Conservation Resource Alliance

# CRA Fisheries Survey Report-2023

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**Cover Photo**

Volunteers from the Elliott Donnelley Chapter of Trout Unlimited assist CRA staff with 2023 fishery survey of Apple Creek

Acknowledgements
This effort would not have been possible without the support of the Elliott Donnelley Chapter of Trout Unlimited (Chicago, IL), the Adams Chapter of Trout Unlimited (Traverse City, MI), and Fly Fishers International, and Fly Fishers International-Great Lakes Council. These organizations funded both the purchase of equipment and provision of funds for Conservation Resource Alliance (CRA) labor to undertake the surveys.

## Introduction

The following is a report of fish species surveyed by backpack electrofishing various sites across CRA's service area in northwest Lower Michigan. All 2023 surveys were performed to determine the fish species diversity and species size structure present in streams prior to planned project work, either dam removal or road/stream crossing replacement.

An aerial view of CRA's service area illustrates a proliferation of streams of all sizes throughout northwest Lower Michigan. Concurrently, it illustrates the extensive road network that intersects with these streams including everything from driveways, two-tracks, and dirt lanes to paved country roads and state highways. As a result, there exists in the region myriad road/stream crossings in varying states of disrepair, improper sizing and alignment with the stream, and excessively elevated outlets with respect to the channel bed. These issues have been found by researchers to result in watershed fragmentation and isolation of aquatic organisms, primarily fish (Evans et al. 2015), from accessing habitats important for life history functions and for genetic flow (Drakou et al. 2009; Keller et al. 2011; Wood et al. 2018). In addition, these intersections threaten aquatic biodiversity persistence and have been found to be a major driver in worldwide fish population declines (Roni et al. 2002; Dudgeon et al. 2006; Dugan et al. 2010). Additionally, negative effects from disjointed crossings can result due to the alteration of stream flow and geomorphology as well as sediment and stream-borne debris movement (Beschta 1978; Jones et al. 2000; Trombulak and Frissell 2000). Dams, in much the same mode as road/stream crossings, pose barriers to bidirectional fish passage and disrupt natural stream function. In the case of dams however, there's no discrimination between jumping and non-jumping species.

In support of CRA's planned and current road/stream crossing and dam removal projects to mitigate the above effects on stream health, CRA has developed internal capacity to perform fishery surveys. Fishery surveys have historically been performed on CRA's behalf with the help of project partners such as the Michigan Department of Natural Resources (MDNR), Grand Traverse Band of Ottawa and Chippewa Indians (GTB), Trout Unlimited (TU), United States Forest Service (USFS), and the United States Fish and Wildlife Service (USFWS). Given constraints on time and funding, it has become difficult to continue acquire fisheries data for their own workplans, let alone CRA's.

Early in 2023, a workplan was developed via input from CRA project management staff which produced recommendations for survey sites. This workplan was submitted to MDNR for consideration as part of the application for a Scientific Collectors Permit, which MDNR administers as managers of the state's fisheries and wildlife resources. The workplan was also shared with the natural resources departments of the three Lower Michigan tribes that are signatories to the 1836 Treaty of Washington which ceded their lands to the United States. The 1836 tribes (Little Traverse Bay Bands of Odawa Indians, Grand Traverse Band of Ottawa and Chippewa Indians, and the Little River Band of Ottawa Indians) co-manage fisheries and wildlife resources in the region.

Survey Area

The 2023 survey sites were located in the northwest corner of Michigan's lower peninsula including Antrim, Benzie, Charlevoix, Grand Traverse, and Lake counties. Watersheds include those of the Ottaway/Boardman, Platte, Pine, Betsie, and Jordan rivers as well as that of Lake Leelanau.

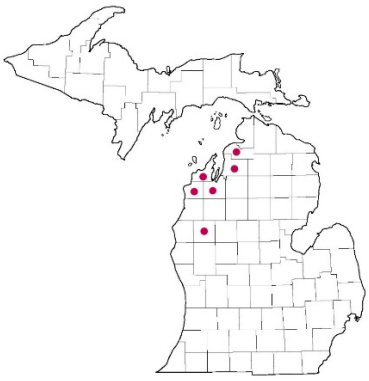

**Figure 1.** Spatial Scale of 2023 CRA Fisheries Surveys

Streams surveyed were of first or second order (Strahlers 1957) and, apart from the Little Betsie River tributary site, were coldwater streams. Forested riparian conditions predominated across all sites and canopy cover above the creeks ranged from moderate to quite dense.

Methods

All surveys were single pass runs to determine species presence, fish community diversity, inch class, and total numbers for eventual comparison with post-project survey data. Additionally, a rapid survey of channel morphology and habitat condition was performed, and all data collected were recorded on a copy of MDNR's *Status and Trends Program Fish Collection (Random Site One-Pass Run)* datasheet. CRA protocol for both the fish survey and habitat survey are adapted from Wills et al., 2006.

Starting at a georeferenced location (culvert edge, flagged branch), a fiberglass reel-tape measure was run on the bank along the course of the creek until the desired footage was achieved and marked with orange survey tape wrapped around a branch. The standard survey station length was 300' but there were discrepancies due to site conditions and limitations. Depending on response or not from adjacent landowners to access-request letters, survey stations were measured below, above, or both above and below road/stream crossings (Apple Ck. was surveyed above and below the dams). Average stream depth and width was estimated and spot-checked with a measuring rod, with maximum and minimum measurements noted.

A Smith Root *Model LR-20B* battery powered backpack shocker (pulsed DC) was employed with a 6' steel rat-tail cathode and fiberglass anode pole with either a triangular (14.5" x 7.75") or circular (11") stainless steel ring. Fish were captured via ¼" mesh dipnet handled by both the shocker operator and, depending on site, assistants with dipnets. Total shocking time (seconds), voltage (v), frequency (Hz), and duty cycle (%) settings were recorded with waterproof ink in a water-resistant field book and subsequently transferred to a datasheet.

Before electrofishing the station, a Hanna Instruments *EC/TDS Tester* handheld multimeter was used to determine both temperature and ambient conductivity of stream water. The meter was calibrated periodically with a 1413 µS/cm standard to confirm accuracy. An area was then selected outside the station to determine effective shocker settings based on the immobilization response observed in fish.

Electrofishing was performed in an upstream direction and fish were collected and held in 5-gallon buckets filled with fresh creek water. Depending on the number of fish collected, electrofishing either continued to completion before working fish up or electrofishing ceased, and fish were worked up and reintroduced downstream of the station and electrofishing continued. Water was continuously refreshed in the bucket to provide optimal temperature and dissolved oxygen conditions. Each fish captured was identified, measured, enumerated, and subsequently released by slowly pouring them back into the stream in an area of deep and/or slack water.

**Photo 1.** CRA seasonal technicians working up fish (Cedar Run Creek)

Results and Discussion

Species observed in the coldwater streams constituted commonly observed *salmonids* (trout, charr, and salmon), *cottids* (sculpin), *cyprinids* (minnows), *gasterosteids* (sticklebacks), and *petromyzontids* (lamprey) in the region (see Figure 2.). The coldwater streams also, unsurprisingly, exhibited relatively low fish species diversity and sometimes only one species was observed but more commonly it was two or three. What stands out initially is the lack of sculpin in some survey locations (Brown Ck., Unnamed Pine River Tributary, and Apple Ck.), especially since brook and/or brown trout were present and water temperatures were cold. Also interesting were the relatively high number of sculpin at Cedar Run Ck. in the 1" and 2" size classes. These young-of-the-year (given their size) indicate good spawning conditions in spring 2023. Another surprising finding was the lack of any brook trout above the Apple Ck. dams as this station was limited to only brown trout being present. Below the dams, brook trout were present with smaller and larger individuals represented but none in the mid-range. Below is an expansion on the discussion of brook trout and sculpin as species of interest in streams.

Native keystone fishes in coldwater streams are a high priority to funding organizations and agencies and as such, funding for most barrier projects surveyed in 2023 was focused on restoring connectivity in regionally native brook trout habitat. Pre-settlement, brook trout are thought to have occupied the very northern portion of the Lower Peninsula and throughout the Upper Peninsula while the extinct Michigan grayling *(Thymallus tricolor)* predominated in coldwater streams in the rest of the glaciated part of northern Lower Michigan (Vincent 1962; Behnke 2002). Through natural range expansion and anthropogenic (i.e., stocking) means, brook trout expanded their range south into the streams formerly occupied by grayling and have become established in these coldwater habitats. Because they are a

native charr of Michigan and their populations are susceptible to habitat fragmentation (Wood et al. 2018), warming water temperatures (Carlson et al. 2015), and competition from nonnative salmonids (Fausch and White 1986; Rose 1986), they and their habitat are of great import for conservation and restoration.

Sculpin are another native species of coldwater streams in the region and commonly are found to co-occur with brook trout in their native range (Zimmerman and Vondracek 2006). Sculpin, found in several of the coldwater streams surveyed in 2023, are indicators of high water quality (Baker and Christensen 1991). Due to their benthic nature and lack of a swim bladder, they are especially susceptible to the negative effects posed by elevated culverts (Petty and Grossman 2004; Nislow et al. 2011; Natsumeda 2007) and other barriers through genetic isolation and the inability to migrate to refugia to escape unfavorable environmental conditions (Coleman et al. 2018). Of note, a very large (5.25") sculpin was sampled in the Unnamed Big Platte Lake Tributary Impoundment near the upstream inlet. This sculpin and all others sampled in 2023 were not identified to species (commonly mottled *(C. bairdii)* or slimy *(C. cognatus)*) due to the potential harm inflicted in the time it would have taken to count pelvic rays.

**Photo 2.** CRA biologist surveying Marvon Ck.

The one warmwater stream surveyed (Little Betsie River tributary) was fed from a surface source (Loon Lake) and exhibited common native *cyprinids*, *percids* (darters), *atherinopsids* (silversides), and *petromyzontids* (see Table 5). This site was selected for equipment testing and as a trial run prior to the sampling season and as such, was not associated with any CRA projects. However, the importance of warmwater stream fish communities should not be understated as their habitats are susceptible to the same barrier and habitat fragmentation issues as coldwater streams (Briggs and Galarowicz 2013).

**Figure 2.** Locations and Species Captured During 2023 Survey Season

| Species | Apple Creek Lower (Grand Traverse Co.) | Apple Creek Upper (Grand Traverse Co.) | Brown Creek/Below Pesek Rd. (Charlevoix Co.) | Cedar Run Creek/Below Co. Rd. 651 (Leelanau Co.) | Little Betsie River Tributary (Grand Traverse County) | Marvon Ck./Below Marvon Rd. (Charlevoix Co.) | Marvon Ck./Below Pesek Rd. (Charlevoix Co.) | Marvon Ck./Above Pesek Rd. (Antrim Co.) | Unnamed Pine River Tributary/Above Gopher Run Rd. (Lake Co.) | Unnamed Pine River Tributary/Below Gopher Run Rd. (Lake Co.) | Unnamed Big Platte Lake Tributary and Impoundment (Benzie Co.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| northern brook silversides *(Labidesthes sicculus)* | | | | | ■ | | | | | | |
| brook stickleback *(Culaea inconstans)* | ■ | | | | | | | | | | ■ |
| brook trout *(Salvelinus fontinalis)* | ■ | | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | |
| brown trout *(Salmo trutta)* | ■ | ■ | | ■ | | ■ | | ■ | | ■ | |
| central mudminnow *(Umbra limi)* | | | | | | | | | | | ■ |
| coho salmon *(Oncorhynchus kisutch)* | | | | | | | | | | | ■ |
| common shiner *(Luxilus cornutus)* | | | | | ■ | | | | | | |
| Johnny darter *(Etheostoma nigrum)* | | | | | ■ | | | | | | |
| lamprey *(Petromyzontid spp.)* | | | | ■ | ■ | ■ | | | | | |
| mimic shiner (*Notropis volucellus*) | | | | | ■ | | | | | | |
| rainbow trout *(Oncorhynchus mykiss)* | ■ | | | | | | | | | ■ | |
| sculpin *(Cottus spp.)* | | | | ■ | | ■ | ■ | | | | ■ |
| western blacknose dace (*Rhinichthys obtusus*) | ■ | | | | | | | ■ | | | ■ |

Length Frequency Tables

**Table 1:** Apple Creek Lower (30 Jun 23-repeat survey) Number of Fish Captured Per Inch Class (0.04 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Blacknose dace | 1 | | | | | | | | | | 1 |
| Brook stickleback* | 1 | | | | | | | | | | 1 |
| Brook trout | | 6 | | | | | | 2 | | | 8 |
| Brown trout | 1 | 74 | 2 | 2 | 6 | 1 | 2 | 1 | | | 89 |
| Rainbow trout** | | | | | | | 1 | | | | 1 |

*observed on 16 Jun 23 survey. Survey re-run due to capture and id complications
** captured outside of survey station during unit setup run

**Table 2:** Apple Creek Upper (11 Aug 23) Number of Fish Captured Per Inch Class (.03 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Brown trout | | 22 | 13 | 1 | 3 | 3 | 1 | 1 | | | 44 |

**Table 3:** Brown Creek (27 Sep 23) Number of Fish Captured Per Inch Class (.02 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Brook trout | | 12 | 10 | 5 | 5 | 1 | 1 | | | | 35 |

**Table 4:** Cedar Run Creek (15 Aug 23) Number of Fish Captured Per Inch Class (.036 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Brook trout | | 5 | 8 | 5 | 4 | 3 | | 1 | | | 26 |
| Brown trout | | 2 | 8 | 4 | 16 | 7 | 4 | 6 | | | 47 |
| Lamprey spp.* | | | | | | | | | | | 2 |
| Sculpin spp. | 31 | 32 | 10 | | | | | | | | 73 |

*length not measured

**Table 5:** Little Betsie River Tributary (25 Apr 23) Number of Fish Captured Per Inch Class (.07 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Brook silversides | | 2 | | 1 | | | | | | | 3 |
| Common shiner | | | | 1 | | | | | | | 1 |
| Johnny darter | | 1 | | | | | | | | | 1 |
| Lamprey spp. | | | | 1 | | | | | | | 1 |
| Mimic shiner | 8 | 6 | | | | | | | | | 14 |

**Table 6:** Marvon Creek Below Marvon Road (20 Sep 23) Number of Fish Captured Per Inch Class (.02 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Brook trout | | 8 | 3 | 8 | 4 | 5 | 1 | 1 | | | 30 |
| Brown trout | | | | | | | 1 | | | | 1 |
| Lamprey spp.* | | | | | | | | | | | 4 |
| Sculpin spp. | 1 | 10 | 3 | | 1 | | | | | | 15 |

*length not measured

**Table 7:** Marvon Creek Below Pesek Road (20 Sep 23) Number of Fish Captured Per Inch Class (.03 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Brook trout | | 11 | 1 | 7 | 4 | 3 | 1 | 1 | | | 28 |
| Sculpin spp. | 5 | 6 | 3 | | | | | | | | 14 |

**Table 8:** Marvon Creek Above Pesek Road (27 Sep 23) Number of Fish Captured Per Inch Class (.03 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Blacknose dace | | | 1 | | | | | | | | 1 |
| Brook trout | | 11 | 5 | 8 | 7 | 4 | 1 | 2 | | | 38 |
| Brown trout | | | | 1 | 1 | | | | | | 2 |
| Sculpin spp. | 7 | 2 | 2 | | | | | | | | 11 |

**Table 9:** Unnamed Tributary to Pine River Upstream of Gopher Run Road (24 Jul 23)
Number of Fish Captured Per Inch Class (.01 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Brook trout | 4 | 5 | | 2 | 2 | | | | | | 13 |

**Table 10:** Unnamed Tributary to Pine River Downstream of Gopher Run Road (24 Jul 23)
Number of Fish Captured Per Inch Class (.01 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Brook trout | 2 | 4 | 2 | 2 | 1 | | | | | | 11 |
| Brown trout | | | | | | | 1 | | | | 1 |
| Rainbow trout | | | | 1 | | | | | | | 1 |

**Table 11:** Unnamed Tributary to Big Platte Lake Downstream of Bixler Road (7 Jul 23)
Number of Fish Captured Per Inch Class (.01 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Brook stickleback | | 2 | | | | | | | | | 2 |
| Central mudminnow | | 3 | 1 | | | | | | | | 4 |
| Coho salmon | | 3 | 1 | | | | | | | | 4 |
| Sculpin spp. | | 5 | 1 | | | | | | | | 6 |

**Table 12:** Unnamed Tributary (Impoundment) to Big Platte Lake Upstream of Bixler Road (7 Jul 23)
Number of Fish Captured Per Inch Class (.152 acre)

| Species | Inch Class | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Central mudminnow | | 4 | 7 | | | | | | | | 11 |
| Sculpin spp. | | 6 | 4 | 1 | 1 | | | | | | 12 |

**Figure 3.** Stream and Ambient Temperature and Ambient Conductance Data From 2023 Fish Surveys

| Date/Time | Location | Water Temperature | Ambient Temperature | Ambient Conductance |
|---|---|---|---|---|
| 8-11/0900 | Apple Creek (upper) | 55.6°F | 60°F | 660 µS |
| 6-30/0930 | Apple Creek (lower) | 57°F | 72°F | 560 µS |
| 9-27/1252 | Brown Creek | 57.9°F | 64°F | 303 µS |
| 8-15/0930 | Cedar Run Creek | 58.5°F | 60°F | 347 µS |
| 4-25/1100 | Little Betsie River trib. | 47.3°F | 49°F | 333 µS |
| 9-20/1100 | Marvon Ck./Below Marvon Rd. | 57°F | 70°F | 346 µS |
| 9-20/1100 | Marvon Ck./Below Pesek Rd. | 57°F | 70°F | 346 µS |
| 9-27/0907 | Marvon Ck./Above Pesek Rd. | 55.6°F | 53°F | 362 µS |
| 7-24/1212 | Unnamed Pine River Tributary/Above and Below Gopher Run Rd. | 56°F | 75°F | 261 µS |
| 7-7/1045 | Unnamed Big Platte Lake Tributary/Impoundment (Bixler Rd.) | 61.5°F/60°F | 80°F | 619 µS/198 µS |

Conclusion

In the years to come, repeated fish surveys using consistent methods will provide an opportunity to assess potential changes to fish species diversity, and size (age) class composition in response to project completion and will similarly inform projects in the future. CRA recognizes the statistical limitations on data from single-pass fish surveys which are described in the literature (Hanks et al. 2018; Kruse et al. 1998). As such, inferences made on population size and some responses would need to be heavily qualified. That said, these data can point toward a homogenization, or similarity, of the fish community between upstream and downstream survey reaches, post barrier removal, which would suggest a successful project outcome.

Having first-hand knowledge of the fish communities in the streams we work on is invaluable and at times can inform the trajectory of our projects. An added benefit to CRA's capacity to do this work expands the knowledge of stream fish in our region through sharing of our data with agency and tribal partners as well as CRA donors. Additionally, CRA will be positioned to assist our partners in joint surveys on collaborative projects or in support of their own efforts.

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**Species Photographs**

Photo A. Juvenile brook trout (Apple Ck.)

Photo B. Juvenile brown trout (Apple Ck.)

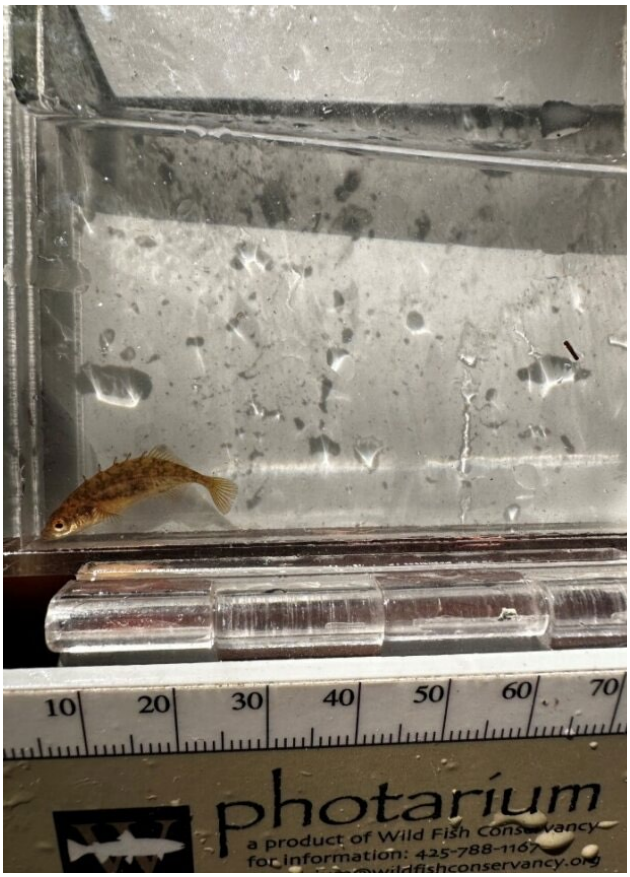


Photo C. Brook stickleback (Apple Ck.)


Photo D. Brown trout (Apple Ck.)

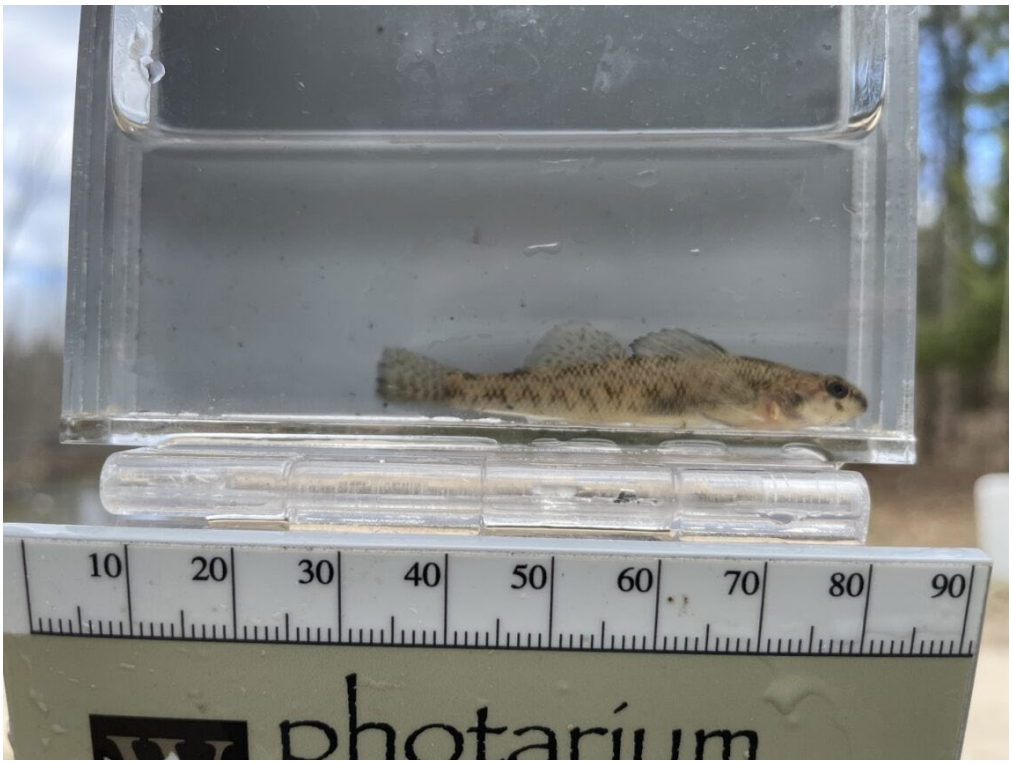

Photo E. Johnny darter (Little Betsie River Tributary)

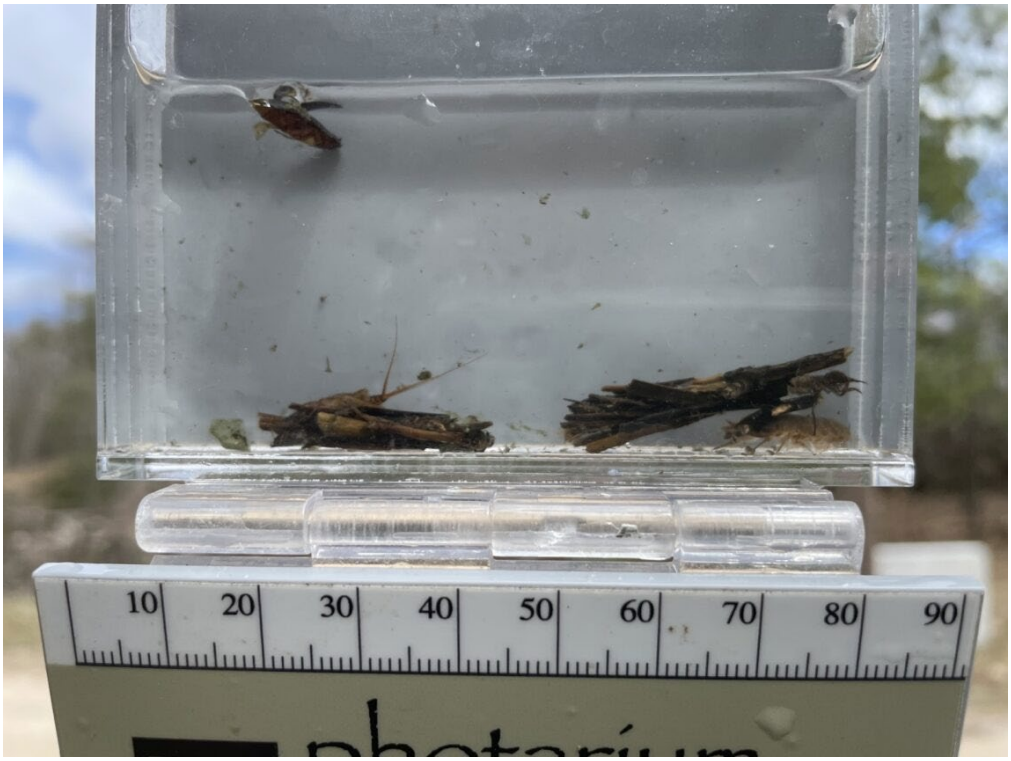

Photo F. Backswimmer (*Notonectidae*), stick caddis (*Limnephilidae*), and sowbug (*Asselidae*) (Little Betsie River Tributary)

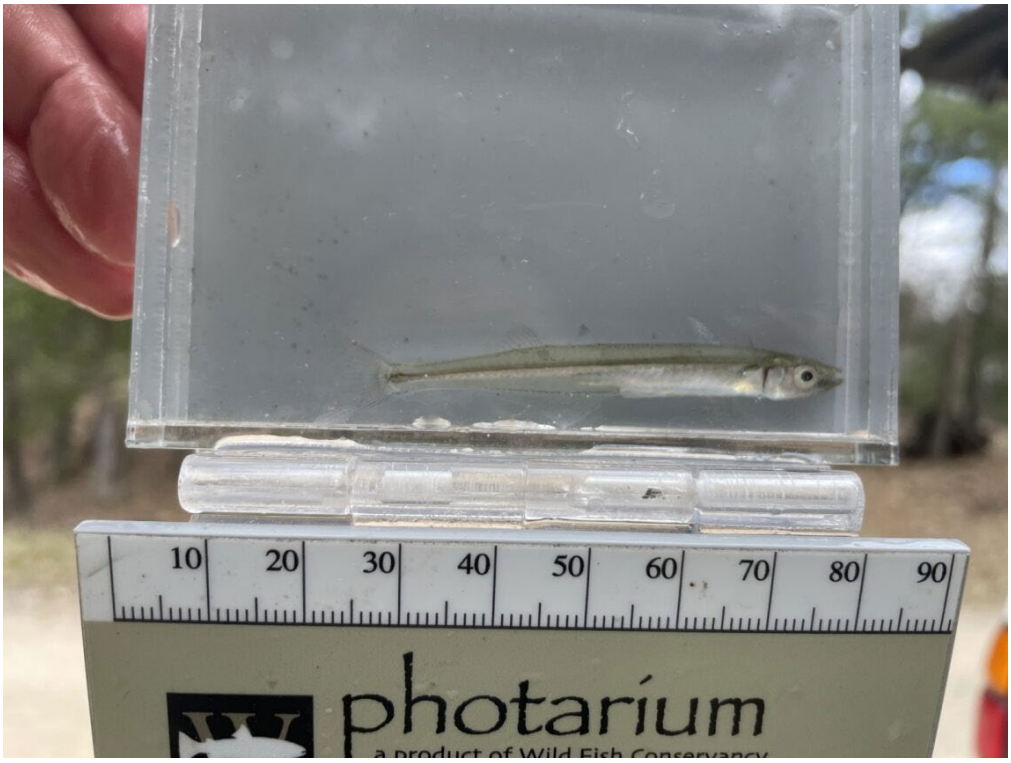

Photo G. Northern brook silversides (Little Betsie River Tributary)

Photo H. Mimic shiner (Little Betsie River Tributary)


Photo I. Rainbow trout (Unnamed Pine River Tributary)


Photo J. Western blacknose dace (Marvon Ck.)

Photo K. Brook trout (Marvon Ck.)

Photo L. Sculpin (Unnamed Big Platte Lake Tributary Impoundment)

Photo M. Central mudminnow (Unnamed Big Platte Lake Tributary Impoundment)

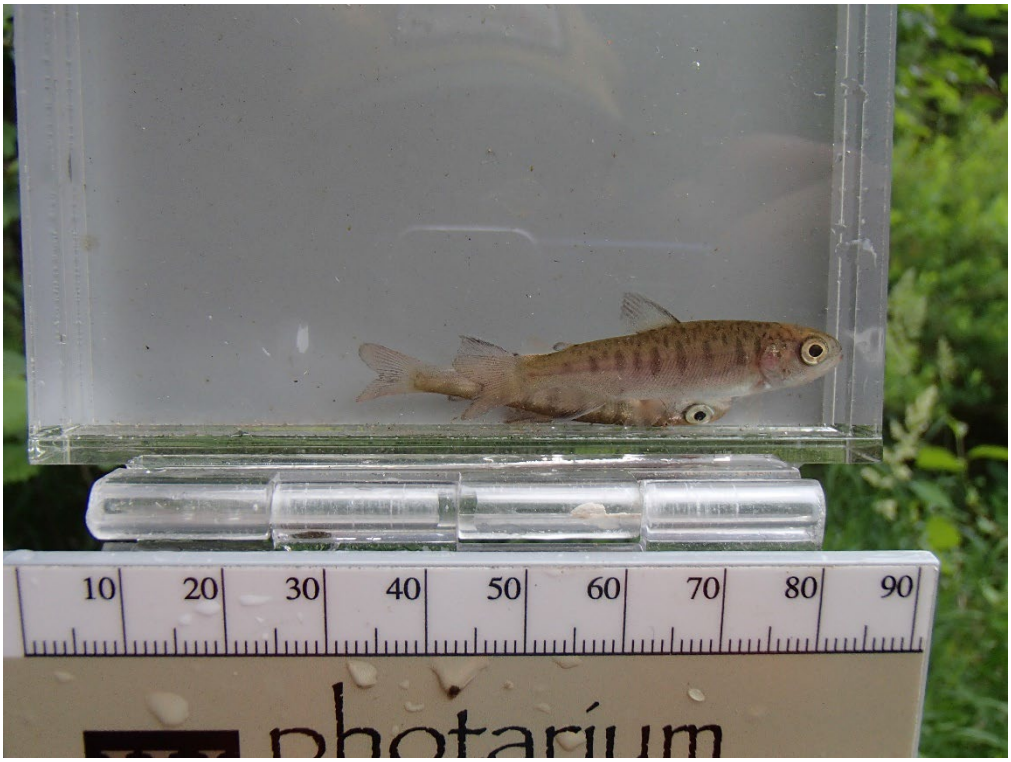

Photo N. Juvenile coho salmon (Unnamed Big Platte Lake Tributary)

Photo O. Brook lamprey (Little Betsie River Tributary)