

MEF21-69 August 1-December 31, 2024 Report

MITIGATION AND ENHANCEMENT FUND (MEF) PROJECT PROPOSAL PROCEDURE

TITLE: Assessment of Trout and Muskellunge Populations within the Upper Paint River Watershed

PROJECT MANAGER(S):

Name Jennifer Johnson

Organization Michigan DNR Fisheries Division

Address 500 West US 2 Norway, MI 49870

Phone 906-563-9247 ext 103

E-Mail johnsonj17@michigan.gov

Name Bette Premo

Organization Iron County Watershed Coalition

Address 429 River Lane Amasa MI 49903

Phone 906-822-7889

E-Mail ironcountywatershedcoalition@gmail.com

Name Mike Golas

Organization Trout Unlimited: Fred Waara Chapter

Address PO Box 123 Marquette, MI 49855

Phone 801-870-9863

E-Mail mikelindagolas@email.com

GOAL AND OBJECTIVES:

The goals of the study are 1) to evaluate muskellunge movement within the Paint River system above Crystal Falls Impoundment, including the SB Paint River 2) determine relative

abundance, size structure, and catch rates of muskellunge in the Paint River system and 3) Evaluate brook and brown trout populations within the SB Paint River. There are five discreet objectives of this plan that will all complement each other in order to achieve the goals of the project:

1. The Michigan DNR will partner with local fishing guides and anglers to collect biological data (trout and muskellunge) for both the mainstem of the Paint River, SB Paint River and Cooks Run (tributary of the SB Paint River) during each fishing trip for five years (2020-2025). Guides and anglers will also record any floy tags associated with captured muskellunge. Volunteers will record the number of previous fishing trips at each location, date, time spent fishing, stretch of river, environmental conditions, and catch (species and length). Anglers are also asked to determine if a muskellunge is male or female. The first objective is to obtain enough data over an extended period of time to calculate catch rates, relative abundance, size structure for muskellunge and trout. Equally important is the second objective, which is to form a lasting partnership between the DNR and anglers. Anglers provide important fisheries information that enables biologists to make informed management decisions. It should be noted that the volunteer angler effort is not included as match for the grant.

In May 2020, Fisheries Division created two forms for muskellunge and trout anglers to fill out for each fishing trip. In total, six muskellunge anglers and three trout anglers expressed interest in filling out the forms and submitting them to Fisheries Division at the end of each season. No local fishing guides were interested in participating. Unfortunately, there were zero submissions on angler activity at the end of the season. A few anglers reported qualitatively by email. Specifically, reports were:

- Caught two muskellunge on the lower end of the Paint River (38 and 39 inches) approximately 2 miles of the landing above the Crystal Falls Dam.
- I was fishing the Paint River between Crystal falls and US41 bridge. We caught a 32" musky with a dorsal fin clip and 2 pink floy tags in it. We also saw 3 others follow. All definitely different fish. The other 3 had pink and possibly orange tags. We also caught a 34.75" with no tags or fin clips.

Fisheries Division will continue to record angler reports for both muskellunge and trout. However, with no interest in submitting the required forms, Fisheries Division does not intend to send out the forms again unless future requests are made.

No updates during the August 1-December 31, 2021 time period.

An angler reported observing a muskellunge at the Uno Dam location (SB Paint River) on June 21, 2022.

Three angler reports were submitted to Jennifer Johnson:

1. September 9, 2022: One musky captured on the Paint River at the Crystal Falls Impoundment. The musky was originally tagged on 05/24/2022 in Section 1. It was determined to be a male and measured 32.5 inches at the time of tagging.
2. September 25, 2022: Two tagged musky were caught by an angler downstream of where the Net River flows into the Paint River.
 - a) Musky 1: Originally captured and tagged on 6/03/2021 at the Section 3 (Blockhouse) survey area. It was determined to be a male and 30.5 inches in length at the time of tagging.
 - b) Musky 2: Originally captured and tagged on 5/23/2022 at the Section 2 (Net River) survey area. It was determined to be a male and 35 inches in length at the time of tagging.
3. September 25, 2022: One musky captured on the Paint River between the Crystal Falls Impoundment and US Hwy 141 (Section 1). The musky was originally tagged on 05/26/2022. It was determined to be a male and 26 inches in length at the time of tagging.

An angler captured a tagged muskellunge between Bates-Amasa Rd. and Erickson Landing around July 12, 2023. The fish was originally captured and tagged on 5/25/23 within the same stretch of river.

No angling reports between August 1-December 31, 2023.

No angling reports between January 1-July 31, 2024.

On August 14, 2024, Jennifer Johnson was contacted by a fellow biologist who received a report of a muskellunge that was caught on July 12, 2024 in Section 1 of the Paint River with an external tag. The fish's length was recorded at 33 inches. The floy tag number submitted was likely incorrect. The number submitted was on a fish

that was confirmed to have lost both of its external tags before the angler caught his fish.

2. The objective is to collect biological data on muskellunge in the Paint River in order to evaluate spatial and temporal trends within the system. Beginning in May 2021, DNR Fisheries crew will electroshock and deploy nets in three sections of the Paint River. Muskellunge captured will have biological data recorded and will be floy and pit tagged. This effort will be done each May (Sections 1 & 2) and August (Section 3) from 2021-2025. Muskellunge will have an assigned colored floy tag based on the location where they are captured. The purpose of the colored floy tags is to evaluate movement within the Paint River system. If anglers see a muskellunge but do not capture it, they can at least record the color of the floy tag and the location where they were observed.

Between April 29-June 3, 2021, Fisheries Division electrofished three sections of the Paint River (Figure 1). In total, Fisheries Division spent 203 person hours on surveys. Methods included electrofishing and deployment of nets, however electrofishing was the most time efficient method and only one used during this time period. Section 1 originally was from the Crystal Falls Dam upstream to Bates-Amasa Road. However, the launch at Bates-Amasa Road had a newly constructed kayak launch that replaced the boat launch, rendering it impossible for the crew to launch the shocking boat. The local township conveyed they would add gravel to the site for boats to launch. Crews also tried accessing the river upstream from Erickson's Landing, however low water levels only allowed them to go a short distance from the landing. Future efforts will keep attempting to launch from the Bates-Amasa Road or access that stretch of river from the Erickson Landing (Figure 1).

In total, 43 (transposed the number for July report-was 34) individual muskellunge were captured during the survey. Of the 43 captured, three muskellunge were recaptures during the course of the survey time period making a total of 40 individual muskellunge tagged. The three recaptures were collected in Section 1 (Figure 1). Muskellunge ranged from 20.4-45.5 inches in length and averaged 31.3 inches. Crews identified 12 females and 28 males. Crew members utilized electroshocking gloves purchased through the grant (\$2,035 see attached invoice). This method worked well in enabling the quick collection of biological data and tagging. Additionally, crew members observed, but did not collect, seven young-of-year muskellunge in Section 1. All 40 muskellunge were pit and floy tagged with unique numbers. Only one color was used for the floy tags (Figure 2) because color would be hard to detect in the water once algae grew on the tags. Additionally, there

were no anglers participating in the volunteer reporting component of the study. Dorsal fin clips were taken for aging and growth analysis and any potential future genetics studies.

Separating out the muskellunge captured by sections, results showed a majority (N=32) were captured in Section 1 (above Crystal Falls Dam to past Erickson's Landing). This is expected as more survey effort was conducted in this section of the river. Section 2 (Net River) captured three and Section 3 (Forks to Blockhouse) captured eight.

Electrofishing Stations	Time Surveyed	# Musky Captured	Recaps	Size Range Tagged
Section 1	7hrs 57 min	32	3	20.4-45.5
Section 2	4hrs 1 min	3	0	34.3-41.1
Section 3	6hrs 45 min	8	0	30.3-38.6

Water temperatures during the electrofishing efforts ranged from 43°F-60°F. Air temperatures ranged from 47°F to 70°F.

In addition to muskellunge, during the May 12th, 2021 survey on Section 3, survey crews also collected biological data on walleye, brook trout and brown trout. Walleye (N=11) ranged from 14-29 inches in length and averaged 22.5 inches. Brook trout (N=11) ranged from 6-10 inches in length and averaged 7.9 inches. Brown trout (N=15) ranged from 8-20 inches in length and averaged 13.4 inches. Brook trout were observed from the beginning of the station (Forks) downstream until N46.24143 W088.63982. Brown trout, muskellunge, walleye were all observed throughout the station. Common white suckers of all sizes were abundant but collected. During the June 3rd survey on Section 3, brook trout ranging from 4-6 inches in length were observed in riffle areas but not collected.

On September 20, 2021, Fisheries Division electrofished Section 1 that totaled 8.5 person hours. A total of 4 new muskellunge were captured and one recapture was collected. The recapture was first tagged on May 11, 2021 in the same section of river. Muskellunge ranged from 10-27 inches in length and averaged 25.9 inches in length. It should be noted that only muskellunge greater than 20 inches were tagged

for these efforts due to a propensity of swimming longer distances and the pit tags are large in size that could be harmful to smaller sized muskellunge. Of the tagged musky, 3 were female and 2 were male. Musky ages 0, 1, 5, 8 and 10 were confirmed present during this survey. Walleye were also captured and recorded during this effort. A total of 69 walleye were captured ranging from 5-24 inches in length with an average of 9.5 inches. Walleye ages 0-2 were present in the collected population.

Aging data showed ages 0-10 present in Section 1. Sections 2 and 3 contained older fish over 30 inches and greater than 5 years old.

Total Musky survey data for 2021 in the Paint River

Electrofishing Stations	Time	# Musky captured	Recaps	Size Range Tagged
Section 1	9hrs 57 min	37	4	20.4-45.5
Section 2	4hrs 1 min	3	0	34.3-41.1
Section 3	6 hrs 45 min	8	0	30.3-38.6

On May 23, 2022, Fisheries Division electrofished Section 2 (Net River) that totaled 6.5 person hours. A total of 3 new muskellunge were captured (no recaptures from previous surveys). Muskellunge ranged from 35-44 inches in length and two were male and one was female. On May 24, 2022, the Fisheries Division crew attempted to electrofish Section 3 (Forks to Blockhouse Campgrounds) which requires a smaller shocking boat. However, the boat broke down at the beginning of the survey and still hasn't been repaired. On May 24 and 26, 2022, Fisheries Division electrofished Section 1 (Crystal Falls Impoundment) for a total of 27 person hours. A total of 10 muskellunge were captured (5 new and 5 recaptures). Muskellunge ranged from 20.5-41.0 inches in length and 8 were male and 2 were female. The recaptures were all originally tagged within the same reach (Section 1).

Time period January-July 2022

Electrofishing Stations	Time	# Musky captured (including recaps)	Recaps	Size Range Tagged
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Section 1	9hrs	10	5	20.5-41.0
Section 2	2hr 8min	3	0	34.3-41.1
Section 3*	0	-	-	-

*Shocking boat not working

Fisheries Division did not conduct surveys on the Paint River or Net River during the August 1-December 31, 2022 time period.

During May 2023, Fisheries Division electrofished four sections of the Paint River. Section 1 (Crystal Falls Impoundment to Erickson's Landing) was surveyed for a total of 9 person hours. Section 2 (Net River) was surveyed for a total of 6 person hours. Section 3 (Forks to Blockhouse Campgrounds) was surveyed for a total of 9 person hours. Section 4 (Bates-Amasa Rd to Erickson Landing) was surveyed for a total of 23 person hours. This was the first year Section 4 was surveyed. During the Section 1 survey, it was noted that there were substantially less muskellunge observed and captured compared to previous surveys.

Time Period May 2023

Electrofishing Stations	Time	# musky captured (including recaps)	Recaps	Size Range Tagged
Section 1	3 hours	2	1	31.5-35.7
Section 2	3 hours	1	0	30.8
Section 3	2 hours 15 min	6	2	31.1-38.3
Section 4	7 hours 35 min	14	1	20.2-35.8

Fisheries Division did not conduct surveys on the Paint River or Net River during the August 1-December 31, 2023 time period.

During April 2024, Fisheries Division electrofished Section 1 of the Paint River (Crystal Falls Impoundment to Erickson's Landing) for a total of 32hrs 36 min per hours. Counting travel and logistics a total of 38.5 person hours have been

dedicated to this project. A total of 12 miles were driven. Due to the breakdown of the Unit's small electrofishing boat, technicians were limited to areas with deeper water. For the entire span of the project, 81 individual musky have been tagged. Of those 81, 20 were recaptures from previous surveys. Of the 20 recaptures, one fish was captured on four different dates within the same stream section (Section 1), one fish was captured on three different dates within the same section (Section 1).

Time Period April 2024

Electrofishing Stations	Time	# musky captured (including recaps)	Recaps	Size Range Tagged
Section 1	10 hrs. 52 min.	17	7	22.3-44.2

TOTAL FOR ENTIRE PROJECT (January 2021-July 2024)

Electrofishing Stations	Time	# musky captured (including recaps)	Recaps	Recap Rate %	Fish per hour	Size Range Tagged
Section 1 (CF Impd)	33 hours	66	17	26	2.0	31.5-35.7
Section 2 (Net River)	9 hours	7	0	0	1.8	30.8
Section 3 (Blockhouse)	9 hours	14	2	14	1.6	31.1-38.3
Section 4 (Bates Amasa)	7.5 hours	14	1	7	1.9	20.2-35.8

Fisheries Division did not conduct surveys on the Paint River or Net River during the August 1-December 31, 2024 time period.

- Beginning in July 2020, the SB Paint River will have a fixed Status and Trends site for the DNR Fisheries Division at the Skybooms location. Three years of data will be

collected, followed by three years off, rotating in that order as time and resources allow. Fisheries and habitat data will be collected during survey years. It should be noted any surveys conducted in 2020 are not factored into the grant match portion submitted in the grant application.

The SB Paint River was surveyed August 3-5, 2020 (Figure 3). In total, 154 brook trout were captured ranging from 2-10 inches in length with an average of 4.5 inches. Brook trout were between 0-3 years old with average growth. Brown trout (N=15) were captured ranging from 2-7 inches in length with an average of 5.5 inches. Not enough brown trout were collected to analyze growth. Field notes indicated poor efficiency for shocking (low conductivity), lack of habitat for trout (man-made bank covers gone or filling in), and water levels were higher than normal. These efforts were not counted toward the grant's match.

On August 16-17, 2021, a Status and Trends Survey (Fixed Site Year 2) was conducted by staff from the DNR Fisheries Division. A total of 2,000 feet were surveyed (mark and recap). Instream water temperature recorded for each day was 58°F and 57°F. Air temperature was recorded at 75°F and 63°F. Non-game species were captured and recorded for the first 500 feet of the first 1,000-foot station. Gamefish were captured and recorded for the entire survey effort. A total of 240 fish were captured during the August effort. Brook trout (N=188) averaged 6.0 inches in length and ranged from 2-13 inches with 25% of the catch meeting or exceeding the legal minimum size for harvest (7 inches). The population estimate for brook trout was calculated at 457/acre. Both the 2021 brook trout population estimate and the average length were above the long term average (418/acre and 5.0 in.) Brown trout (N=34) averaged 9.6 inches in length and ranged from 3-20 inches in length with 73.5% of the catch meeting or exceeding the legal size for harvest (12 inches). The population estimate for brown trout was calculated at 43/acre. The brown trout population estimate was an improvement compared to the 2018 estimate, however it is still well below the long term average of 163/acre. The average length of brown trout nearly double compared to the 2020 survey and is above the long term average of 8.3 inches in length. Other fish species captured included blacknose dace (N=6), longnose dace (N=1), mottled sculpin (N=7), and white sucker (N=1).

Additionally, a temperature logger was deployed at the Status and Trends location from April 20-October 7, 2021. Minimum temperature recorded was 36.4°F. Maximum temperature recorded was 74.4°F and the average was 57.9°F. The average July temperature was calculated at 63.1°F.

No updates for the time period January-July 2022. A survey is scheduled for August 2022.

On August 1-2, 2022, a Status and Trends Survey (Fixed Site Year 3) was conducted by staff from DNR Fisheries Division. A total of 2,000 feet were surveyed (mark and recap). Instream water temperature recorded for each day was 61°F and 55°F. A rain event occurred prior to the survey however the water transparency was recorded as clear. Only brook trout and brown trout were recorded during the survey effort. A total of 219 fish were captured during the August effort.

Brook trout (N=174) averaged 4.8 inches in length and ranged from 2-11 inches with 16% of the catch meeting or exceeding the legal minimum size for harvest (7 inches). The population estimate for brook trout was calculated at 731 per acre. The 2022 brook trout population estimate was above the long term average (450/acre). The 2022 brook trout average length was just under the long term average (5.0 inches). Age analysis indicated ages 0-2 present in the population with a mean growth index of 0.6 inches above state average.

Brown trout (N=45) averaged 10.1 inches in length and ranged from 2-19 inches with 71% of the catch meeting or exceeding the legal size for harvest (≥ 12 inches). The population estimate for brown trout was calculated at 39/acre. The brown trout population estimate decreased slightly from the previous year of 43/acre and is still well below the long term average of 149/acre. However, the average length of brown trout is still above the long-term average of 8.5 inches. Age analysis indicated ages 1-3, 5 and 6 present in the population with a mean growth index of 0.8 inches above state average.

Additionally, a temperature logger was deployed at the Status and Trends location from May 2- November 1, 2022. Minimum temperature recorded was 36.3°F. Maximum temperature recorded was 76.7°F and the average was 56.9°F. The average July temperature was calculated at 63.5°F.

No updates for the time period January-July 2023. A survey is scheduled for August 2023.

On August 3, 2023, a fisheries survey was conducted by staff from the DNR Fisheries Division. A total of 1,000 feet were surveyed. Instream water temperature during the time of the survey was recorded at 63°F. Brook trout (N=32) ranged from 2-11 inches and averaged 6.4 inches in length with 34% of the catch meeting or exceeding the legal size of harvest (7 inches). Brown trout (N=20) ranged from 3-16 inches and averaged 11.5 inches in length with 45% of the catch meeting or

exceeding the legal size of harvest (≥ 12 "). During the survey, field technicians noted the habitat structures known as skybooms, were severely degraded compared to the previous sampling year. A total of 12 hours and 90 miles were part of the match for this effort.

On July 22-23, 2024, a fisheries survey was conducted by four staff from the DNR Fisheries Division. A total of 1,000 feet were surveyed (2,000 ft including the recapture effort). The instream water temperatures during both days of the survey were recorded at 62°F and 56°F. Brook trout (N=152, not including the recapture numbers) ranged from 2"-12" in length. Brown trout (N=38, not including the recapture numbers) ranged from 2"-21" in length. No muskellunge were observed or captured during the survey. Bank covers continue to degrade. A total of 20 person hours and 120 miles were part of the match for this effort.

Fisheries Division did not conduct a survey on the South Branch of the Paint River between August 1- December 31, 2024.

Utilizing volunteers, Trout Unlimited will deploy 13 temperature loggers throughout the Paint River watershed between 2021-2025, with possible additional locations during that time. Long term temperature data will inform managers of any changes to suitable habitat that may be occurring. Trout Unlimited deployed a total of 16 temperature loggers throughout the Paint River Watershed during May-June, 2021. Volunteer hours for deployment of loggers totaled 27 hours. Locations of temperature loggers include:

1. Upstream Gold Mine Road FR3470
2. Downstream Gold Mine Road FR3470
3. South Branch at Lode Creek
4. South Branch at the Forks
5. Ponozzo Road
6. Blockhouse Campground
7. North Branch near Mallard Lake (FR3612)
8. Paint Creek near FH16
9. North Branch at FH 16
10. North Branch on Winslow Lake Road

11. South Branch US 2 bridge
12. Cooks Run at US2
13. South Branch on FR3270
14. Golden Creek FR2197
15. Bush Creek Upstream FR3350
16. Bush Creek Downstream County Rd 657

Trout Unlimited retrieved 16 loggers during the fall 2021 (last day of retrieval was October 26th). Total effort for retrieval was 45 volunteer hours and 200 miles driven. When the data was downloaded, two temperature loggers read a "logger malfunction" and was unable to retrieve any data. However, the average July temperatures for 14 locations were calculated. Mean July water temperature is one of the most critical habitat variables that influence the composition of fish communities in Michigan streams and rivers. Stream survey and temperature data from around Michigan have shown that abundance and biomass of trout declines rather rapidly once mean July temperatures reach and exceeds 68°F. Unfortunately, 36% of the site locations exceeded that threshold and all but one of those sites are designated trout streams. Additionally, 57% of the locations were in the sub-optimal temperature range. Only one location has an average July temperature less than 61°F which was Cooks Run.

Trout Unlimited deployed a total of 16 temperature loggers throughout the Paint River Watershed on June 23, 2022. Volunteer hours for deployment of loggers totaled 53 hours and total mileage was 275 miles.

Trout Unlimited volunteers (N=8) retrieved the 16 temperature loggers throughout the Paint River Watershed in October 2022 (last day of retrieval was October 21st). Total effort for retrieval and data download was 260 volunteer hours and 200 miles driven. All loggers were checked and calibrated by DNR Fisheries Technicians prior to deployment. However, only 4 that were recovered had usable data. There were also two loggers lost during the summer months of deployment. The four locations with data were North Branch of the Paint River (FR3612 crossing), Paint Creek, Bush Creek (FR3350 crossing), and South Branch of the Paint River (southern most bridge on FR3470). Trout Unlimited plans to set up a test procedure prior to 2023 deployment to assure they are recording properly and then turn them over to DNR for a calibration check. Two of the four sites that had useable data were above the

68°F threshold. The other two sites were within the sub-optimal temperature range (62°F-67°F).

DNR Fisheries Division calibrated the temperature loggers in late winter 2023. Trout Unlimited deployed 14 loggers throughout the upper Paint River watershed. A total of 6 people helped with the efforts that totaled 18 hours of effort and 90 miles driven. **CORRECTION—7 VOLUNTEERS, TOTALLING 72 HOURS AND 260 MILES DATE FEBRUARY 2024.**

Trout Unlimited volunteers (N=7) retrieved 14 temperature loggers throughout the Paint River Watershed in October and November 2023 (last day of retrieval was Nov. 3, 2023). Total effort for retrieval, data downloading, and assistance with on-site antenna maintenance was 80 volunteer hours and 250 miles driven. The average July temperatures for the temperature logger locations included 3 that were above the 68°F critical threshold, 9 were within the sub-optimal range (62°F-67°F) and 2 sites were below the optimal average July temperature for brook trout.

At the time of writing this report, Trout Unlimited has not reported their efforts this year for temperature logger deployment. Any information received will be reported during the August-December time period.

For the 2024 field season, Trout Unlimited deployed and retrieved 12 loggers in the Upper Paint River Watershed. Efforts included calibrating the temperature loggers, equipment set up, volunteer orientation, logistical arrangements, deployment & retrieval, data downloading and quality checks. Match was 60 hours and 160 miles driven. Loggers were deployed between June 15-19, 2024 and retrieved between October 5-24, 2024. Of the 12 sites, 2 were above the 68°F critical threshold, 9 were within the sub-optimal range (62°F-67°F) and 1 site was within the optimal range of brook trout (61°F). See table at the end of document.

5. Installation of PIT tag antennas will occur each year in May approximately 2.5 miles upstream from the confluence of the SB Paint River and the North Branch Paint River (Figure 1). Antenna components will be purchased from Biomark and will consist of a solar panel and batteries, control box for uploading (onsite and remotely) data, and a flat-bed antenna array spanning the river at two locations to allow determination of upstream versus downstream movement. The antenna arrays will be installed under approximately 2-inches of substrate and read-range, tuning accuracy, data download capabilities and general structural integrity of the array will be determined. Installation efforts are expected to take approximately three days. PIT tag antenna monitoring will occur once weekly and will be conducted by MI DNR

staff. During the first four weeks of deployment, weekly monitoring will consist of an onsite initial system detection test, using a spare PIT tag passed over the array, and will also include a general inspection of the PIT tag antenna array to ensure the structural integrity of the array. After the initial four-week monitoring period, monitoring will be performed as needed by MI DNR staff. The PIT tag antennas will be deployed until October of each year to ensure detection of any muskellunge. Following the monitoring period, the PIT tag antenna array system will be removed by MI DNR staff and stored at the MI DNR Crystal Falls Field Office until deployment the following year. By late November each year, data collected during annual operation of the PIT tag antennas will be summarized and incorporated into a project database.

In March of 2021, Fisheries Division and project partners purchased the equipment necessary to install a complete pit detection system and pit tag and readers totaling in the amount of \$31,228 (see invoices). On June 2, 2021, MDNR staff installed the two antenna systems with the cooperation of two private landowners. The original estimate of time to install was three days and was based off of other projects similar in scope. However, the installation on the SB Paint only took one workday. Pit tags were tested over both antennae and were recorded by the system.

Over the course of the next month, technicians went to the field site to adjust equipment, restart the modem and settle the cords in the river. On July 23rd, two Fisheries Division employees and a representative from Biomark visited the field site to adjust the capacitor board associated with the two antennas. It was discovered at this time the strength of the pit tag signal was weakening because of the length of cable from the antennas to the electrical box. Both antennas are still reading pit tags, however the range is not currently optimal. Fisheries Division and Biomark decided to switch out the longer cords for shorter ones. This will increase the distance in the water column that the system can read if tagged muskellunge cross the antennas. The cables will be delivered at a later date.

On July 27, 2021, technicians conducted a site visit to prepare for the placement of the electrical boxes closer to the water and to cut exposed metal rods that secured the cables to the bottom of the river. Technicians also had to conduct a "hard restart" on the downstream system because it wasn't uploading current data. The exact reason for the malfunction was unclear, however a strong storm went through the area the evening before and could have caused the system to not work.

The system has so far detected two muskellunge that were tagged and released originally near the Blockhouse Campground, which is approximately 7 river miles. Detection #2 describes multiple recording of one tagged muskellunge.

Detection #1: June 29th at 11:10 am on the downstream antenna. This musky was tagged on May 12 during our Section 3 survey (Forks to Blockhouse). It was a 31.2 inch female with two external floy tags (#611 & #612).

Detection #2: July 16 at 7:43pm on the downstream antenna and then on the upstream antenna the next day on 7/17 at 4:21pm. It was picked up again July 19 at 4:24pm on the downstream antenna. The last pings were on July 20th at 8:45pm on the upstream antenna and 9:31pm on the downstream antenna. On July 28th, at 12:01am, the fish crossed the downstream antenna. The same evening it crossed the upstream antenna at 12:08am. Approximately 16 minutes later, it crossed over the downstream antenna (12:24am). This musky was also captured on May 12 during Fisheries Division's Forks to Blockhouse survey. It was a 38.5 inch female with two external floy tags (#613 & #614).

Update—July 29th at 3:22am the downstream antenna was crossed by the same musky.

Readability range of pit tags was an issue discovered shortly after the July report update. The system was only recording a pit tag if it was one inch above the cords. With the read range supposed to be at ~28 inches, this was an issue that needed to be addressed and troubleshooted. Our first thought was the cords connecting the array to the power box was losing signal. Biomark shipped shorter cords and on August 10th, DNR Fish Division employees switched out the cords. Unfortunately, this was not the issue and we shipped our equipment to Biomark. On September 1, 2021, Biomark ran tests out of their office in Idaho and figured out the combination of the power supply and the solar charge controller were interfering with the HDX tag signal. Once the equipment arrived back at the DNR Fish Shop in Crystal Falls, DNR Fish Division employees, along with a representative from Biomark went to the site location and installed the updated electrical system. Readability range was fixed to the expected distance of ~28 inches.

In October, it was discovered that the cell phone signal was inconsistent on the upstream array system. On October 15th, another site visit was conducted to download any data and troubleshoot. After some discussion, it was decided to purchase a cell phone booster for the system in order to access the data

remotely. That purchase will occur in 2022.

(https://www.amazon.com/hz/wishlist/ls/971K9ZQ6CNM0?ref=wl_share)

Additional costs that were not originally accounted for is the annual cost of remote access/cell service. We are only active for 6 months out of the year, so the annual amount would be (\$151 x 6 months) = \$906.

On August 2, 2021, the upstream antenna was crossed by the same musky described in Detection #2 at 9:15pm and the downstream antenna was crossed at 9:29pm.

Summary of PIT antenna readings for 2021: Two tagged musky from the Blockhouse location (Section 3) were recorded at the antenna location. However, given the technical issues with the array system this year, specifically the readability range of the PIT tags, any descriptions or conclusions of tagged musky movement should not occur until more years of data collection.

January–July 2022:

Cable and antenna booster was ordered on April 26, 2022, in order to increase signal for remote access. Total cost was \$125. On May 25th, we needed to order replacement batteries (N=4) for the systems that totaled \$763.16. SEE ATTACHED INVOICES.

Unfortunately, after multiple site visits and communications with Biomark, the PIT antenna systems for both upstream and downstream still are not operational. The downstream system was temporarily functional at the end of June. No detections were recorded on the system. The upstream system has not been running since last fall.

August–December 2022:

On August 18th, Fisheries Division employees and an employee from Biomark conducted a site visit to determine the issues that were impacting the PIT antenna systems. The purchased booster was also installed on the upstream unit during this month. It was during this visit we discovered one of the issues was the 6A load breaker kept tripping and turning off the reader and modem. Specifically, the solar charge controller can provide up to 20A of charge current for charging batteries. The load circuit, to the IS1001 reader and cell modem, is connected to a 6A breaker. Each pair of batteries is connected to a 10A breaker. The load circuit senses the current of the battery circuits; therefore, the charge current was reduced to a

maximum of 5A to prevent the 6A load breaker from tripping and turning off the reader and modem. This took care of the tripping.

However, the downstream system was offline again on August 19th, 2022. Speaking with Ed Baker, Research Manager for the Michigan DNR and lead for another PIT antenna project, said he was experiencing the same issue at his site and this was due to limited solar input. He now has two solar panels per system and has not had issues since. With this recommendation, we decided to purchase two additional solar panels. In October 2022, we purchased two panels at the price of \$1,112 (see invoice and reimbursement form). The system was taken down for the winter on November 1, 2022.

Summary of PIT Antenna Readings for 2022:

- Five tagged musky from all three locations were recorded at the upstream antenna location. So far 11.5% of the tagged musky have crossed the arrays.
 - Section 1 (Above CF Impoundment)
 - Female, 27.9 inches. Date tagged Sept. 20, 2021. Date crossed: Unclear. Reader says January 1, 2016. Data was downloaded on November 20, 2021, and again on June 27, 2022—so sometime between these two dates.
 - Section 2 (Snake Rapids Net River)
 - Male, 35.0 inches. Date tagged May 23, 2022. Dates crossed: July 2, 2022–August 12, 2022.
 - Male, 34.7 inches. Date tagged May 3, 2021. Dates crossed: August 12–13, 2022.
 - Section 3 (Forks to Blockhouse)
 - Male, 37.6 inches. Date tagged June 3, 2021. Date crossed: July 2–6. One detection was reported earlier from this fish but read January 1, 2016 as well. Download date was June 27, 2022.
 - Female, 38.5 inches. Date tagged May 21, 2021. Date crossed: July 8–August 19, 2022. This fish was also detected last year.

January–July, 2023:

On May 23rd, fisheries technicians and biologist reinstalled the upstream and downstream components for the season on the SB Paint River. The upstream

system was able to be turned on via Bluetooth. However, the downstream system could not connect to the laptop via Bluetooth. This is a critical step in making the system work because it sets up the date and time stamp on the system. On May 31, the fisheries biologist went out to troubleshoot the problem with help via phone from Biomark staff. After a few hours of work, it was determined that the Bluetooth circuit board was not working and had to be replaced. After We Energies approval, a Bluetooth circuit board was purchased for \$340 (receipt included in report). On July 12th, technicians and biologist went to the downstream location and installed the new Bluetooth circuit board. The unit was then able to connect to the biologist's laptop and was officially turned on. The old Bluetooth circuit board will be sent back to Biomark to determine the cause of failure.

Remote access continues to be an issue due to poor cell phone service, despite the installation of a booster on the upstream system. On July 19th, Jen Johnson sent an email to Biomark indicating her disappointment with the remote access and requested Biomark cancel the service and refund monies paid. Biomark agreed, but Jen is still waiting to hear about the specifics of a refund. Moving forward, biologists or technicians will visit the site and download data directly from the units.

Detections Recorded on the Upstream Antenna:

Data was downloaded on May 31 and July 12, 2023. Four individual muskellunge were detected between May 25–June 7. All four fish have previously crossed the units; therefore, no new muskellunge were detected.

Section 2 (Snake Rapids Net River)

1. **Male, 35 inches:** Tagged on 5/23/22. Crossed upstream antenna in 2022 multiple times. He crossed the upstream antenna on May 25, 2023, at 8:44pm.
2. **Male, 34.7 inches:** Tagged on 5/3/21. Crossed upstream antenna in 2022 on three dates in August. He crossed the upstream antenna on May 26, 2023, at 1:51am.

Section 3 (Forks to Blockhouse)

3. **Female, 31.2 inches:** Tagged on May 12, 2021. Crossed the downstream antenna on June 29, 2021. She crossed the upstream antenna on May 29, 2023, at 11:45pm.
4. **Female, 38.5 inches:** Tagged on May 12, 2021. She was detected on the downstream and upstream antennas in 2021 and the upstream antenna in 2022

on multiple dates and times. She most recently crossed the upstream antenna on June 7, 2023.

Additionally, Jen Johnson presented project updates to the **Boundary Waters Musky Club** on January 25, 2023, and at the annual **DNR Coffee and Conversation** meeting on March 14th, 2023. Jen also presented this research at the national **American Fisheries Society Conference** in August 2023 in Grand Rapids, Michigan.

On August 9th, DNR Fisheries Division visited the array systems on the SB Paint River to check for new detections of tagged musky crossing at that location. No new detections were recorded. On October 23, 2023, the two arrays were checked for new detections and the systems were winterized for the season. No new detections of tagged musky were recorded.

On August 23rd, 2023, Jen Johnson presented this research project at the Annual American Fisheries Society Conference in Grand Rapids, Michigan. The conference was well attended and the presentation was well-received by attendees within the scientific community.

January 1 – July 31, 2024

On March 14th, 2024, the biologist gave a project update to attendees of the annual DNR Coffee & Conversations public outreach event.

On April 30, 2024, the biologist and technician reinstalled the upstream and downstream components of each system for the season. Both systems were turned on and were functioning. The biologist conducted two site visits and downloaded data—one on June 10 and one on July 30. Data showed 5 individual musky crossed at least one of the arrays between May 7–July 30, 2024. Four of the five crossed the arrays in previous years, and one musky was a new occurrence. The musky that crossed were from Section 3 (Forks to Blockhouse), Section 2 (Net River–Snake Rapids), and Section 1 (Crystal Falls Impoundment).

NOTE: There was additional 2023 data that was downloaded during the June 10th download on the downstream system. Specifically, three fish crossed the downstream system in 2023. Two of the three fish were already documented on the upstream antenna system. One fish was detected only on the downstream system and was originally tagged in Section 1 (CF Impoundment) in May 2023. This new download brings the 2023 totals of musky to five.

NOTE 2: A similar occurrence happened between the June 10 and July 30 downloads. The July 30 download picked up two additional crossings from May that the June 10 download did not report out. The biologist sent an email to Biomark asking why this would occur.

August 1 – December 31, 2024

On October 29, 2024, the array system was shut down and winterized for the season. No tagged muskellunge were recorded during this time period. Eight individual fish have crossed at least one of the arrays to date, which equates to 10% of all tagged fish. Additionally, 42% of the fish crossed between 12:01am-6:00am, 36% crossed between 6:01pm-12:00am, 10% between 6:01am-12:00pm, and 10% crossed between 12:01pm-6:00pm. 3% did not have time recorded.

On November 14, 2024, Jennifer Johnson presented the project and data to fisheries management students attending Lake Superior State University. The presentation was well received and the students were highly interested and engaged.

Total Array Crossings (~10% of all tagged fish)

Tagged	Individual Fish	Year(s) crossed			
Section 3	3D61D59988A4A	2021		2023	2024
Section 3	3D61D59988A25	2021	2022	2023	2024
Section 3	3D61D59988A43		2022		2024
Section 1	3D6.1D599889FD		2022		
Section 2	3D61D59988A35		2022	2023	2024
Section 2	3D61D59988A10		2022	2023	

Section 1	3D61D59988A3B			2023	
Section 1	3D6.1D59988A07				2024

Grant Monies for August 1-December 31, 2024

\$54 (carryover from early 2024) + \$3.350 (New 2024 amount) = \$3,404

MATCH August 1-December 31, 2024 (Trout Unlimited reported for whole year)

DNR FISHERIES

Hours	\$ Total	\$ Mileage	Supplies/Equipment	Detail
7	447.25	57.2		Pit Antenna System Maintenance (Tech = 3hrs x \$52.95, Biologist = 4hrs x \$72.1) 130 miles
4	288.4			Reports, data organization, communication with anglers (Biologist = 8 hrs x \$72.1)
8	576.8			Presentation at LSSU (including prep, 8 hours x \$72.2)
Total	1312.45	57.2	0	
TOTAL	\$1,370			

TROUT UNLIMITED

Hours	\$ Total	\$ Mileage	\$ Total	Detail
60	600	160	70.4	Temp logger calibration, deployment, retrieval (2024 total)
TOTAL	\$670			

IRON COUNTY WATERSHED COALITION

Hours	\$ Total	\$ Mileage	\$ Total	Detail
				No activity for this time period

TOTAL	\$0			
MATCH				
GRAND TOTAL	\$2,040			

Total Match January 1, 2021-July 31, 2024: \$71,355

		optimal		abundance & biomass decline									
		56.1F	62-67	68-70	70-72	72-74	74-76						
		Average July Temperature											
Site ID	Stream	Location	2017	2018	2019	2020	2021	2022	2023	2024	Trout Designation	Stream Classification	
1	Paint	Ponozzo Rd.	66.0	67.7	67.7	68.8	67.4		65.9	67.5	Yes	Cold transitional	
2	SB Paint	Gibbs City Rd.	64.7	66.3	66.1	66.9	65.9		64.9	66.0	Yes	Cold transitional	
3	Bush D/S	Gibbs City Rd.	67.9	68.8	68.8	70.2	70.1		68.0		Yes	Cold transitional	
4	SB Paint	Lower Goldmine (Northern)	63.1	64.5	64.0	65.2	64		62.5	64.4	Yes	Cold	
5	Cooks Run	HWY US 2 Iron Co	57.0	57.3	57.2	61.2	57.9		56.0	57.3	Yes	Cold	
6	SB Paint	HWY US 2 Gogebic Co	66.1	65.8	66.7	67.3	65.7				Yes	Cold	
7	NB Paint	Winslow Lake Rd.	67.4	61.3	59	67.7	62.4		65.8	67.9	Yes	Cold transitional	
7a	NB Paint	FR3612 in culvert					72.1	72.3			Yes	Cold transitional	
8	Winslow Ck.	Winslow Lake Rd.		71.3	71.7	71.8					Yes	Cold transitional	
9	NB Paint	Forest Hwy 16		66.8	68.0	70.4	67.7		71.0		Yes	Cold transitional	
10	Paint Ck.	North of NB Paint Confluence		64.7	64.1	66.9	error	64.4	62.0	64.5	Yes	Cold transitional	
11	Golden Ck.	At end of walk in (FR2197)		70.8	70.8	70.8	69.9		67.8	68.0	Yes	Cold	
12	Bush U/S	FR3350 bridge		70.1	68.6	68.1	68.2	68	66.5	67.5	Yes	Cold transitional	
13	SB Paint	FR3270 bridge			67.2	68.8	67.0		65.5	67.5	Yes	Cold	
14	Paint River	Blockhouse Campground				69.7	69.8		67.0	68.8	No	Warm transitional	
15	SB Paint	SB Paint DS Lode Creek				66.6	64.9		63.3	65.1	Yes	Cold transitional	
16	SB Paint	Upper Goldmine (Southern)				error	error	62.6	60.7	62.4	Yes	Cold	