THE STATUS OF MUSKRATS IN THE PEACE-ATHABASCA DELTA, WOOD BUFFALO NATIONAL PARK

BC Hydro and Parks Canada

Final Report

Richard Wiacek, M.Sc.
Dave Westworth, M.Sc., P. Biol.

Westworth Associates Environmental Ltd.
Chetwynd, British Columbia
Edmonton, Alberta

October 1999

EXECUTIVE SUMMARY

Muskrat house and pushup surveys were conducted in January and February 1999 in the Peace-Athabasca Delta (jurisdiction of Wood Buffalo National Park) to determine the ability of muskrats to recolonize perched basins following a prolonged period of drying. Perched basins in the delta have been drying since about 1975, however, ice-jams on the Peace and Athabasca Rivers in 1996 and 1997 caused substantial flooding that re-watered numerous basins. Historical data indicate that muskrat populations reached a peak in Wood Buffalo National Park in 1976 in response to flooding on the Peace and Athabasca Rivers, but then declined to a low level in 1978 because of drying of perched basins and loss of suitable habitat. In 1999 mid-winter ground surveys in 24 basins determined that the number of muskrat houses in selected basins was similar ($p = 0.655$) to the number occurring in identical basins during the peak year of 1976, and significantly greater ($p = 0.026$) than the low year of 1978. These results suggest that muskrats can quickly recolonize basins following a prolonged period of drying and that the fall (1998) muskrat population in some parts of the delta was high.

Although muskrat populations were likely high in the fall of 1998, the over-winter survival of muskrats in the Peace-Athabasca Delta in 1999 is unknown (although the proportion of houses active in mid-winter is high). This information is required to determine the ability of muskrats to recolonize basins following a prolonged period of drying. Because of the extended drying period, recently flooded basins may not yet support a sufficient standing crop biomass of aquatic vegetation to provide an adequate winter food supply for muskrats that have recently recolonized these sites. Consequently, over-winter survival of muskrats in the delta may be low. To fully understand the response of muskrats to prolonged drying of the delta, further surveys are recommended.

ACKNOWLEDGMENTS

This project was generously funded by BC Hydro. Numerous individuals provided valuable assistance throughout this study. Alan Chan-McLeod (BC Hydro) initiated project development and, in association with Ed Hill (BC Hydro), was responsible for overall project management. Lou Comin, Chuck Blyth, Charlie Ristau, Jonah Mitchell and David Poll of Parks Canada provided informative comments on project methodology and objectives. Parks Canada graciously allowed the use of its transient house in Fort Chipewyan during the field component of the study. We thank Jonah Mitchell (Parks Canada) for his hospitality in Fort Chipewyan, as well as for taking the time to accompany us during several basin surveys. Willie Coutereille (Parks Canada) also provided us with assistance in the field. Special thanks are extended to Sonny Flett (Metis Association) for insightful discussions on the importance of the Peace-Athabasca Delta to the First Nations, and for providing enthusiastic and ongoing support for the project. Finally, we are especially thankful for the knowledgeable field assistance provided by Fred (Jumbo) Fraser and George (GM) Martin. The project greatly benefited from their experience and guidance in the delta.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOGRAPHS

INTRODUCTION

1.1 Background

The Peace-Athabasca Delta, located primarily within Wood Buffalo National Park in northeastern Alberta, is one of the largest freshwater deltas in the world (Macmillan 1996). This complex and dynamic ecosystem is recognised as a Wetland of International Significance by the Ramsar Convention (1982) and as a UNESCO World Heritage Site (1983). The delta supports a wide variety of plant and animal species, both seasonally and year-round, and encompasses the traditional lands of the Mikisew Cree and Chipewyan First Nations (Macmillan 1996).

The ecological processes and traditional resource use within the Peace-Athabasca Delta are closely tied to a complex hydrological system. The delta ecosystem is dependent on seasonal and annual fluctuations in water level, which periodically recharge numerous lakes and perched basins. Perched basins contain a significant portion of the productive wetlands in the delta and, depending on their degree of connection to lakes and river channels, are classified as having restricted, severely restricted (isolated) or open drainages (Macmillan 1996). High water levels that cause overbank flooding are required to recharge severely restricted perched basins. Although flooding of the delta occurs irregularly, periodic flooding and drawdown ensures the production of large areas of marsh habitat (Ambrock and Allison 1972). Fluctuations in water level in the delta are dependent, in part, on high spring and summer flows along the Peace, Athabasca and Birch Rivers, which result from upstream snowmelt and rainfall (Macmillan 1996). Periodic flooding and drying of perched basins has provided suitable habitat for numerous wildlife species, including waterfowl and muskrats (*Ondatra zibethica*), which in turn have supported First Nations people.

Construction of the W.A.C Bennet Dam in northeastern British Columbia in 1968 altered the flow regime of the Peace River. Regulation of Peace River flows, in conjunction with natural declines in snow pack in tributary headwaters, have contributed to a protracted drying trend in the Peace-Athabasca Delta that began approximately in 1975 (Macmillan 1996). Drying of perched basins has negatively affected populations of waterfowl, muskrats, and other wetland wildlife on the delta.

During the initial filling of the Williston Lake reservoir between 1968-1971, the shoreline and water-surface area of perched basins in the delta were reduced by approximately 36% and 38% respectively (Macmillan 1996). During approximately the same time period (1966 to 1972), the muskrat harvest in the delta fell from 144,000 to 2,000 animals (Macmillan 1996), suggesting a large decline in the muskrat population. Following this decline, muskrat numbers increased between 1972 and 1976 in response to overland flooding on the Athabasca (1971) and Peace (1972 and 1974) Rivers, which recharged perched basins and restored normal water levels in basins (Ambrock and Allison 1972, Poll 1980). However, muskrat numbers declined between 1976-1979 as result of further drying of perched basins (Poll 1980). In the northern and eastern portions of the delta, where recharging of perched basins is directly dependent on overland flood events from the Peace River, the drying trend continued until 1996, and likely caused further reductions in muskrat populations. Drying has not been as prevalent in the southern delta because of the Embarrass River

breakthrough in 1982, which has recharged several basins south of Mamawi Lake (Alan Chan-McLeod personal communication).

Muskrat numbers fluctuate under natural conditions in response to variable water levels (Ambrock and Allison 1972), however, prolonged drought and drawdown of perched basins may have significant impacts on the ability of muskrats to successfully recolonize newly flooded areas (e.g., because of vegetation changes caused by drying). During 1996 and 1997, ice jams associated with spring break-up on the Peace and Athabasca Rivers caused substantial reflooding of the Peace-Athabasca Delta, including numerous perched basins that had been dry for an extended period of time (Macmillan 1996, Alan Chan-McLeod personal communication). Initial observations in 1998 by Parks Canada staff and local trappers indicated that muskrats had returned to a number of perched basins in the delta, suggesting that recharging of perched basins following a long period of drying may restore important wildlife habitat. To quantitatively assess the ecological response of the delta to rewatering, British Columbia Hydro and Power Authority (BC Hydro), in association with Parks Canada, initiated waterfowl nesting and staging surveys (spring/summer 1998) and muskrat surveys (winter 1998/1999) on selected perched basins. This report summarizes the results of winter muskrat surveys in recently flooded basins in the Peace-Athabasca Delta. The objectives of this report are to:

- Determine the ability of muskrats to recolonize perched basins in the Peace-Athabasca Delta (jurisdiction of Wood Buffalo National Park) following prolonged drying, and
- Provide information to assist in developing a long-term monitoring program and ecosystem management strategy for muskrats in the delta.

1.2 Previous Studies

Environment Canada conducted muskrat studies in a number of perched basins in the Peace-Athabasca Delta during the 1950's (Fuller 1951) and 1970's (Surrendi and Jorgenson 1971, Ambrock and Allison 1972, Smith 1974, 1975, 1976, Stelfox and MacGillis 1977, Poll and Stelfox 1978, Poll 1980). These studies examined habitat use and population trends in the three political jurisdictions of the delta (i.e., Wood Buffalo National Park, Chipewyan Indian Reserve, and the Province of Alberta). Westworth (1974) studied the ecology and population dynamics of muskrats in a single marsh (Egg Lake) in the Wood Buffalo National Park between 1970 and 1971. Poll (1980) provided a comprehensive review of muskrat monitoring studies on the delta between 1971 - 1979.

Poll (1980) summarized muskrat monitoring data collected from 37 basins in Wood Buffalo National Park between 1971 and 1979 using fall aerial and ground counts and spring activity tests. Data were collected on the relative abundance and winter survival of muskrats and compared to the changing hydrologic regime of the delta. Poll (1980) concluded that fluctuations in muskrat populations were directly related to changes in water levels in the delta between 1971 and 1978. Population estimates increased from 1971 to 1976 in response to overland flooding of the

Athabasca River in 1971 and the Peace River in 1972 and 1974, which increased the availability of emergent habitat in perched basins. However, following these floods, a combination of regulated Peace River flows and lower tributary runoff prevented further overland flooding into perched basins (until 1996), resulting in the gradual drying of muskrat habitat. Consequently, muskrat numbers declined between 1976 and 1979 as a result of declining water levels in perched basins and subsequent loss of emergent vegetation. In addition to the drying of perched basins, low lying areas of the delta were inundated with water (in part because of the construction of the Little Rapids Weir in 1976), which further reduced the availability of emergent habitat. These two factors, in addition to heavy trapping pressure in the winter of 1976/1977 and high population densities (which resulted in intraspecific competition for decreasing resources), likely led to the rapid decline in muskrat numbers in the delta. Following the last historical muskrat survey in 1979, it is assumed that the muskrat population in Wood Buffalo National Park has continued to decline in response to receding water levels.

1.3 General Muskrat Ecology in the Peace-Athabasca Delta

The primary shelters used by muskrats on the Peace-Athabasca Delta are houses and bank burrows (Fuller 1951, Westworth 1974). These shelters are used throughout the year, but are of critical importance during winter when food resources are limited. Houses may be built during the summer, however, the peak in house building occurs in the fall prior to winter freeze-up. Muskrats construct houses from emergent and submerged aquatic vegetation that is readily available in the vicinity of the building site (Photo 1). During the summer, houses are often built in relatively shallow water in association with preferred food items such as sweetflag (*Acorus calamus*), while sites with deeper water are selected in the fall. Fall/winter houses are often associated with sedge (*Carex vesicaria*), burreed (*Sparganium eurycarpum*) and bulrush (*Scirpus fluviatilis*). Winter houses provide thermal shelter and a stored food supply (Westworth 1974).

A portion of the muskrat population in the delta inhabits bank burrows instead of houses. Bank burrows are more common in basins or channels characterized by steeply sloping shorelines and poorly developed emergent vegetation (Fuller 1951, Westworth 1974). The winter survival of muskrats is closely associated with the use of pushups. Pushups are used by both house-dwelling and burrow-dwelling muskrats, but are used more extensively by muskrats inhabiting bank burrows (Fuller 1951, Westworth 1974). Pushups refer to the mounds of vegetation created by muskrats after the wetlands become ice covered (Photo 2). These structures are primarily composed of submerged aquatics, including water millfoil (*Myriophyllum exalbescens*) and pondweeds (*Potamogeton* spp.) (Westworth 1974). Their primary function is to provide breathing holes, enabling muskrats to extend their feeding radius under the ice. During the winter, muskrats also use pushups as shelters.

Muskrats are primarily herbaceous and consume a wide variety of plant materials, depending on availability. At Egg Lake in the Peace-Athabasca Delta, Westworth (1974) reported that muskrats preferred sweetflag and burreed, followed by sedge and bulrush. The importance of submerged

plants, including millfoil and pondweed, as a food source was likely underestimated during the study. Submerged plants, including the roots and rhizomes of emergents, likely constitute a primary food source during the winter. Cattail (*Typha latifolia*) was almost absent from Egg Lake, but may be an important food source in other parts of the delta where it is more common.

Muskrats are monogamous and territorial, and family groups remain together throughout the winter until the beginning of the next breeding season (Westworth 1974). At Egg Lake, Westworth (1974) indicated that muskrat families occupied a relatively limited area within 50 m of a nest house in early summer. Following the birth of the second litter, this area was expanded to include additional feeding areas. Family home ranges had an average minimum length of 130 m. At Egg Lake, breeding began in late April in response to the appearance of open water. Westworth (1974) indicated that fur trapping accounted for 50% of the annual muskrat production in trapped areas and was a principal source of muskrat mortality. Predation, disease and parasitic infection were not considered significant sources of mortality, although predation could be important during periods of low water levels.

Receding water levels in Egg Lake between 1968 and 1971 reduced the amount of habitat available for muskrats (Westworth 1974). Muskrats were forced to relocate to deeper water, which resulted in intraspecific competition. Muskrats that did not relocate to deeper water were likely at risk of predation. Low water levels can also increase the probability of "freeze-out" during the winter, which can lower over-winter survival (freeze-out refers to complete ice formation in a basin that may force muskrats out of their shelters in search of food). Surrendi and Jorgensen (1971) indicated that the number of active muskrat houses in the delta increased with increasing total depth of ice and water. Heavy snow cover can also be beneficial to muskrats by reducing the rate of ice formation (Westworth 1974).

Photo 1. Typical muskrat house constructed from surrounding vegetation, Peace-Athabasca Delta, Wood Buffalo National Park, January 1999.

Photo 2. Muskrat pushup, Peace-Athabasca Delta, Wood Buffalo National Park, January 1999.

2.0 METHODS

The primary objective of this study was to determine the ability of muskrats to recolonize perched basins in the Peace-Athabasca Delta (jurisdiction of Wood Buffalo National Park) following a prolonged period of drying. This was accomplished by:

- Counting muskrat houses and pushups in selected basins in the delta and comparing these values to those collected in the 1970s prior to and during the drying period (Poll 1980),
- Comparing perched basins north and east of Mamawi Lake that have been dry for an extended period of time to those directly south of Mamawi Lake (e.g., Otter Lake) that have been periodically recharged by the Embarrass River breakthrough.

The study design was reviewed and approved by BC Hydro and Parks Canada. All necessary permits required to conduct research in Wood Buffalo National Park were obtained prior to the onset of the muskrat surveys.

Muskrat houses in the Peace-Athabasca Delta have been counted using both aerial and ground surveys (Ambrock and Allison 1971, Smith 1974, 1975, 1976, Stelfox and McGillis 1978, Poll 1980). Under suitable conditions (e.g., with suitable light and prior to heavy snowfall) aerial surveys, in combination with ground surveys, provide an effective means for surveying large areas of the delta (Photo 3). However, aerial surveys can underestimate the total number of houses in basins dominated by dense shrub and emergent vegetation because of difficulty in house detection (Photo 4; Poll 1980). Under these conditions, ground surveys provide a more reliable (but more time-consuming) count of muskrat houses (Poll 1980).

Aerial surveys of basins were initially planned in Wood Buffalo National Park to collect data from a large number of basins and identify important areas for more detailed ground counts. However, initial field observations revealed high variability in shrub and emergent vegetation cover in basins (e.g., Photos 3 and 4), therefore, ground surveys were favoured over aerial surveys. Consequently, surveys were conducted only on snowmobiles, which limited overall coverage of the delta but provided more reliable house counts. Aerial surveys can be incorporated into future surveys, if required, to locate clusters of houses in large lakes (e.g., Mamawi Lake, Lake Claire) that can be later surveyed from the ground.

Basins were selected for muskrat house and pushup counts using on 2 criteria: availability of historical data and overlap with current vegetation plots. Basins surveyed during the 1970s (e.g., Poll 1980) that were within snowmobiling distance of Fort Chipewyan were selected for muskrat house and pushup counts. This reduced the travel time to basins and maximized the number of basins that could be surveyed. In addition, several basins that are currently part of Parks Canada long-term vegetation monitoring program were also selected for monitoring. Parks Canada initiated long-term vegetation monitoring in selected perched basins in the Peace-Athabasca Delta in 1993 to examine changes in plant communities in response to changing environmental factors (e.g., prolonged drying of perched basins; Timoney 1996). Long-term monitoring of muskrats in these basins will help identify how changes in vegetation composition resulting from periodic basin

drying and flooding may affect muskrat populations. Basins with historical and vegetation data were identified on topographic maps and air photos to assist in identification in the field.

Ground surveys involved the use of snowmobiles to systematically search all areas of a basin for muskrat houses. Between 2 – 4 field staff systematically searched each basin. In addition to house counts, the total number of pushups on each perched basin was also counted to provide a complete index of muskrat activity in reflooded basins. All detectable muskrat houses and pushups were recorded in each basin. Muskrat houses and pushups were also examined to determine whether they were active or inactive. This involved probing houses and pushups with a "rat probe" consisting of a 1.5 cm diameter x 1 m long sharpened metal rod (Photo 5). Houses and pushups that contained a plunge hole and/or soft, unfrozen vegetation were considered active, and were marked with a stick for future reference (Photo 6). All houses and pushups in small basins were assessed for activity, while only a representative sample of shelters were examined in larger lakes and basins (e.g., Egg Lake). Assessing the proportion of active houses in a basin provides an estimate of muskrat survival (Ambrock and Allison 1972).

Photo 3. Under suitable conditions, muskrat houses are highly visible and can be readily counted using either aerial or ground survey techniques, Peace-Athabasca Delta, WBNP, January 1999.

Photo 4. Muskrat houses are occasionally built in dense willow shrubs and are difficult to detect during aerial surveys, Peace-Athabasca Delta, Wood Buffalo National Park, January 1999.

Photo 5. Testing a muskrat house with a "rat probe" to determine whether it is active or inactive, Peace-Athabasca Delta, Wood Buffalo National Park, January 1999.

Photo 6. Active muskrat house marked with a long stick, Peace-Athabasca Delta, Wood Buffalo National Park, January 1999.

3.0 RESULTS AND DISCUSSION

Muskrat surveys on the Peace-Athabasca Delta were conducted between 29 January and 6 February 1999. In total, 24 basins were surveyed (Figure 1) including 2 isolated drainages, 19 restricted drainages, and 3 open drainages (Table 1). Historical (1970s) survey data are available for 17 of the sampled basins, and long-term vegetation data are available for 11 of these basins (Table 1, Figure 1). Snow cover was relatively low during the survey period allowing for an accurate count of houses, however drifting snow on several basins made it difficult to accurately count pushups.

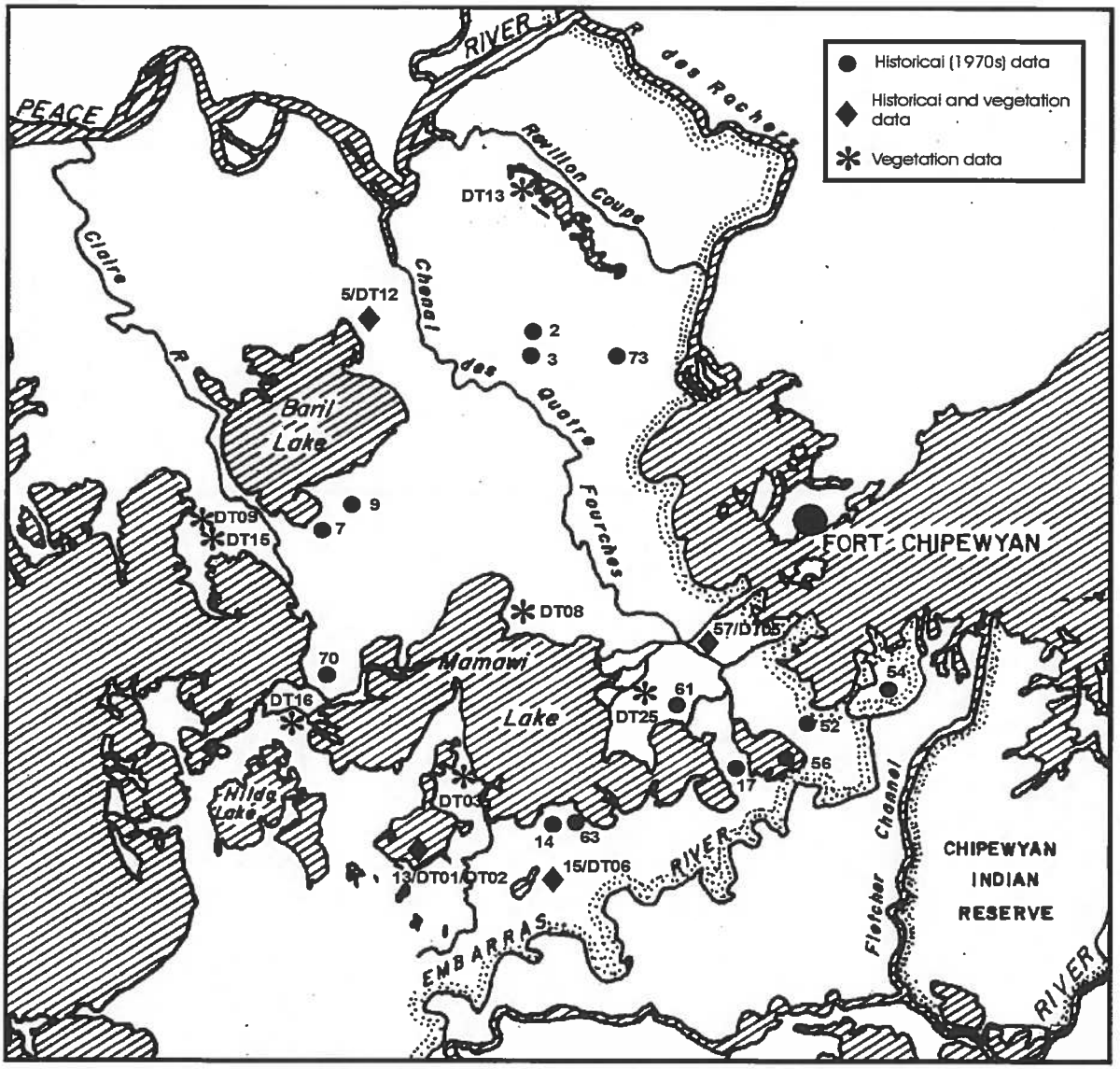

Figure 1. Approximate locations of muskrat house and pushup surveys in the Peace-Athabasca Delta, Wood Buffalo National Park, January – February 1999. Basins are identified according to historic (1970s) basin number and/or vegetation plot number (refer also to Table 1).

Table 1. Comparison of early winter muskrat house counts conducted in selected basins on the Peace-Athabasca Delta from 1973-1978 with muskrat house and pushup counts conducted in January and February 1999, Wood Buffalo National Park. Earlier surveys did not record the number of pushups.

Basin Number	Drainage[1]	Houses[2]							Pushups
		1973	1974	1975	1976[3]	1977	1978[4]	1999	1999
2	isolated	71	-	-	-	53	1	101	12
3	isolated	157	161	312	301	207	52	560	49
5/DT12[5]	restricted	52	237	167	153	42	10	55	33
7	restricted	266	96	64	97	58	5	130	37
9	restricted	43	91	86	214	57	22	1	34
13/DT01&02	restricted	185	52	54	83	51	34	202	320
14	restricted	35	31	29	18	25	18	54	50
15/DT06	restricted	34	47	32	21	36	10	159	227
17	restricted	43	48	75	92	140	124	190	5
52	restricted	-	-	110	70	74	47	41	0
54	open	-	-	216	200	188	95	12	0
56	restricted	-	-	53	22	93	35	60	45
57/DT05	restricted	-	-	138	130	58	45	149	21
61	restricted	-	-	46	42	4	0	40	0
63	restricted	-	-	5	41	5	2	44	160
70	restricted	-	-	-	-	81	16	2	0
73	open	-	-	-	-	6	0	17	69
Total		**886**	**763**	**1387**	**1484**	**1178**	**516**	**1817**	**1062**
Mean		**98**	**95**	**99**	**106**	**69**	**30**	**107**	**62**
Basins with vegetation transects									
DT03	restricted	-	-	-	-	-	-	174	418
DT08	restricted	-	-	-	-	-	-	1	14
DT09	open	-	-	-	-	-	-	1	0
DT13	restricted	-	-	-	-	-	-	622	56
DT15	restricted	-	-	-	-	-	-	7	9
DT16	restricted	-	-	-	-	-	-	7	0
DT25	restricted	-	-	-	-	-	-	68	0

[1] Drainage based on Ecosat Geobotanical Surveys Inc. (1989)
[2] Data for 1973 to 1978 obtained from Poll (1980).
[3] 1976 represents a peak year for muskrat house counts in the Peace-Athabasca Delta because of recent flooding (1972, 1974).
[4] 1978 represents a low year for muskrat house counts in the Peace-Athabasca Delta because of basin drying.
[5] DT refers to vegetation transect.

Ground counts of muskrat houses peaked in 1976 in the Peace-Athabasca Delta (jurisdiction of Wood Buffalo National Park) as a result of overland flooding on the Peace River in 1972 and 1974 (Table 1; Poll 1980). Rapid drying of perched basins and subsequent loss of emergent habitat, in association with high trapping mortality and intraspecific competition for dwindling food resources, caused the muskrat population to decline to low numbers by 1978 (as determined by a low house count, Table 1; Poll 1980). A comparison of muskrat house counts in identical basins between 1976 (high house count and population abundance) and 1999 indicated no difference in the number of houses counted (paired-sample t-test; $n = 14$, $p = 0.6554$). Conversely, a comparison of house

counts in identical basins between 1978 (low house count and population abundance) and 1999 indicated that significantly more houses were counted in 1999 than in 1978 (paired sample t-test; n = 17, p = 0.0260). The high number of muskrat houses currently present in selected basins in the Peace-Athabasca Delta compared to 1978 suggests that muskrats can quickly recolonize basins following a prolonged period of drying. In addition, the results indicate that in the fall of 1998 (i.e., when most houses were built), the muskrat population in some parts of the delta was high and comparable to peak populations in the 1970s.

Although the overall number of houses in selected basins was high in 1999 and comparable to peak numbers in 1976, several basins (numbers 5, 9, 54 and 70) showed a marked decline in the number of houses between years (Table 1). In addition, basin #65 (Jemis Lake, vegetation transect DT08) previously had large numbers of muskrat houses (Sonny Flett personal communication), but only contained one inactive house and 14 inactive pushups in 1999. These basins are characterized by very little vegetation, high water levels and extensive willow encroachment, which may have discouraged muskrat recolonization. Muskrat tracks were also noted at two pushups on basin #5, suggesting that muskrats may have been food-stressed and were searching for food. Muskrat house counts were also low on several basins used for vegetation sampling (DT09, DT15 and DT16). These basins were all reported to be shallow, which likely limited their suitability for muskrats because of winter freeze-out. Overall, basins that had few houses also tended to have few pushups, indicating that few muskrats likely occurred in these basins.

In contrast to the above basins, several basins had considerably higher house counts than recorded in the peak year of 1976 (basins 3, 13, 14, 15). This could be the result of several factors, including improved environmental/water conditions or more thorough searches of basins. Basin #3 is large and contains numerous side channels that are obscured by dense willow growth. These channels can be easily overlooked while searching the perimeter of the basin, resulting in an inaccurate house count. Great care was taken during the muskrat surveys to locate side channels using aerial photographs, however, these areas may have been omitted from the surveys in the 1970s.

Basins 13 (Otter Lake), 14 and 15 (east Pair Lake) all occur south of Mamawi Lake, and since 1982 have likely been subjected to periodic rewatering by high spring flows along Mamawi Creek as a result of the Embarrass River breakthrough. The increase in house counts compared to the historical (1976) peak suggests that periodic flooding from the Embarrass River breakthrough has increased the quality and/or quantity of muskrat habitat in these basins. However, increased muskrat populations on these basins, especially Otter Lake, may have resulted in increased intraspecific competition and a food-stressed population. For example, field observations on Otter Lake indicated that little muskrat food (emergent vegetation) was available, and that houses were relatively small. In addition, only 26.3% of the houses and 8.8% of the pushups were active (Table 2), suggesting that the survival rate of muskrats in the basin was low. The remains of 5 dead muskrats were also discovered near houses, suggesting that individuals may have been abandoning their foraging areas because of food stress.

The highest muskrat house count in Wood Buffalo National Park was obtained on basin DT13 (Egg Lake; 622 houses). Westworth (1974) estimated that 94 and 113 pairs of house-dwelling muskrats occurred in Egg Lake in 1970 and 1971 respectively. Based on an average of 6 houses per family home range (Westworth 1974), approximately 564 and 678 houses occurred on Egg Lake in 1970 and 1971 respectively, similar to the number recorded in 1999.

Table 2. Over-winter survival rates of muskrat houses in selected basins in the Peace-Athabasca Delta (jurisdiction of Wood Buffalo National Park), 1975-1979 and mid-winter survival rates in 1999.

Basin Number	Drainage[1]	% of Houses Remaining Active[2]				Mid-winter 1999
		1975-1976	1976-1977	1977-1978	1978-1979	
2	isolated	-	-	42.8	-	71.6
3	isolated	85.1	45.0	54.7	50.0	60.9
5/DT12[3]	restricted	66.7	31.3	36.4	62.5	29.1
7	restricted	0.0	40.0	26.7	60.0	100.0
9	restricted	40.9	40.0	60.0	81.8	100.0
13/DT01&02	restricted	20.0	58.8	0.0	25.0	26.3
14	restricted	40.0	0.0	0.0	57.1	75.9
15/DT06	restricted	20.0	20.0	40.0	100.0	43.4
17	restricted	53.3	24.0	77.1	24.4	61.6
52	restricted	85.0	80.0	88.2	91.7	39.0
54	open	80.0	95.0	93.1	76.9	66.7
56	restricted	30.0	60.0	50.0	57.1	85.0
57/DT05	restricted	86.7	100.0	100.0	90.9	81.9
61	restricted	60.0	0.0	0.0	0.0	37.5
63	restricted	33.3	-	0.0	-	45.5
70	restricted	-	-	60.0	61.5	0.0
73	open	-	-	-	0.0	70.6
Mean		**50.1**	**45.7**	**45.6**	**55.9**	**58.5**
Basins with Vegetation Transects						
DT03	restricted	-	-	-	-	59.4
DT08	restricted	-	-	-	-	0.0
DT09	open	-	-	-	-	100.0
DT13	restricted	-	-	-	-	72.9
DT15	restricted	-	-	-	-	100.0
DT16	restricted	-	-	-	-	100.0
DT25	restricted	-	-	-	-	48.5

[1] Drainage based on Ecosat Geobotanical Surveys Inc. (1989)
[2] Data for 1975 to 1979 obtained from Poll (1980).
[3] DT refers to vegetation transect

Winter is the critical time period for many species of wildlife, including muskrats, because of limited food supplies and adverse environmental conditions. The proportion of active houses in a basin in early spring is thought to reflect over-winter survival of muskrats (Ambrock and Allision 1972). The proportion of active muskrat houses in Wood Buffalo National Park in January 1999 was relatively high (Table 2), however, a direct comparison of house activity could not be made

between 1999 and historical (1970s) data because of the difference in survey periods. Historical survival rates are based on the number of active houses observed in the spring (early to mid-April) and represented over-winter survival rates, while the 1999 survey represents mid-winter (January) survival rates. To make a direct comparison with historical data, additional surveys are required in April 1999.

Over-winter survival of muskrats is generally a function of both water depth and food availability, although other factors, such as trapping pressure, population density and intraspecific strife can also affect over-winter survival (Poll and Stelfox 1978, Poll 1980). Ambrock and Allison (1972) and Westworth (1974) reported that the proportion of active houses in the delta increased with increasing water and snow depth. Deep snows, especially during early winter, can reduce the extent of ice formation and maintain water at houses, minimizing the risk of freeze-out (Ambrock and Allison 1972). Ambrock and Allison (1972) noted that even in shallow basins, snow cover > 60 cm maintained water at houses. Complete freezing of basins can restrict the availability of food for muskrats, however, muskrats can survive by burrowing into mud to feed on the roots of emergent plants, if abundant (Ambrock and Allison 1972). During a period of food stress, complete freeze-up of basins can severely limit muskrat survival. Muskrats faced with freeze-out and a limited food supply may burrow out of their houses and travel across the surface of the ice, making them susceptible to predation (Ambrock and Allison 1972).

The number of muskrat houses in the delta in January/February 1999 was high, indicating a high fall (1998) population. House counts are useful in providing a population estimate, however they do not provide an index of over-winter survival. Over-winter survival of muskrats in the Peace-Athabasca Delta in 1999 is unknown (although the overall proportion of houses active in mid-winter is high). This information is important to determine the ability of muskrats to recolonize basins following a prolonged period of drying. Because of the extended drying period, recently flooded basins may not yet support a sufficient standing crop biomass of aquatic vegetation to provide an adequate winter food supply for muskrats that have recently recolonized these sites. Consequently, over-winter survival in the delta may be low. Suitable aquatic vegetation may not become established in basins until after a drawdown period, at which time exposed mudflats provide a substrate for reseeding and germination of emergent vegetation. Once germination occurs, another significant flood event may be required within several years of the drawdown to provide suitable foraging habitat for muskrats.

In summary, the number of muskrat houses counted in the delta in January/February 1999 was high, indicating that muskrats can quickly recolonize perched basins following an extended period of drying. However, it is not known whether food supplies in these recently reflooded basins are adequate to ensure high rates of over-winter survival or the high productivity rates recorded for delta muskrat populations in the past. To fully understand the response of muskrats to prolonged drying of the delta, further surveys are required.

4.0 RECOMMENDATIONS

The mid-winter 1999 muskrat survey provides a "snapshot" picture of muskrat populations in the Peace-Athabasca Delta following a prolonged period of drying. The results of the survey indicate that muskrats can quickly recolonize perched basins in large numbers following an extended period of drying. However, it is not yet clear whether over-winter survival of muskrats is high in the delta, or whether additional drawdown and reflooding events are required to provide adequate over-wintering and foraging habitats for muskrats.

The following recommendations are suggested:

- Conduct spring (April) house surveys to determine the number of active vs. inactive houses in the delta. This will provide an estimate of over-winter survival. During the January 1999 survey, active houses were marked with sticks. These houses can be revisited to determine whether they are still active.
- Examine changes in plant species composition and abundance in vegetation monitoring basins in relation to muskrat populations. Determine the amount of suitable forage available to muskrats (habitat carrying capacity) following a prolonged drying period.
- Conduct fall/early winter house and pushup surveys and spring house activity surveys in the selected perched basins, including vegetation monitoring basins, over several years to determine long-term changes in muskrat populations in the delta following the recent flooding events.
- In several basins (e.g., vegetation monitoring plots), conduct long-term detailed monitoring of muskrats (live-trapping, mark-recapture, habitat assessments) to accurately determine yearly population fluctuations, productivity and survival in relation to changes in vegetation structure and flooding events.

Westworth, D.A. 1974. Ecology of the muskrat (*Ondatra zibethicus spatulatus*) on the Peace-Athabasca Delta, Wood Buffalo National Park. M.Sc. Thesis, Department of Zoology, University of Alberta, Edmonton, Alberta, Canada.

6.0 PERSONAL COMMUNICATIONS

Flett, Sonny. Metis Association, Fort Chipewyan, Alberta, Canada.

Chan-McLeod, Alan. Senior Environmental Co-ordinator, British Columbia Hydro and Power, Vancouver, British Columbia, Canada.