Targeted Sampling for Northern Madtom (*Noturus stigmosus*) in the Thames River, Ontario, 2022

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2026

Canadian Data Report of
Fisheries and Aquatic Sciences 1450

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Cat. No. Fs97-13/1450E-PDF ISBN 978-0-660-79080-0 ISSN 1488-5395

Correct citation for this publication:

Barnucz, J., White, C., Gáspárdy, R.C., Colm, J.E., and Drake, D.A.R. 2026. Targeted Sampling for Northern Madtom (*Noturus stigmosus)* in the Thames River, Ontario, 2022. Can. Data Rep. Fish. Aquat. Sci. 1450: vii + 24 p.

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ABSTRACT

Barnucz, J., White, C., Gáspárdy, R.C., Colm, J.E., and Drake, D.A.R. 2026. Targeted Sampling for Northern Madtom (*Noturus stigmosus)* in the Thames River, Ontario, 2022. Can. Data Rep. Fish. Aquat. Sci. 1450: vii + 24 p.

Northern Madtom (*Noturus stigmosus*), a species listed as Endangered under Canada's *Species at Risk Act*, exhibits a limited geographic distribution in southwestern Ontario, with extant populations in the Detroit River, St. Clair River, Thames River, and Lake St. Clair. In 2022, Fisheries and Oceans Canada conducted targeted sampling for Northern Madtom in the Thames River as part of ongoing research to better understand the distribution of the species in Canada. Repeat-pass trawling was used to re-sample historical detection locations in a 20 km stretch between Dutton-Dunwich and Big Bend conservation areas. A pair of sites were sampled at each location (n = 20 sites total), composed of a historical site at a prior detection location, and a targeted site nearby containing similar habitat. A total of 17 species were detected, including 23 Northern Madtom (37 – 103 mm total length) from seven sites and 51 Eastern Sand Darter (*Ammocrypta pellucida*; 27 – 64 mm total length) from 11 sites. The most abundant species were Ghost Shiner (*Paranotropis buchanani*), Round Goby (*Neogobius melanostomus*), Channel Catfish (*Ictalurus punctatus*), Blackside Darter (*Percina maculata*), and Eastern Sand Darter.

RÉSUMÉ

Barnucz, J., White, C., Gáspárdy, R.C., Colm, J.E., and Drake, D.A.R. 2026. Targeted Sampling for Northern Madtom (*Noturus stigmosus)* in the Thames River, Ontario, 2022. Can. Data Rep. Fish. Aquat. Sci. 1450: vii + 24 p.

Le chat-fou du Nord (*Noturus stigmosus*), une espèce inscrite comme espèce en voie de disparition aux termes de la *Loi sur les espèces en péril* du Canada, présente une répartition géographique limitée dans le sud-ouest de l'Ontario, dont une présence de populations dans la Détroit River, la rivière Sainte-Claire, la Thames River et le lac Sainte-Claire. En 2022, Pêches et Océans Canada a effectué un échantillonnage ciblé du chat-fou du Nord dans la Thames River, dans le cadre des efforts de recherche en cours visant à mieux comprendre la répartition de l'espèce au Canada. Des relevés répétés au chalut ont été utilisés pour procéder à un nouvel échantillonnage des emplacements où l'espèce a été détectée par le passé, dans un tronçon de 20 km entre les zones de conservation de Dutton-Dunwich et de Big Bend. Une paire de sites a fait l'objet d'un échantillonnage à chaque emplacement (n = 20 sites) : un site à l'endroit où le poisson avait déjà été détecté par le passé, et un site voisin à proximité du premier avec un habitat similaire. Au total, 17 espèces ont été détectées, dont 23 chats-fous du Nord (de 37 à 103 mm de longueur totale) provenant de sept sites et 51 dards de sable (*Ammocrypta pellucida*) de 27 à 64 mm de longueur totale provenant de 11 sites. Les espèces les plus abondantes étaient le mené fantôme (*Paranotropis buchanani*), le gobie à taches noires (*Neogobius melanostomus*), la barbue de rivière (*Ictalurus punctatus*), le dard noir (*Percina maculata*) et le dard de sable (*Ammocrypta pellucida*).

INTRODUCTION

Fisheries and Oceans Canada (DFO) has the responsibility to provide for the protection and recovery of fishes listed under the *Species at Risk Act (*SARA). To inform scientific aspects of the recovery process, DFO regularly conducts field sampling to satisfy several research objectives for SARA-listed fishes, such as evaluating the distribution and abundance of species, determining species-habitat relationships, and better understanding the influence of threats and recovery actions. DFO data reports are published to support the Species at Risk Program by providing an overview of field activities and to provide a medium for archiving data associated with the sampling of SARA-listed fishes and their habitat.

Northern Madtom (*Noturus stigmosus*) has a limited distribution in Ontario, with detections of the species known from the Detroit River, St. Clair River, Lake St. Clair, Thames River, and Sydenham River (COSEWIC 2012; Colm et al. 2022; DFO 2024). Northern Madtom is detected infrequently in Canada, with fewer than 500 individuals captured in Canadian waters as of 2021 (Colm et al. 2022). To inform an updated Recovery Potential Assessment of Northern Madtom in Canada (Colm et al. 2022; DFO 2024), targeted sampling was conducted in 2022 to better understand the distribution of Northern Madtom in the Thames River. Sampling was conducted to re-visit areas where previous detections of Northern Madtom have occurred, as well as to sample adjacent areas using a paired design. Sampling data may be used to support future analyses to explore the detection probability of Northern Madtom.

METHODS

SITE SELECTION

To develop a list of candidate sampling locations, previous Northern Madtom (NMT) detection records in the Thames River between 2003 and 2020 were queried from the DFO Biodiversity Science database (Figure 1, Appendix 1). This query produced 58 sites where Northern Madtom was previously detected from spring, summer, and fall sampling. The records included 11 research projects across ten field seasons but were grouped to 48 candidate locations due to re-sampling the same or nearby locations over the years.

Small motorized vessels were used to access sites and conduct sampling across five days on September 22 and between October 24 – 27, 2022. During this time, water levels were extremely low. For reference, mean daily stage height was 3.63 m (3.49 – 3.76 m) and mean daily discharge was 11.98 m^3/s (8.98 – 15.4 m^3/s) during 2022 sampling. When NMT was previously detected using trawls, the average mean daily stage height was 4.51 m (3.54 – 5.40 m) and average mean daily discharge was 41.56 m^3/s (10.2 – 74.8 m^3/s). Real-time (2022) and historical (2003 – 2020) hydrometric data for station 02GE006 – Thames River near Dutton were extracted from the Environment and Climate Change Canada Real-time Hydrometric Data web site and the Environment and Climate Change Canada Historical Hydrometric Data web site on November 7, 2022.

Due to launching and navigation issues as a result of low water levels, many candidate locations were not accessible in 2022, including one location near Kent Bridge and 22 locations downstream of Big Bend Conservation Area. The remaining 24 locations were located in a navigable reach approximately 20 km long between Big Bend Conservation Area and Dutton-Dunwich Conservation Area (location of former Tait's Bridge; Figures 1 – 3). The field team travelled to each candidate location and assessed whether current conditions were suitable for trawling. Candidate sites were evaluated and selected for trawling if they were at least 0.75 m in depth and contained minimal trawling hazards (e.g., absence of woody debris, large boulders,

or other snags). Sites were scanned for depth and sampling hazards with a Garmin™ Echomap™ Plus 95 SV sonar unit, equipped with GPS receiver, Garmin™ ClearVü™ and SideVü™ technology.

Once the candidate site was selected, an adjacent targeted site that was 200 – 500 m upstream or downstream from the location and satisfied the same depth and absence-of-hazard criteria was also selected. A total of ten candidate sites were sampled in 2022 (hereafter referred to as "historical" sites), each with one paired targeted site. Sixteen candidate locations were deemed to be trawlable; however, there was insufficient space for an adjacent targeted site at two of the locations, and available time did not allow for sampling at four locations.

Historical and targeted sites consisted of a 50 m transect that followed the river channel, marked using a float immediately adjacent to the upstream (start) and downstream (end) extent of the transect (Figure 4). In some cases, the site location was adjusted slightly upstream, downstream or laterally to avoid sampling hazards. Hazards were marked using the GPS function in the sonar unit.

FISH ASSEMBLAGE SAMPLING

A Gerken Siamese trawl was used for fish sampling. The construction and dimensions of the trawling gear were identical to the gear described by Barnucz and Drake (2021). The trawl was fished from a 5 m tunnel-hull Jon boat powered with a 40 hp outboard tiller engine. Prior to deploying the trawl, the vessel travelled approximately 50 m upstream of the transect then travelled in reverse in a downstream direction towards the start of the transect. The trawl was deployed by one person from the bow of the vessel, ensuring the trawl boards were lowered at the upstream extent of the transect, in line with the float, slowly releasing the tow lines as the vessel continued downstream to prevent tangling (Figure 5). Once towlines were taut, the trawl was fished while towed downstream at an approximate speed of 2 to 3 km/hr to maintain bottom contact relative to flow. Once the vessel travelled 50 m, the trawl was retrieved quickly from the water over the bow of the sampling vessel. The trawl was gently shaken while it was retrieved from the water to help move fish to the cod end. Once the entire trawl was in the vessel, the cod end was untied and captured fishes were placed into bins of fresh river water for counting and identification. Three consecutive repeated trawling passes were completed over the same transect at each site, with fishes retained in separate bins by trawl tow and processed after the final pass. Transect length, vessel speed, location, and elapsed time (seconds) were monitored by GPS during each tow. Sampling effort was recorded as total trawl tows per site, transect length (50 m), and trawl time (s) per tow. Identical sampling methods were used for collecting fishes at historical and targeted sites.

Enumeration of fishes

Fishes were processed separately by trawl tow once all three passes were complete. Fishes were identified to the lowest practical level of taxonomic resolution (typically species), enumerated, and the minimum and maximum total length, per species, was recorded for each trawl tow. Additionally, individual total length (mm) and weight (g) was measured for any captured SARA-listed fishes. Photo and physical vouchers were taken for a subset of individuals of each species to confirm species identity in the lab based on Holm et al. (2019 a, b), Holm and Burridge (2019), and Mandrak et al. (2022). Physical vouchers were preserved in 10% buffered formalin in the field and transferred to 70% ethanol in the lab.

HABITAT SAMPLING

Habitat sampling methods including assessments of water quality, water depth, water velocity, substrate composition, air temperature, and windspeed were identical to Barnucz and Drake (2021).

SAMPLING PERMITS AND DATA ARCHIVING

Sampling for this project was conducted under SARA Permit Number 22-PCAA-00067. Trawling was conducted following Standard Operating Protocol GWACC-113 approved by the DFO and Environment and Climate Change Canada Animal Care Committee (operated under approval of the Canadian Council on Animal Care). Data associated with the collections in this report are housed under the project code “2023-NMT-TR” in the Biodiversity Science database within the Great Lakes Laboratory for Fisheries and Aquatic Sciences (Great Lakes Fish Biodiversity Database - Open Government Portal). Every effort has been made to ensure the accuracy of data contained in this report; however, results may be updated as part of ongoing data verification procedures.

RESULTS

FISH ASSEMBLAGE SAMPLING

Twenty sites (10 pairs), consisting of 60 trawl tows in total, were sampled in the Thames River (Table 1, Figure 1, Appendix 2). A total of 2,039 fishes representing 17 species were collected across all sites (Table 2, Figure 6). Based on pooled catch data the most abundant species were Ghost Shiner (*Paranotropis buchanani*), Round Goby (*Neogobius melanostomus*), Channel Catfish (*Ictalurus punctatus*), Blackside Darter (*Percina maculata*), and Eastern Sand Darter (*Ammocrypta pellucida*) (Table 2, Figure 6, Appendix 3). The most frequently occurring species across all sites were Ghost Shiner (90% of sites), Round Goby (90% of sites), Blackside Darter (90% of sites), and Channel Catfish (75% of sites) (Table 2).

Northern Madtom and Eastern Sand Darter captures are summarized in Table 3, Figure 6, and Appendix 4. Based on pooled catch data, 23 Northern Madtom were detected across seven sites (35% of sites), with 20 of these captured from historical sites and three from targeted sites. A total of 51 Eastern Sand Darter were captured across eleven sites (55% of sites), with 16 of these captured from historical sites and 35 captured from targeted sites.

Northern Madtom lengths and weights are summarized in Table 3a, Figure 7, and Appendix 4a. Across all sites, Northern Madtom total length ranged from 37 – 103 mm (mean: 60.5 mm), and weight ranged from 0.4 – 10.9 g (mean: 3.1 g). At historical sites, total length ranged from 37 – 103 mm (mean: 59.2 mm) and weight ranged from 0.4 – 10.9 g (mean: 2.8 g). At targeted sites, total length ranged from 47 – 101 mm (mean: 74 mm) and weight ranged from 1.0 – 10.3 g (mean: 5.7 g).

Eastern Sand Darter lengths and weights are summarized in Table 3b, Figure 8, Appendix 4b. Across all sites, Eastern Sand Darter total length ranged from 27 – 64 mm (mean: 48.7 mm) and weight ranged from 0.2 – 1.4 g (mean: 0.6 g). At historical sites, total length ranged from 39 – 64 mm (mean: 48.4 mm) and weight ranged from 0.2 – 0.8 g (mean 0.49 g). At targeted sites, total length ranged from 27 – 64 mm (mean: 48.7 mm), and weight ranged from 0.3 – 1.4 g (mean: 0.65 g).

HABITAT SAMPLING

Habitat measurements are summarized by sampling site in Table 4, Table 5, and Table 6. Across all sites, air temperature ranged from 11.1 – 21.5°C (mean: 16.1°C), water temperature ranged from 11.70 – 20.37°C (mean: 14.04°C), conductivity ranged from 534 – 762 µS/cm (mean: 599.9 µS/cm), dissolved oxygen ranged from 8.23 – 10.78 mg/L (mean: 10.17 mg/L), pH ranged from 8.20 – 8.40 mg/L (mean: 8.25 mg/L), water clarity ranged from 0.12 – 0.28 m (mean: 0.20 m), and turbidity ranged from 18.18 – 62.88 NTU (mean: 29.25 NTU). The mean depth ranged from 0.80 – 2.57 m with a grand mean of 1.20 m. The mean water velocity ranged from 0.08 – 0.47 m/s with a grand mean of 0.28 m/s. The dominant substrate class across all sites was sand (9 sites) followed by gravel (7 sites) and cobble (4 sites). Sand ranged from 0 – 95% (mean: 33.5%). Gravel ranged from 0 – 75% (mean: 34.5%). Cobble ranged from 0 – 80% (mean: 17.3%). Organic coverage ranged from 0 – 20% (mean: 5.8%). Boulder ranged from 0 – 30% (mean: 4.5%). Silt ranged from 0 – 30% (mean: 4.0%). Clay ranged from 0 – 10% (mean: 0.5%). The dominant riparian vegetation class was deciduous (8 sites) followed by herbaceous (6 sites), shrubs (5 sites), and no riparian vegetation (1 site). Herbaceous ranged from 10 – 60% (mean: 35.8%). Deciduous ranged from 5 – 60% (mean: 34.8%). Shrubs ranged from 5 – 50% (mean: 24.5%). No vegetation ranged from 0 – 60% (mean: 5%). The dominant aquatic vegetation class was open water across all sites. No aquatic vegetation was observed across all sites.

ACKNOWLEDGEMENTS

We thank Megan Cowperthwaite for her involvement in field sampling, laboratory identification of fishes, and data management. We thank Josh Stacey and Jessica Epp-Martindale for their helpful reviews. Funding for this project was provided by DFO’s Species at Risk Program.

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Table 1. *Summary of sites and sampling effort at historical and targeted sites in the Thames River, Ontario, 2022.*

Pair ID	Site ID	Field number	Historical or Targeted	Effort (tows)	Effort (seconds)			
					Tow 1	Tow 2	Tow 3	Total
1	1a	2022-NMT-TR-251022-001A	Historical	3	54	62	63	**179**
1	1b	2022-NMT-TR-251022-002A	Targeted	3	69	64	67	**200**
2	2a	2022-NMT-TR-251022-003A	Historical	3	80	80	89	**249**
2	2b	2022-NMT-TR-251022-004A	Targeted	3	65	76	53	**194**
3	3a	2022-NMT-TR-251022-005A	Historical	3	77	77	81	**235**
3	3b	2022-NMT-TR-261022-001A	Targeted	3	76	78	81	**235**
4	4a	2022-NMT-TR-241022-001A	Historical	3	62	77	69	**208**
4	4b	2022-NMT-TR-261022-002A	Targeted	3	83	74	79	**236**
5	5a	2022-NMT-TR-241022-002A	Historical	3	75	77	78	**230**
5	5b	2022-NMT-TR-261022-003A	Targeted	3	97	83	87	**267**
6	6a	2022-NMT-TR-241022-003A	Historical	3	80	80	80	**240**
6	6b	2022-NMT-TR-261022-004A	Targeted	3	83	91	78	**252**
7	7a	2022-NMT-TR-271022-001A	Historical	3	81	78	82	**241**
7	7b	2022-NMT-TR-271022-002A	Targeted	3	81	77	88	**246**
8	8a	2022-NMT-TR-271022-003A	Historical	3	75	70	74	**219**
8	8b	2022-NMT-TR-271022-004A	Targeted	3	73	83	67	**223**
9	9a	2022-NMT-TR-220922-001A	Historical	3	72	58	70	**200**
9	9b	2022-NMT-TR-220922-003A	Targeted	3	63	77	74	**214**
10	10a	2022-NMT-TR-220922-002A	Historical	3	84	57	67	**208**
10	10b	2022-NMT-TR-220922-004A	Targeted	3	68	67	56	**191**

Table 2. *Aggregate catch of each species captured at historical and targeted Northern Madtom sites in the Thames River, Ontario, 2022. Relative abundance (RA) and frequency of occurrence (FO) of each species is shown across all sites.*

Scientific name	Common name	Historical	Targeted	Total	RA (%)	FO (%)
Ammocrypta pellucida	Eastern Sand Darter	16	35	**51**	**2.5**	**55**
Aplodinotus grunniens	Freshwater Drum	0	1	**1**	**0.0**	**5**
Cyprinella spiloptera	Spotfin Shiner	8	0	**8**	**0.4**	**10**
Etheostoma blennioides	Greenside Darter	37	7	**44**	**2.2**	**45**
Etheostoma nigrum	Johnny Darter	0	3	**3**	**0.1**	**15**
Hypentelium nigricans	Northern Hogsucker	1	0	**1**	**0.0**	**5**
Ictalurus punctatus	Channel Catfish	106	50	**156**	**7.7**	**75**
Moxostoma erythrurum	Golden Redhorse	3	9	**12**	**0.6**	**40**
Moxostoma macrolepidotum	Shorthead Redhorse	11	5	**16**	**0.8**	**45**
Neogobius melanostomus	Round Goby	98	80	**178**	**8.7**	**90**
Paranotropis buchanani	Ghost Shiner	626	802	**1428**	**70.0**	**90**
Noturus flavus	Stonecat	2	0	**2**	**0.1**	**5**
Noturus stigmosus	Northern Madtom	20	3	**23**	**1.1**	**35**
Percina caprodes	Logperch	10	4	**14**	**0.7**	**40**
Percina maculata	Blackside Darter	44	53	**97**	**4.8**	**90**
Percopsis omiscomaycus	Trout-perch	2	0	**2**	**0.1**	**10**
Pimephales notatus	Bluntnose Minnow	2	1	**3**	**0.1**	**10**
	Total fishes	**986**	**1053**	**2039**	**-**	**-**
	Total species	**15**	**13**	**17**	**-**	**-**

Table 3. *Summary of species at risk fishes, a) Northern Madtom and b) Eastern Sand Darter, captured at historical and targeted sites in the Thames River, Ontario, 2022.*

a) Northern Madtom

	Historical	Targeted	Overall
Total individuals	20	3	**23**
Frequency of occurrence (%)	50	20	**35**
Relative abundance (%)	2.0	0.3	**1.1**
Mean Total Length (mm)	59.2	74	**60.5**
Total Length range (mm)	37 – 103	47 – 101	**37 – 103**
Mean weight (g)	2.8	5.7	**3.1**
Weight range (g)	0.4 – 10.9	1.0 – 10.3	**0.4 – 10.9**

b) Eastern Sand Darter

	Historical	Targeted	Overall
Total individuals	16	35	**51**
Frequency of occurrence (%)	50	60	**55**
Relative abundance (%)	1.6	3.3	**2.5**
Mean Total Length (mm)	48.6	48.7	**48.7**
Total Length range (mm)	39 – 64	27 – 64	**27 – 64**
Mean weight (g)	0.49	0.65	**0.64**
Weight range (g)	0.2 – 0.8	0.3 – 1.4	**0.2 – 1.4**

Table 4. *Summary of abiotic habitat conditions at each site sampled for Northern Madtom in the Thames River, Ontario, 2022.*

Site ID	Air Temp. (°C)	Water temp. (°C)	Conductivity (µS/cm)	Dissolved oxygen (mg/L)	pH	Turbidity tube (m)	Turbidity (NTU)	Mean depth (m)	Mean water velocity (m/s)
1a	19.7	12.15	562	10.56	8.23	-	23.24	0.97	0.47
1b	20.6	12.34	565	10.64	8.22	0.23	20.64	1.13	0.29
2a	21.1	12.64	568	10.67	8.22	0.18	27.31	1.00	0.32
2b	20.4	12.89	572	10.73	8.24	0.22	23.95	1.00	0.32
3a	18.7	12.96	573	10.80	8.26	0.28	24.28	1.07	0.24
3b	14.6	12.86	567	10.30	8.24	0.19	19.32	1.00	0.32
4a	18.8	12.41	534	10.56	8.35	0.14	29.06	1.70	0.35
4b	14.5	12.92	567	10.32	8.26	0.22	19.19	1.07	0.27
5a	21.5	12.52	534	10.76	8.23	0.19	28.47	0.87	0.29
5b	14.1	12.94	569	10.45	8.28	0.23	19.01	1.07	0.27
6a	21.5	12.54	535	10.78	8.22	0.18	28.69	1.27	0.39
6b	15.8	13.02	570	10.36	8.27	0.24	18.18	1.17	0.27
7a	8.2	11.64	556	10.42	8.19	0.27	20.02	0.80	0.23
7b	9.5	11.70	558	10.38	8.20	0.21	20.14	0.83	0.22
8a	8.7	11.78	559	10.58	8.25	0.27	19.33	1.07	0.33
8b	11.1	12.08	565	10.65	8.29	0.25	19.04	1.07	0.16
9a	15.3	20.34	760	8.23	8.23	0.13	57.42	1.03	0.32
9b	15.6	20.34	761	8.79	8.27	0.13	52.66	1.20	0.26
10a	14.5	20.32	760	8.40	8.26	0.13	62.88	2.57	0.08
10b	17.7	20.37	762	9.00	8.30	0.12	52.24	2.20	0.16
Min.	**8.2**	**11.64**	**534**	**8.23**	**8.19**	**0.12**	**18.18**	**0.80**	**0.08**
Mean	**16.1**	**14.04**	**599.9**	**10.17**	**8.25**	**0.20**	**29.25**	**1.20**	**0.28**
Max.	**21.5**	**20.37**	**762**	**10.80**	**8.35**	**0.28**	**62.88**	**2.57**	**0.47**

Table 5. *Summary of substrate composition by percent type at each site sampled for Northern Madtom in the Thames River, Ontario, 2022.*

Site ID	Organic	Clay	Silt	Sand	Gravel	Cobble	Boulder	Bedrock	Rubble	Concrete	Dominant type
1a	0	0	0	20	20	30	30	0	0	0	Cobble
1b	0	0	0	0	50	25	25	0	0	0	Gravel
2a	0	0	0	60	40	0	0	0	0	0	Sand
2b	0	0	0	30	40	30	0	0	0	0	Gravel
3a	10	0	5	45	40	0	0	0	0	0	Sand
3b	20	0	0	80	0	0	0	0	0	0	Sand
4a	5	0	10	20	65	0	0	0	0	0	Gravel
4b	5	0	0	50	45	0	0	0	0	0	Sand
5a	0	0	0	5	45	50	0	0	0	0	Cobble
5b	5	0	0	95	0	0	0	0	0	0	Sand
6a	0	0	5	20	75	0	0	0	0	0	Gravel
6b	5	0	5	0	10	80	0	0	0	0	Cobble
7a	0	0	0	10	20	50	20	0	0	0	Cobble
7b	5	0	0	45	30	10	10	0	0	0	Sand
8a	0	0	0	5	75	20	0	0	0	0	Gravel
8b	5	10	10	20	40	10	5	0	0	0	Gravel
9a	0	0	5	40	15	40	0	0	0	0	Sand
9b	10	0	0	20	70	0	0	0	0	0	Gravel
10a	25	0	10	65	0	0	0	0	0	0	Sand
10b	20	0	30	40	10	0	0	0	0	0	Sand
Min.	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-**
Mean	**5.8**	**0.5**	**4.0**	**33.5**	**34.5**	**17.3**	**4.5**	**0**	**0**	**0**	**Sand**
Max.	**25**	**10**	**30**	**95**	**75**	**80**	**30**	**0**	**0**	**0**	**-**

Table 6. *Summary of riparian and aquatic vegetation by percent of each vegetation type present within habitat sampled for Northern Madtom in the Thames River, Ontario, 2022.*

Site ID	Dominant riparian vegetation type	Deciduous	Coniferous	Herbaceous	Shrubs	None	Dominant aquatic vegetation type	Floating	Submerged	Open water	Emergent
1a	None	5	0	10	25	60	Open water	0	0	100	0
1b	Herbaceous	20	0	40	20	20	Open water	0	0	100	0
2a	Herbaceous	30	0	40	30	0	Open water	0	0	100	0
2b	Herbaceous	30	0	40	30	0	Open water	0	0	100	0
3a	Herbaceous	20	0	60	20	0	Open water	0	0	100	0
3b	Deciduous	45	0	35	20	0	Open water	0	0	100	0
4a	Herbaceous	40	0	45	10	5	Open water	0	0	100	0
4b	Deciduous	50	0	30	20	0	Open water	0	0	100	0
5a	Deciduous	40	0	30	30	0	Open water	0	0	100	0
5b	Shrubs	30	0	20	50	0	Open water	0	0	100	0
6a	Shrubs	30	0	30	40	0	Open water	0	0	100	0
6b	Deciduous	50	0	20	20	10	Open water	0	0	100	0
7a	Herbaceous	20	0	60	20	0	Open water	0	0	100	0
7b	Shrubs	20	0	40	40	0	Open water	0	0	100	0
8a	Shrubs	20	0	40	40	0	Open water	0	0	100	0
8b	Shrubs	30	0	35	35	0	Open water	0	0	100	0
9a	Deciduous	50	0	40	10	0	Open water	0	0	100	0
9b	Deciduous	55	0	35	10	0	Open water	0	0	100	0
10a	Deciduous	60	0	35	5	0	Open water	0	0	100	0
10b	Deciduous	50	0	30	15	5	Open water	0	0	100	0
Min.	**-**	**5**	**0**	**10**	**5**	**0**	**-**	**0**	**0**	**100**	**0**
Mean.	**Deciduous**	**34.8**	**0.0**	**35.8**	**24.5**	**5.0**	**Open water**	**0**	**0**	**100**	**0**
Max.	**-**	**60**	**0**	**60**	**50**	**60**	**-**	**0**	**0**	**100**	**0**

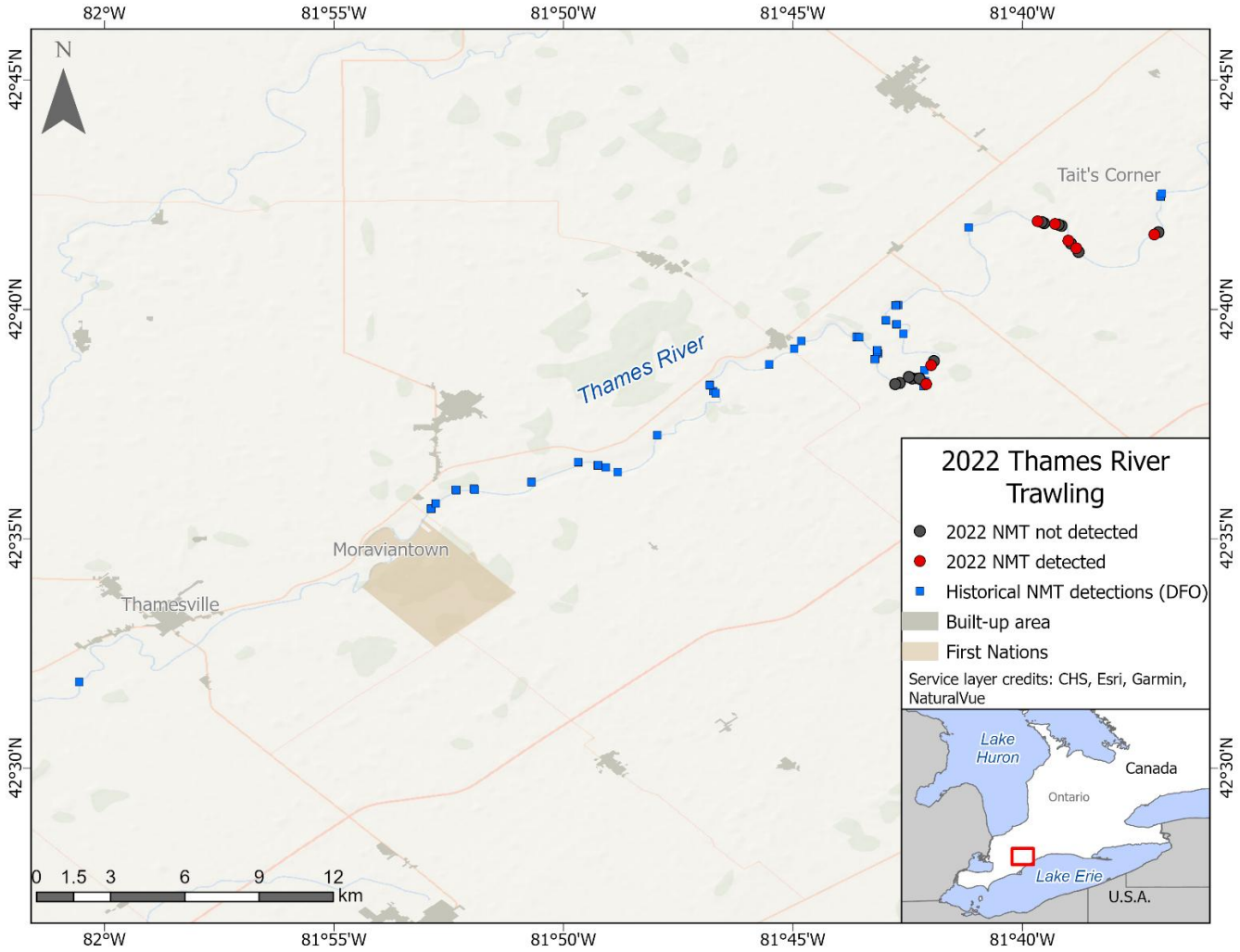


Figure 1. *Northern Madtom (NMT) 2022 sampling locations and previous detections in the Thames River, Ontario.*

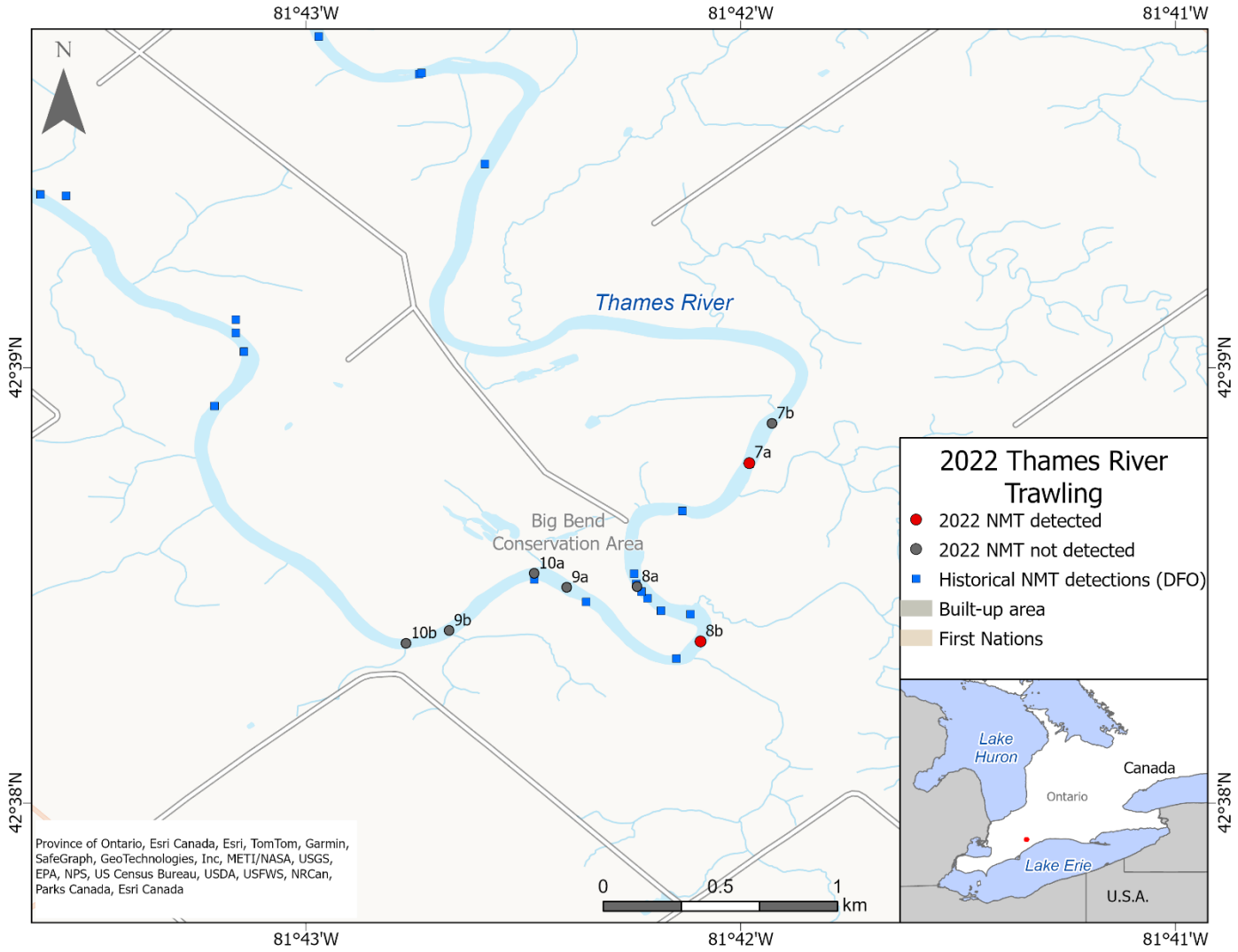


Figure 2. *Northern Madtom (NMT) 2022 sampling locations and previous detections near Big Bend Conservation Area in the Thames River, Ontario.*

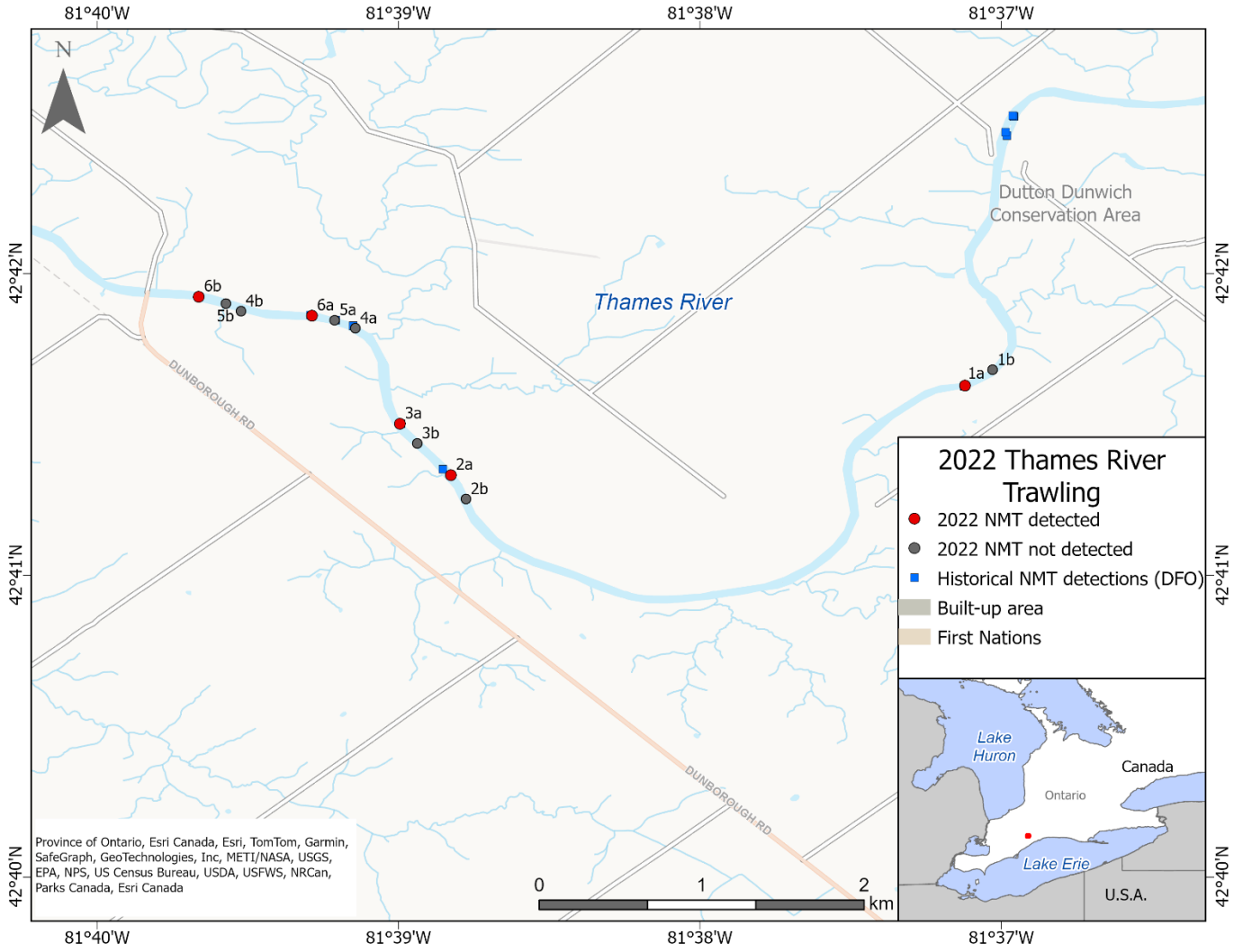


Figure 3. *Northern Madtom (NMT) 2022 sampling locations and previous detections near Dutton-Dunwich Conservation Area in the Thames River, Ontario.*

Figure 4. *Site photo of Targeted Site 1b (2022-NMT-TR-251022-002A).*

Figure 5. *Field crew sampling Historical Site 6a (2022-NMT-TR-241022-003A).*

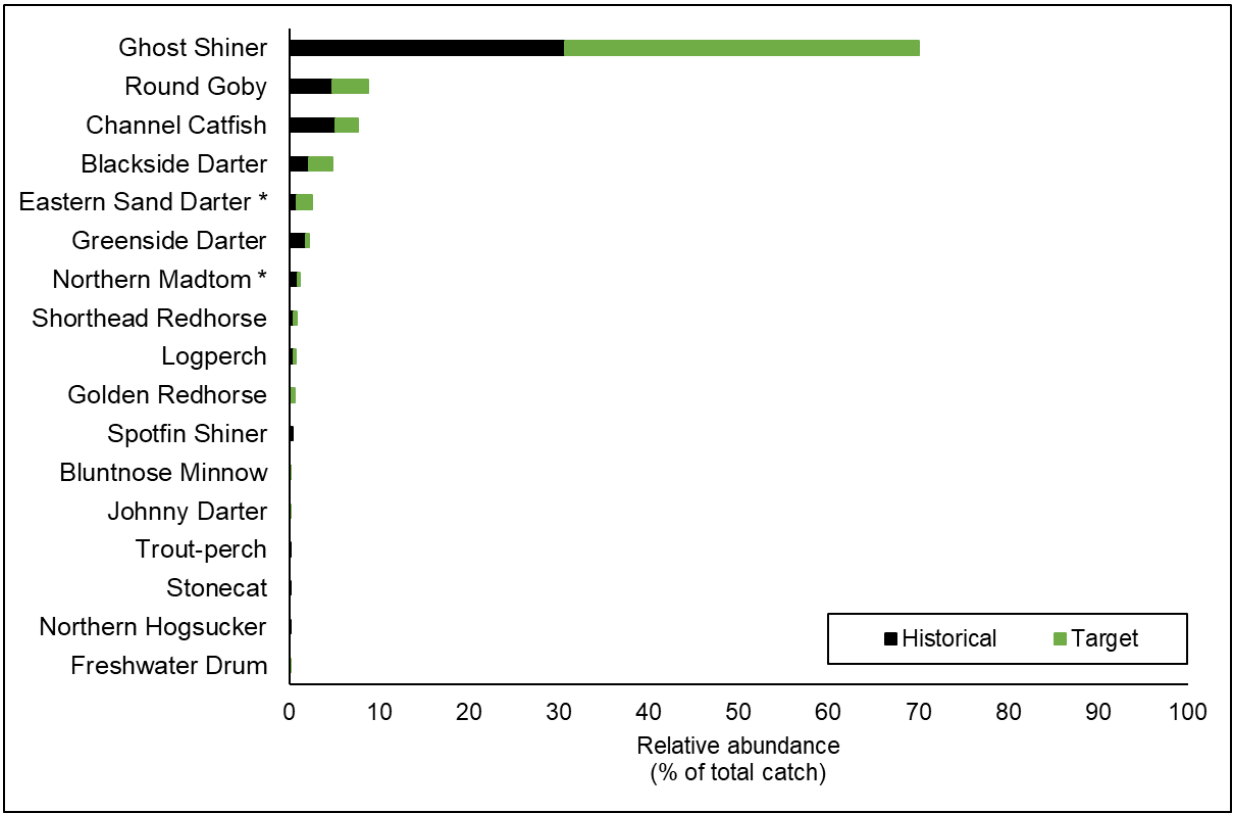
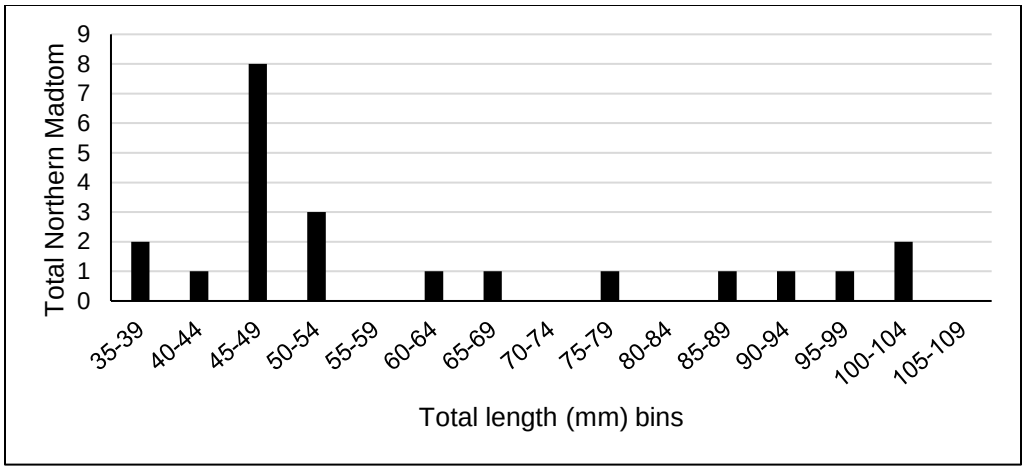
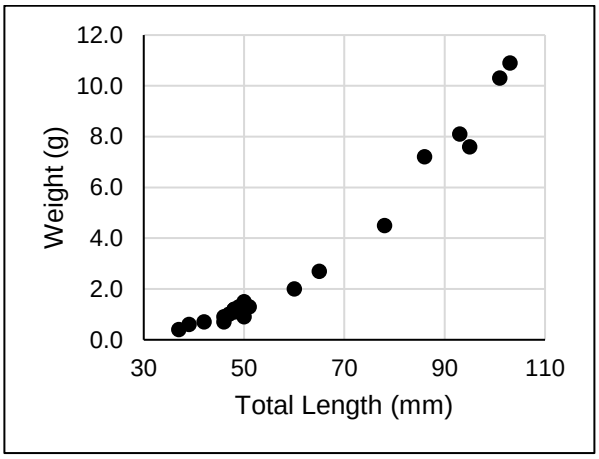


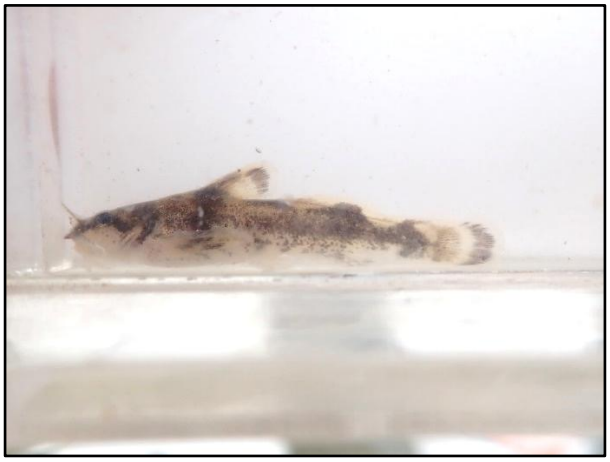
Figure 6. *Relative abundance of fishes captured at historical and targeted trawling sites in the Thames River, Ontario, 2022 (* species at risk).*



a) Length-frequency

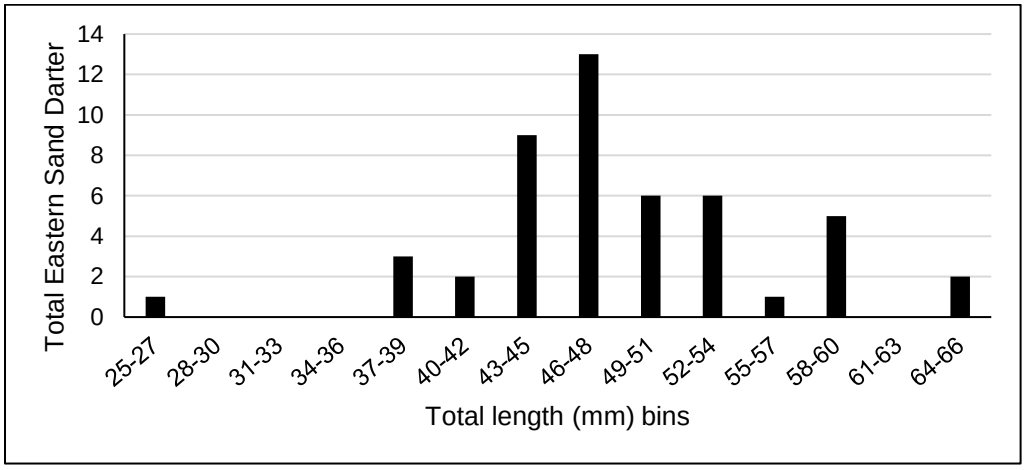


b) Length-weight relationship

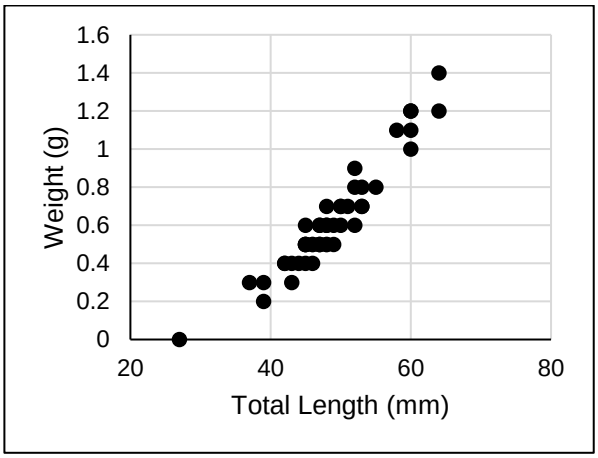


c) Voucher photo (Site ID 3a, 37 mm)

Figure 7. *Summary of Northern Madtom detections (n = 23, 22 measured) in the Thames River, Ontario, 2022: a) length-frequency, b) relationship between total length (mm) and weight (g), and c) voucher photo.*



a) Length-frequency



b) Length-weight relationship

*c) Voucher photo (*Site ID 7b, 49 mm*)*

Figure 8. *Summary of Eastern Sand Darter detections (n = 51, 49 measured) in the Thames River, Ontario, 2022: a) length-frequency, b) relationship between total length (mm) and weight (g), and c) voucher photo.*

Appendix 1. *List of DFO Northern Madtom (NMT) detection records between 2003 and 2020 including sampling date, total NMT collected, gear type used (TRL = benthic trawl, SN = seine net, BEF = boat electrofisher), and river condition at time of detection (daily mean stage height (m) and discharge (m^3/s) measured at the Thames River near Dutton (02GE006) hydrometric station). Field notes from 2022 indicate which locations were accessible by small vessel, had adequate depth for trawling, were deemed trawlable, had space for a paired site, and were sampled in 2022. Stage height and discharge data on historical sampling dates were extracted from the Environment and Climate Change Canada Historical Hydrometric Data website on November 7, 2022.*

Previous detection records									2022					
Location	Latitude	Longitude	Date	Field Number	Total NMT	Gear	Stage height (m)	Discharge (m^3/s)	Accessible	Adequate depth	Trawlable	Space/Habitat for pair	Sampled	Notes
1	42.70868	-81.61597	23-Oct-13	2013-NMT-PG231013-002A	1	TRL	5.17	64.9	TRUE	FALSE	-	-	-	Too shallow
1	42.70872	-81.61604	15-Jun-15	2015-RGDS-TR-150615-004A	4	TRL	5.289	70	TRUE	FALSE	-	-	-	Too shallow
2	42.70781	-81.61643	23-Oct-13	2013-NMT-PG231013-003A	1	TRL	5.17	64.9	TRUE	FALSE	-	-	-	Too shallow
2	42.70762	-81.61636	28-Oct-09	TRT09-281009-001	1	TRL	3.757	15.8	TRUE	FALSE	-	-	-	Too shallow
3	42.69378	-81.61873	28-Oct-09	TRT09-281009-002	1	TRL	3.757	15.8	TRUE	TRUE	TRUE	TRUE	TRUE	
4	42.68919	-81.64754	28-Oct-09	TRT09-281009-005	1	TRL	3.757	15.8	TRUE	TRUE	TRUE	TRUE	TRUE	
5	42.69170	-81.64986	15-Jun-15	2015-RGDS-TR-150615-007A	1	TRL	5.289	70	TRUE	TRUE	TRUE	TRUE	TRUE	
6	42.69712	-81.65251	23-Oct-13	2013-NMT-PG231013-010A	4	TRL	5.17	64.9	TRUE	TRUE	TRUE	TRUE	TRUE	
7	42.69752	-81.65251	23-Oct-13	2013-NMT-PG231013-011A	1	TRL	5.17	64.9	TRUE	TRUE	TRUE	TRUE	TRUE	
8	42.69771	-81.65487	23-Oct-13	2013-NMT-PG231013-012A	1	TRL	5.17	64.9	TRUE	TRUE	TRUE	TRUE	TRUE	
9	42.69641	-81.68608	17-Jun-15	2015-RGDS-TR-170615-001A	1	TRL	5.068	60.7	TRUE	TRUE	TRUE	FALSE	-	no space for pair
10	42.66825	-81.71172	11-Aug-05	THRESD05-081105-TR06-003	1	SN	3.536	11.7	TRUE	TRUE	TRUE	TRUE	FALSE	out of time
11	42.66809	-81.71259	29-Oct-09	TRT09-291009-001	2	TRL	3.745	15.5	TRUE	TRUE	TRUE	TRUE	FALSE	out of time
12	42.66269	-81.71618	29-Oct-09	TRT09-291009-002	1	TRL	3.745	15.5	TRUE	TRUE	TRUE	TRUE	FALSE	out of time
13	42.66129	-81.71224	17-Jun-15	2015-RGDS-TR-170615-005A	2	TRL	5.068	60.7	TRUE	FALSE	-	-	-	Too shallow
13	42.66125	-81.71233	18-Aug-05	THRESD05-081805-TR08-003	1	SN	3.3	6.47	TRUE	TRUE	TRUE	TRUE	FALSE	out of time
14	42.65781	-81.70981	29-Oct-09	TRT09-291009-005	1	TRL	3.745	15.5	TRUE	FALSE	-	-	-	Too shallow
15	42.64633	-81.69966	29-Oct-09	TRT09-291009-008	2	TRL	3.745	15.5	TRUE	TRUE	TRUE	TRUE	TRUE	
16	42.64452	-81.70224	24-Sep-03	BB240903BEF-003	1	BEF	3.722	-	TRUE	TRUE	FALSE	-	-	Too many hazards
18	42.64143	-81.70381	07-Aug-20	2020-ESDPT-070820-002A	1	TRL	3.937	21.1	TRUE	TRUE	TRUE	TRUE	TRUE	
18	42.64212	-81.70409	11-Aug-20	2020-ESDPT-110820-001A	1	TRL	3.999	23.2	TRUE	FALSE	-	-	-	Too shallow
18	42.64173	-81.70401	13-Sep-10	MTR10-130910-002A	1	TRL	3.544	10.4	TRUE	FALSE	-	-	-	Too shallow
19	42.64118	-81.70358	06-Aug-20	2020-ESDPT-060820-001A	1	TRL	4.172	28.8	TRUE	FALSE	-	-	-	Too shallow
20	42.64070	-81.70306	13-Sep-10	MTR10-130910-001A	3	TRL	3.544	10.4	TRUE	TRUE	TRUE	FALSE		no space for pair
21	42.64057	-81.70193	18-Aug-04	TR04SN180804011	1	SN	3.505	-	TRUE	FALSE	-	-	-	Too shallow
22	42.63887	-81.70247	06-Jul-09	ESDPG09-TR09-060709-002	1	SN	4.018	23.2	TRUE	FALSE	-	-	-	Too shallow
23	42.64104	-81.70593	06-Aug-20	2020-ESDPT-060820-002A	2	TRL	4.172	28.8	TRUE	TRUE	TRUE	FALSE	-	no space for pair
24	42.64160	-81.70667	07-Aug-20	2020-ESDPT-070820-001A	3	TRL	3.937	21.1	TRUE	TRUE	TRUE	TRUE	TRUE	

Previous detection records														2022
Location	Latitude	Longitude	Date	Field Number	Total NMT	Gear	Stage height (m)	Discharge (m^3/s)	Accessible	Adequate depth	Trawlable	Space/Habitat for pair	Sampled	Notes
25	42.64190	-81.70792	05-Aug-20	2020-ESDPT-050820-001A	1	SN	4.593	44.5	TRUE	TRUE	TRUE	TRUE	TRUE	
26	42.64854	-81.72018	27-Oct-09	TRT09-271009-006	1	TRL	3.777	16.4	FALSE	-	-	-	-	d/s of Big Bend
27	42.65062	-81.71905	07-Jul-09	ESDPG09-TR09-070709-003	1	SN	4.016	23.2	FALSE	-	-	-	-	d/s of Big Bend
28	42.65134	-81.71936	24-Oct-13	2013-NMT-PG241013-017A	1	TRL	5.286	69.9	FALSE	-	-	-	-	d/s of Big Bend
29	42.65185	-81.71936	24-Oct-13	2013-NMT-PG241013-018A	1	TRL	5.286	69.9	FALSE	-	-	-	-	d/s of Big Bend
30	42.65659	-81.72587	24-Oct-13	2013-NMT-PG241013-013A	3	TRL	5.286	69.9	FALSE	-	-	-	-	d/s of Big Bend
31	42.65664	-81.72685	24-Oct-13	2013-NMT-PG241013-014A	1	TRL	5.286	69.9	FALSE	-	-	-	-	d/s of Big Bend
32	42.65520	-81.74692	20-Jun-15	2015-RGDS-TR-200615-004A	2	TRL	4.582	42	FALSE	-	-	-	-	d/s of Big Bend
33	42.65239	-81.74947	27-Oct-09	TRT09-271009-002	1	TRL	3.777	16.4	FALSE	-	-	-	-	d/s of Big Bend
34	42.64668	-81.75861	24-Oct-13	2013-NMT-PG241013-003A	2	TRL	5.286	69.9	FALSE	-	-	-	-	d/s of Big Bend
35	42.63917	-81.78016	20-Jun-15	2015-RGDS-TR-200615-001A	3	TRL	4.582	42	FALSE	-	-	-	-	d/s of Big Bend
36	42.63700	-81.77885	22-Oct-13	2013-NMT-PG221013-008A	1	TRL	5.25	68.2	FALSE	-	-	-	-	d/s of Big Bend
37	42.63624	-81.77804	22-Oct-13	2013-NMT-PG221013-009A	2	TRL	5.25	68.2	FALSE	-	-	-	-	d/s of Big Bend
38	42.62098	-81.79923	16-Jun-15	2015-RGDS-TR-160615-007A	1	TRL	5.399	74.8	FALSE	-	-	-	-	d/s of Big Bend
39	42.60754	-81.81357	25-Jun-14	2014-GC-CH-250614-003A	1	TRL	4.262	31.4	FALSE	-	-	-	-	d/s of Big Bend
40	42.60928	-81.81792	25-Jun-14	2014-GC-CH-250614-005A	1	TRL	4.262	31.4	FALSE	-	-	-	-	d/s of Big Bend
41	42.60992	-81.82076	25-Jun-14	2014-GC-CH-250614-009A	1	TRL	4.262	31.4	FALSE	-	-	-	-	d/s of Big Bend
41	42.61008	-81.82076	25-Jun-14	2014-GC-CH-250614-010A	1	TRL	4.262	31.4	FALSE	-	-	-	-	d/s of Big Bend
42	42.61109	-81.82787	25-Jun-14	2014-GC-CH-250614-011A	1	TRL	4.262	31.4	FALSE	-	-	-	-	d/s of Big Bend
42	42.61119	-81.82799	25-Jun-14	2014-GC-CH-250614-012A	1	TRL	4.262	31.4	FALSE	-	-	-	-	d/s of Big Bend
43	42.60392	-81.84492	16-Jun-15	2015-RGDS-TR-160615-003A	3	TRL	5.399	74.8	FALSE	-	-	-	-	d/s of Big Bend
44	42.60155	-81.86585	26-Jun-14	2014-GC-CH-260614-005A	1	TRL	4.473	38.1	FALSE	-	-	-	-	d/s of Big Bend
44	42.60117	-81.86556	26-Jun-14	2014-GC-CH-260614-006A	1	TRL	4.473	38.1	FALSE	-	-	-	-	d/s of Big Bend
45	42.60114	-81.87234	26-Jun-14	2014-GC-CH-260614-003A	2	TRL	4.473	38.1	FALSE	-	-	-	-	d/s of Big Bend
45	42.60096	-81.87218	26-Jun-14	2014-GC-CH-260614-004A	2	TRL	4.473	38.1	FALSE	-	-	-	-	d/s of Big Bend
46	42.59617	-81.87968	16-Jun-15	2015-RGDS-TR-160615-001A	1	TRL	5.399	74.8	FALSE	-	-	-	-	d/s of Big Bend
47	42.59429	-81.88143	26-Jun-14	2014-GC-CH-260614-001A	2	TRL	4.473	38.1	FALSE	-	-	-	-	d/s of Big Bend
47	42.59419	-81.88123	26-Jun-14	2014-GC-CH-260614-002A	2	TRL	4.473	38.1	FALSE	-	-	-	-	d/s of Big Bend
48	42.53132	-82.00917	21-Jul-16	2016-RGDS-210716-001A	2	TRL	3.544	10.2	FALSE	-	-	-	-	u/s to Kent Bridge

Appendix 2. *Location of sites sampled for Northern Madtom in the Thames River, Ontario, 2022.*

Site ID	Category	Field number	Historical DFO site code	Date	Narrative locality description	Latitude	Longitude
1a	Historical	2022-NMT-TR-251022-001A	TRT09-281009-002A	25-Oct-22	~1.4 km D/S of Tait's Bridge	42.69381	-81.61868
1b	Targeted	2022-NMT-TR-251022-002A	-	25-Oct-22	1.25 km D/S of Tait's Bridge	42.69468	-81.61715
2a	Historical	2022-NMT-TR-251022-003A	TRT09-281009-005A	25-Oct-22	~2 km U/S of Simpson's Bridge	42.68887	-81.64711
2b	Targeted	2022-NMT-TR-251022-004A	-	25-Oct-22	~2.15 km U/S of Simpson's Bridge	42.68754	-81.64627
3a	Historical	2022-NMT-TR-251022-005A	2015-RGDS-TR-150615-007A	25-Oct-22	~1.75 km U/S of Simpson's Bridge	42.69170	-81.64993
3b	Targeted	2022-NMT-TR-261022-001A	-	26-Oct-22	U/S of Simpson's Bridge	42.69062	-81.64897
4a	Historical	2022-NMT-TR-241022-001A	2013-NMT-PG-231013-010A	24-Oct-22	U/S of Simpson's Bridge	42.69698	-81.65238
4b	Targeted	2022-NMT-TR-261022-002A	-	26-Oct-22	U/S of Simpson's Bridge	42.69792	-81.65871
5a	Historical	2022-NMT-TR-241022-002A	2013-NMT-PG-231013-011A	24-Oct-22	U/S of Simpson's Bridge	42.69743	-81.65353
5b	Targeted	2022-NMT-TR-261022-003A	-	26-Oct-22	U/S of Simpson's Bridge	42.69835	-81.65954
6a	Historical	2022-NMT-TR-241022-003A	2013-NMT-PG-231013-012A	24-Oct-22	U/S of Simpson's Bridge	42.69767	-81.65479
6b	Targeted	2022-NMT-TR-261022-004A	-	26-Oct-22	U/S of Simpson's Bridge	42.69872	-81.66104
7a	Historical	2022-NMT-TR-271022-001A	TRT09-291009-008	27-Oct-22	1.5 km U/S of Big Bend CA	42.64636	-81.69968
7b	Targeted	2022-NMT-TR-271022-002A	-	27-Oct-22	~1 km U/S of Big Bend ramp	42.64788	-81.69881
8a	Historical	2022-NMT-TR-271022-003A	MTR10-130910-002A 2020-ESDPT-070820-002A	27-Oct-22	Gravel bar D/S of canoe launch	42.64163	-81.70398
8b	Targeted	2022-NMT-TR-271022-004A	-	27-Oct-22	U/S of first big riffle u/s of Big Bend launch	42.63952	-81.70155
9a	Historical	2022-NMT-TR-220922-001A	2020-ESDPT-070820-001A	22-Sep-22	~80 m U/S of Big Bend launch	42.64160	-81.70667
9b	Targeted	2022-NMT-TR-220922-003A	-	22-Sep-22	~420 m D/S of Big Bend launch	42.63995	-81.71118
10a	Historical	2022-NMT-TR-220922-002A	2020-ESDPT-050820-001A	22-Sep-22	Across from Big Bend launch	42.64213	-81.70792
10b	Targeted	2022-NMT-TR-220922-004A	-	22-Sep-22	~560 m D/S of Big Bend launch	42.63946	-81.71283

Appendix 3. *Aggregate catch of fishes at each site sampled for Northern Madtom in the Thames River, Ontario, 2022 (n = 20).*

a) Historical (n = 10)

Site ID	Field Number	*Ammocrypta pellucida*	*Aplodinotus grunniens*	*Cyprinella spiloptera*	*Etheostoma blennioides*	*Etheostoma nigrum*	*Hypentelium nigricans*	*Ictalurus punctatus*	*Moxostoma erythrurum*	*Moxostoma macrolepidotum*	*Neogobius melanostomus*	*Paranotropis buchanani*	*Noturus flavus*	*Noturus stigmosus*	*Percina caprodes*	*Percina maculata*	*Percopsis omiscomaycus*	*Pimephales notatus*	Total Fishes	Species detected
1a	2022-NMT-TR-251022-001A	0	0	0	25	0	0	0	0	0	3	0	0	2	2	9	1	0	**42**	**6**
2a	2022-NMT-TR-251022-003A	5	0	0	2	0	0	2	0	4	13	1	0	1	2	5	0	0	**35**	**9**
3a	2022-NMT-TR-251022-005A	1	0	0	0	0	0	4	1	0	1	59	0	3	0	9	0	0	**78**	**7**
4a	2022-NMT-TR-241022-001A	1	0	0	0	0	0	6	0	1	13	5	2	0	1	6	0	0	**35**	**8**
5a	2022-NMT-TR-241022-002A	0	0	7	3	0	0	2	0	3	9	4	0	0	1	1	0	0	**30**	**8**
6a	2022-NMT-TR-241022-003A	0	0	1	5	0	1	3	1	1	20	1	0	10	1	4	0	0	**48**	**11**
7a	2022-NMT-TR-271022-001A	0	0	0	1	0	0	0	0	0	19	8	0	4	1	3	0	0	**36**	**6**
8a	2022-NMT-TR-271022-003A	1	0	0	1	0	0	2	0	2	13	11	0	0	2	6	0	2	**40**	**9**
9a	2022-NMT-TR-220922-001A	8	0	0	0	0	0	54	0	0	1	235	0	0	0	1	0	0	**299**	**5**
10a	2022-NMT-TR-220922-002A	0	0	0	0	0	0	33	1	0	6	302	0	0	0	0	1	0	**343**	**5**
	Total captured	**16**	**0**	**8**	**37**	**0**	**1**	**106**	**3**	**11**	**98**	**626**	**2**	**20**	**10**	**44**	**2**	**2**	**986**	**15**
	Relative abundance (%)	**1.6**	**0.0**	**0.8**	**3.8**	**0.0**	**0.1**	**10.8**	**0.3**	**1.1**	**9.9**	**63.5**	**0.2**	**2.0**	**1.0**	**4.5**	**0.2**	**0.2**	**-**	**-**
	Freq. of occurrence (%)	**50**	**0**	**20**	**60**	**0**	**10**	**80**	**30**	**50**	**100**	**90**	**10**	**50**	**70**	**90**	**20**	**10**	**-**	**-**

b) Targeted (n = 10)

Site ID	Field Number	*Ammocrypta pellucida*	*Aplodinotus grunniens*	*Cyprinella spiloptera*	*Etheostoma blennioides*	*Etheostoma nigrum*	*Hypentelium nigricans*	*Ictalurus punctatus*	*Moxostoma erythrurum*	*Moxostoma macrolepidotum*	*Neogobius melanostomus*	*Paranotropis buchanani*	*Noturus flavus*	*Noturus stigmosus*	*Percina caprodes*	*Percina maculata*	*Percopsis omiscomaycus*	*Pimephales notatus*	Total Fishes	Species detected
1b	2022-NMT-TR-251022-002A	0	0	0	4	0	0	0	0	1	7	0	0	0	4	3	0	0	**19**	**5**
2b	2022-NMT-TR-251022-004A	8	0	0	2	0	0	0	0	0	5	1	0	0	0	3	0	0	**19**	**5**
3b	2022-NMT-TR-261022-001A	11	0	0	0	1	0	0	0	0	0	5	0	0	0	6	0	1	**24**	**5**
4b	2022-NMT-TR-261022-002A	5	0	0	0	0	0	6	2	1	4	181	0	0	0	2	0	0	**201**	**7**
5b	2022-NMT-TR-261022-003A	5	0	0	0	0	0	5	1	2	0	28	0	0	0	0	0	0	**41**	**5**

Site ID	Field Number	*Ammocrypta pellucida*	*Aplodinotus grunniens*	*Cyprinella spiloptera*	*Etheostoma blennioides*	*Etheostoma nigrum*	*Hypentelium nigricans*	*Ictalurus punctatus*	*Moxostoma erythrurum*	*Moxostoma macrolepidotum*	*Neogobius melanostomus*	*Paranotropis buchanani*	*Noturus flavus*	*Noturus stigmosus*	*Percina caprodes*	*Percina maculata*	*Percopsis omiscomaycus*	*Pimephales notatus*	Total Fishes	Species detected
6b	2022-NMT-TR-261022-004A	3	0	0	0	1	0	3	0	0	2	63	0	2	0	8	0	0	**82**	**7**
7b	2022-NMT-TR-271022-002A	3	0	0	1	0	0	3	0	0	6	53	0	0	0	13	0	0	**79**	**6**
8b	2022-NMT-TR-271022-004A	0	0	0	0	1	0	7	4	0	4	259	0	1	0	10	0	0	**286**	**7**
9b	2022-NMT-TR-220922-003A	0	0	0	0	0	0	19	1	1	28	101	0	0	0	7	0	0	**157**	**6**
10b	2022-NMT-TR-220922-004A	0	1	0	0	0	0	7	1	0	24	111	0	0	0	1	0	0	**145**	**6**
	Total captured	**35**	**1**	**0**	**7**	**3**	**0**	**50**	**9**	**5**	**80**	**802**	**0**	**3**	**4**	**53**	**0**	**1**	**1053**	**13**
	Relative abundance (%)	**3.3**	**0.1**	**0.0**	**0.7**	**0.3**	**0.0**	**4.7**	**0.9**	**0.5**	**7.6**	**76.2**	**0.0**	**0.3**	**0.4**	**5.0**	**0.0**	**0.1**	**-**	**-**
	Freq. of occurrence (%)	**60**	**10**	**0**	**30**	**30**	**0**	**70**	**50**	**40**	**80**	**90**	**0**	**20**	**10**	**90**	**0**	**10**	**-**	**-**

Appendix 4. *Individual total length (mm) and weight (g) measurements for a) Northern Madtom, and b) Eastern Sand Darter captured in the Thames River, Ontario, 2022.*

a) Northern Madtom (n = 23)

Site ID	Field number	Total length (mm)	Weight (g)
1a	2022-NMT-TR-251022-001A	60	2.0
1a	2022-NMT-TR-251022-001A	65	2.7
2a	2022-NMT-TR-251022-003A	95	7.6
3a	2022-NMT-TR-251022-005A	37	0.4
3a	2022-NMT-TR-251022-005A	46	0.7
3a	2022-NMT-TR-251022-005A	51	1.3
6a	2022-NMT-TR-241022-003A	42	0.7
6a	2022-NMT-TR-241022-003A	46	0.9
6a	2022-NMT-TR-241022-003A	48	1.1
6a	2022-NMT-TR-241022-003A	48	1.2
6a	2022-NMT-TR-241022-003A	48	1.2
6a	2022-NMT-TR-241022-003A	49	1.1
6a	2022-NMT-TR-241022-003A	49	1.3
6a	2022-NMT-TR-241022-003A	50	1.5
6a	2022-NMT-TR-241022-003A	78	4.5
6a	2022-NMT-TR-241022-003A	93	8.1
6b	2022-NMT-TR-261022-004A	47	1.0
6b	2022-NMT-TR-261022-004A	101	10.3
7a	2022-NMT-TR-271022-001A	39	0.6
7a	2022-NMT-TR-271022-001A	50	0.9
7a	2022-NMT-TR-271022-001A	86	7.2
7a	2022-NMT-TR-271022-001A	103	10.9
8b	2022-NMT-TR-271022-004A	-	-
	Minimum	**37**	**0.4**
	Mean	**60.5**	**3.1**
	Maximum	**103**	**10.9**

b) Eastern Sand Darter (n = 51)

Site ID	Field number	Total length (mm)	Weight (g)
2a	2022-NMT-TR-251022-003A	47	0.6
2a	2022-NMT-TR-251022-003A	48	0.5
2a	2022-NMT-TR-251022-003A	51	0.7
2a	2022-NMT-TR-251022-003A	53	0.8
2a	2022-NMT-TR-251022-003A	60	1.0
2b	2022-NMT-TR-251022-004A	42	0.4
2b	2022-NMT-TR-251022-004A	47	0.5
2b	2022-NMT-TR-251022-004A	52	0.8
2b	2022-NMT-TR-251022-004A	53	0.7
2b	2022-NMT-TR-251022-004A	55	0.8
2b	2022-NMT-TR-251022-004A	58	1.1
2b	2022-NMT-TR-251022-004A	60	1.1
2b	2022-NMT-TR-251022-004A	60	1.2

Site ID	Field number	Total length (mm)	Weight (g)
3a	2022-NMT-TR-251022-005A	64	1.2
3b	2022-NMT-TR-261022-001A	45	0.4
3b	2022-NMT-TR-261022-001A	45	0.5
3b	2022-NMT-TR-261022-001A	46	0.5
3b	2022-NMT-TR-261022-001A	48	0.6
3b	2022-NMT-TR-261022-001A	48	0.7
3b	2022-NMT-TR-261022-001A	50	0.7
3b	2022-NMT-TR-261022-001A	50	0.7
3b	2022-NMT-TR-261022-001A	50	0.7
3b	2022-NMT-TR-261022-001A	53	0.7
3b	2022-NMT-TR-261022-001A	60	1.2
3b	2022-NMT-TR-261022-001A	64	1.4
4a	2022-NMT-TR-241022-001A	48	0.5
4b	2022-NMT-TR-261022-002A	37	0.3
4b	2022-NMT-TR-261022-002A	42	0.4
4b	2022-NMT-TR-261022-002A	45	0.5
4b	2022-NMT-TR-261022-002A	48	0.6
4b	2022-NMT-TR-261022-002A	49	0.6
5b	2022-NMT-TR-261022-003A	39	0.3
5b	2022-NMT-TR-261022-003A	45	0.6
5b	2022-NMT-TR-261022-003A	47	0.5
5b	2022-NMT-TR-261022-003A	47	0.6
5b	2022-NMT-TR-261022-003A	-	-
6b	2022-NMT-TR-261022-004A	27	0.0
6b	2022-NMT-TR-261022-004A	43	0.4
6b	2022-NMT-TR-261022-004A	50	0.6
7b	2022-NMT-TR-271022-002A	49	0.5
7b	2022-NMT-TR-271022-002A	52	0.9
7b	2022-NMT-TR-271022-002A	-	-
8a	2022-NMT-TR-271022-003A	52	0.6
9a	2022-NMT-TR-220922-001A	39	0.2
9a	2022-NMT-TR-220922-001A	43	0.3
9a	2022-NMT-TR-220922-001A	44	0.4
9a	2022-NMT-TR-220922-001A	45	0.5
9a	2022-NMT-TR-220922-001A	45	0.5
9a	2022-NMT-TR-220922-001A	46	0.4
9a	2022-NMT-TR-220922-001A	46	0.5
9a	2022-NMT-TR-220922-001A	47	0.5
	Minimum	**27**	**0**
	Mean	**48.7**	**0.6**
	Maximum	**64**	**1.4**