰ At the same time, Chipewyans in the area were becoming more accomplished hunters of beaver, and fewer animals escaped to breed again. As beaver populations declined, hunters turned their attention to other small fur-bearers, and muskrat returns rose accordingly. Therefore, a rise in the number of muskrat furs does not necessarily indicate an increased abundance of these animals, simply more intensive hunting.

c. Natural population controls

Disease periodically affected animal populations in the 19th century as now. Although no specific mention is made of disease among muskrats, several recorded distemper epidemics affected the beaver population. As with a reduced population due to overhunting, this forced hunters to rely more heavily upon muskrats. This would initially have been reflected as a rise in the number of muskrat furs taken in by the post.

The relationship of Muskrat populations to water levels has long been recognized. In 1821, William Brown noted that their numbers "depend entirely upon the state of the Lakes and Rivers

²⁹ B39/e/3 fo. 9, Athabasca District Reports.

³⁰ B39/e/3 fo. 9, Athabasca District Reports.

-- For when the water is high for a few years they become very numerous, but when low they entirely disappear".³¹ Poor hunts were also recorded in years when winter water levels were low and temperatures severely cold, as the animals were more susceptible to freezing and predation. Such an event was recorded at Fort Chipewyan in 1825, when chief trader James Keith attributed the "almost entire failure of [the] spring hunts in [Musk]Rats ... to a combination of the peculiar state of the Ice & water & the annoyance from the Foxes & wolverines".³²

d. Competition and conflict among hunters

Prior to amalgamation in 1821, rival trading companies actively attempted to undermine their opposition, often by offering higher prices for furs. Theft of furs was not unknown, and a comparative discussion of returns for the years 1815 to 1820 indicates that the 7 packs of furs constituting the entire 1816 Outfit of the Hudson's Bay Company were confiscated that year by the North West Company.³³ The HBC was not always on the losing end of such rivalry, however; in 1821, James Keith recorded that the previous year many Native hunters who had been loyal to the North West Company switched their allegiance to the Hudson's Bay Company after a dispute with the NW Co., and fur returns could be expected to have risen accordingly³⁴. As late as 1888, the establishment of rival independent traders in close proximity to HBC posts was being blamed for reduced fur returns.³⁵ After 1889, little or no opposition existed in the Athabasca District, and HBC profits increased.³⁶

Even after amalgamation in 1821, individual HBC posts encountered competition from other HBC posts. Although strictly discouraged by the company, some degree of rivalry appears to have existed between individual chief traders, apparently to the detriment of business as a whole. In 1821, George Simpson accused John Clark, the HBC representative at Isle à la Crosse, of unfair trade practices, complaining that he "has done us more injury than the No. West. Co. -- he has withdrawn nearly all the valuable hunters to the other side of Portage La Loche by his lavish

³¹ B39/e/3 fo. 9, Athabasca District Reports.

³² B39/e/8 fo. 4, Athabasca District Reports.

³³ B39/e/3 fo. 22, Athabasca District Reports.

³⁴ Accurate accounts of fur returns were not kept for Outfit 1820, preventing comparison with 1819 returns. However, any gains made in 1820 would have been offset by a measles epidemic the same year which killed many Native hunters.

³⁵ B39/e/13 fo. 4, Athabasca District Reports.

³⁶ B39/e/20 fo. 1, Athabasca District Reports.

expenditure, and is in every respect a more formidable opponent than our avowed Enemies ...".³⁷ Such rivalry would have been reflected in decreased muskrat returns at Fort Chipewyan.

Conflict also arose between different groups of hunters. The promise of remuneration for furs enticed many Native groups to leave their traditional hunting territories and placed them into more frequent contact with other groups with which they were not always friendly. Encounters between these groups sometimes had fatal consequences. In his Report on the District for 1823, Chief Factor James Keith refers to November 1823 murder of five Hudson's Bay Company employees by a group of Beaver Indians, and subsequent confrontations between the Beaver Indians and the Chipewyans or "Caribou Eaters".³⁸ Tensions between the two groups greatly affected fur returns that year, as the Chipewyans, apprehensive of further encounters, all but suspended their hunting activities. The next year, Keith reported again that the Chipewyans were absent most of the season due to a desire to remove themselves from the proximity of the Beaver Indians.³⁹

e. Illness among hunters

Europeans brought many previously-unencountered diseases to the New World, and mention of illness and disease -- often widespread -- among Natives occurs fairly frequently in 19th century post journals. Sick individuals would have found their ability to hunt impaired at best, and infection by diseases for which they had no immunity often led to death. Obviously, fur returns would have suffered accordingly.

Although game appears to have been plentiful on the delta in recent memory, starvation was also a problem throughout the 19th century, and hunters and traders alike often had difficulty obtaining enough food to subsist on. In 1888, James McDougall reported "serious starvation" among the Native population at Fort Chipewyan; many died, and few collected furs.⁴⁰

Conclusions

Hudson's Bay Company records kept throughout the 19th century give an indication of when spring and summer high water events occurred on the Peace-Athabasca Delta. Using these historical accounts, flooding attributed to ice jams along the Peace River can be identified in the years 1874, 1876, 1886, 1894 and 1904. Spring floods, possibly the result of ice jams on the

³⁷ B39/e/1 fo. 7, Athabasca District Reports.

³⁸ B39/e/8 fo. 4, Athabasca District Reports.

³⁹ B39/e/9 fo. 9, Athabasca District Reports.

⁴⁰ B39/e/13 fo. 4, Athabasca District Reports.

Peace, have been identified in 1842 and 1887. Spring floods due to ice jams on the Chenal des Quatre Fourches occurred in 1805, 1838, 1857 and 1870, while ice jams of unknown severity that detained boats between Fort Vermilion and Fort Chipewyan took place in 1849 and 1900. It is not known which river the latter two events occurred on.

Summer flooding appears to have played a significant role in the rejuvenation of water on the Peace-Athabasca delta. Research undertaken for this study supports, in part, the findings of the Peace-Athabasca Delta Study Group, which stress the importance of summer flooding in the recharging of the delta's groundwater system, ponds and marshes.⁴¹ Although the role of summer flooding in filling perched basins on the delta is not clearly indicated by the historical evidence examined, it is obvious that repeated summer floods played a major role in raising water levels on the delta and had a measurable effect upon both plant and animal biota. Summer flooding on the delta was recorded in the following years: 1826, 1832, 1835, 1836, 1838, 1840, 1841, 1854, 1859, 1861, 1873, 1877, 1882 and 1888. Further indirect evidence for summer flooding was noted in 1844, 1852 and 1855.

The correlation between documented years in which high water occurred and a dendrochronology prepared by the PAD study group is best in the latter part of the 19th century. Overall, agreement exists in most years in which the very highest summer floods were recorded. Years in which ice jams occurred tend not to be represented on the dendrograph, possibly because years in which spring flooding took place were not always accompanied by summer high water.

Muskrat returns are not recommended as an indirect indicator of water levels on the delta. Many variables, often unrecorded, affected the yearly sales in these pelts, and could easily lead to a skewed impression of the general muskrat population in the Athabasca district.

Sources Consulted

Primary Sources

Hudson's Bay Company Archives

A/11	London Inward Correspondence
A/50/1-15	Abstracts of Fur Returns
A/74	Annual Reports on Fur Trade
B39/a/1 - B39/a/68	Fort Chipewyan Post Journals, 1805 to 1910

⁴¹ The Peace-Athabasca Delta: A Canadian Resource. *Summary Report* (1972), The Peace-Athabasca Delta Project Group, p. 24.

- B224/a/1 - B224/a/31 Fort Vermilion Post Journals, 1826 to 1910
- B44/a/1 - B44/a/2 Colville House Post Journals, 1818 to 1821
- B335/a/1 - B335/a/3 Red River Post Journals, 1875 to 1887
- B39/d/1 - B39/d/148 Fort Chipewyan Account Books
- B39/e/1 - B39/e/25 Reports on Districts, Fort Chipewyan
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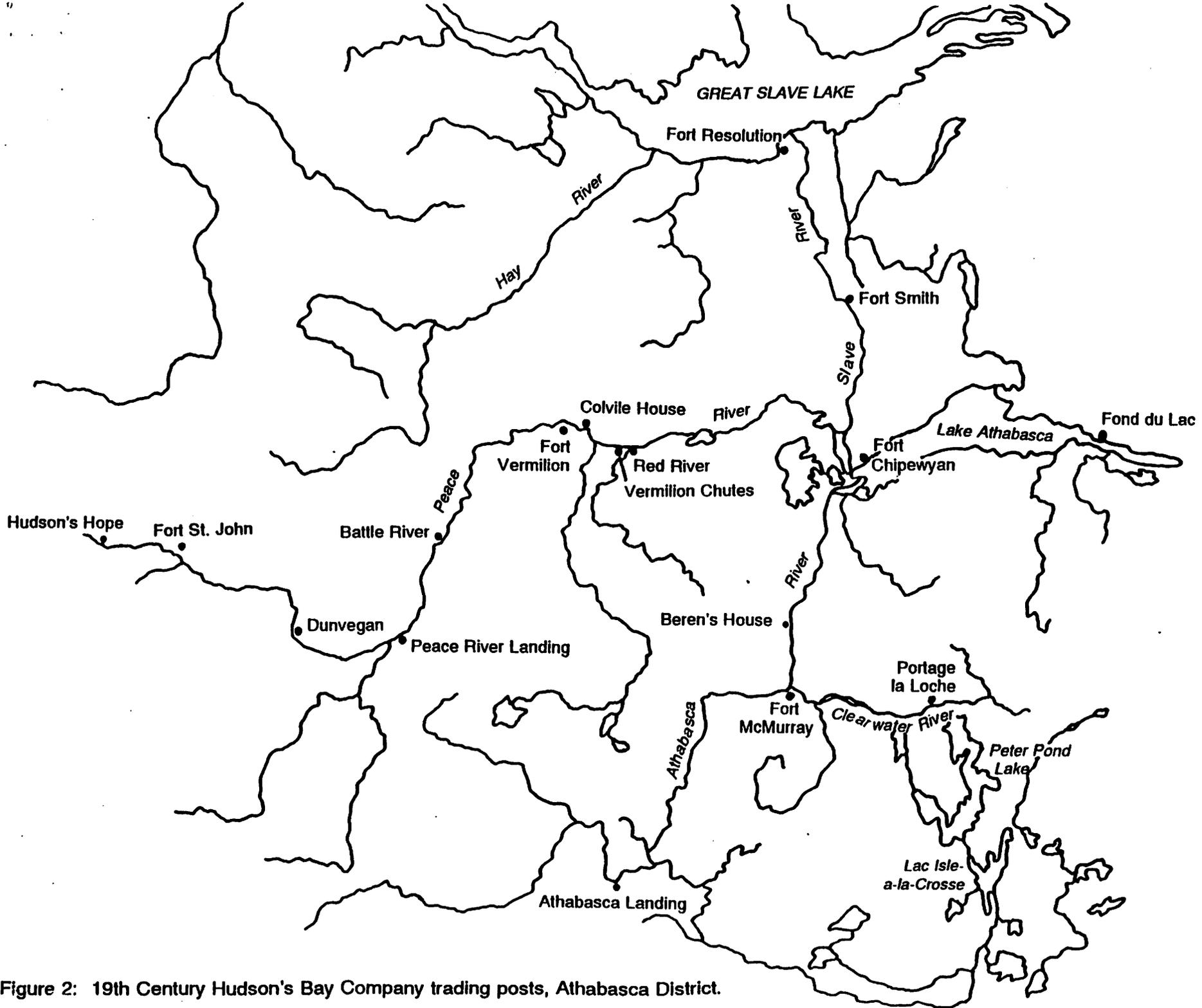


Figure 2: 19th Century Hudson's Bay Company trading posts, Athabasca District.

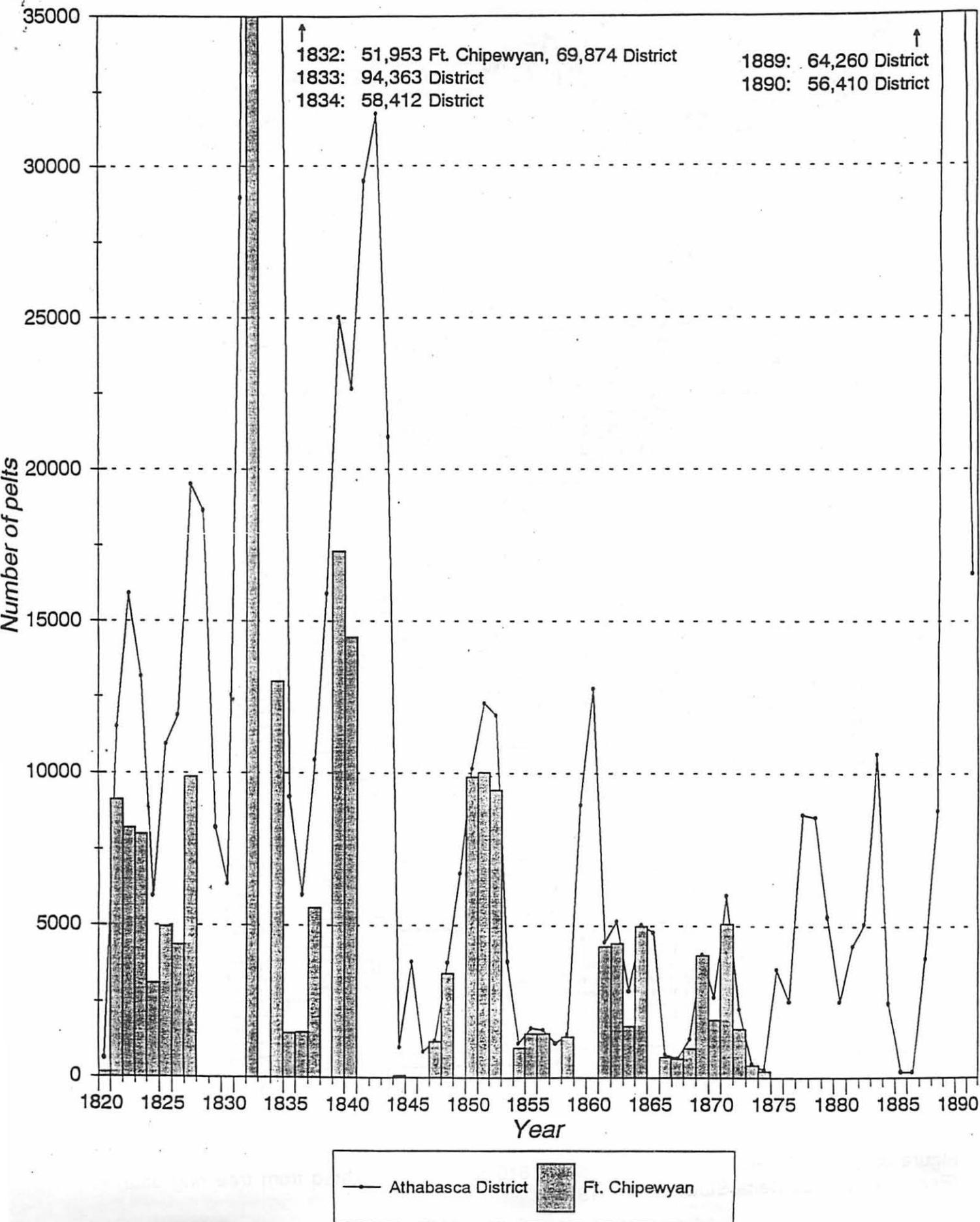


Figure 1: 19th Century Muskrat Returns, Athabasca District

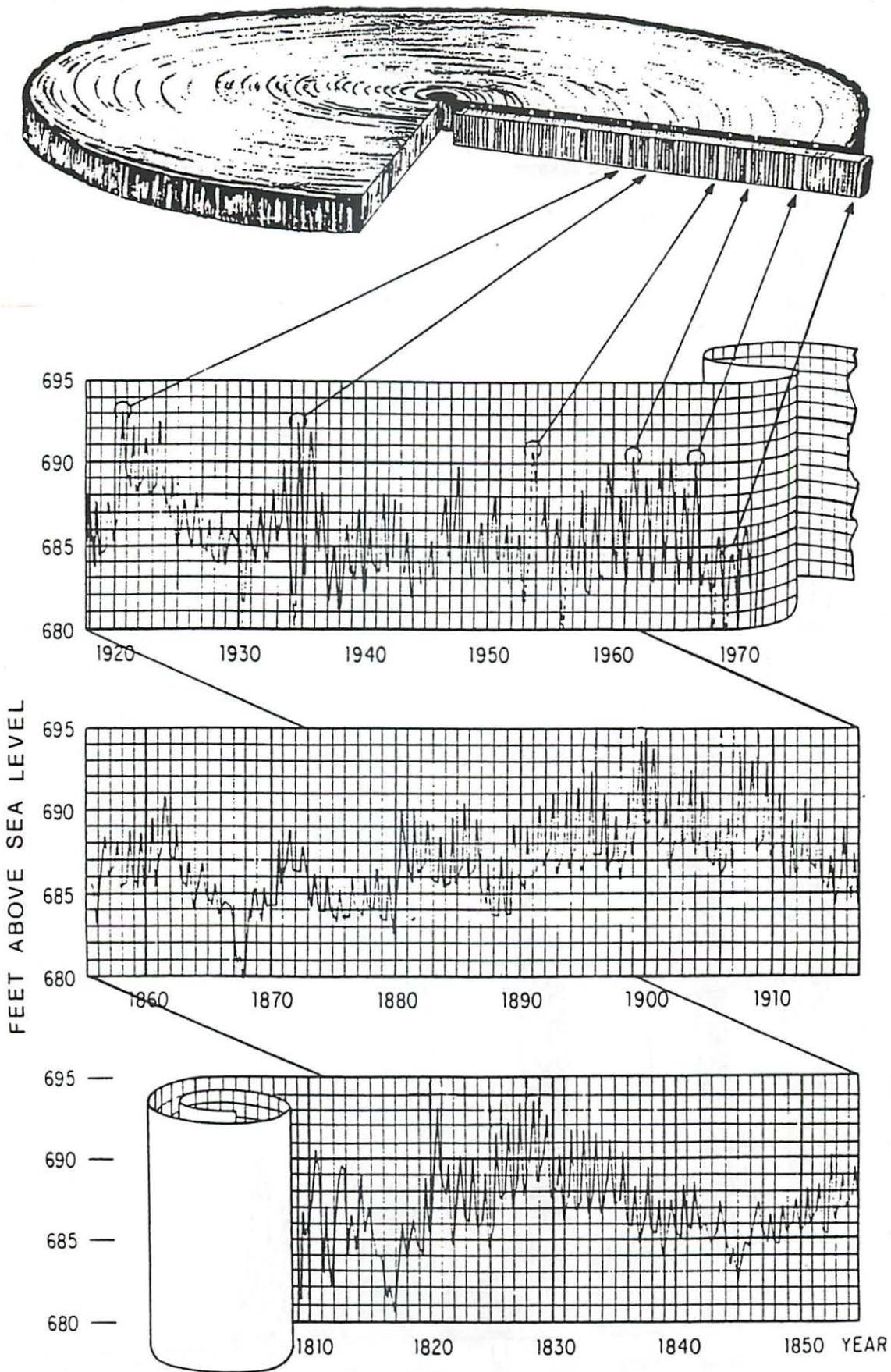


Figure 3: Water levels of Lake Athabasca, 1810 to 1970, estimated from tree ring data (Peace-Athabasca Delta Study Group, 1972).

Historical Services
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15/11/93

Dear Murray,

Enclosed is your completed report on water levels on the Peace-Athabasca delta. I think I've exhausted pretty much all the possible sources, with the exception of George Simpson's Correspondence Inward. Since the District Reports were so incomplete, I was using these as a way of identifying reasons for fluctuating muskrat returns, but due to time constraints I've only read through to the 1830s. I'd suggest that if you see inexplicable fluctuations in any years after that that you want examined, let me know and I'll continue to pursue this source.

I haven't had the chance to talk to Terry Prowse about any of this yet. Unless you have any objections, I'd like to send him a copy for his comments.

I hope this will be helpful to you. My final impression after completing the research is that summer high water played a very definite role in flooding the delta on a near-annual basis, ice jams or not. I don't quite know if this agrees or disagrees with the other information you're presently getting, but it comes through in the historical record quite strongly.

Let me know if there's any other information you want looked up ... it's been a pleasure working with you!

Regards,

Sharon

