

# Aquatic Invasive Species Early Detection, Monitoring, and Control Annual Report

## Abstract:

Aquatic Invasive Species (AIS) are any species not native to a water that have the potential to cause damage to the economy, natural resources, or recreational opportunities. FWP AIS Bureau performs early detection surveys to detect new populations in a timely enough manner to eradicate or contain a population and prevent spread to other waters. This annual report summarizes early detection and monitoring survey efforts for aquatic invasive species by Montana Fish, Wildlife & Parks and partners during the 2021 sampling season. It includes highlights of control and eradication projects occurring across the state.

## 2021 Report Highlights

- ▶ Provide results of AIS early detection efforts
- ▶ Foster a greater understanding of the threats of AIS to Montana’s waters
- ▶ Encourage partners and others to sample, report, and watch out for AIS invaders
- ▶ Summarize efforts from the last five years to detect invasive dreissenid mussels in Tiber Reservoir
- ▶ Highlight eradication and control projects occurring across the state

A major facet of AIS early detection efforts include sampling for invasive mussel larvae with fine-meshed nets that are towed through the water column as seen below. The plankton collected is preserved in alcohol and is sent to FWP’s AIS Lab for analysis.



The Montana Fish, Wildlife & Parks (FWP) Aquatic Invasive Species (AIS) Bureau implements an AIS Management Plan through coordination and collaboration, prevention of new AIS introductions, early detection and monitoring, control and eradication, and outreach and education. The goal of the AIS Management Plan is to minimize the harmful impacts of AIS through the prevention and management of AIS into, within, and from Montana.

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## Early Detection and Monitoring – Background

Early detection and monitoring are essential aspects of any effective aquatic invasive species (AIS) Program. Montana Fish, Wildlife & Parks (FWP) implemented a statewide Aquatic Invasive Species Early Detection and Monitoring Program in 2004. Early detection allows FWP biologists to locate small or source AIS populations, while monitoring allows FWP to study existing population trends and investigate suspect findings. These efforts can lead to eradication efforts or long-term control or management strategies. FWP monitors for all aquatic invasive species including zebra/quagga mussels, Corbicula clams, New Zealand mudsnails, faucet snails, Eurasian watermilfoil, flowering rush, curlyleaf pondweed, fragrant waterlily. All past reports, Sampling Standard Operating Procedures, and Management Plans can be found under the “Resources & Reports” sections at <https://cleandraindry.mt.gov/>.

## News for 2021

The 2021 field season was a busy one like normal. A few noteworthy happenings across the state in 2021, which include:

- The end of five years of intensive sampling on Tiber Reservoir following the discovery of invasive mussels.
- Statewide crayfish survey project
- Investigated several public reports of AIS
- Sampling training for AIS Bureau staff
- Supplemental macroinvertebrate training for FWP early detection permanent and seasonal staff

## Tiber Reservoir Five Years After

October 2021 marked the end of the sampling season and the five-year anniversary of the discovery of invasive mussel larvae (veligers) during routine annual sampling on Tiber Reservoir near Chester, MT (Figure 1). This discovery in 2016 led to substantial sampling over the next five years by FWP and partners to unsuccessfully find additional veligers and adults. Based on detection standards in the Western US, Montana Fish, Wildlife & Parks is working to remove its administrative rule and delist Tiber Reservoir as "positive" for dreissenid mussels for the 2022 boating season. This delisting will remove mandatory watercraft inspections and decontamination requirements for leaving the waterbody. Additional sampling will continue at this reservoir to ensure no mussels have established and gone undetected. Sampling details on this water can be found in the section “Mussel Response at Tiber Reservoir” of this report.



**Figure 1. Tiber Reservoir in November as it begins to freeze. The large reservoir, with 181 miles of shoreline, extends upstream of the dam for approximately 24 miles.**



**Figure 2. Dr. Susie Adams, Mitchell Gorton, and Beatrice, the unofficial AIS Early Detection and Monitoring Program mascot, compile crayfish survey data on Bighorn Lake, MT.**

### Statewide Crayfish Surveys

In 2021, Montana Fish, Wildlife & Parks, along with Dr. Susie Adams with the US Forest Service in Mississippi began a two-year collaborative statewide crayfish survey (Figure 2). Montana has few known native species of crayfish, but because of challenges with sampling and identification, crayfish distribution in the state is not well defined. There is potential for invasive crayfish introduction (e.g., rusty crayfish or red swamp crayfish) and movement of native species to locations where they would be considered invasive, which could have lasting impacts to native ecosystems. Additionally, crayfish are harvested for personal consumption and another goal of this project is to address potential human health concerns. The goals of this project are: (1) provide a snapshot of current crayfish species distributions to be used as a baseline in the future, (2) inform managers about non-native crayfish species that may have been introduced in the state, (3) provide a basis for addressing questions about the native ranges of signal crayfish (*Pacifastacus leniusculus*) and virile crayfish (*Faxonius virilis*), and (4) guide crayfish consumption advice.

FWP AIS staff conducted statewide crayfish surveys. Voucher samples collected by seasonal sampling crews, fisheries staff, pollution program staff, and others were submitted to Dr. Adams for identification and analysis. This project also resulted in collaboration with graduate students from the University of Idaho looking at mercury contamination within the Columbia River Basin.



One early finding of this project includes the discovery of a species never documented in Montana. The southern plains crayfish (*Procambarus simulans*) was discovered at the Miles City Fish Hatchery. The nearest known population of this species occurs in Colorado and their impacts in Montana are unknown. Sampling in 2022 will further investigate this population.

### Investigated Public Reports

FWP offices often receive information from the public or partners reporting an unusual or unknown organism. Samples are often brought to offices where they are identified by regional or AIS staff. FWP staff will travel to the location as necessary to investigate the report.

There are times when the report turns out to be a native species. One such finding occurred from a report from a recreationist in May 2021 on East Fork Reservoir near Lewistown. The report consisted of crayfish with clams attached to its legs. A crew went out to the reservoir and verified that there were multiple crayfish with native pea clams closed onto their legs (Figure 3). AIS staff had never encountered this before, and it was an unusual observation of native species. This was a great example of how important and useful it is for members of the public to recognize something unusual and report it.



**Figure 3. FWP staff investigated an AIS report at East Fork Reservoir near Lewistown, MT and found a *Virile* crayfish with native pea clams closed onto its legs.**

FWP also receives reports that turn out to be new populations of AIS. FWP received a report of New Zealand mudsnails in Mitchell Slough, an area adjacent to the Bitterroot River near Victor, MT in May. FWP staff verified there were low densities of this invasive snail in several road crossings near Victor and Bell Crossing (Figure 4). Unfortunately, this is the first time New Zealand mudsnails have been detected in Montana's natural water bodies west of the Continental Divide.

AIS sightings can also be reported online at <http://cleandraindry.mt.gov/reportais>.

### Supplemental Invertebrate Training for FWP Sampling Crew

FWP AIS Early Detection and Monitoring Program endeavors to improve FWP's capacity to sample for AIS across the state. To accomplish this, the program provided seasonal field technicians additional technical training with a contracted, aquatic macroinvertebrate expert. This additional training helped field staff become more proficient in species identifications of species native in Montana. Early detection staff also helped train other bureau staff during an AIS staff meeting in Dupuyer in October (Figure 5).



**Figure 4. Photo of New Zealand mudsnail specimen found in Mitchell Slough near Victor, MT.**



**Figure 5. FWP AIS Bureau staff pose for a picture during AIS sampling training at Dupuyer Creek in October 2021.**

## Early Detection and Monitoring Methods

### Waterbody Risk Assessment

FWP assesses risk for AIS introductions to waterbodies annually to maximize sampling efforts. Annual plans are developed in the winter for the following season. Sampling plans are dynamic due to constantly evolving variables used in determining risk. Sites are prioritized based upon variables such as previous years sampling efforts and detections, water calcium levels, water quality data and angler pressure data, boater movement data from watercraft inspection stations, monitoring conducted by other state and federal agencies, surface-water hydrology, and other assorted variables. Other regional coordination groups such as the 100<sup>th</sup> Meridian Initiative Columbia River Basin AIS Team and Missouri River Basin AIS Team also are working on waterbody prioritization analyses. These additional efforts as well as other partners' efforts will only further the State's ability to prioritize sampling efforts with finite budgets.

### Sampling Methods

Montana utilizes a variety of techniques for monitoring AIS populations. FWP routinely monitors for a variety of taxa while conducting standard dreissenid monitoring. Since there are a variety of aquatic invasive species, different sampling techniques are used to increase the likelihood of early detection of





**Figure 6. FWP AIS Early Detection and Monitoring Program staff prepare for a dive to SCUBA survey Tiber Reservoir on a rare calm day. They search for any evidence of invasive dreissenid mussels.**

each of these species. Sampling methods include the use of plankton nets, kick nets, ponar dredges, benthic sleds, plant rakes, shoreline visual surveys, visual surveys, artificial substrate samplers, rock picking, mussel detection dogs, eDNA, snorkeling, and SCUBA diving (Figure 6). All of Montana's monitoring methods are described in the AIS Field Sampling and Lab Operating Procedures (Montana Fish, Wildlife & Parks, 2019) and have been scientifically reviewed and are coordinated with partners and neighboring states. Seasonal AIS technicians spend a week in Helena (Figure 7) training on sampling methods and species identification prior to deployment for the sampling season.

### AIS Sampling Prior to Fish Transfers

The movement of fish can be a vector for transferring AIS including species of plants, snails, clams, mussels, and pathogens. FWP moves large numbers of fish through both its hatchery and wild fish transfer programs. Hatcheries cannot receive certification to sell or move fish without passing an AIS inspection and fish health inspection. To accomplish this, the FWP Fish Health Laboratory and the FWP AIS Bureau work closely together to inspect all federal, state, and commercial hatcheries annually as well as waterbodies that fish biologists use for wild fish stock transfers. AIS inspections include both on-site AIS surveys and fish disease/pathogen testing. AIS Program protocols include monitoring for all aquatic invasive species taxa whenever possible. Specifics about pathogen sampling



**Figure 7. Stacy Schmidt, FWP AIS scientist supervisor, instructs Ryan Callison, AIS monitoring technician, during an AIS sampling training at Dupuyer Creek, MT.**

protocols and findings can be obtained by contacting the fish health coordinator, Ken Staigmiller ([kstaigmiller@mt.gov](mailto:kstaigmiller@mt.gov)).

FWP AIS and fish health staff have been working for many years on the standards for hatchery inspections, both within Montana and for facilities importing fish into the state. Due to recent New Zealand mudsnails detections in out-of-state hatcheries, FWP completed a review of hatchery sampling protocols and reviewed standard operating procedures (SOPs) for each individual facility. Hatchery-specific SOPs were developed and utilized to ensure the highest probability of detection of new populations of invasive species. This effort began during the 2020 field season and was completed in 2021. This process also identified strategies to improve biosecurity at hatchery facilities and those upgrades have been initiated.

## 2021 AIS Sampling Results

In 2021, FWP and partners cumulatively sampled approximately 350 waterbodies. Most of these waters received all taxa AIS surveys. For more specific information on individual waters or areas, send a specific information request to Craig McLane ([cmclane@mt.gov](mailto:cmclane@mt.gov)) or download the survey data through FWP's GIS data page at <http://gis-mtfwp.opendata.arcgis.com/datasets?q=AIS>.

### New Detections in 2021

In 2021, new detections of AIS included the following locations:

- ▶ New Zealand mudsnails (*Potamopyrgus antipodarum*)
  - Mitchell Slough – Victor, MT
  - Beavertail Pond – Clinton, MT
  - Big Sheep Creek – Dell, MT
- ▶ Red-rim melania (*Melanoides tuberculatus*) (Figure 8)
  - Gardner River – Gardiner, MT
  - Warm spring near Beaverhead River – Beaverhead State Park, MT
- ▶ Chinese mystery snail (*Cipangopaludina chinensis*)
  - Flathead Lake – Finley Point State Park, MT (1 empty shell)
  - Powder River – (1 empty shell)
- ▶ Big-eared radix (*Radix auricularia*)
  - Harpers Lake – Clearwater, MT
  - Pond One (Canyon Ferry Wildlife Management Area) – Townsend, MT
- ▶ Southern plains crayfish (*Procambarus simulans*) (Figure 9)
  - Miles City Fish Hatchery – Miles City, MT
- ▶ Eurasian watermilfoil (*Myriophyllum spicatum*)
  - Nilan Reservoir – Augusta, MT
- ▶ Curlyleaf pondweed (*Potamogeton crispus*)
  - Shields River – Near confluence with Yellowstone River, MT
  - Big Elk Creek – Two Dot, MT
  - Fifth Street Pond – Libby, MT
  - Eastward expansion in Fort Peck Reservoir – Malta, MT



**Figure 8. Red-rim melania found in the Gardner River, near Gardiner, MT.**



**Figure 9. Southern plains crayfish found in ponds at Miles City Hatchery, Miles City, MT.**



2021 FWP Plankton Net Survey Location

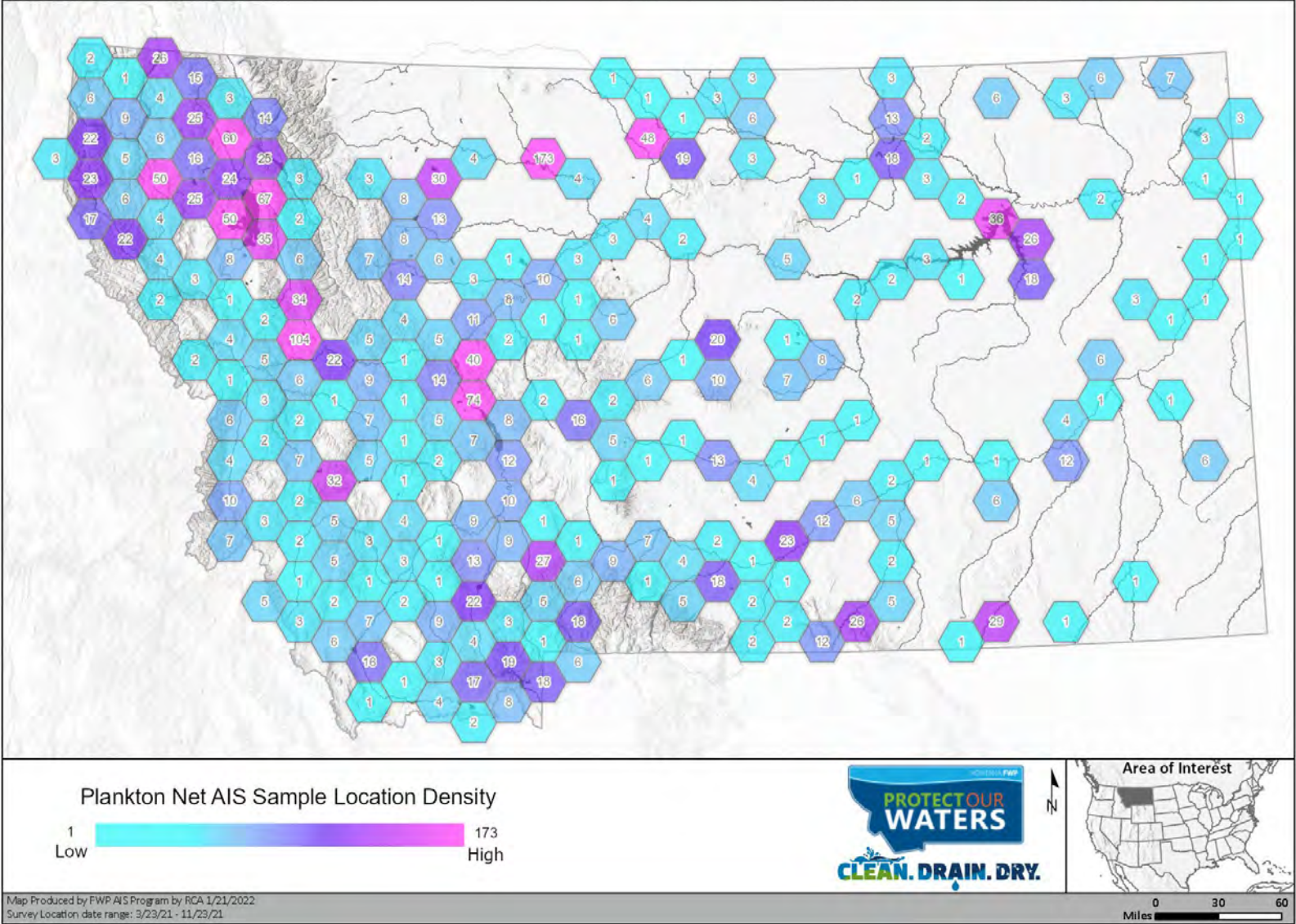
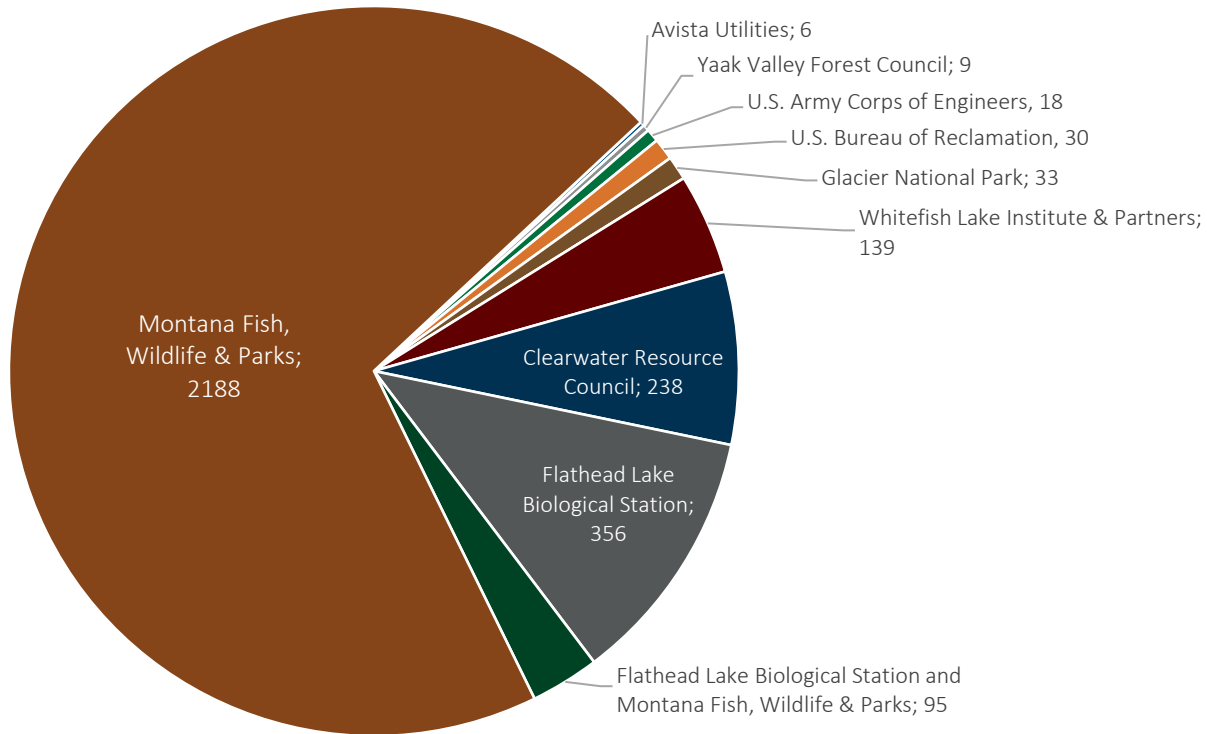


Figure 10. Map of AIS plankton sampling intensity, 2021.

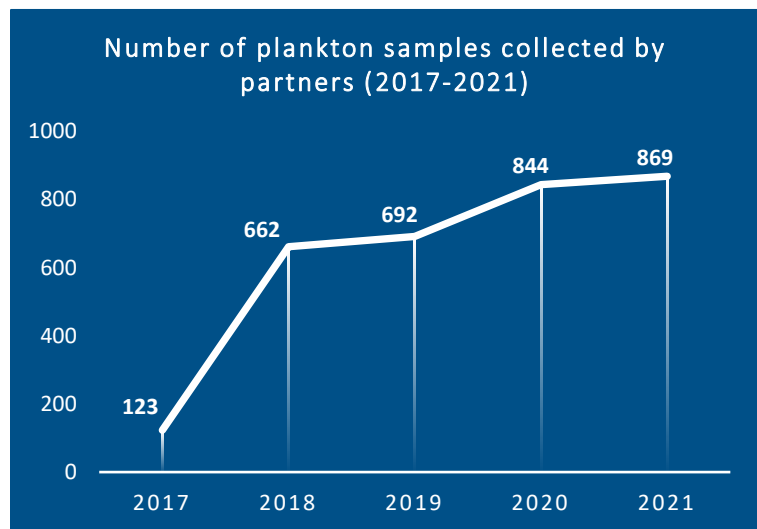


**Figure 11. 2021 Aquatic Invasive Species Plankton Sampling Effort by All Reported Entities**

### Statewide Sampling Efforts

The program goal is to comprehensively monitor the state every year, which includes all types of waterbodies (lakes, reservoirs, ponds, creeks, rivers, etc.) and for all AIS taxa. Montana FWP strives to provide statewide AIS sampling as shown in the map in Figure 10. Most sampling sites include plankton sampling as well as all taxa surveys looking for invasive plants, snails, crayfish, and other invertebrates. FWP surveys all high risk sites annually, with more frequent sampling at the highest risk sites. Lower risk sites are visited less frequently depending on risk of AIS introduction.

After plankton samples are collected, they are submitted to FWP's AIS lab for analysis. Figure 11 shows the breakdown of the plankton sampling effort by each entity in 2021. While most samples are collected by FWP, efforts from partners have increased overtime (Figure 12). FWP is dedicated to working closely with partners and developing new partnerships to encourage AIS sampling on a local level. Figure 13 shows mussel veliger sampling effort by partners in 2021.



**Figure 12. Plankton samples submitted to FWP's AIS lab during the last five years showing an increase over time.**

2021 Partner Agency AIS Plankton Survey locations

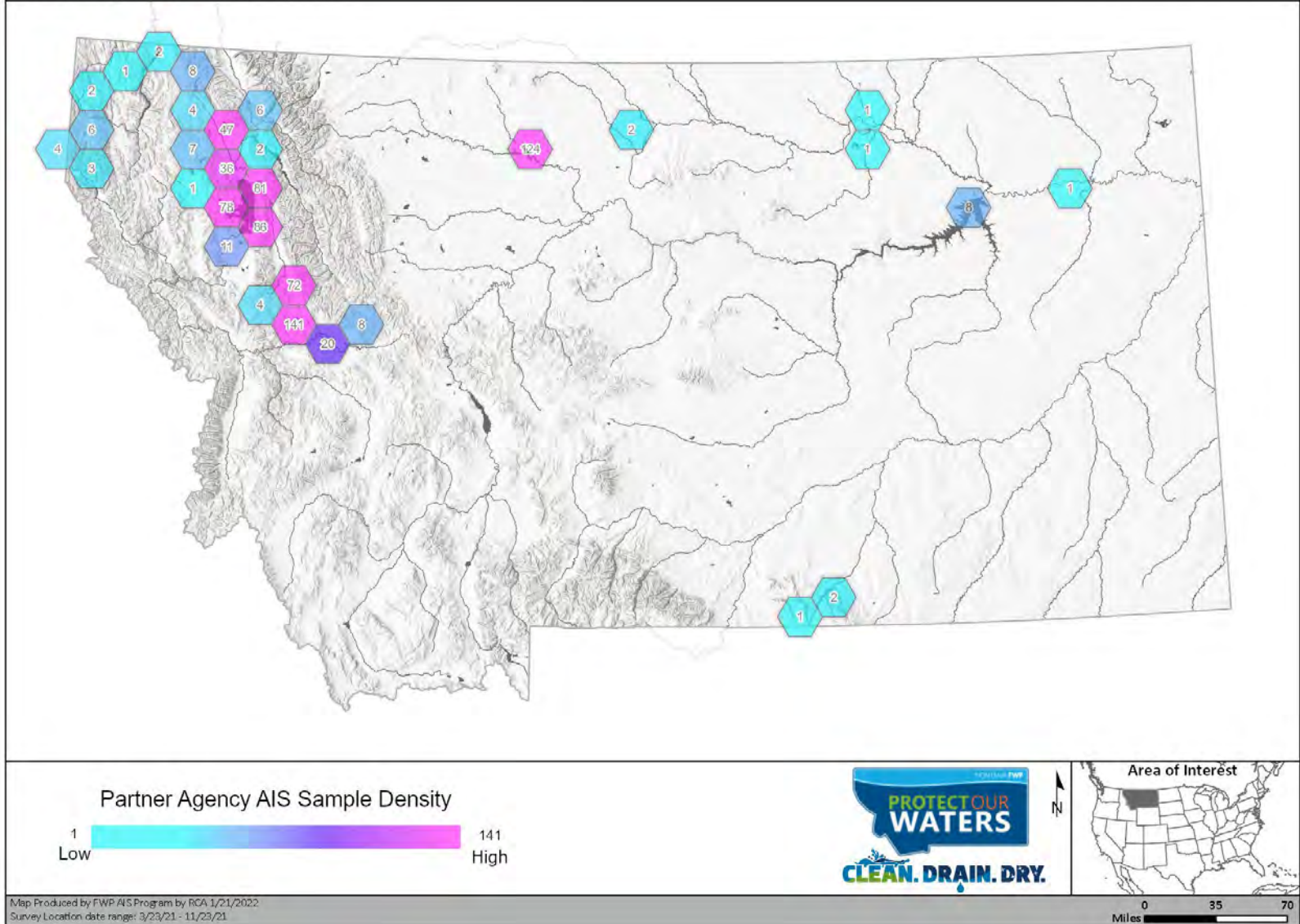


Figure 13. Mussel veliger sampling effort by partners in 2021.



The following tables show the locations of known AIS and the results from monitoring of those waters. Waters with no observations for a species in 2021 does not indicate that the species is no longer there, only that the species was not collected during sampling efforts. The lack of observations could indicate reduced species abundance, the species was missed by sampling crews, or samplers focused on a different area of the waterbody where the species was not prevalent or present. Map depictions of AIS locations in Montana can be found in Appendix A and Appendix B.

Animals

Dreissenid mussels – zebra (*Dreissena polymorpha*) and quagga (*Dreissena bugensis*)

Waterbody where previously found	Adult dreissenid mussels	Dreissenid mussel larvae (plankton sampling)	Dreissenid mussel eDNA
Canyon Ferry Reservoir	NO	NO	NO
Tiber Reservoir	NO	NO	NO

Corbicula clam (*Corbicula fluminea*)

Waterbody where previously found	Observed during 2021 sampling efforts	Corbicula clam larvae (plankton sampling)
Lake Elmo	YES	NO

New Zealand mudsnails (*Potamopyrgus antipodarum*)

Waterbody where previously found	Observed during 2021 sampling efforts
Beaverhead River	YES
Beavertail Pond*	YES
Big Sheep Creek *	YES
Bighorn River	YES
Bluewater Creek	YES
Clark Canyon Reservoir	NO
Darlington Ditch 1	YES
Ennis Lake	NO
Gardner River	YES
Hauser Reservoir	YES
Jefferson River	NO

Waterbody where previously found	Observed during 2021 sampling efforts
Madison River	YES
Marias River (below Tiber Dam)	YES
Missouri River (below Holter Dam)	YES
Mitchell Slough*	YES
Nelson Spring Creek	Not Sampled
Odell Creek	Not Sampled
Poindexter Slough	NO
Quake Lake	YES
Rainbow Dam Reservoir	YES
Ruby River	YES

\* = New find in 2021

Faucet snail (*Bithynia tentaculata*)

Waterbody where previously found	Observed during 2021 sampling efforts
Browns Lake	YES
Georgetown Lake	YES
Lake Frances	NO
Lost Coon Lake (Lost Loon Lake)	YES

Waterbody where previously found	Observed during 2021 sampling efforts
McWenegar Slough	NO
Smith Lake	YES
Upsata Lake	YES

Red-rim melania snail (*Melanoides tuberculatus*)

Waterbody where previously found	Observed during 2021 sampling efforts
Beaverhead River	NO
Gardner River*	YES

Waterbody where previously found	Observed during 2021 sampling efforts
Powder River	NO
Warm Spring Ditch adjacent to Beaverhead River*	YES

\* = New find in 2021

Big-eared radix (*Radix auricularia*)

Waterbody where previously found	Observed during 2021 sampling efforts
Bitterroot River	NO
Ennis Lake*	YES

Waterbody where previously found	Observed during 2021 sampling efforts
Harpers Lake	YES
Pond 1 (Canyon Ferry Wildlife Management Area)*	YES

\* = New find in 2021

Southern plains crayfish (*Procambarus simulans*)

Waterbody where previously found	Observed during 2021 sampling efforts
Miles City Fish Hatchery*	YES

\* = New find in 2021

Plants

Eurasian watermilfoil (*Myriophyllum spicatum*)

Waterbody where previously found	Observed during 2021 sampling efforts
Beaver Lake	YES
Cabinet Gorge Reservoir	YES
Clark Fork River (below Thompson Falls Reservoir)	YES
Fort Peck Dredge Cuts	YES
Fort Peck Lake	YES
Fort Peck Powerhouse Tailrace	YES
Fort Peck Trout Pond	YES
Jefferson River	YES

Waterbody where previously found	Observed during 2021 sampling efforts
Jefferson Slough	YES
Madison River (downstream of I-90)	YES
Missouri River (upstream of Canyon Ferry Reservoir)	YES
Missouri River (downstream of Fort Peck Dam)	YES
Nelson Dredge	YES
Nilan Reservoir*	YES
Noxon Rapids Reservoir	YES
Pond 4 - Canyon Ferry	NO

\* = New find in 2021

Fragrant waterlily (*Nymphaea odorata*)

Waterbody where previously found	Observed during 2021 sampling efforts
Beaver Lake	NO
Blanchard Lake	YES
Browns Lake	NO
Clearwater River	YES
Duck Lake (NW MT)	Not Sampled
Elbow Lake	Not Sampled
Holland Lake	YES
Lake Alva	NO
Lake Inez	YES

Waterbody where previously found	Observed during 2021 sampling efforts
Lake Mary Ronan	NO
Loon Lake	YES
Placid Lake	YES
Salmon Lake	YES
Savage Lake	YES
Seeley Lake	YES
Swan Lake	NO
Upsata Lake	YES

Flowering rush (*Butomus umbellatus*)

Waterbody where previously found	Observed during 2021 sampling efforts
Cabinet Gorge Reservoir	YES
Clark Fork River	YES
Flathead Lake	YES

Waterbody where previously found	Observed during 2021 sampling efforts
Flathead River	YES
Noxon Rapids Reservoir	YES
Thompson Falls Reservoir	YES

Curlyleaf pondweed (*Potamogeton crispus*)

Waterbody where previously found	Observed during 2021 sampling efforts
Beaverhead River	YES
Bitterroot River	YES
Blackfoot River	NO
Bozeman Creek	Not Sampled
Cabinet Gorge Reservoir	YES
Canyon Ferry Lake	YES
Clark Canyon Reservoir	YES
Clark Fork River	YES
Darlington Ditch	NO
Deadman's Basin	NO
East Gallatin River	YES
Ennis Lake	YES
Ester Lake	YES
Fifth Street Pond (Libby)*	YES
Flathead Lake	YES
Flathead River	YES
Fort Peck Lake	YES
Gallatin River	YES
Hauser Reservoir	YES
Hebgen Lake	YES
Helena Valley Regulating Reservoir	YES
Holter Reservoir	YES
Jefferson River	YES
Kicking Horse Reservoir	Not Sampled

Waterbody where previously found	Observed during 2021 sampling efforts
Kootenai River	YES
Lake Helena	YES
Lower Glaston Lake	Not Sampled
Madison River	YES
Marias River	NO
Missouri River	YES
Mitchell Slough – East Canal*	YES
Musselshell River	YES
Newlan Reservoir	YES
Noxon Rapids Reservoir	YES
Pablo Reservoir	Not Sampled
Pond 2 – Canyon Ferry	Not Sampled
Pond 4 - Canyon Ferry	YES
Post Creek	YES
Quake Lake	YES
Rainbow Dam Reservoir	YES
Shields River*	YES
Slip and Slide Creek (Ponds)	YES
Smith River	YES
Thompson Falls Reservoir	YES
Tiber Reservoir	NO
Triangle Pond (Noxon)*	YES
Upper Holter Lake	YES
Wayne Edsall Pond	YES

\* = New find in 2021



## Aquatic Invasive Species Laboratory

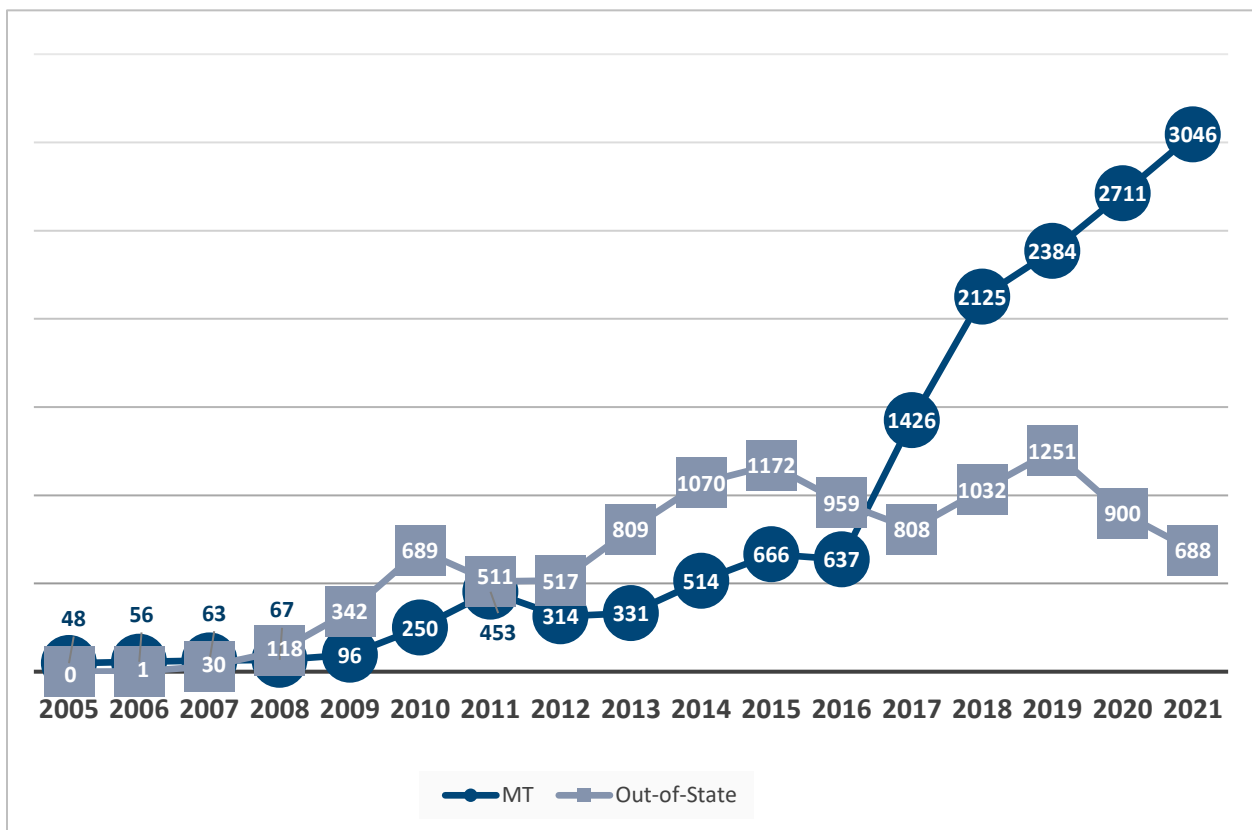
FWP operates an AIS laboratory in Helena, MT (Figure 14) with a satellite lab in Kalispell, MT. These labs process plankton samples for FWP crews, Montana partners and Missouri River Basin (MRB) states. The lab also processes samples from outside the basin as a confirmatory service for other labs. Figure 15 illustrates the volume of samples handled by the lab each year since 2005. The lab has discovered new populations of *Dreissena spp.* veligers as well as *Corbicula sp.* (Asian clam) veligers for multiple downstream states. To ensure the highest level of confidence of results, the lab undergoes routine internal and external quality control testing.



**Figure 14. Keegan Effertz, lead lab technician and Katie Richter, lab technician in the main FWP AIS lab in Helena, MT. The FWP AIS lab looks for the larval stages of invasive dreissenid (zebra & quagga mussels) and Corbicula clam species.**

## Sample Prioritization and Lab Process Turnaround Time

Due to a slowing turnaround processing time, the lab implemented a new risk categorization system in 2019. Risk categorization improved turnaround time on high priority samples and ensured rapid analysis. In 2021, the lab received a record number of 3,734 samples (3,046 MT, 688 MRB). Turnaround times are available in Table 1 with an average two-day turnaround time for highest priority samples and a seven-day overall turnaround time.



**Figure 15. Number of plankton samples processed by year: in-state (FWP and partners) vs. out-of-state.**

The FWP AIS laboratories continue to work on methods to improve sample processing time along with annual increases in number of samples. To keep turnaround times low, the lab is evaluating a limit on the number of samples different entities can submit to the lab. This will ensure all samples can be completed in a timely manner based on available staff, equipment, and lab space.

**Table 1. FWP AIS lab waterbody priority ranking system with 2021 average turnaround times. Overall average turnaround time in the lab was one week, which is likely the fastest turnaround time to date.**

Priority (5- high; 1- low)	Rank	Turnaround Time (Average Days)	Total # Samples
Risk 5 and Hatcheries	5	2	390
Risk 4	4	6	1,163
Risk 3 Lake	3a	7	661
Risk 3 River	3b	5	282
Out-of-State	3c	12	657
Risk 2	2	8	495
Risk 1	1	5	127
Totals		7	3,772



## Mussel Response at Tiber Reservoir

Montana significantly expanded its fight against AIS following the first detection of larval dreissenid mussels in the state in 2016. FWP also expanded efforts to detect veligers and adult mussels in Tiber Reservoir, which continued for the last five years. These efforts included plankton tow sampling, shoreline searches, artificial substrate sampling, eDNA sampling, remotely operated submersible vehicle (ROV) surveys (Figure 16), SCUBA surveys (Figure 17), snorkel surveys, benthic sled sampling, ponar dredge sampling, and mussel detection dogs.

This year, FWP processed 258 plankton tow samples from Tiber Reservoir with microscopy for the presence of invasive mussel larvae. No adult mussels or larvae were found with all sampling efforts. The Flathead Lake Biological Station with support from FWP and the U.S. Bureau of Reclamation also collected and processes eDNA samples during two sampling events from Tiber Reservoir in July and October.



**Figure 16. Ben Colbry, Bureau of Reclamation, and Kyren Zimmerman, in collaboration with Flathead Lake Biological Station and FWP survey for adult dreissenid mussels at Tiber Reservoir with the use of a remotely operated underwater vehicle.**



**Figure 17. U.S. Fish & Wildlife Service AIS dive team prepares to conduct a SCUBA survey looking for adult dreissenid mussels – October 2021.**

No dreissenid mussel DNA was detected in the 74 samples collected through these efforts in 2021. See Appendix C for details on sampling locations.

FWP’s dive team and the USFWS dive team collaborated in October and conducted SCUBA surveys on the dam and Turner Point. Only native species including fatmucket mussels were found during these efforts.

Table 2 shows the cumulative total of sampling for the last five years (2017-2021). After five years of no additional invasive, dreissenid mussel findings, FWP initiated the process to have Tiber Reservoir delisted as a “positive” waterbody. This will remove mandatory decontaminations and controlled access to ramps on the reservoir.

**Table 2. Summary of sampling efforts on Tiber Reservoir (2017-2021) looking for dreissenid mussels.**

Method	2017	2018	2019	2020	2021	Total
Plankton Net - Microscopy	85	108	120	115	258	559
Substrate (artificial or dredging)	4	14	205	5	12	240
eDNA Sample (plankton/filtering)	28	26	40	67	59	220
Snorkel and Shoreline Visual Surveys	86	22	15	25	31	175
Mussel Detection Dog Search	14	14	3	7	8	46
Scuba Surveys		4	7	4	6	17



## AIS Control Efforts



### Beaver Lake Eurasian Watermilfoil Eradication

In 2021, FWP continued control efforts at Beaver Lake in NW Montana to eradicate Eurasian watermilfoil. Since its detection in 2011, FWP, the City of Whitefish, and the Whitefish Lake Institute worked to eliminate this invasive plant and prevent further spread within the lake or to adjacent waters. After completing a lake-wide survey, the FWP dive team utilized a variety of different methods including hand pulling individual plants and the placement of benthic barriers to suppress concentrated plant patches. In response to high public use at this site, FWP added additional signage to increase public awareness and to limit possible spread within and away from the lake. FWP will continue suppression efforts with the goal of eradicating Eurasian watermilfoil from the lake.



**Figure 18. Jayden Duckworth, part of the FWP dive team, prepares his SCUBA equipment to install bottom barriers to eradicate Eurasian watermilfoil from Beaver Lake.**



**Figure 19. Craig McLane, part of the FWP dive team, works to install a benthic barrier at the bottom of Beaver Lake over a Eurasian watermilfoil bed in 2021.**



**Figure 20. Stacy Schmidt (right) and Jayden Duckworth (left) work to remove some fragrant waterlily plants in Holland Lake, MT.**



### Holland Lake Fragrant Waterlily Control

In September 2021 FWP assisted the U.S. Forest Service (USFS) in a fragrant waterlily removal project at Holland Lake (Figure 20). Fragrant waterlily is an invasive rooted aquatic perennial lily with large floating leaves and showy flowers. Due to its proximity from the shoreline, the use of SCUBA diving and snorkeling was the most effective way to target these plants for removal. Over the course of two days, the FWP dive team focused on areas where plants could not be effectively removed from wading from shore. Due to the widespread growth throughout the lake, this will be an ongoing project to contain this population until eradication or management plans are completed.



### Slip and Slide Creek Ponds Curlyleaf Pondweed Eradication

The USFS acquired property with three small reservoirs located in the Slip and Slide Creek drainage, a tributary of the Yellowstone River near Gardner, MT. The USFS was worried that some of the plants might be invasive species so FWP surveyed the reservoirs in 2019 and found well established curlyleaf pondweed populations in all three of the ponds. This is the first reported population of curlyleaf pondweed within the Yellowstone River drainage, so preventing the spread of this population is particularly important. The dams were classified high for dam failure. In 2020, the USFS began draining the three ponds to mitigate the dam risk and to eradicate the curlyleaf pondweed populations (Figure 21). Sampling of the area in 2021 identified curlyleaf pondweed only in those three ponds and not in surrounding areas. The USFS drained the remaining ponds later in the season and follow-up surveys will continue in 2022. This effort will reduce the risk of curlyleaf pondweed from spreading downstream into the Yellowstone River.



**Figure 21. Middle Slip and Slide Creek Pond on USFS land near Gardner, MT. It was drained to remove the high-hazard dam status and to eradicate curlyleaf pondweed.**





### Nilan Reservoir Eurasian Watermilfoil Eradication

A new population of Eurasian watermilfoil was found in Nilan Reservoir late in the season in October. Nilan Reservoir is located about 15 miles west of Augusta, MT along the Rocky Mountain front. The population was found in a small bay near the fishing access boat ramps. Extremely low water levels and winter temperature prevented lake-wide surveys. Additional survey work in 2022 will look to see if additional populations are in other portions of the lake.

FWP initiated a rapid response effort treatment in coordination with Montana Department of Natural Resources (DNRC) (dam owner) and the Nilan Water Users Association (landowners and irrigators that use the water), with the goal of eradicating this new population. FWP applied fluridone, a slow acting systemic herbicide, in November. The bay was curtained off from the rest of the reservoir to reduce water exchange and treated. This area will remain curtained off until spring to give the herbicide the best chance at killing the Eurasian watermilfoil.



**Figure 22. The bay on Nilan Reservoir where Eurasian watermilfoil was found in October 2021. The narrow neck connecting the bay to the lake is the location of the curtain installation prior to the fluridone treatment.**



### Lake Elmo Corbicula Clam Eradication

There were no confirmed populations of Corbicula clams (*Corbicula fluminea*) in Montana until FWP staff found them in Lake Elmo during an AIS monitoring workshop in June 2019. FWP staff in Helena and Region 5 in Billings developed a plan to drain the reservoir in September 2021 and leave it dewatered until April 2022. Funding from the Montana Invasive Species Council AIS Grant Program helped cover the costs to pump and dewater the lake. Initial draining occurred from September to October, but seepage from ground water prompted additional pumping by FWP through the remainder of the year until the lake finally froze in December. Drying and freezing of the lakebed should eradicate this population.



**Figure 23. Live, adult Corbicula found in Lake Elmo, MT.**





**Figure 24. A view of the dewatered Lake Elmo in the fall of 2021 with the goal of eradicating established *Corbicula*.**

During this dewatered time, Region 5 fisheries biologists and state park managers plan to take advantage of access to the lakebed to implement fisheries and state park improvements.

### Looking Forward

Fish, Wildlife & Parks is constantly evaluating the AIS Early Detection and Monitoring Program to identify opportunities to improve efficacy and efficiency. These improvements lead to more reliable sampling efforts, data collection, sampling handling, and AIS control efforts.



**Figure 25. The pump used to dewater the remaining approximately four feet of water that remained after passively draining all possible water through the irrigation control structure.**

### Plans to improve FWP’s monitoring program in 2022:

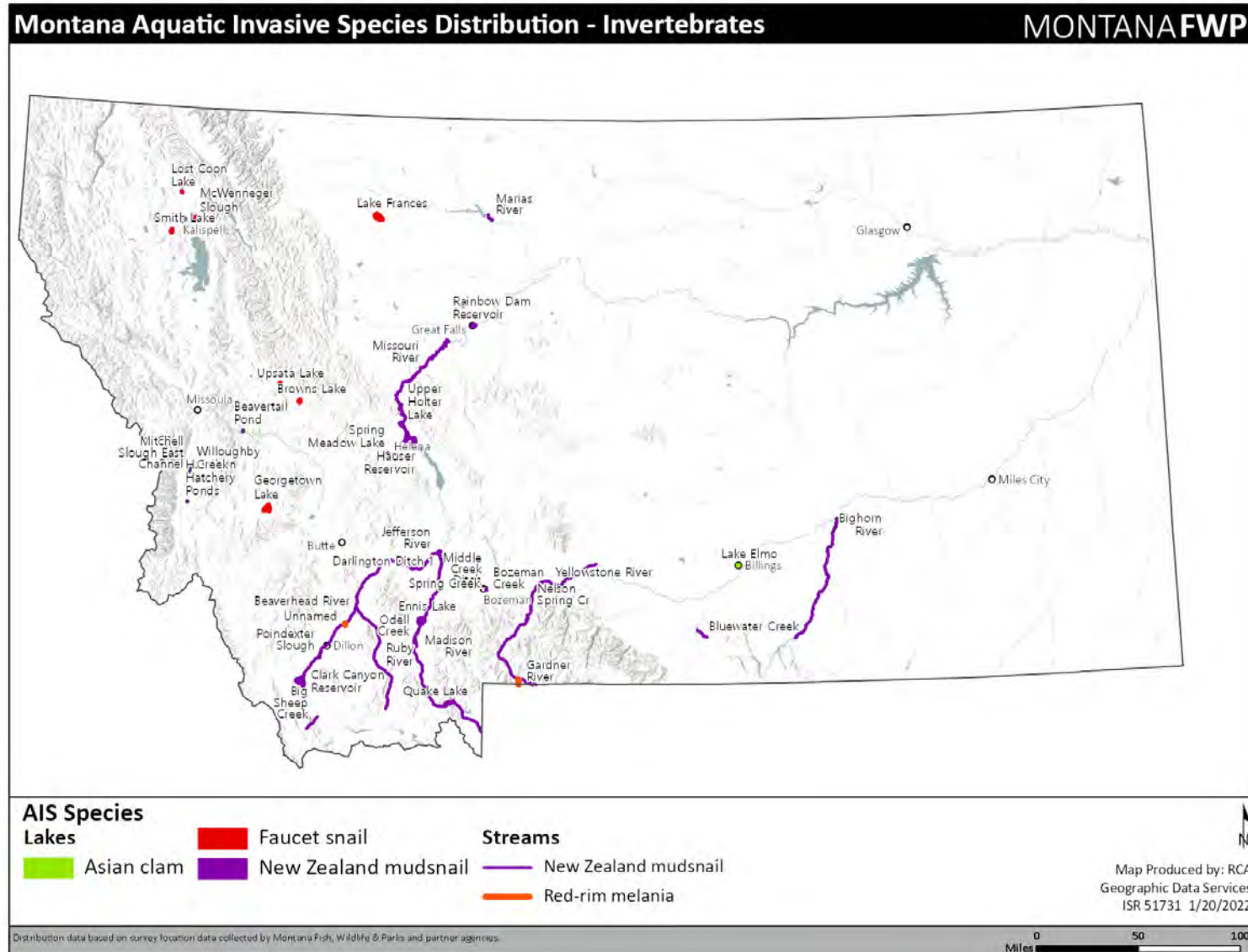
- ▶ Help partners improve their all taxa AIS monitoring efforts through trainings and technical expertise. These were performed in a limited capacity in 2021. The goal in 2022 is to return to several in-person classroom and field technique workshops.
- ▶ Survey for AIS in known geothermal areas. Time constraints prevented this from occurring in 2021 due to other needed duties and surveys. FWP rescheduled this to begin this project in 2022.
- ▶ Expand partner involvement with early detection survey and the use of the AIS Survey Mobile Data Collection App. This is an ongoing effort. Past efforts have seen an increase in partner sampling over the last five years.
- ▶ Continue to lead state and regional AIS monitoring coordination with state and regional partners.
- ▶ Advertise and increase use of the “Reporting AIS Sightings” efforts through public events and workshops.

Statewide monitoring efforts by FWP and partners continue to become more effective and expand capacity within the state to detect new AIS populations, slow the spread of existing populations, and eradicate some populations where feasible. These efforts are critical to the early detection and monitoring of invasive species and are an important aspect of the AIS program and the statewide AIS Management Plan. While these efforts do not guarantee discovery of all AIS species as they are introduced, they significantly increase the potential to discover new populations before they become established or spread beyond their current boundaries. Limiting the establishment or spread of AIS allows time for new research in control and eradication methods emerge and allows for greater efficiency in monitoring and early detection methods. These advances will ultimately save the State of Montana time and money while protecting its aquatic resources and infrastructure.

### Literature Cited

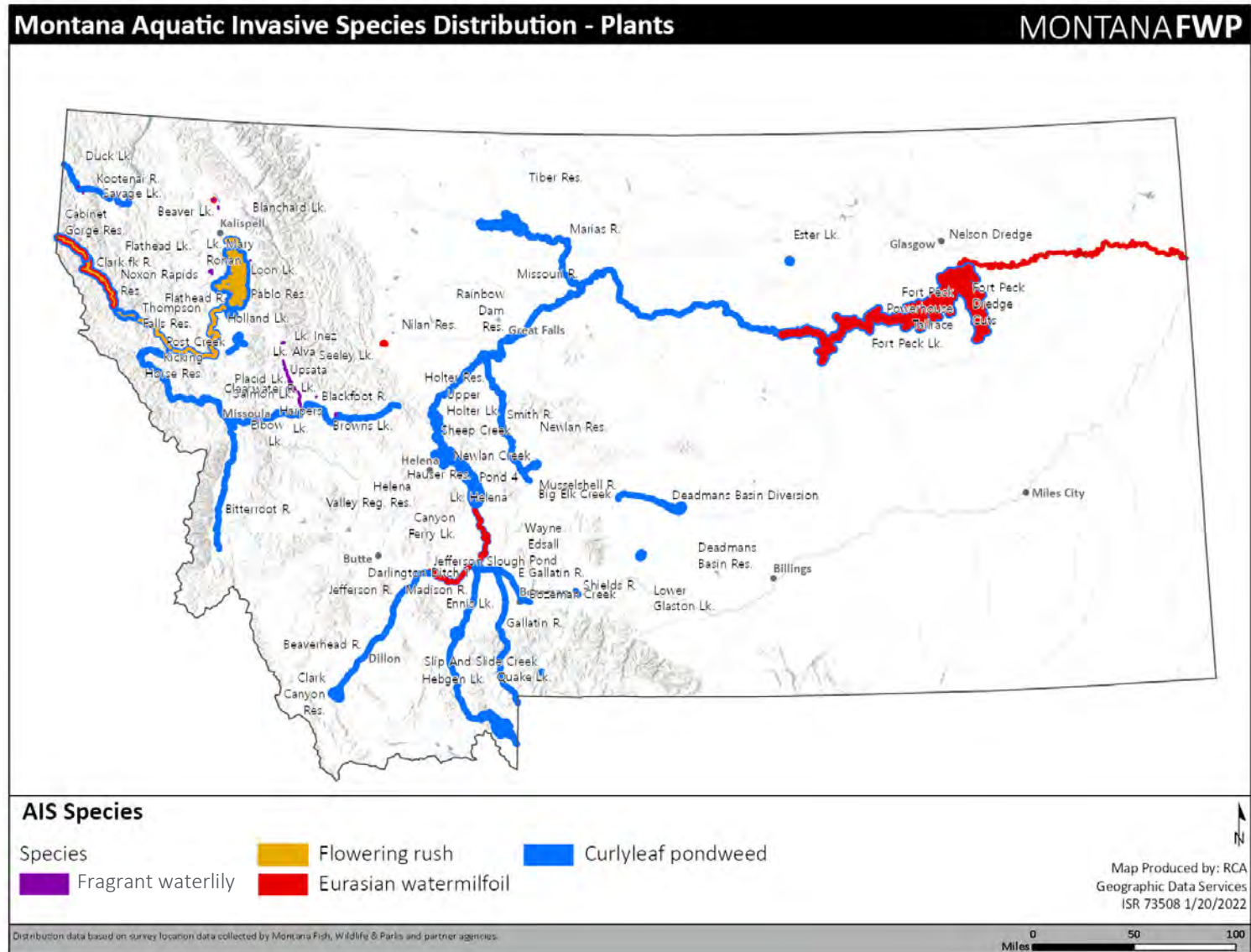
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# Appendix A. Map of Invasive Snails and Clams in Montana





# Appendix B. Map of Invasive Aquatic Plants in Montana





# Appendix C. Mussel Response Sampling Events on Tiber Reservoir - 2021

