PLAINS MINNOW (*HYBOGNATHUS PLACITUS*) RELATIVE ABUNDANCE AND DISTRIBUTION IN CANADA

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Teillet, M., Watkinson, D.A., Tyree, M.R., Hlasny, R., and Enders, E.C. 2021. Plains Minnow (*Hybognathus placitus*) relative abundance and distribution in Canada. Can. Data Rep. Fish. Aquat. Sci. 1329: vi + 12 p.

Plains Minnow is listed as Threatened under Canada's *Species at Risk Act* and as Imperiled in Saskatchewan. Sampling conducted at 17 access points in southern Saskatchewan in September 2020 aimed to employ a standardized sampling protocol developed by Fisheries and Oceans Canada to monitor the relative abundance and distribution of Plains Minnow. In total, 43 Plains Minnow were caught at two access points in Rock Creek. Results suggested that the relative abundance of Plains Minnow in Canada remains low and the distribution is variable or is contracting within the known range.

RÉSUMÉ

Teillet, M., Watkinson, D.A., Tyree, M.R., Hlasny, R., and Enders, E.C. 2021. Plains Minnow (*Hybognathus placitus*) relative abundance and distribution in Canada. Can. Data Rep. Fish. Aquat. Sci. 1329: vi + 12 p.

Le méné des plaines est inscrit comme menacé en vertu de la *Loi sur les espèces en péril* du Canada et comme en péril en Saskatchewan. L'échantillonnage effectué à 17 points d'accès dans le sud de la Saskatchewan en septembre 2020 visait à utiliser un protocole d'échantillonnage standardisé qui était développé par Pêches et Océans Canada afin de surveiller l'abondance relative et la répartition du méné des plaines. Au total, 43 méné des plaines ont été capturés à deux points d'accès de Rock Creek. Les résultats suggèrent que l'abondance relative du méné des plaines au Canada demeure faible et que sa répartition est variable ou se contracte à l'intérieur de l'aire de répartition connue.

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1. INTRODUCTION

Plains Minnow (*Hybognathus placitus*) is a small-bodied fish with a restricted range in Canada that is limited to southern Saskatchewan in Grasslands National Park. Plains Minnow is listed as Threatened under Canada's *Species at Risk Act* (SARA) and is listed as Imperiled (S2) by the Saskatchewan Conservation Data Centre. Fisheries and Oceans Canada and the Saskatchewan Ministry of Environment conducted a collaborative sampling effort using a standardized sampling protocol (Macnaughton et al. 2019) to assess the relative abundance and distribution of Plains Minnow in Saskatchewan.

2. METHODS

2.1 Habitat and Site Descriptions

Access points across southern Saskatchewan were sampled in September 2020 to assess the relative abundance and distribution of Plains Minnow in Canada (Table 1, Figure 1). Habitat characteristics were measured at each access point and included: water temperature (°C), conductivity ($\mu S \cdot cm^{-1}$), turbidity (NTU), Secchi depth (when suitable water depth was present; cm), depth (m), water velocity ($m \cdot s^{-1}$), and wetted and rooted width (m) of the channel. Percent substrate composition based on the Wentworth Scale and macrophyte cover were estimated visually.

Table 1. Sampled access points in Saskatchewan, Canada that were within the known range of Plains Minnow or possible range extensions.

Waterbody	Date Sampled	Description	Access type	Coordinates
Rock Creek	15/09/2020	Access 1, Road Crossing	Known Range	49.00191, -106.78039
Rock Creek	15/09/2020	Access 2, Confluence of Wetherall Creek	Known Range	49.00808, -106.76195
Rock Creek	15/09/2020	Access 3, Grasslands NP Main	Known Range	49.00806, -106.71826
Morgan Creek	15/09/2020	Access 1, Grasslands NP Main Access	Known Range	49.01131, -106.63637
Horse Creek	15/09/2020	Trail Crossing	Range Extension	49.00303, -106.83099
Wetherall Creek	15/09/2020	Confluence of Rock Creek	Range Extension	49.00837, -106.76224
Morgan Creek	15/09/2020	Access 2, South of Trail, Grasslands NP	Range Extension	49.02922, -106.58276
Morgan Creek	16/09/2020	Access 3, McGowen's, Grasslands NP	Range Extension	49.07170, -106.53053
Frenchman River	16/09/2020	Access 1, Trail Crossing	Range Extension	49.02071, -107.28410
Frenchman River	16/09/2020	Access 2, Roadside Access	Range Extension	49.05468, -107.35123
Frenchman River	16/09/2020	Access 3, Roadside Access	Range Extension	49.09995, -107.40481
Frenchman River	16/09/2020	Access 4, Roadside Access	Range Extension	49.15207, -107.52832
McEachem Creek	16/09/2020	Road Crossing	Range Extension	49.00523, -106.94147
East Poplar River	17/09/2020	Road Crossing	Range Extension	49.02797, -105.43163
Poplar River	17/09/2020	Road Crossing	Range Extension	49.02984, -105.89376
West Beaver Creek	17/09/2020	Hwy 2 Crossing	Range Extension	49.02255, -105.08031
Denniel Creek	17/09/2020	Hwy 18 Crossing	Range Extension	49.26230, -107.69902

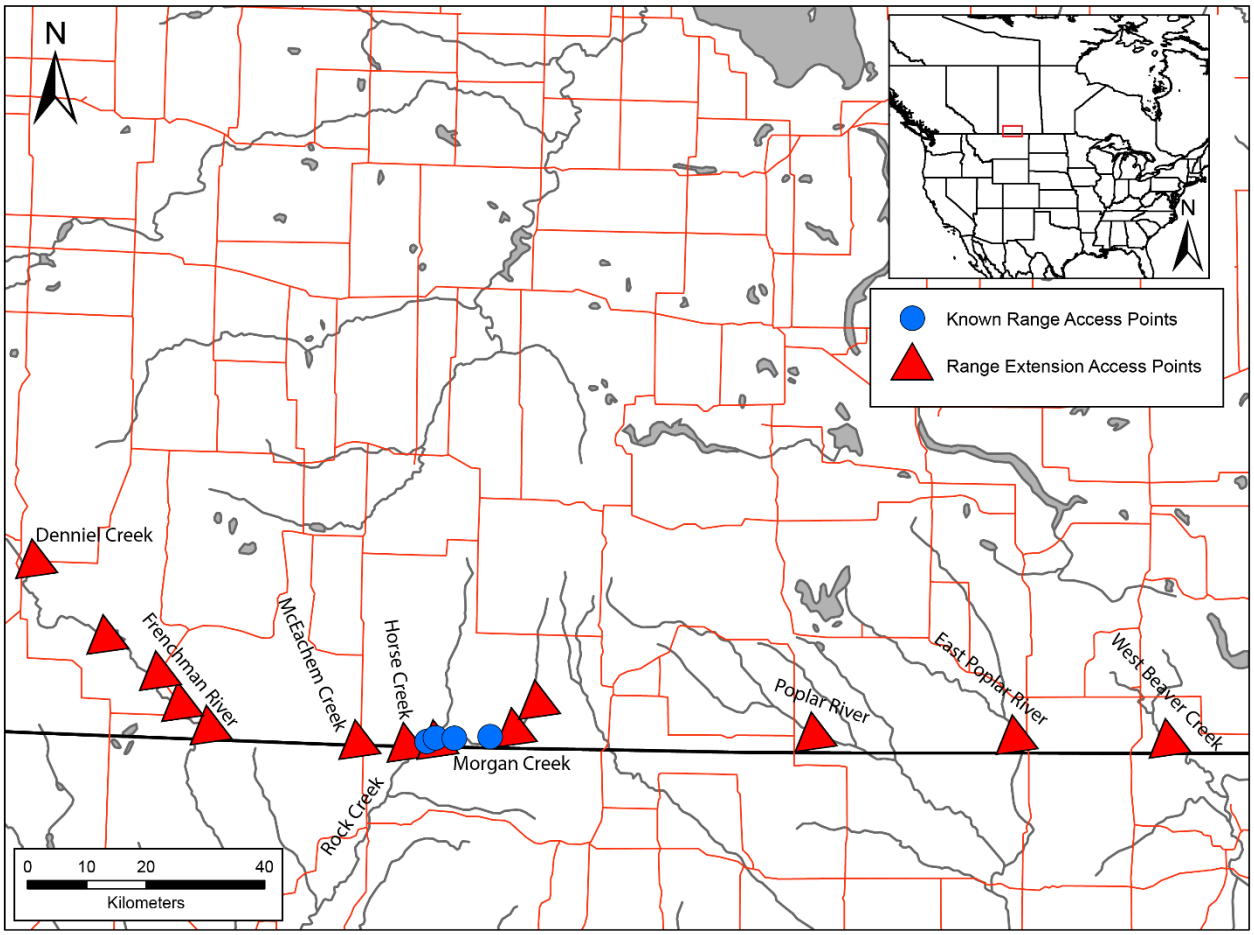

Figure 1. Map of access points sampled for Plains Minnow in Saskatchewan in 2020.

2.2 Fish Sampling Protocol

Fish sampling followed a standardized sampling protocol outlined by Macnaughton et al. (2019). Three sample sites were randomly selected at each access point with the exceptions of Rock Creek - Access 1, where two additional sites were selected to increase sampling effort, and Wetherall Creek, where only two sites were selected due to limited wetted habitat (Table 1). Fish were collected at each sample site using a 9.14 m long by 1.8 m high seine net with a 1.8 by 1.8 m bag and 4.76 mm mesh. A block net was anchored downstream to stop fish from escaping the site during sampling. Effort at each sample site varied depending on stream morphology; however, the target effort at each site was 100 m^2. The seine net was dragged downstream towards the block net, however, in some instances where there were backwaters, snags, or no flow, the seine net was dragged upstream towards a block net. Once sampling was complete at a sample site, all fish were identified and enumerated, fork length of Plains Minnow was measured and, unless retained as vouchers (Appendix 1), fish were released immediately. In total, 18 Plains Minnow vouchers were collected in ethanol or formalin for identification confirmation, genetics, and aging. Vouchered fish are stored at the Freshwater Institute in Winnipeg, Manitoba.

3. RESULTS

3.1 Habitat

Water temperature ranged from 10.5–16.8 °C among access points and varied depending on the time of day (Table 2). Conductivity ranged from 209–2850 $\mu S \cdot cm^{-1}$ across the access points. Turbidity in the system was variable, with a mean of 48.8 NTU and range of 7.6–413 NTU. Water velocities varied from 0–0.07 $m \cdot s^{-1}$. Depth at sample sites varied from 0.2–1.3 m. Sites ranged from clay to boulder substrates, but the majority of sites were gravel dominated (Table 3).

Table 2. Summary of water quality variables at each access point. 'Not recorded' denotes equipment malfunction or lack of equipment; and 'N/A' denotes Secchi Depth to the bottom of the waterbody.

Waterbody	Access Point	Water Temperature (°C)	Conductivity ($\mu S \cdot cm^{-1}$)	Turbidity (NTU)	Secchi Depth (cm)
Rock Creek	Access 1	11.5	525	22.4	51
Rock Creek	Access 2	12.2	1552	20.6	74
Rock Creek	Access 3	11.8	1746	13.6	19
Horse Creek	Trail Crossing	16.8	502	413	30
Wetherall Creek	Confluence of Rock Creek	14.2	1724	7.6	N/A
Morgan Creek	Access 1	11.7	283	20.8	N/A
Morgan Creek	Access 2	13.6	246	13.8	N/A
Morgan Creek	Access 3	10.5	209	Not recorded	N/A
Frenchman River	Access 1	14.5	Not recorded	38.8	34
Frenchman River	Access 2	13.7	Not recorded	39.4	30
Frenchman River	Access 3	12.2	831	27.3	52
Frenchman River	Access 4	12.9	256	34.1	42
McEachem Creek	Road Crossing	11.0	1587	66.7	20
East Poplar River	Road Crossing	10.7	1412	9.2	N/A
Poplar River	Road Crossing	11.7	210	20.0	N/A
West Beaver Creek	Hwy 2 Crossing	14.0	2850	23.9	38
Denniel Creek	Hwy 18 Crossing	11.3	770	8.9	N/A
Mean		**12.6**	**980**	**48.8**	**39**

Table 3. Summary of mean habitat variables at each access point. Minimum and maximum ranges are displayed in brackets and percent substrate composition are reported as means. 'Not recorded' denotes equipment malfunction or lack of equipment.

Waterbody	Access Point	Mean Water Velocity ($m \cdot s^{-1}$)	Mean Water Depth (m)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
Rock Creek	Access 1	0.02 (0.01-0.03)	0.80 (0.54-0.94)		41		45	14	
Rock Creek	Access 2	0.02 (0.02-0.03)	0.79 (0.62-0.89)		40	13	47		
Rock Creek	Access 3	0.04 (0.02-0.08)	0.51 (0.34-0.70)		24	3	43	30	
Horse Creek	Trail Crossing	0.01 (0-0.02)	0.76 (0.42-0.95)		70		23	7	
Wetherall Creek	Confluence of Rock Creek	0	0.29 (0.22-0.36)		100				
Morgan Creek	Access 1	Not recorded	0.39 (0.28-0.58)	13	12	17	57	2	
Morgan Creek	Access 2	Not recorded	0.67 (0.49-0.85)	80	20				
Morgan Creek	Access 3	Not recorded	0.55 (0.40-0.80)	27	18	5	50		
Frenchman River	Access 1	0.02 (0.01-0.02)	0.92 (0.72-1.14)	16	7		60	17	
Frenchman River	Access 2	0.03 (0.01-0.05)	0.73 (0.38-0.90)	3	17		60	20	
Frenchman River	Access 3	0.02 (0.01-0.02)	0.61 (0.33-1.05)		23	22	50	5	
Frenchman River	Access 4	0.02 (0.02)	0.79 (0.32-1.16)	17	50		30	3	
McEachern Creek	Road Crossing	0	0.93 (0.82-1.00)	34	48		18		
East Poplar River	Road Crossing	0.07 (0.02-0.16)	0.40 (0.34-0.45)	10	45		38		7
Poplar River	Road Crossing	Not recorded	0.20 (0.20)		20	30	10	30	
West Beaver Creek	Hwy 2 Crossing	0.04 (0-0.10)	0.46 (0.38-0.50)	7	7	6	80		
Denniel Creek	Hwy 18 Crossing	0	1.03 (0.88-1.25)	100					

3.2 Fish

A total of 11,117 fish (Table 4), represented by 16 species were collected at the 17 access points sampled. In total, 43 Plains Minnow were caught at two access points: Rock Creek Access 1 (n = 21) and Rock Creek Access 3 (n = 22). The fork length of Plains Minnow ranged from 44–107 mm, with a mean of 72 mm (Figure 2). The mean catch-per-unit-effort (CPUE) of Plains Minnow at the access points within the known distribution (Rock Creek and Morgan Creek) was 0.03 fish·m^{-2} (Table 5).

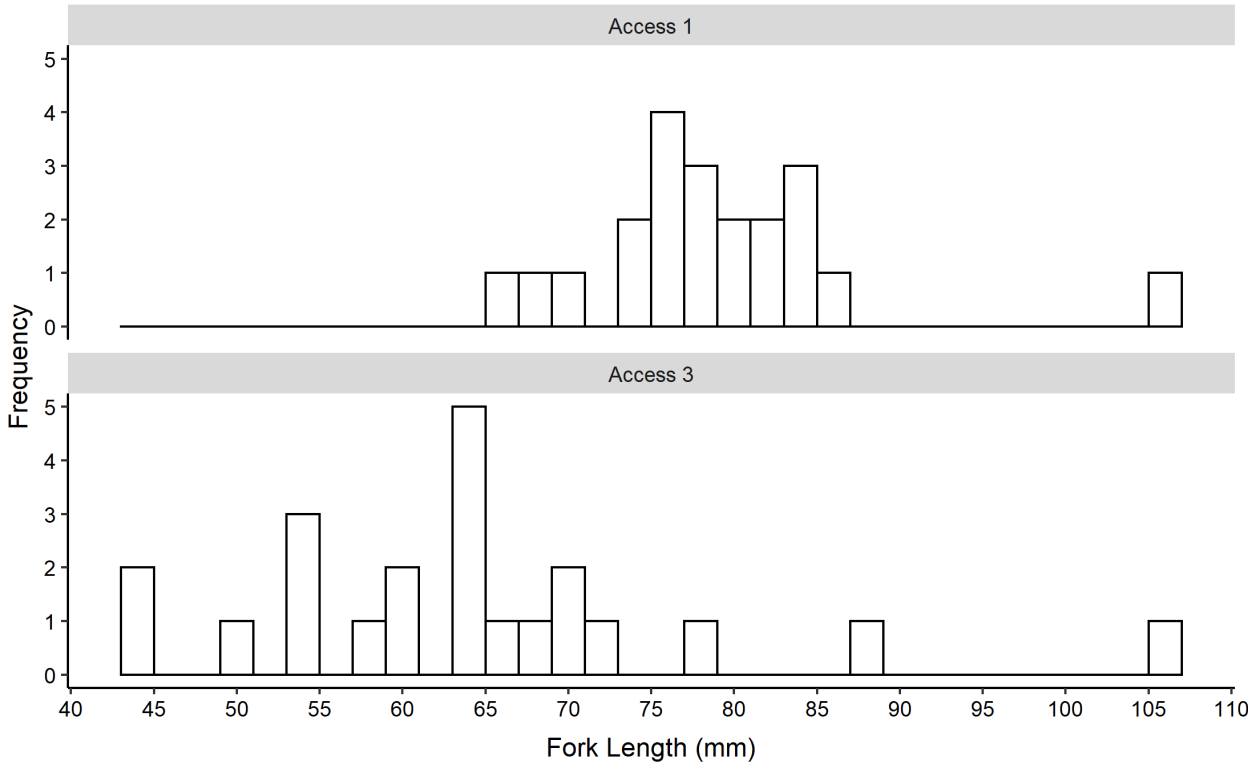

Figure 2. Frequency distribution of fork length (mm) measurements of Plains Minnow caught in Rock Creek at Access 1 and Access 3.

Table 4. Total catch at the 17 access points sampled in southern Saskatchewan in September 2020. Species codes are listed in Appendix 2.

Waterbody	Access Point	LKCH	CARP	BRMW	PLMW	PRDC	NRDC	FHMW	FHCH	LNDC	WHSK	SHRH	SCAT	NRPK	BKSB	IWDT	WALL	Total
Rock Creek	Access 1	628		127	21		1	176		95	144	2	2		13	7		**1216**
Rock Creek	Access 2	50		20		7	6	201		24	73	2				1		**384**
Rock Creek	Access 3	380	1	41	22			383		233	74	1			1			**1136**
Horse Creek	Trail Crossing	58		6		4		2463			52				561	9		**3153**
Wetherall Creek	Confluence of Rock Creek	1		1		4		15		1	4				8	1		**35**
Morgan Creek	Access 1	289						198		119	35		1		2	3		**647**
Morgan Creek	Access 2	133		1			7	18		5	30					2		**196**
Morgan Creek	Access 3	259		96		182		153		16	237				181	19		**1143**
Frenchman River	Access 1								1	1		1						**3**
Frenchman River	Access 2	3										4					1	**8**
Frenchman River	Access 3	1									2							**3**
Frenchman River	Access 4	6									7	1						**14**
McEachern Creek	Road Crossing	741				1		1860			43				179			**2824**
East Poplar River	Road Crossing						5	269			23			1	6	4		**308**
Poplar River	Road Crossing			2							8			14		9		**33**
West Beaver Creek	Hwy 2 Crossing							9			4			2				**15**
Denniel Creek	Hwy 18 Crossing													2				**2**
Total		**2549**	**1**	**294**	**43**	**198**	**19**	**5745**	**1**	**494**	**736**	**11**	**3**	**19**	**951**	**55**	**1**	**11120**

Table 5. Catch-per-unit-effort (fish·m^{-2}) at the 17 access points sampled in southern Saskatchewan in September 2020. Species codes are listed in Appendix 2.

Waterbody	Access Point	Effort (m^2)	LKCH	CARP	BRMW	PLMW	PRDC	NRDC	FHMW	FHCH	LNDC	WHSK	SHRH	SCAT	NRPK	BKSB	IWDT	WALL
Rock Creek	Access 1	510	1.23	0	0.25	0.04	0	0.001	0.35	0	0.19	0.28	0.004	0.004	0	0.03	0.01	0
Rock Creek	Access 2	320	0.16	0	0.06	0	0.02	0.02	0.63	0	0.08	0.23	0.006	0	0	0	0.003	0
Rock Creek	Access 3	236	1.61	0.004	0.17	0.09	0	0	1.62	0	0.99	0.31	0.004	0	0	0.004	0	0
Horse Creek	Trail Crossing	360	0.16	0	0.02	0	0.01	0	6.84	0	0	0.14	0	0	0	1.56	0.03	0
Wetherall Creek	Confluence of Rock Creek	95	0.01	0	0.01	0	0.04	0	0.16	0	0.01	0.04	0	0	0	0.08	0.01	0
Morgan Creek	Access 1	270	1.07	0	0	0	0	0	0.73	0	0.44	0.13	0	0.004	0	0.007	0.01	0
Morgan Creek	Access 2	195	0.68	0	0.005	0	0	0.04	0.09	0	0.03	0.15	0	0	0	0	0.01	0
Morgan Creek	Access 3	305	0.85	0	0.31	0	0.60	0	0.50	0	0.05	0.78	0	0	0	0.59	0.06	0
Frenchman River	Access 1	530	0	0	0	0	0	0	0	0.002	0.002	0	0.002	0	0	0	0	0
Frenchman River	Access 2	380	0.008	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0.003
Frenchman River	Access 3	340	0.003	0	0	0	0	0	0	0	0	0.006	0	0	0	0	0	0
Frenchman River	Access 4	340	0.02	0	0	0	0	0	0	0	0	0.02	0.003	0	0	0	0	0
McEachem Creek	Road Crossing	630	1.18	0	0	0	0.002	0	2.95	0	0	0.07	0	0	0	0.28	0	0
East Poplar River	Road Crossing	590	0	0	0	0	0	0.01	0.46	0	0	0.04	0	0	0.002	0.01	0.007	0
Poplar River	Road Crossing	330	0	0	0.006	0	0	0	0	0	0	0.02	0	0	0.04	0	0.03	0
West Beaver Creek	Hwy 2 Crossing	450	0	0	0	0	0	0	0.02	0	0	0.009	0	0	0.004	0	0	0
Denniel Creek	Hwy 18 Crossing	300	0	0	0	0	0	0	0	0	0	0	0	0	0.007	0	0	0
Mean		**363.6**	**0.41**	**0.0002**	**0.05**	**0.008**	**0.04**	**0.004**	**0.84**	**0.0001**	**0.10**	**0.13**	**0.002**	**0.0004**	**0.003**	**0.15**	**0.01**	**0.0002**

4. DISCUSSION

To increase our understanding of the relative abundance and distribution of the SARA listed Plains Minnow, we sampled 17 access points in 10 streams in southern Saskatchewan. Using a standardized protocol (Macnaughton et al. 2019), we caught Plains Minnow at two access points in Rock Creek, within the known range of the species. Previous sampling in 2006 and 2007 had collected Plains Minnow in Rock Creek with an average CPUE of 0.09 fish·m^{-2} (Watkinson unpublished data). This is slightly higher than the CPUE of 0.04 fish·m^{-2} observed in 2020 in Rock Creek. Watkinson (unpublished data) also found Plains Minnow in Morgan Creek in 2006 and 2007 with a CPUE of 0.53 fish·m^{-2}; however, no Plains Minnow were caught in Morgan Creek during sampling in 2020. This suggests that the relative abundance of Plains Minnow in Canada remains low and its distribution is variable or could be contracting within the known range. Sampling effort in 2020 may have been insufficient to properly assess the distribution of Plains Minnow given that the species may occur at low abundances and/or have patchy distribution.

To study if Plains Minnow occur outside its known distribution in Canada, 13 access points were sampled that are situated outside the known distribution of the species (Table 1). However, no Plains Minnow were found at any of these access points (Table 4) and the distribution of the species in Canada remains very restricted. The occurrence of piscivores, like Northern Pike (*Esox lucius*) and Walleye (*Sander vitreus*) (Table 4), at other access points may limit Plains Minnow presence elsewhere in the Canadian drainage.

A previous study that sampled Plains Minnow in Canada did not collect young-of-the-year (<55 mm fork length; Taylor & Miller 1990); however, the smaller Plains Minnow collected in this study (44–60 mm, Figure 2) may represent young-of-the-year for the species, which suggests that successful reproduction is occurring.

One Common Carp (*Cyprinus carpio*), an introduced fish species, was collected during standardized sampling at Rock Creek Access 3 (Table 4). Two additional Common Carp and a Black Bullhead (*Ameiurus melas*), also introduced, were collected during directed sampling that was conducted independent of the standardized sampling program at Rock Creek Access 1. Common Carp feed on benthos and could reduce the availability of photosynthetic diatoms and algae that are suspected to be the main component of Plains Minnow diet (COSEWIC 2012). Additionally, Common Carp feeding and spawning behaviour typically increases turbidity, which could also reduce photosynthetic diatoms and algae growth (Weber & Brown 2009). To date, Common Carp and Black Bullhead abundance are low and no impact is expected, but continued monitoring is recommended.

Collections of fish at the four access points in the Frenchman River and its tributary, Denniel Creek, were very low (Table 4). At these five access points the total catch was only 30 individuals represented by six different fish species and these individuals were often large-bodied. This was in contrast to the large catches of typically hundreds of small-bodied fish at other access points (Table 4). Collections made in September 2003–2007 in the Frenchman River system at many of the same locations were considerably higher and more diverse with a backpack electrofishing unit (n = 343; species = 8) and seine net (n = 5,129; species = 13) (Appendix 3 and Appendix 4). Low collections in the Frenchman River in 2020 could be an indication that habitat for fish in the drainage prior to sampling was limiting for fish populations. Alternatively, fish populations in the Frenchman River may have patchy distributions and effort may need to be increased for future sampling in the drainage. Additional data collection related to water quality and habitat availability is recommended in the Frenchman River to identify possible limiting factor(s) for fish populations in the system.

In conclusion, the sampling trip conducted in September 2020 revealed that the relative abundance and distribution of Plains Minnow in Canada remains low, with 43 individuals collected at two access points. Continued use of the standardized sampling protocol (Macnaughton et al., 2019) discussed in this report is recommended to analyse the trends in relative abundance of Plains Minnow and monitor the effects of recovery actions.

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6. APPENDICES

Appendix 1. Number of individuals retained as vouchers. Vouchers are stored at the Freshwater Institute in Winnipeg, Manitoba.

Waterbody	Access Point	LKCH	CARP	BRMW	PLMW	PRDC	NRDC	FHMW	FHCH	LNDC	WHSK	SHRH	SCAT	BKSB	IWDT
Rock Creek	Access 1	3		9	16		1			2	1	1	1	2	1
Rock Creek	Access 2	2		10		1	3	3		1	1				1
Rock Creek	Access 3	1	1	1	2			1		1	1	1		1	
Horse Creek	Trail Crossing	1		3		1								1	1
Wetherall Creek	Confluence of Rock Creek			1		4				1	1			1	1
Morgan Creek	Access 1	1						1		1	1				1
Morgan Creek	Access 2	1		2				1		4	1				1
Frenchman River	Access 1								1	1					
Frenchman River	Access 2	1													
Frenchman River	Access 3	1									1				
Frenchman River	Access 4	1									1	1			
McEachern Creek	Road Crossing	1				1		2			1			1	
West Beaver Creek	Hwy 2 Crossing							1			1				
Total		**13**	**1**	**26**	**18**	**7**	**4**	**9**	**1**	**11**	**11**	**3**	**1**	**6**	**6**

Appendix 2. Species codes for fish mentioned in this report.

Code	Common Name	Scientific Name
LKCH	Lake Chub	*Couesius plumbeus*
CARP	Common Carp	*Cyprinus carpio*
BRMW	Brassy Minnow	*Hybognathus hankinsoni*
PLMW	Plains Minnow	*Hybognathus placitus*
PRDC	Northern Pearl Dace	*Margariscus nachtriebi*
NRDC	Northern Redbelly Dace	*Chrosomus eos*
FHMW	Fathead Minnow	*Pimephales promelas*
FHCH	Flathead Chub	*Platygobio gracilis*
LNDC	Longnose Dace	*Rhinichthys cataractae*
WHSK	White Sucker	*Catostomus commersonii*
SHRH	Shorthead Redhorse	*Moxostoma macrolepidotum*
BKBH	Black Bullhead	*Ameiurus melas*
SCAT	Stonecat	*Noturus flavus*
NRPK	Northern Pike	*Esox lucius*
BKSB	Brook Stickleback	*Culaea inconstans*
IWDT	Iowa Darter	*Etheostoma exile*
WALL	Walleye	*Sander vitreus*

Appendix 3. Total catch of fish collected using a backpack electrofishing unit (Smith-Root, model 12A) in the Frenchman River in September 2003. Species codes are listed in Appendix 2.

Waterbody	Date (dd/mm/yyyy)	Latitude	Longitude	Effort (s)	LKCH	CARP	BRMW	PRDC	FHMW	FHCH	LNDC	WHSK	SHRH	BKBH	SCAT	NRPK	BKSB	IWDT
Frenchman R.	24/09/2003	49.49325	-109.08656	417				1			24	32						3
Frenchman R.	24/09/2003	49.40978	-108.02044	1025	30	2			9		28	17	5					
Frenchman R.	24/09/2003	49.05161	-107.35500	532	17	5			63		41	42						2
Frenchman R.	24/09/2003	49.49325	-109.08656	417														
Frenchman R.	24/09/2003	49.40978	-108.02044	1025														
Frenchman R.	24/09/2003	49.05161	-107.35500	532								2						
				Total	**47**	**7**	**0**	**1**	**72**	**0**	**93**	**93**	**5**	**0**	**0**	**0**	**0**	**5**

Appendix 4. Total catch of fish collected using a seine (9.14 m/1.82 m/4.76 mm) in the Frenchman River drainage in September 2003, 2006, and 2007. Species codes are listed in Appendix 2.

Waterbody	Date (dd/mm/yyyy)	Latitude	Longitude	Effort (m^2)	LKCH	CARP	BRMW	PRDC	FHMW	FHCH	LNDC	WHSK	SHRH	BKBH	SCAT	NRPK	BKSB	IWDT
Frenchman R.	27/09/2006	49.20365	-107.69005	640	5	1			894		4	33						40
Frenchman R.	27/09/2006	49.09898	-107.40431		208	3	32		241	2	39	102						
Frenchman R.	27/09/2006	49.02102	-107.28420	560	77	6			188	7	92	149	1	133	2			
Frenchman R.	27/09/2006	49.02046	-107.28407		15	3			10	1	53	35			4			
Frenchman R.	08/09/2007	49.15228	-107.52845	160	72		45		343		11	34						3
Frenchman R.	08/09/2007	49.15228	-107.52845	200	50		1		1460			198		9		1		
Denniel C.	24/09/2003	49.26192	-107.69942	25	7		1		507								4	3
				Total	**434**	**13**	**79**	**0**	**3643**	**10**	**199**	**551**	**1**	**142**	**6**	**1**	**4**	**46**