WESTERN SILVERY MINNOW (*HYBOGNATHUS ARGYRITIS*) RELATIVE ABUNDANCE AND DISTRIBUTION IN THE MILK RIVER DRAINAGE IN 2021 AND 2022

Matthew Teillet, Doug A. Watkinson, Tyana Rudolfsen, Jacqueline Twilley, Lisa Schaubel, Shane F. Petry, Lee F. G. Gutowsky, and Eva C. Enders

Fisheries and Oceans Canada
Ecosystems and Oceans Science
Ontario and Prairie Region
Freshwater Institute
Winnipeg, MB
R3T 2N6

2024

Canadian Data Report of
Fisheries and Aquatic Sciences 1382

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

Canadian Data Report of Fisheries and Aquatic Sciences

Data reports provide a medium for filing and archiving data compilations where little or no analysis is included. Such compilations commonly will have been prepared in support of other journal publications or reports. The subject matter of the series reflects the broad interests and policies of Fisheries and Oceans Canada, namely, fisheries management, technology and development, ocean sciences, and aquatic environments relevant to Canada.

The correct citation appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts*.

Data reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page.

Numbers 1-25 in this series were issued as Fisheries and Marine Service Data Records. Numbers 26-160 were issued as Department of Fisheries and Environment, Fisheries and Marine Service Data Reports. The current series name was changed with report number 161.

Rapport statistique canadien des sciences halieutiques et aquatiques

Les rapports statistiques servent de base à la compilation des données de classement et d'archives pour lesquelles il y a peu ou point d'analyse. Cette compilation aura d'ordinaire été préparée pour appuyer d'autres publications ou rapports. Les sujets des rapports statistiques reflètent la vaste gamme des intérêts et politiques de Pêches et Océans Canada, notamment la gestion des pêches, la technologie et le développement, les sciences océaniques et l'environnement aquatique, au Canada.

Le titre exact figure au haut du résumé de chaque rapport. Les rapports à l'industrie sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques*.

Les rapports statistiques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement d'origine dont le nom figure sur la couverture et la page du titre.

Les numéros 1 à 25 de cette série ont été publiés à titre de Records statistiques, Service des pêches et de la mer. Les numéros 26-160 ont été publiés à titre de Rapports statistiques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom de la série a été modifié à partir du numéro 161.

Canadian Data Report of
Fisheries and Aquatics Sciences 1382

2024

WESTERN SILVERY MINNOW (*HYBOGNATHUS ARGYRITIS*) RELATIVE ABUNDANCE AND DISTRIBUTION IN THE MILK RIVER DRAINAGE IN 2021 AND 2022

by

Matthew Teillet, Doug A. Watkinson, Tyana Rudolfsen, Jacqueline Twilley, Lisa Schaubel, Shane F. Petry, Lee F. G. Gutowsky, and Eva C. Enders

Fisheries and Oceans Canada
Ecosystems and Oceans Science
Ontario and Prairie Region
Freshwater Institute
Winnipeg, MB
R3T 2N6

Cat. No. Fs97-13/1382E-PDF ISBN 978-0-660-69138-1 ISSN 1488-5395

Correct citation for this publication:

Teillet, M., Watkinson, D.A., Rudolfsen, T., Twilley, J., Schaubel, L., Petry, S.F., Gutowsky, L.F.G., and Enders, E.C. 2024. Western Silvery Minnow (*Hybognathus argyritis*) relative abundance and distribution in the Milk River drainage in 2021 and 2022. Can. Data Rep. Fish. Aquat. Sci. 1382: v + 15 p.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Teillet, M., Watkinson, D.A., Rudolfsen, T., Twilley, J., Schaubel, L., Petry, S.F., Gutowsky, L.F.G, and Enders, E.C. 2024. Western Silvery Minnow (*Hybognathus argyritis*) relative abundance and distribution in the Milk River drainage in 2021 and 2022. Can. Data Rep. Fish. Aquat. Sci. 1382: v + 15 p.

Western Silvery Minnow (*Hybognathus argyritis*) is a species at risk whose Canadian range is limited to the Milk River, Alberta. The waters of the Milk and St Mary's rivers have been shared by Canada and the USA since the early twentieth century via the Boundary Waters Treaty of 1909. Sampling was conducted in the Milk River in 2020 after the failure of a drop structure in Montana, USA that facilitated the transfer of water from the St. Mary Diversion to assess potential impacts on the relative abundance and distribution of fish species. Sampling found low relative abundances of Western Silvery Minnow and their distribution was limited to the furthest downstream access point on the Milk River in Canada. In 2021 and 2022, targeted sampling for Western Silvery Minnow was conducted following a standardized sampling protocol. In total, 12 Western Silvery Minnow were captured at one access point in 2021 and 48 individuals were captured at one access point in 2022. Similar to 2020, all Western Silvery Minnow were collected at downstream access points on the Milk River in Canada. Analysis of Western Silvery Minnow otoliths confirms that young-of-the-year were present in 2022, suggesting that Western Silvery Minnow are successfully reproducing in the drainage. Decreased turbidity during natural flows may drive a downstream migration of Western Silvery Minnow to the lowest reaches of the Milk River where turbidity remains high. We recommend that Western Silvery Minnow sampling is conducted during augmented flows to assess if the relative abundance increases and distribution expands during augmentation.

RÉSUMÉ

Teillet, M., Watkinson, D.A., Rudolfsen, T., Twilley, J., Schaubel, L., Petry, S.F., Gutowsky, L.G.F., and Enders, E.C. 2024. Western Silvery Minnow (*Hybognathus argyritis*) relative abundance and distribution in the Milk River drainage in 2021 and 2022. Can. Data Rep. Fish. Aquat. Sci. 1382: v + 15 p.

Le méné d'argent de l'Ouest (*Hybognathus argyritis*) est une espèce en péril dont l'aire de répartition canadienne se limite à la rivière Milk, Alberta. Les eaux des rivières Milk et St Mary's sont partagées par le Canada et les États-Unis depuis le début du XXe siècle via le Traité des eaux limitrophes de 1909. Un échantillonnage a été effectué en 2020 en raison de la défaillance d'une structure de chute dans le Montana, États-Unis, qui a facilité le transfert d'eau de la Déviation St. Mary. L'échantillonnage a révélé une faible abondance relative du méné d'argent de l'Ouest et la répartition de l'espèce était limitée au point d'accès le plus en aval sur la rivière Milk. En 2021, un échantillonnage ciblé du méné d'argent de l'Ouest a été effectué selon du protocole d'échantillonnage normalisé. Seulement 12 individus ont été capturés à partir de 15 points d'accès échantillonnés dans le bassin versant de la rivière Milk en 2021. Comme en 2020, tous les individues ont été capturés au point d'accès le plus en aval de la rivière Milk. Dix individus étaient probablement des jeunes de l'année en fonction de leur taille, ce qui suggère qu'une recruitment a eu lieu en 2021. Nous recommandons que l'échantillonnage futur soit effectué pendant les débits augmentés afin d'évaluer avec précision l'abondance relative et la répartition du méné d'argent de l'Ouest au Canada.

1. INTRODUCTION

Western Silvery Minnow (*Hybognathus argyritis*) is assessed as threatened in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2017) and is listed as threatened pursuant to the *Species at Risk Act* of Canada and the *Wildlife Act* of Alberta. Its Canadian distribution is limited to the Milk River in Alberta. Flows in the Milk River drainage are typically augmented from April to October each year via the St. Mary Diversion that originates in Montana USA, increasing discharge approximately 10–15-times that of natural flow (COSEWIC 2017). The flows of the Milk and St. Mary rivers have been shared by Canada and the USA since the early twentieth century via the Boundary Waters Treaty of 1909. As such, this agreement allows water to be diverted from the St. Mary River in Montana into the Milk River in Canada for conveyance back into the eastern portion of Montana. In 2020, a drop structure in the upper portion of the diversion in Montana failed, resulting in natural summer flows in the Milk River.

Sampling was conducted in 2020 by Fisheries and Oceans Canada (DFO) and Alberta Environment and Protected Areas (EPA) to assess the distribution and abundance of species at risk in the drainage when flows were natural. Of the six access points sampled within the known range of Western Silvery Minnow, distribution was restricted to the furthest downstream access point and relative abundance was low (Teillet et al. 2021). After repairs were made to the diversion structure, normal augmentation in the drainage resumed in the fall of 2020 (Appendix 1).

In 2021 and 2022, DFO and EPA conducted targeted sampling following a standardized sampling protocol (Macnaughton et al. 2019a) to determine the relative abundance and distribution of Western Silvery Minnow in Canada.

2. METHODS

2.1 FISH SAMPLING PROTOCOL

Targeted sampling followed a standardized protocol developed by DFO (Macnaughton et al. 2019a). The sampling protocol dictates that sampling occurs after augmentation flows have ended and flows have returned to natural levels in the Milk River drainage to accommodate wading. A total of 15 access points were sampled within the Milk River drainage in September 2021, and one additional access point was sampled during augmented flows in September 2022 (Figure 1). One access point was located in the North Milk River, and three access points were located in the Milk River, upstream of the known range of Western Silvery Minnow (Figure 1, Table 1). The eleven remaining access points were within the known range of Western Silvery Minnow (Figure 1, Table 1).

At each access point, five sample sites were randomly selected. Sample sites were fished in a downstream to upstream direction to avoid disturbing fish habitat. All fishing was conducted 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. Seining followed methods outlined in Bonar et al. (2007) where the net is held by one individual on the shoreline, while the other end is extended and then pulled in an upstream to downstream radius (180° arch) sampling a semi-circle area (~100 m^2; Macnaughton et al. 2019a). At some access points, backwater channels were specifically targeted and were included as one of the five sample sites. In these cases, the seining was conducted from downstream to upstream and the whole backwater area was sampled (Macnaughton et al. 2019a). The sample area was measured with a tape measure.

Once seining was completed at a sample site, fork length (to the nearest mm) of Western Silvery Minnow and other species at risk (i.e., Plains Sucker (*Pantosteus jordani*) and Rocky Mountain Sculpin (*Cottus* sp.))

were measured. All non-target species were identified and enumerated. A list of the specimens that were retained as vouchers are found in Appendix 2.

2.2 HABITAT AND SITE DESCRIPTIONS

Habitat sampling followed the protocol outlined in Macnaughton et al. (2019a). The following variables were measured at each access point: water temperature (°C), conductivity ($\mu S \cdot cm^{-1}$), turbidity (Nephelometric Turbidity Unit, NTU), and Secchi depth (cm; when suitable water depth was present). Wetted and rooted width (m) of the channel were measured at each fish sampling site. Depth (m), water velocity ($m \cdot s^{-1}$), percent substrate composition (Wentworth scale), and percent macrophyte cover were recorded in three quadrats in the middle of each third of the semi-circle seine haul (Macnaughton et al. 2019a).

2.3 AGE ESTIMATES

Age estimates were taken from vouchered Western Silvery Minnow specimens collected in 2021 and 2022 at the Freshwater Institute, Winnipeg, Manitoba. In total, 33 Western Silvery Minnow vouchers were aged. Otoliths were extracted from specimens and soaked in water for 20 min. Otolith annuli were counted under a dissecting microscope at 1.25x magnification to become acquainted with the species and make initial notes. Otoliths were soaked in water again and photographed using LAS X software (Leica Microsystems). The brightness and contrast of the photos were then adjusted to further highlight the annuli. If annuli could still not be interpreted, otoliths were resoaked and grinded laterally with a wet stone. Images were retaken with LAS X software and the final age estimation made.

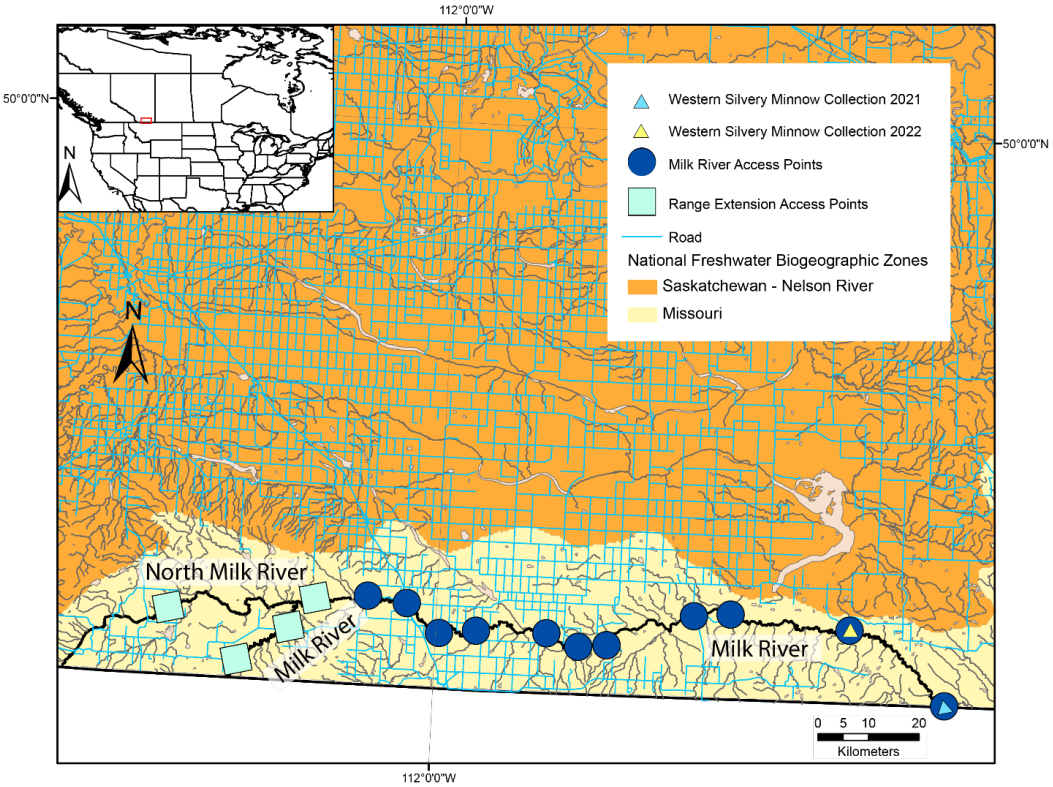


Figure 1. Map of access points in the Milk River drainage sampled in 2021 with the triangle denoting the site where Western Silvery Minnow were collected. In 2022, a single site (yellow triangle) was sampled and Western Silvery Minnow were collected.

Table 1. Access points sampled in the Milk River drainage in 2021 and 2022. Sites are listed in upstream to downstream order.

River	Access Point	Date Sampled (dd/m/yyyy)	Coordinates
North Milk R.	Range Rd 212A	22/9/2021	49.11419, -112.72289
Milk R.	Twin River Provincial Grazing Reserve	22/9/2021	49.02972, -112.53260
Milk R.	Hwy 501 Bridge	22/9/2021	49.09209, -112.39651
Milk R.	Twin River Heritage Rangeland Natural Area	22/9/2021	49.14585, -112.32896
Milk R.	Township Rd 24A	22/9/2021	49.15503, -112.18707
Milk R.	Town of Milk River	22/9/2021	49.14534, -112.08047
Milk R.	Goldspring Park	21/9/2021	49.09548, -111.98973
Milk R.	Coffin Bridge	21/9/2021	49.10284, -111.89083
Milk R.	Township Rd 21A	23/9/2021	49.10427, -111.70081
Milk R.	Writing on Stone Campground	21/9/2021	49.08265, -111.61297
Milk R.	Deer Creek Bridge	24/9/2021	49.08820, -111.53696
Milk R.	Hwy 880 Bridge	23/9/2021	49.14558, -111.30449
Milk R.	Ross Ranch	23/9/2021	49.15122, -111.20603
Milk R.	Pinhorn Ranch	23/9/2021 22/9/2022	49.13066, -110.88341
Milk R.	Eastern border crossing	23/9/2021	49.00197, -110.62196

3. RESULTS

3.1 FISH

Of the 15 access points that were sampled in 2021 during natural flows, Western Silvery Minnow were only collected at the furthest downstream access point (Figure 1; Table 2). This access point is near the eastern crossing of the Milk River back into the US. Sampling at the Pinhorn Ranch access point during augmented flows in 2022 yielded 48 Western Silvery Minnow. Across both years of sampling, 60 Western Silvery Minnow were caught with fork lengths ranging from 32–140 mm (Figure 2) with a mean catch-per-unit-effort (CPUE) of 0.06 fish·m^{-2} (Table 3). Other species caught along with Western Silvery Minnow included Spottail Shiner (*Notropis hudsonius*), Flathead Chub (*Platygobio gracilis*), Longnose Sucker (*Catostomus catostomus*), Plains Sucker, Trout-perch (*Percopsis omiscomaycus*), and Sauger (*Sander canadensis*) (Table 2).

Two other species at risk, Plains Sucker (Threatened) and Rocky Mountain Sculpin (Threatened), were caught during targeted sampling for Western Silvery Minnow (Table 2). In total, 78 Plains Sucker were caught at six access points, with fork lengths ranging from 26–129 mm (Appendix 3). Three Rocky Mountain Sculpin were caught at two access points in the upper Milk River drainage, with total lengths ranging from 37–95 mm (Appendix 4).

3.2 HABITAT

Water temperatures ranged from 8.9–17.3 °C among access points (Table 4). Conductivity was generally higher at downstream access points, with an overall range of 186–782 µS·cm^{-1} (Table 4). Turbidity in the system was generally low for most access points, ranging from 0.05–38.33 NTU (Table 4). Water velocities varied, ranging from 0–0.96 m·s^{-1} at sample sites (Table 5). Substrate ranged from clay to boulder, but the majority of sample sites were predominantly sand or gravel (Table 5). Macrophyte cover was low across all access points, ranging from 0–12%. At the two access points on the Milk River upstream of its confluence with the North Milk River (Figure 1) there was no flow and only isolated pools were sampled.

3.3 AGE ESTIMATES

Of the 33 Western Silvery Minnow that were aged, six were young-of-the-year that were captured in 2022 (Figure 3). None of the individuals collected in 2021 was a young-of-the-year. One individual was estimated to be age-4, which is the maximum observed age for this species in Canada (Watkinson unpublished data). The breakdown of Western Silvery Minnow individuals by age class is as follows: Age 0 (n = 6), Age 1 (n = 23), Age 2 (n = 1), Age 3 (n = 2), and Age 4 (n = 1; Figure 3).

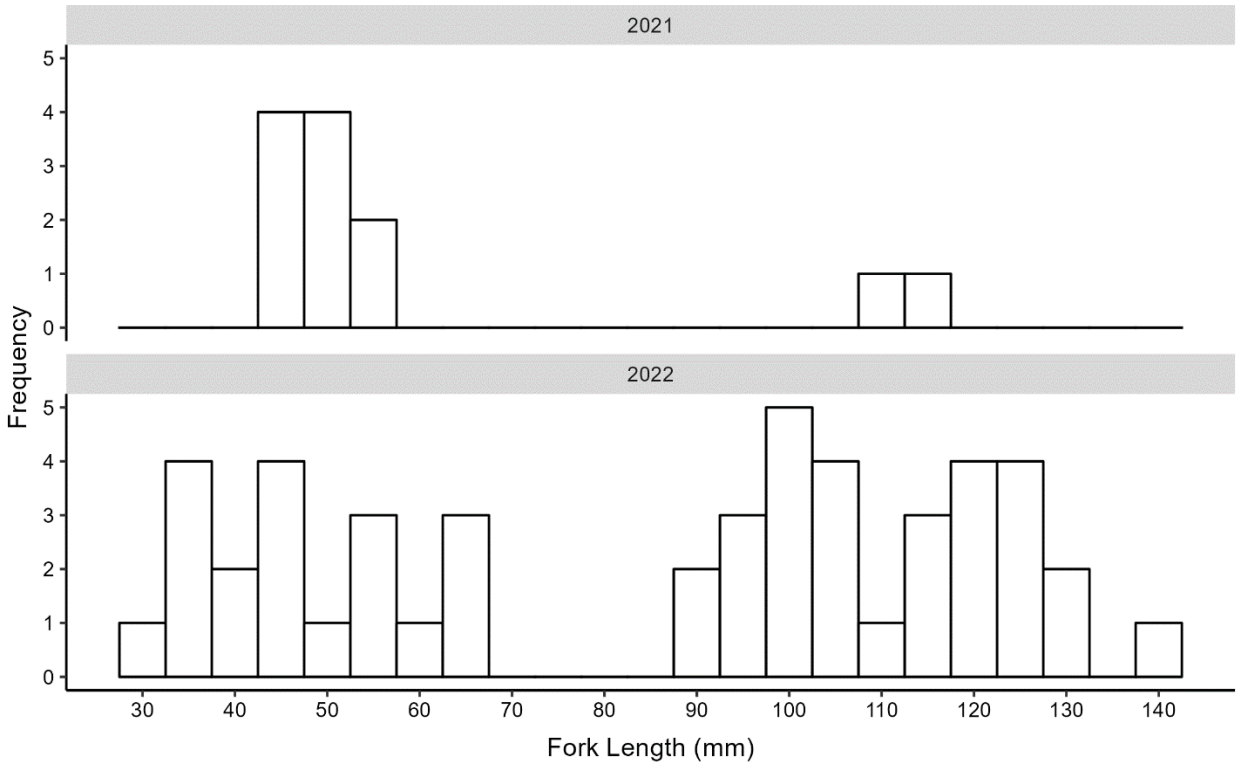


Figure 2. Frequency distribution of fork length (mm) of Western Silvery Minnow at the eastern border crossing access point in September 2021 and Pinhorn Ranch in September 2022.

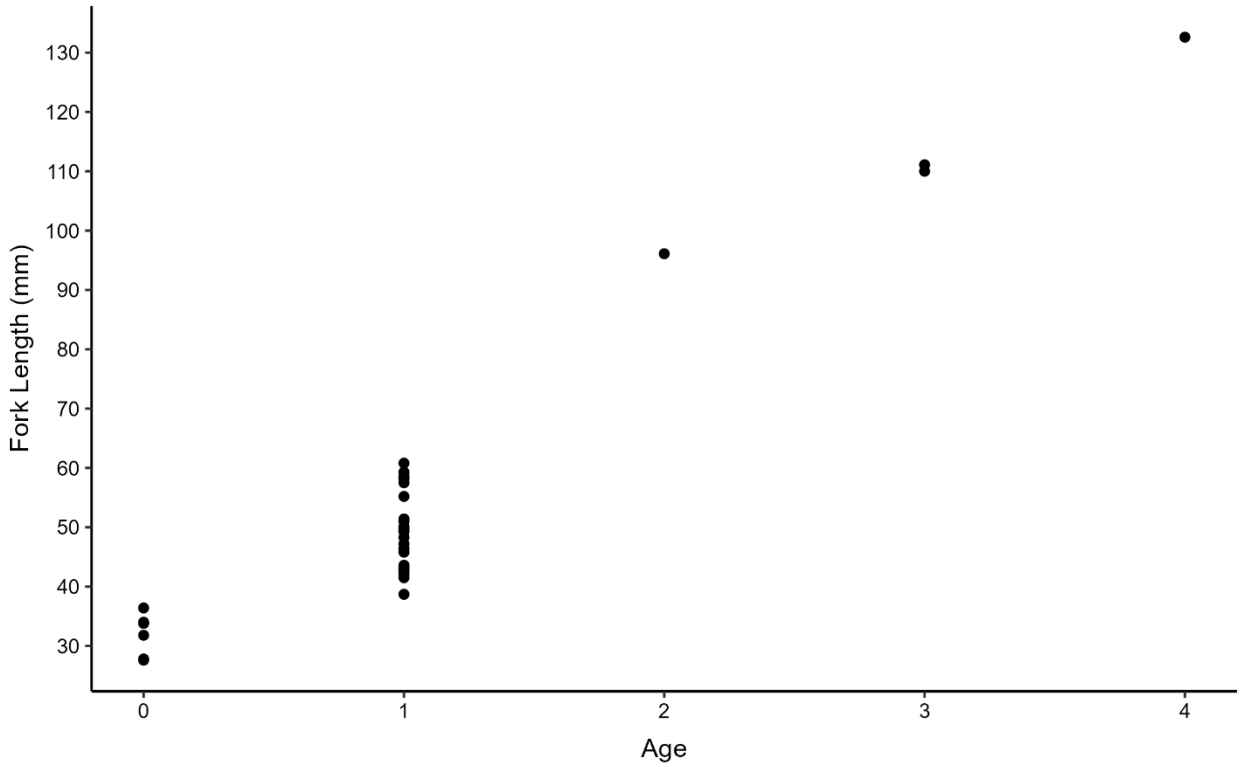


Figure 3. Western Silvery Minnow age estimations by fork length. All specimens were collected in 2021 and 2022.

Table 2. Total catch at 15 access points sampled in the Milk River drainage in September 2021 and 2022. Species codes are listed in Appendix 5.

River	Access Point	WSMW	LKCH	STSH	FHMW	FHCH	LNDC	LNSK	WHSK	PLSK	TRPR	RMSC	SAUG	Total
North Milk R.	Range Rd 212A		2				24					1		**27**
Milk R.	Twin River Provincial Grazing Reserve		37				142	5	60	30	16	2		**292**
Milk R.	Hwy 501 Bridge		41				373		174		78			**666**
Milk R.	Twin River Heritage Rangeland Natural Area								1		1			**2**
Milk R.	Township Rd 24A		4		1		8			1	3			**17**
Milk R.	Town of Milk River					1	37		5					**43**
Milk R.	Goldspring Park						24	1	1					**26**
Milk R.	Coffin Bridge					9	3							**12**
Milk R.	Township Rd 21A		2				14		1					**17**
Milk R.	Writing on Stone					14	57	3	5	1	4			**84**
Milk R.	Deer Creek Bridge						4		1		1			**6**
Milk R.	Hwy 880 Bridge		33			200		5	1	36				**275**
Milk R.	Ross Ranch		4		20	984	77	9	90	9	2			**1195**
Milk R.	Pinhorn Ranch (2021)		9											**9**
Milk R.	Pinhorn Ranch (2022)	48				112		9		1	3		3	**176**
Milk R.	Eastern border crossing	12		1		8		2			5			**28**
	Total	**60**	**132**	**1**	**21**	**1328**	**763**	**34**	**339**	**78**	**113**	**3**	**3**	**2875**

Table 3. Sampling effort (m^2) and Catch-per-unit-effort ($fish \cdot m^{-2}$) for all fish species across the 15 access points sampled in September 2021 and 2022 in the Milk River drainage. Species codes are listed in Appendix 5.

Access Point	Effort (m^2)	WSMW	LKCH	STSH	FHMW	FHCH	LNDC	LNSK	WHSK	PLSK	TRPR	RMSC	SAUG
Range Rd 212A	488.31	0	0.004	0	0	0	0.049	0	0	0	0	0.002	0
Twin River Provincial Grazing Reserve	502.65	0	0.074	0	0	0	0.283	0.010	0.119	0.060	0.032	0.004	0
Hwy 501 Bridge	476.61	0	0.086	0	0	0	0.783	0	0.365	0	0.164	0	0
Twin River Heritage Rangeland Natural Area	502.65	0	0	0	0	0	0	0	0.002	0	0.002	0	0
Township Rd 24A	502.65	0	0.008	0	0.002	0	0.016	0	0	0.002	0.006	0	0
Town of Milk River	502.65	0	0	0	0	0.002	0.074	0	0.010	0	0	0	0
Goldspring Park	451.74	0	0	0	0	0	0.053	0.002	0.002	0	0	0	0
Coffin Bridge	502.65	0	0	0	0	0.018	0.006	0	0	0	0	0	0
Township Rd 21A	536.67	0	0.004	0	0	0	0.026	0	0.002	0	0	0	0
Writing on Stone	502.65	0	0	0	0	0.028	0.113	0.006	0.010	0.002	0.008	0	0
Deer Creek Bridge	502.65	0	0	0	0	0	0.008	0	0.002	0	0.002	0	0
Hwy 880 Bridge	644.64	0	0.066	0	0	0.398	0	0.010	0.002	0.072	0	0	0
Ross Ranch	635.88	0	0.006	0	0.031	1.547	0.121	0.014	0.142	0.014	0.003	0	0
Pinhorn Ranch (2021)	502.65	0	0.018	0	0	0	0	0	0	0	0	0	0
Pinhorn Ranch (2022)	453.53	0.106	0	0	0	0.247	0	0.020	0	0.002	0.007	0	0.007
Eastern border crossing	860.45	0.014	0	0.001	0	0.009	0	0.002	0	0	0.006	0	0
Mean	**541.03**	**0.007**	**0.017**	**0.0001**	**0.002**	**0.141**	**0.096**	**0.004**	**0.041**	**0.009**	**0.014**	**0.0004**	**0.0004**

Table 4. Summary of water quality variables at each of the 15 access points sampled in September 2021 and 2022.

Access Point	Water Temperature (°C)	Conductivity ($\mu S \cdot cm^{-1}$)	Turbidity (NTU)
Range Rd 212A	9.2	219	3.30
Twin River Provincial Grazing Reserve	8.9	782	18.50
Hwy 501 Bridge	11.2	781	38.33
Twin River Heritage Rangeland Natural Area	13.4	231	7.03
Township Rd 24A	15.1	258	11.30
Town of Milk River	13.3	326	2.35
Goldspring Park	14.5	291	2.23
Coffin Bridge	15.4	307	3.64
Township Rd 21A	14.4	385	0.05
Writing on Stone	14.7	301	3.30
Deer Creek Bridge	9.5	366	2.47
Hwy 880 Bridge	10.9	365	4.50
Ross Ranch	17.3	406	6.20
Pinhorn Ranch (2021)	10.9	322	8.52
Pinhorn Ranch (2022)	11.9	186	28.40
Eastern border crossing	11.6	275	26.20

Table 5. Summary of mean habitat variables at each access point in September 2021 and 2022. Minimum and maximum ranges are displayed in brackets. Percent substrate composition and percent macrophyte cover are reported as means.

Access Point	Mean Water Velocity ($m \cdot s^{-1}$)	Mean Water Depth (m)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)	Macrophyte (%)
Range Rd 212A	0.10 (0-0.32)	0.54 (0.21-1.10)		7	7	51	30	5	3
Twin River Provincial Grazing Reserve	0.19 (0.17-0.21)	0.28 (0.27-0.28)	10	1	43	44		2	8
Hwy 501 Bridge	0.01 (0-0.01)	0.30 (0.20-0.74)		24	40	22	5	9	
Twin River Heritage Rangeland Natural Area	0	0.33 (0.08-0.61)	1	1	40	58			5
Township Rd 24A	0.09 (0.01-0.30)	0.33 (0.13-0.54)		2	39	55	3	1	8
Town of Milk River	0.12 (0-0.27)	0.37 (0.11-0.98)		3	61	25	2	9	
Goldspring Park	0.23 (0-0.96)	0.39 (0.06-0.94)		7	41	35	11	6	3
Coffin Bridge	0.15 (0-0.62)	0.26 (0.13-0.57)			15	81		4	
Township Rd 21A	0.13 (0-0.58)	0.35 (0.06-1.02)		18	15	48	17	2	3
Writing on Stone	0.16 (0-0.34)	0.27 (0.10-0.42)		1	75	22	2		9
Deer Creek Bridge	0.21 (0-0.33)	0.26 (0.12-0.53)			65	35			5
Hwy 880 Bridge	0.08 (0-0.38)	0.16 (0.03-0.48)		14	79	6	1		2
Ross Ranch	0.11 (0-0.49)	0.35 (0.07-0.73)		2	98				12
Pinhorn Ranch (2021)	0.25 (0-0.45)	0.20 (0.06-0.46)		10	82	8			1
Pinhorn Ranch (2022)	0.12 (0.01-0.43)	0.38 (0.26-0.48)		80	20				
Eastern border crossing	0.10 (0-0.44)	0.48 (0.14-0.82)		39	61				

4. DISCUSSION

Targeted sampling for Western Silvery Minnow during natural flow in the Milk River drainage in 2021 revealed low abundances and a restricted distribution, similar to sampling conducted in 2020 (Teillet et al. 2021). When sampling was conducted at one access point during augmented flow in 2022 (Appendix 1), there was further upstream distribution of Western Silvery Minnow in the Milk River and greater relative abundance than was seen in the previous two years of sampling. The standardized sampling protocol for Western Silvery Minnow (Macnaughton et al. 2019a) recommends that sampling is conducted during natural flows. Western Silvery Minnow may have a complex relationship with available flows in the Milk River. Given the hydrograph fluctuates drastically in the drainage due to augmentation and rain events (Appendix 1), Neufeld (2016) speculated on the relationship between Western Silvery Minnow catch rate and flow regime. On one hand, augmented flows have been shown to decrease suitable habitat for Western Silvery Minnow based on water velocities (Neufeld 2016) and prevent seining in some habitats due to fast water velocities and increased water depths (Macnaughton et al. 2019a). On the other hand, it has been suggested that natural flows may decrease the ability for the species to disperse in the drainage and may lead to more variability in capture efficiency (Macnaughton et al. 2019a). Results from sampling in 2022 suggest the latter may be significant in structuring Western Silvery Minnow relative abundance and distribution in the Milk River, and the species may require augmented flows to disperse in the drainage.

Furthermore, previous sampling conducted as early as May and as late as August in 2005, 2006, 2007, and 2013 (Macnaughton et al. 2019a) found Western Silvery Minnow distributed at multiple access points throughout the Milk River. The discrepancy between sampling results from 2005–2013 and 2020–2021 could be explained by a seasonal migration. Western Silvery Minnow may undergo a seasonal upstream migration in the Milk River from the lowest downstream reaches in Canada and the USA, upstream of the Fresno Reservoir, during flow augmentation. Under natural flow conditions, the distribution of Western Silvery Minnow in Canada may be extremely restricted. Further investigation into Western Silvery Minnow sample timing is required to better understand the current distribution of the species in Canada. Sampling during augmented flows is recommended to properly assess Western Silvery Minnow distribution and relative abundances in the Milk River drainage.

Young and Koops (2013) found a mean fork length of juvenile Western Silvery Minnow to be 56 mm. Of the 60 Western Silvery Minnow that were captured in 2021 and 2022, 25 individuals had a fork length <60 mm (Figure 2). Analysis of vouchered Western Silvery Minnow otoliths confirms that young-of-the-year were present in 2022 (Figure 3), which suggests that Western Silvery Minnow are successfully reproducing in the drainage.

The distribution of Western Silvery Minnow is limited to reaches of the Milk River with lower slope and finer grain substrates (COSEWIC 2017). Throughout the Milk River where Western Silvery Minnow have been previously sampled (Table 4), the cessation of augmentation results in decreased turbidity everywhere but the furthest downstream access point (eastern border crossing). The relatively higher turbidity in the lowest portions of the Milk River in Canada is related to the high silt content in these reaches (Table 5). This turbidity may be an important component of the habitat requirements for Western Silvery Minnow and drive a downstream migration to more turbid reaches in Montana during natural flows.

5. ACKNOWLEDGEMENTS

Fisheries and Oceans Canada wishes to acknowledge A. Waterer, R. Barrett, R. Muster, and S. Glowa for assistance during the field collections. Thank you to R. Barrett for assistance with data entry, C. Kovachik

for voucher organization and identifications, and R. Wastle from the FWI Aging Lab for help with methodology. We also thank Kenton Neufeld and Ashley Gillespie for their review of this report.

6. REFERENCES

Bonar, S.A., Hubert, W.A., and Willis, D.W. 2009. Standard methods for sampling North American freshwater fishes. American Fisheries Society. Bethesda, MD. 335 p.

COSEWIC. 2017. COSEWIC assessment and status report on the Western Silvery Minnow *Hybognathus argyritis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 47 p.

Macnaughton, C.J., Rudolfsen, T., Watkinson, D.A., and Enders, E.C. 2019a. Standardized field sampling method for monitoring the distribution and relative abundance of the Western Silvery Minnow (*Hybognathus argyritis*) population in Canada. Can. Tech. Rep. Fish. Aquat. Sci. 3315: vii + 26 p.

Macnaughton, C.J., Rudolfsen, T., Watkinson, D.A., and Enders, E.C. 2019b. Standardized field sampling method for monitoring the distribution and relative abundance of Plains Sucker (*Pantosteus jordani*) populations in Canada. Can. Tech. Rep. Fish. Aquat. Sci. 3316: viii + 35 p.

Macnaughton, C.J., Rudolfsen, T., Watkinson, D.A., and Enders, E.C. 2019c. Standardized field sampling method for monitoring the occurrence and relative abundance of the Rocky Mountain Sculpin (*Cottus* sp.) in Canada. Can. Tech. Rep. Fish. Aquat. Sci. 3313: x + 54 p.

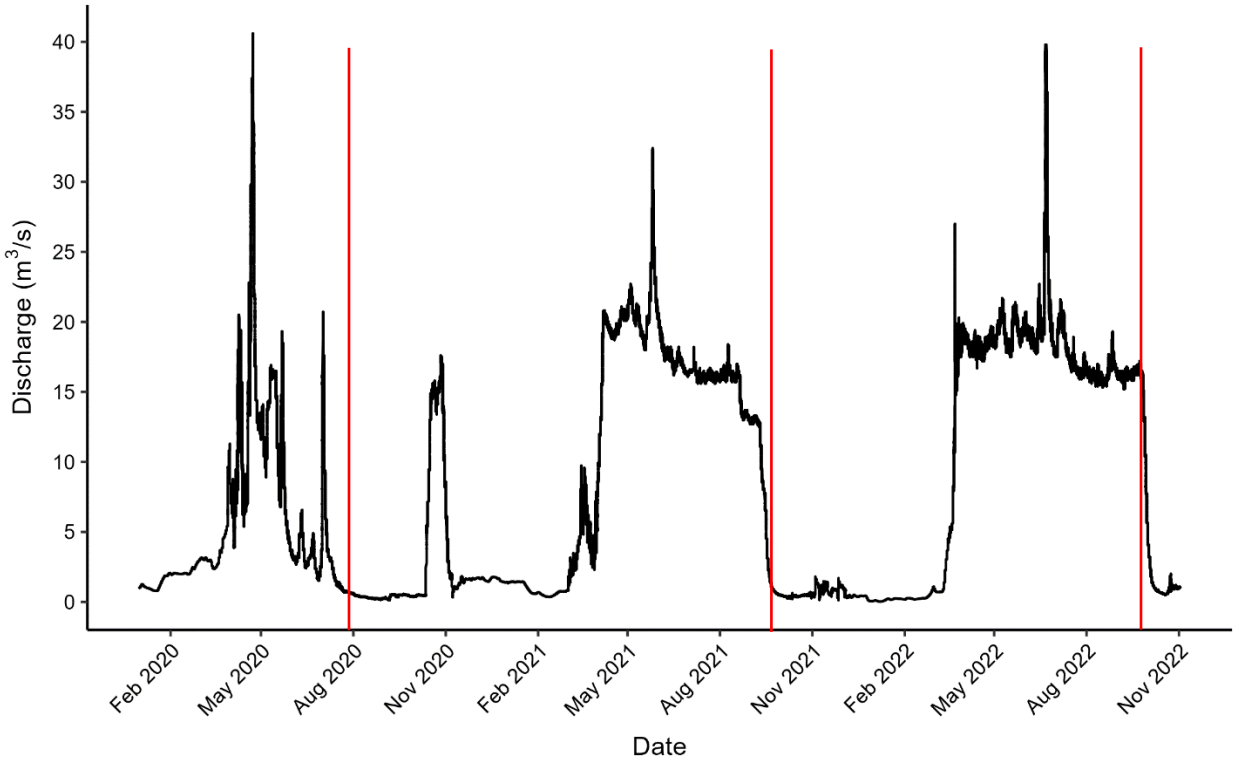
Neufeld, K.R. 2016. Improving our ability to assess the impacts of hydrologic alteration on stream fishes: An interdisciplinary approach to assess the Threatened Western Silvery Minnow *Hybognathus argyritis* in Canada. Thesis (MSc), University of Alberta, Edmonton, AB. 116 p.

Teillet, M., Watkinson, D.A., Petry, S.F., and Enders, E.C. 2021. Report on Plains Sucker (*Pantosteus jordani*), Rocky Mountain Sculpin (*Cottus* sp.), Western Silvery Minnow (*Hybognathus argyritis*), and Stonecat (*Noturus flavus*) sampling conducted in 2020 in the Milk River drainage, Alberta. Can. Data Rep. Fish. Aquat. Sci. 1330: vi + 13 p.

Young, J.A.M., and Koops, M.A. 2013. Recovery potential modelling of Western Silvery Minnow (*Hybognathus argyritis*) in Canada. Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, Research Document 2013/084. 23 p.

7. APPENDICES

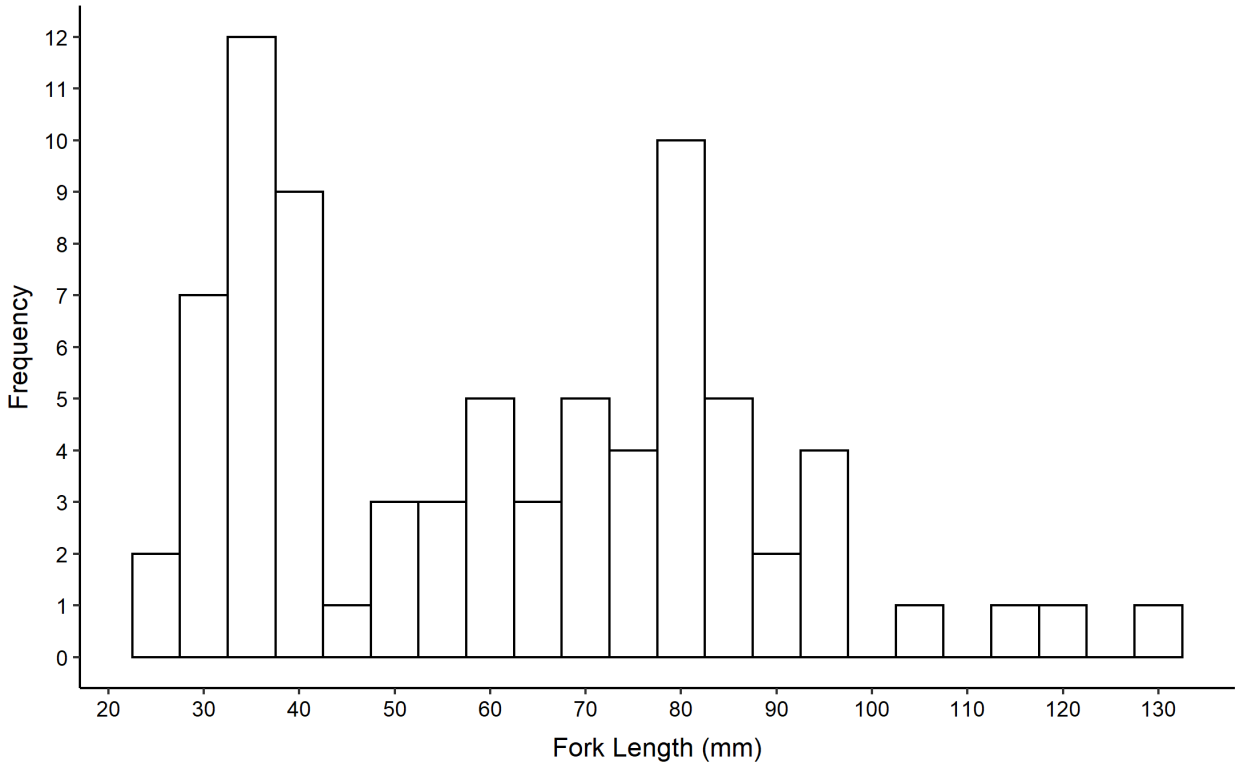
Appendix 1. Hydrograph illustrating discharge over three years (2020–2022) in the Milk River at Water Survey of Canada station 11AA005. Red lines denote sampling periods.



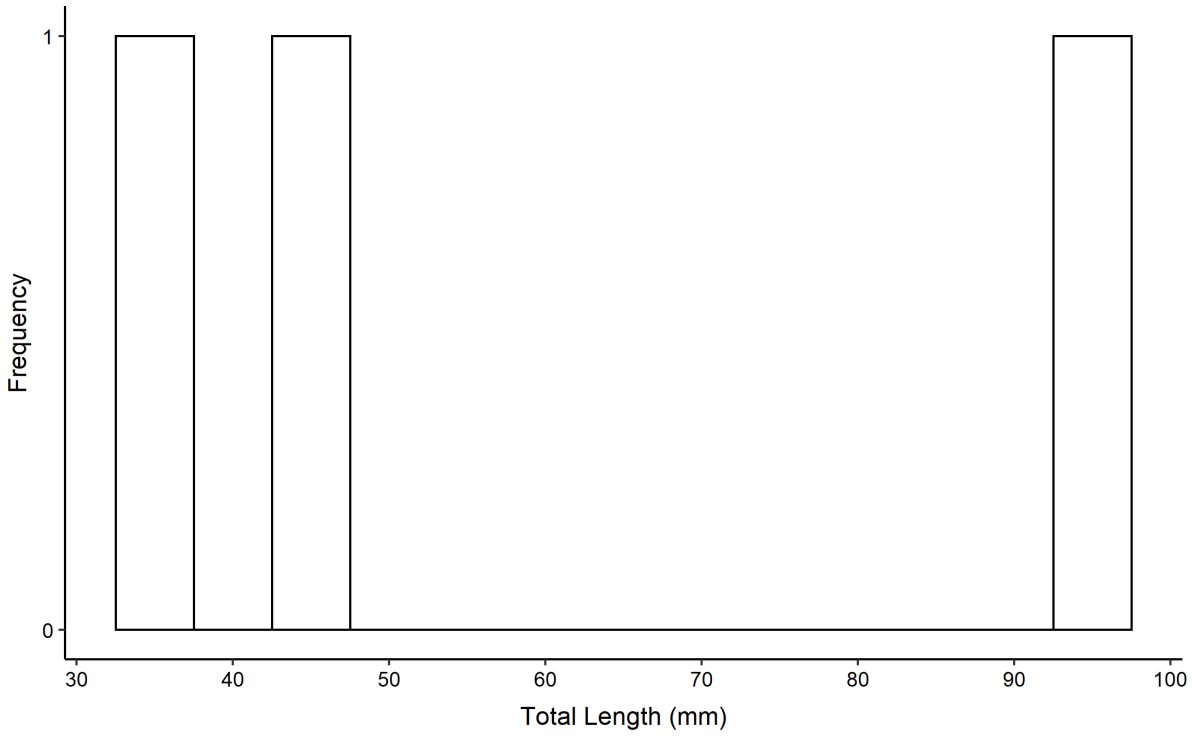
Appendix 2. Number of individuals retained as vouchers. Vouchers are stored at the Freshwater Institute in Winnipeg, Manitoba.

Access Point	WSMW	LKCH	STSH	FHMW	FHCH	LNDC	LNSK	WHSK	PLSK	TRPR
Highway 501 Bridge		5								3
Twin R. Heritage Rangeland Natural Area		3					2		27	2
Hwy 501 Bridge		5								3
Township Rd 24A		2		1					1	2
Town of Milk River					1					
Goldspring Park							1	1		
Coffin Bridge					2	1				
Writing on Stone Campground					8	5	3	1		4
Deer Creek Bridge						2		1		1
Hwy 880 Bridge							1	1	1	
Ross Ranch		2		8	2	2	5	5	4	2
Pinhorn Ranch (2022)	21	1			1					1
Eastern border crossing	12		1		3		2			2
Total	**12**	**17**	**1**	**9**	**16**	**10**	**14**	**9**	**33**	**19**

Appendix 3. Fork length distribution of Plains Sucker across 15 access points in the Milk River drainage in 2021.



Appendix 4. Total length distribution of Rocky Mountain Sculpin at two access points in the Milk River drainage in 2021.



Appendix 5. Species codes for fish mentioned in this report.

Code	Common Name	Scientific Name
LKCH	Lake Chub	*Couesius plumbeus*
WSMW	Western Silvery Minnow	*Hybognathus argyritis*
STSH	Spottail Shiner	*Notropis hudsonius*
FHMW	Fathead Minnow	*Pimephales promelas*
FHCH	Flathead Chub	*Platygobio gracilis*
LNDC	Longnose Dace	*Rhinichthys cataractae*
LNSK	Longnose Sucker	*Catostomus catostomus*
WHSK	White Sucker	*Catostomus commersonii*
PLSK	Plains Sucker	*Pantosteus jordani*
TRPR	Trout-Perch	*Percopsis omiscomaycus*
RMSC	Rocky Mountain Sculpin	*Cottus* sp.
SAUG	Sauger	*Sander canadensis*