

**Waterfowl  
populations  
on the  
Peace-Athabasca  
Delta,  
1969 and 1970**

**by D. J. Nieman  
and H. J. Dirschl**

**Occasional Paper  
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Environment Canada  
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## Abstract

Regulation of the flow of the Peace River through the W. A. C. Bennett Dam in British Columbia has substantially altered the water level regime of the Peace–Athabasca Delta in north-eastern Alberta. Concern over the possible effects of regulation of the Peace River on waterfowl habitat on the delta led the Canadian Wildlife Service to implement a two-year waterfowl study in the area in 1969.

The delta supports large numbers of migrating, breeding, moulting and staging waterfowl, and acts as a refuge for prairie ducks displaced by drought. The habitat preferences of those populations were investigated with respect to their distribution during the breeding, moulting and fall staging activities.

Fifteen species of waterfowl were summer residents on the delta. Dabbler breeding pairs were attracted mainly to the numerous potholes, marshy lakes and creek channels of the Mamawi Lake area. Diving ducks preferred larger, deeper and more open water bodies in the Athabasca Delta section.

Dabbler and diver broods were concentrated on the potholes and lakes in a closed drainage system with water levels well maintained throughout the brood-rearing season. There appeared to be considerable brood movement to those areas, which were unaffected by the major water level decline evident on most of the delta.

Preferred moulting areas were, characteristically, large, moderately deep lakes with dense stands of emergent vegetation. Fall staging populations were attracted to relatively large

lakes with extensive mudflats exposed by recent water level declines.

Waterfowl distribution on the delta showed no apparent correlation with specific shoreline vegetation types in 1969 and 1970.

Water levels are the prime factor in the distribution and habitat utilization of waterfowl in the Peace–Athabasca Delta. A progressive and cumulative water level decline has resulted in the deterioration and consequent reduced use of much waterfowl breeding, moulting and fall staging habitat.

## Résumé

La régularisation du débit de la rivière de la Paix par le barrage Bennett, en Colombie-Britannique, a sensiblement modifié le régime du niveau d'eau du delta Paix–Athabasca, dans le nord-est de l'Alberta. Préoccupé des effets possibles de cette régularisation sur l'habitat des oiseaux aquatiques, le Service canadien de la Faune a entrepris, en 1969, une étude de deux ans sur la sauvagine de la région.

Le delta constitue le soutien vital d'un grand nombre d'oiseaux aquatiques au cours des migrations, de la nidification, de la mue et des haltes et sert de refuge aux canards chassés des prairies par la sécheresse. L'étude a porté sur les préférences de ces populations en matière d'habitats, selon leur distribution pendant la reproduction, la mue et les haltes d'automne.

Durant la période estivale, le delta a servi d'habitat à quinze espèces d'oiseaux aquatiques. Les couples de canards de surface étaient surtout attirés par les nombreuses marmittes, les lacs marécageux et les lits de ruisseau de la région du lac Mamawi. Les canards plongeurs préféraient les étendues d'eau plus vastes, plus profondes et plus à découvert de la section du delta Athabasca.

Les couvées de canards plongeurs et de surface se concentraient sur les marmittes et les lacs d'un

système de drainage fermé dont les niveaux d'eau se sont bien maintenus tout au cours de l'élevage des petits. Il semble y avoir eu affluence des couvées dans ces régions non touchées par la principale baisse de niveau des eaux qui s'est fait sentir dans la majeure partie du delta.

Les aires de mue préférées étaient, d'une façon caractéristique, de vastes lacs modérément profonds, couverts de dense végétation émergente. A leur halte d'automne, les populations choisissaient d'assez grands lacs pourvus de vastes zones vaseuses, exposées par les récentes baisses des eaux.

La distribution des oiseaux aquatiques dans le delta n'a pas révélé de corrélation apparente avec les types précis de la végétation de rivage présente en 1969 et 1970.

Le niveau d'eau est le principal facteur de la distribution et de l'utilisation de l'habitat par la sauvagine dans le delta Paix-Athabasca. La baisse progressive et cumulative des eaux a produit une détérioration et, par conséquent, une utilisation réduite de nombreux habitats dont se servaient les oiseaux aquatiques lors de leur nidification, de leur mue et de leur halte d'automne.

The hydrological regime of the Peace-Athabasca Delta (Fig. 1) in north-eastern Alberta is dependent upon high spring and summer flows of the Peace, Athabasca and Birch Rivers. Maintenance of the delta is effected through silt deposition and water retention in shallow basins, which has created extensive muddy lowlands, marshes, numerous shallow ponds and lakes, and meandering streams.

Regulation of the flow of the Peace River through the W. A. C. Bennett Dam near Hudson Hope, British Columbia has changed the water level regime of the delta to an extent which is substantially altering the ecology of the area (Dirschl, 1971). The discharge of the Peace River has remained quite low since filling of the reservoir was begun in late 1967. The current water level decline on the Peace-Athabasca Delta has resulted in a progressive deterioration of waterfowl habitat. Many perched basins and small streams have dried up completely and the larger lakes and marshes are showing substantial water level declines. Waterfowl production habitat on the delta is decreasing and the distribution of the breeding birds altered due to these conditions (Nieman, 1971).

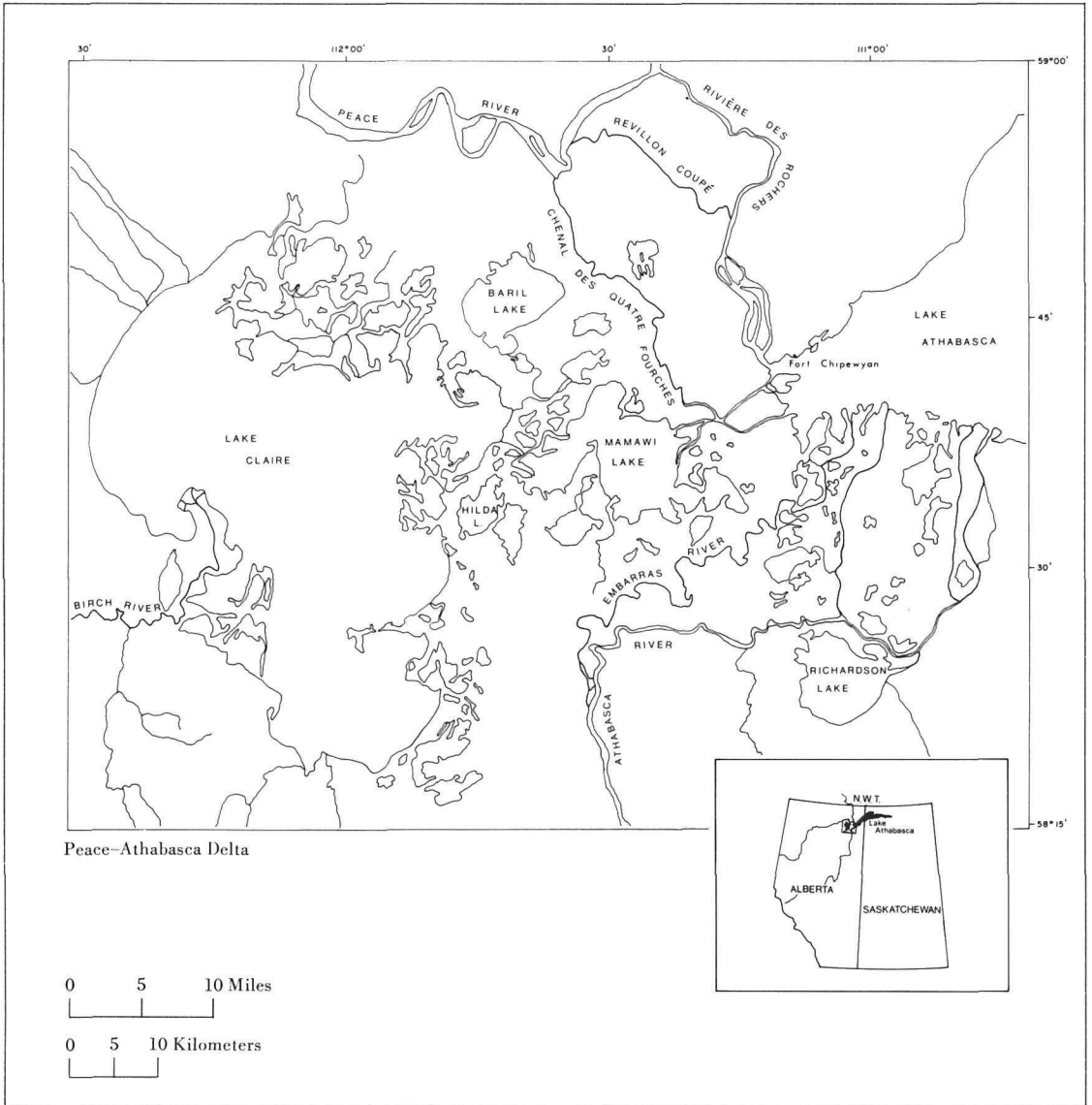
The Peace-Athabasca Delta is the most northerly "prairie-type" marsh complex in North America, and supports vast numbers of migrating, breeding, moulting and staging waterfowl. In addition to being a regular and important contributor to the continental waterfowl population, the delta functions as a reservoir that maintains a nucleus of breeding stock able to survive the adversity of prolonged drought on the Prairies (Smith *et al.*, 1964).

The delta is also an important congregating area for large numbers of moulting ducks which, like the breeding stock are predominantly dabblers. In addition it represents an important spring and fall staging area for many species of



**Figure 1**  
Geographic location of the Peace–Athabasca Delta

**Figure 1**



## The area

ducks and geese. Contributing to all four major flyways the delta has been referred to as "one of the greatest migrational 'clearing houses' for waterfowl in the whole of north-western Canada . . ." (Soper, 1934).

Thus, any detrimental effects on waterfowl habitat resulting from damming the Peace River may have serious repercussions on waterfowl populations utilizing the Peace–Athabasca Delta which would be felt far beyond its boundaries. In 1968, the Canadian Wildlife Service, concerned with the ecological effects of the altered flow regime of the Peace River, began an ecological evaluation of the Peace–Athabasca Delta (Dirschl, 1970, 1971; Dabbs, 1971; Nieman, 1971). Included in the project was a study to determine the habitat requirements of waterfowl populations for breeding, brood rearing, moulting and fall staging activities.

This report presents data pertaining to these habitat requirements in 1969 and 1970. Data pertaining to breeding pair biology, nesting chronology, and duckling survival of Mallard (*Anas platyrhynchos*) and Canvasback (*Aythya valisineria*) resident populations were analysed as part of an M. Sc. thesis at the University of Saskatchewan by the senior author (Nieman, 1971).

The Peace–Athabasca Delta lies between 58° 15' and 58° 50'N, and between 110° 40' and 112° 30'W in northeastern Alberta. The delta encompasses an area of about 1,700 square miles (ca. 4,400 km<sup>2</sup>) adjacent to the western extremity of Lake Athabasca (Fig. 1). The Lake Claire – Mamawi Lake section of the delta forms part of Wood Buffalo National Park.

Water levels and silt deposition in the Peace–Athabasca Delta are affected by the Peace, Athabasca and Birch Rivers. The Peace River bypasses the delta on the north but is connected to Lake Athabasca and adjacent marshes by five channels: Rivière des Rochers, Revillon Coupé, Chenal des Quatre Fourches, and the Baril and Claire Rivers. (The latter two are believed inconsequential in affecting water levels of the delta.) The level of the Peace River partly controls the outflow from Lake Athabasca and the delta, and in fact when in flood it contributes water to Lake Athabasca by reversing the flow of the Rivière des Rochers and Chenal des Quatre Fourches. The Athabasca River enters the southwest extremity of Lake Athabasca via the Embarras River, and the Fletcher, Goose Island, and Big Point Channels. Those tributaries contribute to the recent delta deposits south of Lake Athabasca, and they also direct water from the lake into the Chenal des Quatre Fourches and Rivière des Rochers. The Birch River originates in the Birch Mountains southwest of Lake Claire. It enters Lake Claire from the west and flows directly through the delta.

The W. A. C. Bennett Dam controls approximately 27,000 square miles (70,000 km<sup>2</sup>) of drainage area in the headwaters of the Peace River (Bennett, 1970). Since the filling of the reservoir behind the dam was begun in the spring of 1968 flow rates in the Peace River have remained quite low, resulting in an unusual

# Methods and techniques

and prolonged reduction in the water levels of Lake Athabasca and contiguous marshes, to nearly 5 feet below the normal lake level (Bennett, 1970.)

## Selection of study areas

With respect to topography and drainage, the Peace–Athabasca Delta may be divided into three sections, referred to in this paper as the Lake Claire section, the Mamawi Lake section, and the Athabasca Delta section (Fig. 2). Each section contains large and small lakes; rivers, streams and potholes; as well as various types of shorelines and adjacent higher ground.

## Classification of water bodies

The water bodies within each section of the delta were classified into the following types according to depth, drainage, and aquatic vegetation:

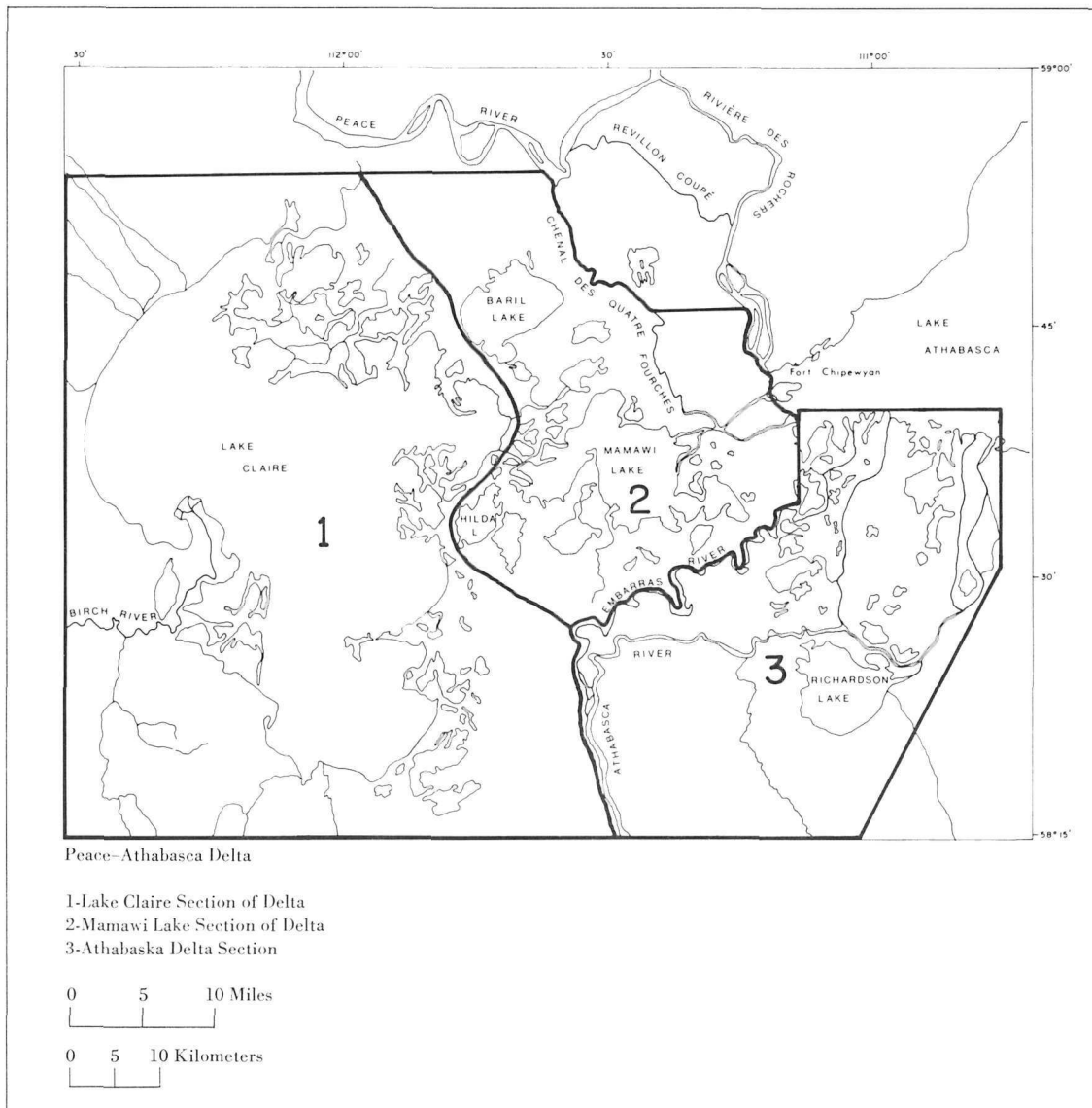
- Water channel type 1 (WC1): relatively deep (>5 ft.), wide, open free-flowing streams and rivers (Fig. 3);
- Water channel type 2 (WC2): similar to WC1 but freely flowing only when in flood. More aquatic vegetation than WC1 (Fig. 4);
- Water channel type 3 (WC3): small, shallow (< 5 ft.) streams within the delta. Aquatic vegetation dense (Fig. 5);
- Standing water type 1 (SW1): freely drained with water levels interdependent. Relatively deep, aquatic vegetation sparse (Fig. 6);
- Standing water type 2 (SW2): requiring inflow to supply but outflow controlled. Depth and amount of aquatic vegetation variable (Fig. 7);
- Standing water type 3 (SW3): perched basins requiring inflow to supply and without outflow channels. Shallow (< 3 ft.), aquatic vegetation dense (Fig. 8).

## Waterfowl census techniques

The distribution and size of breeding, moulting and spring and fall staging waterfowl populations were determined by aerial censuses from a Piper Supercub aircraft. The aircraft was flown at approximately 60 miles per hour (96 km/hr) at an altitude of 100 feet (30 m) above ground level.

**Figure 2**  
Study blocks used in waterfowl investigations

**Figure 2**



**Figure 3**  
The Athabasca River, an example of water body type WC1

**Figure 4**  
Mamawi creek, an example of water body type WC2

**Figure 5**  
The Charles River, an example of water body type WC3

**Figure 6**  
Lake Claire, an example of water body type SW1

**Figure 7**  
Baril Lake, an example of water body type SW2

**Figure 8**  
Lake P7, an example of water body type SW3

Figure 3



Figure 6



Figure 4



Figure 7



Figure 5

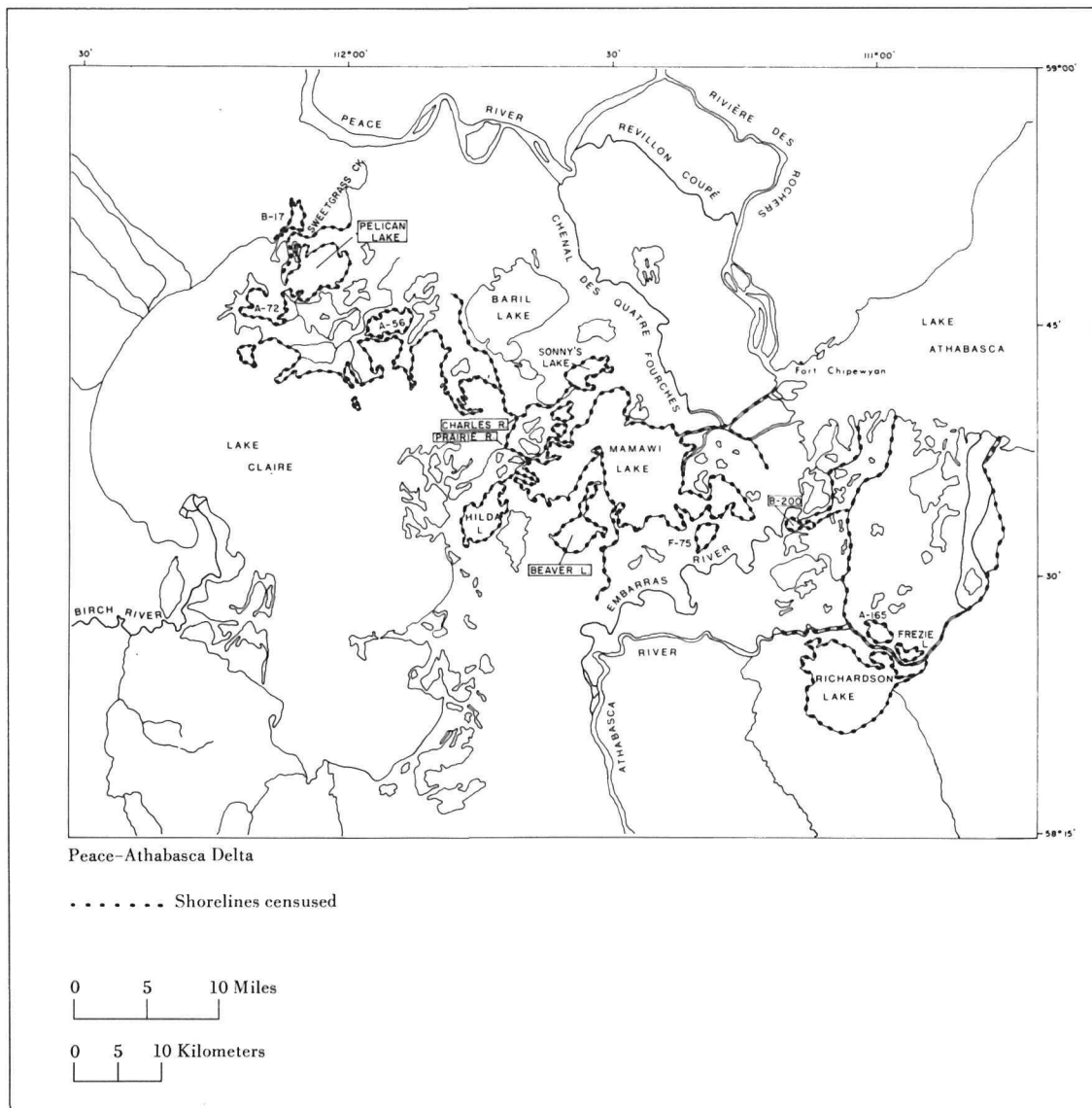


Figure 8



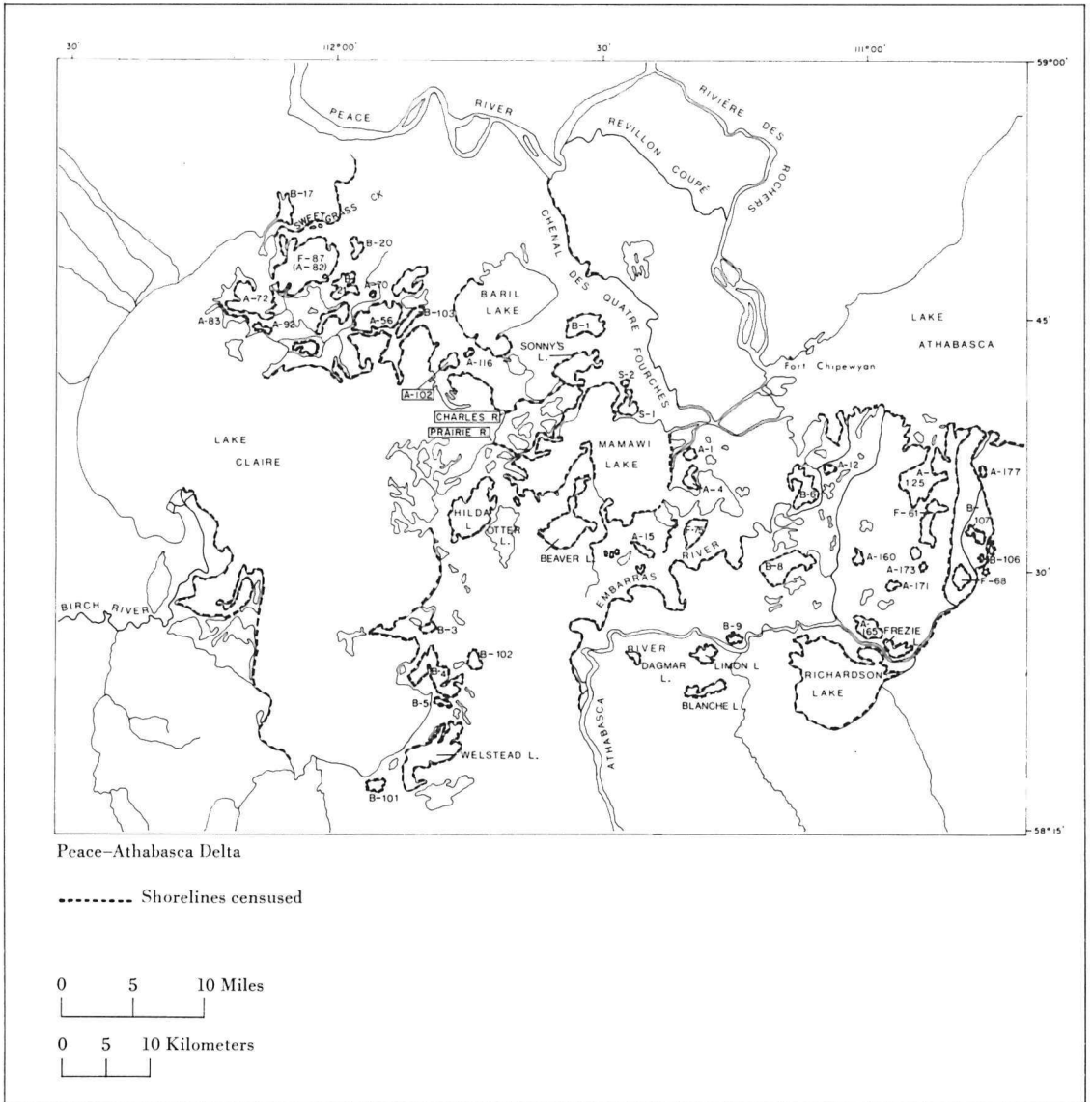
**Figure 9**  
 Shorelines censused to determine the distribution of  
 waterfowl breeding pairs and broods on the Peace-  
 Athabasca Delta

**Figure 9**



**Figure 10**  
 Shorelines censused to determine the major concentrations of waterfowl moulting and fall staging populations

**Figure 10**



Birds between the aircraft and shore — about 400 yards (366 m) distant — were counted and identified.

Brood census was conducted from an airboat driven parallel to the shoreline at a distance of approximately 100 yards (92 m) from the shore. A helicopter was utilized in 1970 to count broods on potholes and lakes inaccessible by airboat because of distance or low water levels. The observer recorded brood data by species, brood size, and age class on magnetic recording tape.

All counts were made from 0800 to 1000 hours and from 1600 to 1800 hours on a maximum of 553 miles of shoreline, depending upon the waterfowl activity being investigated. In 1970, the distribution of the spring staging population, of breeding pairs and of broods was determined by censuses on 183, 183 and 217 representative habitat units respectively (Fig. 9). The units were one mile (1.6 km) in length, and marked with coloured plastic tape. Moulting and fall staging populations were censused on 328 and 553 miles of shoreline respectively (Fig. 10). Replicate counts were made to increase accuracy.

Perched basins were poorly sampled in 1969, particularly with regard to brood census, due to their inaccessibility by airboat because of low water levels.

## Species composition

Fourteen species of ducks were present on the Peace–Athabasca Delta in both 1969 and 1970, during the spring staging and breeding pair surveys, and species composition was very similar in both years (Table 1). In 1970, Mallards, Pintails (*Anas acuta*), Widgeons (*Mareca americana*) and Green-winged Teal (*Anas carolinensis*) were the predominant dabbling species; they represented 86 per cent of the dabblers and 54 per cent of all waterfowl observed. The diving species — Goldeneye (*Bucephala clangula*), Lesser Scaup (*Aythya affinis*), Canvasback and Ring-necked Duck (*Aythya collaris*) represented 36 per cent of the total birds observed.

On the study areas censused in both years, breeding waterfowl increased by approximately 44 per cent from 1969 and 1960. This was probably due to a greater number of birds available as a result of the highly productive 1969 waterfowl breeding season over most of the prairie region.

## Distribution of breeding pairs

In 1970, breeding pair populations ranged from nil to 14 pairs per mile of shoreline. The dabblers were attracted mainly to the Mamawi Lake area which provided excellent habitat early in the spring, *viz.* numerous potholes; shallow, marshy lakes and creek channels. In the Mamawi Lake section of the delta an average of 5.0 pairs per mile of shoreline were present, compared to 2.9 and 2.2 pairs per mile in the Athabasca Delta and Lake Claire areas, respectively (Table 2).

Diving ducks were most concentrated in the Athabasca Delta section: a mean density of 1.0 pairs per mile of shoreline compared to 0.9 pairs per mile for the Mamawi Lake area, and 0.6 pairs per mile in the Lake Claire section of the delta. The Athabasca Delta section provides larger, deeper, and more open water bodies than the other two areas.



**Table 1**  
Composition by species of spring waterfowl populations on the Peace–Athabasca Delta, 1969 and 1970 (64 and 183 miles of shoreline censused, respectively)

Species	Dabblers				Divers				
	1969		1970		1969		1970		
	No.	Per mile	No.	Per mile	Species	No.	Per mile	No.	Per mile
Mallard	290	4.5	910	5.0	Lesser Scaup	80	1.3	670	3.7
Pintail	140	2.2	840	4.6	Canvasback	55	0.9	320	1.7
Widgeon	115	1.8	390	2.1	Goldeneye	40	0.6	375	2.0
Shoveler	95	1.5	260	1.4	Ring-necked	40	0.6	230	1.3
Blue-winged Teal	45	0.7	60	0.3	Redhead	15	0.2	35	0.2
Gadwall	20	0.3	70	0.4	Bufflehead	6	0.1	4	<0.1
Green-winged Teal	2	<0.1	300	1.6	Ruddy	3	<0.1	5	<0.1
Totals	707	11.0	2,830	15.4		239	3.7	1,639	8.9

**Table 2**  
Numbers of breeding pairs identified in the three major study areas on the Peace–Athabasca Delta, 1970, and number per mile of shoreline censused

	Study areas					
	Claire		Mamawi		Athabasca	
	No.	Per mile	No.	Per mile	No.	Per mile
Dabblers	125	2.2	446	5.0	102	2.9
Divers	38	0.7	83	0.9	36	1.0
Geese	0	0.0	0	0.0	0	0.0
Total	163	2.8	529	5.9	138	3.9
Miles censused	58		90		35	

**Table 3**  
Distribution of breeding pairs on the different water body types in the Peace–Athabasca Delta, 1970, by total numbers identified and the number per mile of shoreline censused

	Water body types											
	WC1		WC2		WC3		SW1		SW2		SW3	
	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile
Dabblers	36	2.0	66	4.4	86	6.6	141	1.9	344	5.4		
Divers	30	1.7	49	3.3	10	0.9	28	0.4	40	0.6		
Geese	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0		
Total	66	3.7	115	7.7	96	7.5	169	2.3	384	6.0		
Miles censused	18		15		13		73		64		0	

### Habitat utilization

Relatively large, shallow lakes (SW2) and small, shallow streams (WC3), both with dense aquatic vegetation (Fig. 11, 12), respectively accommodated 5.4 and 6.6 dabbling pairs per mile. Deep, slow-moving streams with submergent and emergent aquatic vegetation (WC2) (Fig. 13) provided the preferred diver habitat: 3.3 pairs per mile were present on this water body type compared to 0 to 1.7 pairs per mile on the other types (Table 3).

Breeding pair distribution showed no correlation with specific shoreline vegetation types in either 1969 and 1970. Habitat selection appeared, however, to be related to the depth and permanence of water bodies (Nieman, 1971).

Breeding waterfowl on the deep creek and river channels of the delta increased by as much as 112 per cent from 1969 to 1970 (Table 4). Concurrent decreases of up to 100 per cent in 1970 were evident on the shallow lakes, as progressively declining water levels resulted in a deterioration of wetland habitat utilized in 1969.

**Table 4**  
Water areas showing marked changes in breeding pair populations from 1969 to 1970

Water area	Breeding pairs per mile		Percent increase
	1969	1970	
Claire River	3.3	7.0	112
Mamawi Creek	6.2	11.4	84
Charles River	9.3	11.4	23
Big Point Channel	3.7	3.8	3
Richardson Lake	3.7	3.4	-8
Athabasca River	2.6	2.2	-15
Beaver Lake	7.0	5.3	-24
Lake Claire	5.7	2.0	-65
Mamawi Lake	15.3	0.1	-99
Small Lake	7.5	0.0	-100
Fletcher Channel	1.6	0.0	-100
Totals	65.9	46.6	-29

**Figure 11**

Relatively shallow lakes and potholes with emergent vegetational cover received high dabbling breeding pair and brood use

**Figure 12**

Shallow streams with emergent cover provided preferred dabbling breeding pair and brood habitat

**Figure 13**

Deep, open water bodies received high breeding pair and brood use by diving ducks

**Figure 11**



**Figure 12**



**Figure 13**



# Brood populations

## Species composition

In 1970, Mallards (42 per cent), Shovelers (*Spatula clypeata*) (17 per cent) and Pintails (16 per cent) together constituted 76 per cent of the dabbling broods, and 55 per cent of all broods observed. Canvasback (40 per cent), Lesser Scaup (29 per cent) and Goldeneye (15 per cent) represented 84 per cent of the diver broods identified (Table 5). Species composition was essentially the same in 1969 and 1970.

On water bodies censused in both years there was an increase in broods of approximately 21 per cent from 1969 and 1970.

## Distribution of broods

In 1970, brood populations ranged from 0 to 19 per mile of shoreline. The dabbling broods (1.3 to 1.6 per mile) were well distributed on all sections of the delta with the highest populations in the Lake Claire area. The potholes to the south and to the east of Lake Claire provided relatively stable water levels unaffected by the water level decline in other parts of the delta.

The larger, deeper, more permanent water bodies of the Athabasca Delta section supported the majority of the diver broods — approximately 1.2 broods per mile of shoreline compared to 0.4 and 0.2 broods per mile in the other parts of the delta (Table 6).

## Habitat utilization

Brood populations were highest in both years on SW3 water types (Table 7). Water bodies in the SW3 category were mainly potholes and lakes in a closed drainage system with water levels well maintained throughout the brood-rearing season (Fig. 11). The distribution of breeding pairs and the concentration of broods on SW3 potholes seems to indicate considerable brood movement to these areas of stable water levels. No attraction for specific shoreline vegetation types was ap-

**Table 5**

Composition by species of brood populations on the Peace-Athabasca Delta, 1969 and 1970 (124 and 217 miles of shoreline censused, respectively)

Species	Dabblers		Divers		
	Total broods		Total broods		
	1969	1970	1969	1970	
Mallard	17	120	Canvasback	18	53
Shoveler	4	50	Lesser Scaup	16	31
Pintail	4	47	Goldeneye	14	16
Gadwall	3	23	Redhead	2	4
Blue-winged Teal	3	19	Ring-necked	0	3
Green-winged Teal	6	15	Bufflehead	0	0
Widgeon	0	13	Ruddy Duck	0	0
Totals	37	287		50	107

**Table 6**

Number of broods identified in the three major study areas on the Peace-Athabasca Delta, 1970, and number per mile of shoreline censused

	Study areas					
	Claire		Mamawi		Athabasca	
	No.	Per mile	No.	Per mile	No.	Per mile
Dabblers	127	1.6	94	1.3	82	1.3
Divers	13	0.2	27	0.4	76	1.2
Geese	0	0.0	0	0.0	3	0.1
Total	140	1.7	121	1.6	161	2.6
Miles censused	81		75		61	

parent. In 1970, 4.6 dabbling broods per mile utilized this habitat type as compared to 2.8 or fewer broods per mile on the other water body types. Two diver broods per mile were observed on SW3 and 0.6 broods or fewer per mile on the other habitat types.

Despite the higher brood populations on the delta in 1970, decreases of up to 40 per cent occurred on potholes and lakes which became too shallow to provide adequate brood habitat (Table 8; Fig. 14, 15). Brood populations as much as doubled from 1969 to 1970 on the deep, permanent creek and river channels of the Peace-Athabasca Delta (Fig. 12, 13).

**Figure 14**  
The Charles River in June 1969, preferred dabbler breeding pair habitat



**Figure 14**

**Figure 15**  
The Charles River was dry by July 1970 due to a progressive water level decline on the delta. This river was a prime waterfowl production area prior to the filling of the W.A.C. Bennett Dam



**Figure 15**

**Table 7**  
Distribution of broods on the different water body types in the Peace-Athabasca Delta, 1970, by total numbers identified and by the number per mile of shoreline censused

	Water body types											
	WC1		WC2		WC3		SW1		SW2		SW3	
	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile
Dabblers	5	0.3	6	0.4	48	2.8	16	0.2	60	1.1	168	4.6
Divers	6	0.4	10	0.6	11	0.7	13	0.4	3	0.1	73	2.0
Geese	0	0.0	0	0.0	0	0.0	1	0.0	2	0.0	0	0.0
Total	11	0.6	16	0.9	59	3.5	30	0.7	65	1.2	241	6.6
Miles censused	17		17		17		75		55		36	

**Table 8**  
Water areas showing marked changes in brood populations from 1969 to 1970

Water area	Broods per mile		Percent increase
	1969	1970	
Grey Wavey Creek	0.00	0.50	∞
Claire River	0.25	1.00	300
Mamawi Creek	0.40	1.00	150
Charles River	0.40	0.80	100
Lake B-200	2.00	1.60	-20
Richardson Lake	2.40	1.60	-33
Totals	5.45	6.50	19

# Moulting populations

## Species composition

In 1970, dabbling ducks made up 93 per cent of all moulting birds (Table 9). Predominant species were the Pintail, Mallard, Widgeon, Gadwall (*Anas strepera*) and Shoveler. Lesser numbers of Green and Blue-winged Teal (*Anas discors*) were also present.

The remainder of the moulting waterfowl consisted of the diver species: Lesser Scaup, Canvasback, Ring-necked Duck, Goldeneye, Redhead (*Aythya americana*), Ruddy duck (*Oxyura jamaicensis*) and Bufflehead (*Bucephala albeola*).

## Distribution of moulting populations

The major moulting areas on the Peace-Athabasca Delta in 1969 and 1970 supported from 1,000 to 9,000 birds (Table 10). Large numbers of moulting waterfowl were recorded on all sections of the delta (Table 11; Fig. 16). The Lake Claire section (260 birds per mile) and Athabasca section (18 birds per mile) harbored the majority of moulting dabblers and divers, respectively.

## Habitat utilization

Major dabbler moulting areas were SW2 and SW3 water body types, supporting 197 and 422 birds per mile, respectively (Table 12). Streams, rivers and SW1 lakes were poorly utilized (0-55

**Table 10**

Comparison of 1969 and 1970 waterfowl populations on some major moulting areas, Peace-Athabasca Delta, with changes indicated

Moulting area	No. waterfowl		Percent increase
	1969	1970	
Welstead Lake	6,050	9,180	52
Lake B-4	5,540	7,920	43
Hilda Lake	5,040	5,870	16
Sonny's Lake	2,740	0	-100
Otter Lake	2,200	3,210	46
Blanche Lake	1,470	1,130	-23
Lake B-21	1,300	1,950	50
Lake B-8	1,270	510	-60
Lake B-1	980	150	-85
Lake B-20	910	40	-96
Lake A-70	800	0	-100
Lake A-165	750	1,690	125
Lake B-6	720	1,710	138
Lake A-125	710	450	-37
Lake B-5	600	1,430	138
Lake B-17	520	640	23
Lake A-171	510	1,120	120
Limon Lake	430	140	-67
Lake A-56	360	310	-14
Pelican Lake	780	2,500	221
Lake S-1	310	620	100
Lake A-177	300	120	-60
Lake A-104	280	4,300	1,435
Lake B-9	250	970	288
Lake A-173	250	70	-72
Lake A-83	240	0	-100
Lake Claire	370	800	116
Baril Lake	370	80	-78
Lake A-116	370	0	-100
Beaver Lake	370	0	-100
Lake S-2	180	150	-17
Lake A-4	160	1,130	606
Charles River	130	4	-97
Lake A-15	90	260	189
Lake A-92	90	10	-89
Lake A-1	70	50	-29
Lake A-160	50	1,160	2,220
Sweetgrass Creek	50	90	80
Lake A-102	40	1,200	2,900
Total	37,650	50,964	35

**Table 9**

Composition by species of waterfowl moulting populations on the Peace-Athabasca Delta, 1970 (328 miles of shoreline censused)

Species	Dabblers		Divers	
	Total	Species	Total	Species
Pintail	13,850	Lesser Scaup	1,900	
Mallard	12,830	Canvasback	960	
Widgeon	7,850	Ring-necked	250	
Gadwall	7,800	Goldeneye	230	
Shoveler	5,970	Redhead	190	
Green-winged Teal	2,900	Ruddy Duck	3	
Blue-winged Teal	350	Bufflehead	2	
Totals	51,550		3,535	

**Figure 16**  
Moulting waterfowl on the Peace-Athabasca Delta

**Figure 16**



**Table 11**  
Numbers of moulting waterfowl identified in the three major study areas on the Peace-Athabasca Delta, 1970, with the number per mile of shoreline censused

	Study areas					
	Claire		Mamawi		Athabasca	
	No.	Per mile	No.	Per mile	No.	Per mile
Dabblers	30,456	260.3	12,801	115.3	18,434	184.3
Divers	1,417	12.1	111	1.0	1,872	18.7
Geese	0	0.0	0	0.0	0	0.0
Total	31,873	272.4	12,912	116.3	20,306	203.1
Miles censused	117		111		100	

**Table 12**  
Distribution of moulting waterfowl on the different water body types in the Peace-Athabasca Delta, 1970, by total numbers identified and by the number per mile of shoreline censused

	Water body types											
	WC1		WC2		WC3		SW1		SW2		SW3	
	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile
Dabblers			83	20.8	6	0.6	5,154	55.4	31,971	197.4	24,477	422.0
Divers			2	0.5	1	0.1	1,121	12.1	992	6.1	1,284	22.1
Geese			0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total			85	21.3	7	0.6	6,275	67.5	32,963	203.5	25,761	444.2
Miles censused	0		4		11		93		162		58	

birds per mile) reflecting the dabbler preference for lakes of moderate depth with good emergent cover.

Divers were primarily associated with the large, deep lakes (SW1) or the shallower lakes with dense stands of vegetational cover (SW3). Twelve and 22 divers per mile were observed on SW1 and SW3 water bodies, respectively. The water channels and SW2 lakes supported from 0 to six birds per mile.

During the flightless period, the waterfowl on the Peace-Athabasca Delta prefer large, deep, water bodies but a lack of size and depth apparently may be compensated for to some degree by abundant emergent vegetation.

In 1970 much of the previous year's moulting habitat became unsuitable due to a marked reduction in water levels (Fig. 17). Nine moulting areas of major importance in 1969 showed decreases of 80 to 100 per cent in waterfowl use in 1970 because of very low water or a complete lack of water (Table 10). This loss of moulting habitat caused moulting waterfowl to congregate in the few remaining favorable areas, nine of which showed population increases between 100 and 3,000 per cent. The distribution of moulting populations was affected to a high degree by the water regime change caused by the Bennett Dam.

**Figure 17**

Many lakes which were important as waterfowl moulting areas in 1969 were nearly dry in 1970. Reduced water levels on the delta caused a progressive deterioration of waterfowl habitat

**Figure 17**



## Fall staging populations

### Species composition

Dabblers, divers, and geese represented 63 per cent, 7 per cent, and 30 per cent, respectively, of the waterfowl staging population on the delta in 1970 (Table 13). In 1969, the predominant dabbler species were Mallard, Shoveler, Widgeon and Pintail. The following year, species composition was essentially the same as 1969 except for the presence of large numbers of Green-winged Teal. Species composition of the divers (Lesser Scaup, Canvasback, Ring-necked) and geese — Canada (*Branta canadensis*), White-fronted (*Anser albifrons*), Snow (*Chen hyperborea*), Ross' (*Chen rossii*) — was similar for both years.

### Distribution of fall staging populations

During both years, the major fall staging areas on the delta supported peak waterfowl populations, up to 30,000 each in number, during September and early October.

Dabblers and geese were evenly distributed on all three sections of the delta with populations of 91 to 143 and 29 to 53 birds per mile of shoreline, respectively (Table 14). Divers preferred the Lake Claire and Athabasca Delta sections of the delta: 11.6 to 16.6 birds per mile as compared to 2.9 birds per mile on the Mamawi Lake section.

### Habitat utilization

Lakes of the SW2 type provided the preferred staging habitat for both dabblers (211.1 birds per mile) and divers (20.3 birds per mile) in both years (Table 15). Those relatively large lakes possessed extensive mudflats exposed by recent water level declines (Fig. 18). Geese preferred the larger, more open lakes of the water body type SW1 category (107.1 birds per mile). They were mainly found around the large expanses of mudflats surrounding those lakes. Rivers, streams and the very shallow SW3 lakes attracted few birds.

**Table 13**  
Composition by species of waterfowl fall staging populations on the Peace–Athabasca Delta, 1969 and 1970 (553 miles of shoreline censused)

Species	Dabblers		Species	Divers		Species	Geese and Swans	
	Number			Number			Number	
	1969	1970		1969	1970		1969	1970
Mallard	25,400	9,400	Lesser Scaup	7,450	2,600	Canada Goose	19,000	16,400
Shoveler	20,600	3,950	Canvasback	2,350	850	White-fronted Goose	2,300	2,000
Widgeon	19,800	7,500	Ring-necked	2,200	900	Snow and Ross' Goose	1,100	1,000
Pintail	15,700	6,300	Goldeneye	170	300	Whistling Swan	11	300
Gadwall	5,800	3,000	Redhead	115	80			
Green-winged Teal	4,000	7,200	Ruddy	25	0			
Blue-winged Teal	1,500	200	Bufflehead	7	6			
<b>Totals</b>	<b>92,850</b>	<b>37,550</b>		<b>12,317</b>	<b>4,736</b>		<b>22,411</b>	<b>19,700</b>

**Table 14**  
Numbers of fall staging waterfowl identified in the three major study areas on the Peace–Athabasca Delta, 1970, with the number per mile of shoreline censused

	Study areas					
	Claire		Mamawi		Athabasca	
	No.	Per mile	No.	Per mile	No.	Per mile
Dabblers	24,037	123.3	24,047	143.1	17,426	91.7
Divers	2,257	11.6	494	2.9	3,150	16.6
Geese	5,806	29.8	9,002	53.6	6,703	35.3
<b>Total</b>	<b>32,100</b>	<b>164.6</b>	<b>33,543</b>	<b>199.7</b>	<b>27,279</b>	<b>143.6</b>
<b>Miles censused</b>	<b>195</b>		<b>168</b>		<b>190</b>	

**Table 15**  
Distribution of fall staging waterfowl on the different water body types in the Peace–Athabasca Delta, 1970, by total numbers identified and by the number per mile of shoreline censused

	Water body types													
	WC1		WC2		WC3		SW1		SW2		SW3		All types	
	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile	No.	Per mile
Dabblers	0	0.0	457	35.2			7,970	61.8	35,890	211.1	21,193	91.0	65,510	118.4
Divers	0	0.0	62	4.8			1,101	8.5	3,446	20.3	1,292	5.6	5,901	10.7
Geese	0	0.0	0	0.0			13,819	107.1	6,149	36.2	1,543	6.6	21,511	38.9
<b>Total</b>	<b>0</b>	<b>0.0</b>	<b>519</b>	<b>39.9</b>			<b>22,890</b>	<b>177.4</b>	<b>45,485</b>	<b>267.6</b>	<b>24,028</b>	<b>103.1</b>	<b>92,922</b>	<b>168.0</b>
<b>Miles censused</b>	<b>8</b>		<b>13</b>		<b>0</b>		<b>129</b>		<b>170</b>		<b>233</b>		<b>553</b>	



**Figure 18**

The shoreline of one of the major waterfowl fall staging lakes on the Peace-Athabasca Delta. Large numbers of ducks, geese and swans loaf on the extensive area of mud-flat exposed by the recent water level decline

**Figure 18**



The progressive water level decline in the Peace-Athabasca Delta, which resulted in habitat deterioration for the breeding and moulting activities, had a similar effect on the fall staging areas. Nine water bodies heavily utilized in the fall of 1969 showed population decreases of 80 to 100 per cent in 1970 (Table 16). Despite the smaller total fall staging population observed in 1970, those areas that remained suitable were more heavily utilized than in the previous years. On six such areas, waterfowl populations increased by 70 to 500 per cent.

**Table 16**  
Water areas showing marked changes in fall staging populations from 1969 to 1970

Water area	Number of waterfowl		Per cent increase
	1969	1970	
Mamawi Lake	1,200	7,200	500
Lake F-75	1,210	4,110	240
Lake F-61	3,250	8,630	165
Pelican Lake	1,350	3,120	131
Baril Lake	270	520	93
Mamawi Creek	130	220	69
Lake A-104	1,270	1,950	54
Hilda Lake	10,400	14,800	42
Beaver Lake	2,200	2,800	27
Lake B-103	1,970	450	-77
Lake Athabasca	27,000	4,220	-84
Lake B-4	8,300	1,220	-85
Lake Claire	24,200	3,160	-87
Lake A-125	8,400	4,380	-48
Lake A-12	460	0	-100
Lake A-1	600	0	-100
Lake B-106	1,720	0	-100
Lake B-101	1,580	0	-100
Totals	95,510	56,880	-40

## Conclusions

The Peace–Athabasca Delta is most important as a dabbling duck area. Mallard, Pintail, Widgeon and Shoveler are the most abundant species, with Gadwall, Green-winged and Blue-winged Teal occurring in lesser numbers. A relatively small portion of the waterfowl population is composed of diving species: mainly Lesser Scaup, Canvasback, Goldeneye and Ring-necked Duck. Red-head, Ruddy Duck and Bufflehead are present in small numbers.

All of the above species, as well as a few Canada Geese, nest on the delta. Large numbers of Canada, White-fronted, Snow and Ross' Geese, and Whistling Swans, (*Olor Columbianus*), and small flocks of Oldsquaw Ducks (*Clangula hyemalis*), pass through during migration.

Waterfowl are distributed on the Peace–Athabasca Delta according to their seasonal requirements for breeding, brood-rearing, moulting and fall staging habitat.

Dabbler breeding pairs are attracted to large, shallow lakes, perched basins and small streams with adequate emergent cover. Those water areas, attractive to the breeding pairs in early spring, do not maintain sufficient water throughout the summer to support broods. The high spring and summer flows of the Peace River, instrumental in recharging water levels on the delta prior to completion of the W. A. C. Bennett Dam, did not occur in 1969 and 1970. This resulted in the drying up of large numbers of the perched basins and a significant loss of waterfowl habitat.

Brood movement appears extensive on the delta as much of the spring breeding habitat becomes sub-optimal by mid-summer due to lack of water. The broods concentrate on the potholes and lakes which maintain relatively stable water levels throughout the brood-rearing season.

Diver breeding pairs are associated with the larger lakes and deep, slow-moving streams. Most

of the diver broods are found in creek channels and the deeper lakes.

Waterfowl in the delta select moulting areas which will supply adequate water body size and depth for escape during the flightless period. Water depth may be compensated for to some extent by the presence of good stands of emergent cover. Preferred moulting areas are characteristically large lakes of moderate depth with scattered stands of emergent vegetation.

Fall staging populations are primarily distributed on large lakes of moderate depth and ringed by extensive mudflats.

There was little evidence that waterfowl are attracted to specific shoreline vegetation types for breeding, brood-rearing, moulting or fall staging activities. Rather it appears that waterfowl are distributed on the Peace–Athabasca Delta according to specific water body types related to pond size, depth and permanence (Nieman, 1971).

It appears from this study that water levels are the prime determinant in the distribution and habitat utilization of waterfowl in the Peace–Athabasca Delta. The concentration of waterfowl on specific bodies within the delta area; the extensive brood movement; and the deterioration and consequent reduced use of much breeding, moulting and fall staging habitat are all results of a progressive and cumulative water level decline (Dirschl, 1970). Water has become a limiting factor in the use of the delta by waterfowl.

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