

June 24, 2016

# Red River Basin River Watch Annual Report 2015

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**Red River Basin River Watch** partners with K-12 and community education staff, resource management professionals, higher education institutions and other non-profits to create opportunities for citizen engagement in surface water quality issues in the Red River Watershed through data collection and field experiences.

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## Introduction

This report fulfills the final reporting requirements for the Clean Water Legacy River Watch Project from January 2014 through June 2016. The Red River Watershed Management Board is the project sponsor with lead coordination and project management provided by the International Water Institute. The purpose of this report is to provide a summary of progress towards meeting the identified outcomes within the 2014 – 2015 Clean Water Fund Work Plan.

## Program Overview

River Watch enhances watershed understanding and awareness for tomorrow’s decision-makers through direct hands-on, field-based experiential watershed science. Over 40 schools throughout the Red River of the North Basin participate in a variety of unique and innovative watershed engagement opportunities suited to their school, community, and watershed needs.

**Water Quality Monitoring:** Collect and record conditions at local rivers and stream using state-of-the-art scientific methods and equipment.

**Biological Monitoring:** Macro invertebrate and mussel monitoring provides additional insights on watershed health.

**River Explorers:** Guided kayak excursions on local rivers to observe and document watershed conditions.

Ongoing **Teacher Training** provides access to resources and experts on current watershed issues.

**Adopt-A-River:** Civic engagement through river and stream clean-up activities.

**River Watch Forum:** annual opportunity for students to share and learn about emerging watershed issues.



The remainder of this report discusses the project progress in meeting the tasks and measureable outcomes of the expanded River Watch activities from January 2015 through December 2015 (12 months). The budget summary provided provides financial performance information encompassing the entire project period from January 2014 through June 2016 (30 months).

## Project Progress

**OBJECTIVE 1:** Develop a standardized framework for program implementation to build rigor and consistency with communities currently involved in River Watch (RW), while expanding monitoring and engagement opportunities.

### Work tasks/Measureable outcomes:

**1A Expand/Update the current River Watch Database to allow for the input and use of Water Quality and Snow Study data by mobile devices.**

*1A1 Transfer the current River Watch Database to a new mobile device friendly web platform by December 31, 2013.*

*1A2 Develop and add a data portal to the website for entry of Snow Study data by December 31, 2013.*

*1A3 Training for education staff on use and features of new website, completed by January 15, 2014.*

**1B Develop native mussel monitoring options for RW teams as means of developing native mussel reference collections and assessing watershed health in the Red River Basin.**

*1B1 Native mussel inventory protocols developed, materials assembled and permits acquired. Collection and identification protocols established by April 2014.*

*1B2 Training and implementation of native mussel field collection methods, documentation, and identification. Ongoing over contract period, completed by October 2015.*

*1B3 Resources (modules, videos, print) developed and/or adapted to connect mussel findings with water quality conditions. Mussel data entered in MN DNR Natural Heritage Information System database. Ongoing over contract period, completed by January 2016.*

*1B4 Teacher evaluation of ease of use, problems, and highlights of native mussel collection activity, as well as pre/post surveys of students. Ongoing over contract period, completed by October 2015. Results will be reported as part of Final Report due June 30, 2016.*

### Objective 1 Progress:

- Objective 1A work tasks were completed in 2014.
- As part of our kayak outings discussed under Objective 2 we collected mussel shells on our river excursions to make a reference collection for our watersheds. To date we have not positively identifying the shells we have collected and have not entered our findings in the MN DNR Natural Heritage Information System, <http://www.dnr.state.mn.us/nhnrp/nhis.html> (the mussels and fish data base component). However, the collection and elementary identification of mussels as performed by the students has provided them with a better understanding and appreciation of the biological stream community.
- IWI staff worked with Bernard Sietman (MNDNR) and Andre Delorme (Valley City State University) two mussel experts within the Red River Basin to determine collection protocols and develop other reference materials. A mussel lesson plan and collection guide developed by the Wisconsin DNR was adopted for use in conjunction with the Red River of North Mussel Field Guide prior to the mussel collections in 2015 and is provided along with other reference materials as *Attachment A*.

**OBJECTIVE 2:** Increase awareness and knowledge of local land use and watershed connections through a Red River Explorers Paddling Program to allow RW teams and community members to “water-truth” streams in the Red River Basin, documenting local watershed conditions.

**Work tasks/Measureable outcomes:**

- 2A Expand capacity and structure of Red River Explorers Paddling Program to allow RW teams and community members to safely explore and document river conditions, including development of website to share information about river conditions.**
- 2A1 *Adult team members scout rivers at different water levels to assess safety and water levels needed for safe passage by RW student exploratory teams. Ongoing through 2015.*
- 2A2 *Additional features and information that might be collected will be reviewed with watershed district managers and research scientists to maximize utility of data collection from river trips. Equipment purchased for documenting field conditions. Completed by July 2014.*
- 2A3 *Scouting reports posted to IWI website for RW teams and public access in planning river trips. Ongoing through 2015.*
- 2B Lead six guided river ecology excursions in both 2014 and 2015 on various reaches of rivers in the Red River Basin.**
- 2B1 *Twelve guided river ecology excursions in the Red River Basin, all utilizing GPS and mapping/photo documentation of baseline geomorphology and recreation conditions.*
- 2B2 *Share information from river trips on public website. Reporting will include number of trip participants, river route and reaches covered, photo-documentation of river conditions, and a summary of observations by trip participants on river conditions and recreation suitability.*
- 2B3 *Final Report to include link to all of trip reports and responses from local resource managers and research scientists as to utility of reconnaissance information provided about watershed conditions, due June 30, 2016.*
- 2C Watershed Connections via stream tables and groundwater models.**
- 2C1 *Stream tables and ground water models purchased and staff trained in use and presentation. To be completed by July 2014.*
- 2C2 *Resources (modules, videos, print) developed and/or adapted to connect streams with ground water. Eight classroom visits with materials and equipment provided for use by teachers with staff assistance. Ongoing over contract period, completed by January 2016.*
- 2C3 *Evaluation (self-reported) of changes in knowledge, attitude and perceptions of local rivers after stream table and/or groundwater model exposure. To be completed by November 2015 and included in Final Report due June 30, 2016.*

**Objective 2 Progress:**

- Twenty (20) river trips were completed in 2015, ten (10) with River Watch teams and ten (10) with other community organizations. Adequate river levels and good weather allowed for more river trips than planned for in 2015. A river explorer trip summary is provided in *Appendix I*.
- Five (5) River Resource Condition Reports were developed and posted to [web](#) in 2015. Information including notes, geo-tagged pictures, and input from local resource professionals was used in the development of these reports.
- Positive feedback has been received from local resource managers regarding the condition reports. The reports have been useful in documenting erosion and bank stability areas and the recreational suitability of the reaches paddled.
- Three stream tables and two ground water models have been made available to the River Watch schools for classroom use. IWI staff assisted the schools in their use when requested. Resources and information relating to the stream tables and groundwater models are available on the IWI website. You can review this information by clicking [here](#).

**OBJECTIVE 3:** Assist in provision of Science, Technology, Engineering and Math (STEM) education and engagement opportunities through watershed science.

*Work tasks/Measureable outcomes:*

- 3A Provide professional teacher development through watershed inquiry and education opportunities. Regional fall kick-off events, incorporating team building skills, local watershed project presentations and data interpretation will be held for RW teachers and youth leaders. Summer training sessions will be held for teachers to provide extended learning opportunities on watershed topics such as river ecology, watershed connections, and biological monitoring.**
- 3A1 2-3 regional fall kick-off events in both 2014 and 2015; and minimum of two, one-day, summer teacher training sessions. Summary report will be provided to document participants at regional kick-off events, topics covered, and evaluation comments from participants. A summary report will also be provided for the summer teacher training documenting participation, materials presented, and evaluation summary from participants.*
- 3B Utilize the annual River Watch Forum to provide exposure to relevant research topics and an opportunity to present findings from current research involvements. Provide opportunities for youth to engage in scientific research.**
- 3B1 River Watch Forum presented in March 2014 and 2015 with keynote speaker and concurrent sessions focused on emerging watershed education and research. Poster displays of assigned research topic and special investigations by RW teams in collaboration with research partners.*
- 3B2 Summary report written to document participating RW teams/schools and highlighting awards and watersheds represented in research, with links to posters. To be completed by June 30, 2014 and June 30, 2015 and included in Final Report due June 30, 2016.*

**Objective 3 Progress:**

- Three (3) regional fall kick-off events were held across the basin in November 2015. River Watch teams were introduced to the River Watch Forum 2016 Team Challenge and the activities at each kick-off event prepared the attending teams for their poster presentations. One-hundred thirteen (113) students and seventeen (17) teachers attended these events. Students and teachers received training on desktop river exploration and effective communication. All of the information related to the 2016 Forum and the 2015 kick-off events can be viewed on the web [here](#).
- The 20 year anniversary River Watch Forum was held March 17, 2015 with 300 people in attendance, 250 students and teachers along with 50 public at large including resource managers. Students prepared posters for the event and presented them throughout the day’s proceedings. The posters that were at the 2015 forum can be viewed [here](#) and the proceedings for the day were highlighted in our April/May 2015 newsletter and can be viewed on the [web](#) and also in the attached 2015 River Watch Forum Planner, *Appendix II*.

**OBJECTIVE 4:** Project Management and Reporting

*Work tasks/Measureable outcomes:*

- 4A Track project grant-related expenditures. Compile and organize invoices, pay bills and submit for expense reimbursements in a timely manner.**
- 4A1 Grant-related expenditures tracked, bills paid and expense reimbursements submitted at least quarterly.*
- 4B Track objectives and tasks to ensure outcomes are being met. Prepare and complete reports and results from the Red River Basin River Watch program as follows:**
1. December 31, 2014, Interim report to MPCA
  2. February 15, 2015, Interim report and initial evaluation results to the:
    - Commissioners of Education and the Pollution Control Agency,
    - Legislative Natural Resources Finance and Policy Committees, and

o **K-12 Finance and Policy Committees**

3. **June 30, 2016, Final report including final evaluation results to entities identified for February 15, 2015 report above.**

4B1

1. *Interim report of project status and budget to MPCA by December 31, 2014.*
2. *Interim report and initial evaluation to Commissioners of Education, MPCA and Legislative and Education Committees by February 15, 2015.*
3. *Final report of project outcomes, budget, and final evaluation results by June 30, 2016 to all entities receiving February 15, 2015 report noted above.*

**Objective 4 Progress:**

- This final report was submitted to the MPCA project manager June 27, 2016.
- This report satisfies reporting requirement 3 listed above.
- Invoices have been submitted quarterly and the final request for reimbursement will be submitted by July 1, 2016. Below is a summary of the project budget covering January 2014 through June 2016.

<b>Project Budget</b>	<b>MPCA Grant Funds Available</b>	<b>Total MPCA Funds Expended</b>	<b>Total Remaining Balance</b>	<b>% Budget Expended</b>
<b>Objective 1: Rigor</b>	\$49,160.36	\$49,138.63	\$21.73	99%
<b>Objective 2: River Recon</b>	\$89,261.88	\$89,261.88	\$0	100%
<b>Objective 3: Educate and Engage</b>	\$47,110.26	\$47,095.31	\$14.95	99%
<b>Objective 4: Project Mgmt. &amp; Reporting</b>	\$14,467.50	\$14,467.50	\$0	100%
<b>TOTAL PROJECT BUDGET</b>	\$200,000.00	\$199,963.32	\$36.68	99.9%

**Program Evaluation**

Eighteen (18) educators that were involved with the River Watch program during both the 2014 and 2015 project years were provided an opportunity to give responses to a couple of program evaluation pieces. The first was to provide a written response to a directive and the second was to complete a ten question online survey. Six (6) educators responded to the directive and nine (9) completed the survey.

Overall educators are pleased with the program and the educational offerings. Individual responses to the directive and survey results are provided in *Attachments B and C*.

**Summary**

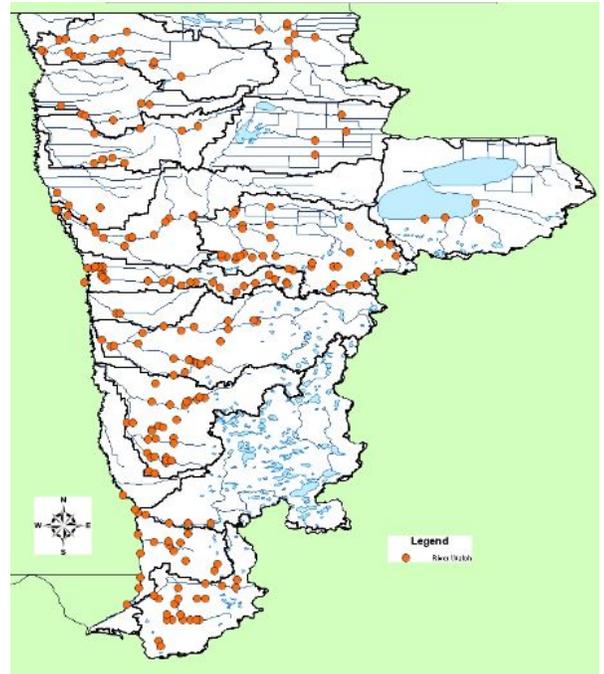
Past support for Red River Basin River Watch (RW) from the Red River Watershed Management Board, local watershed districts, and other regional partners has built a solid watershed education foundation across the Red River Basin. The International Water Institute (IWI) RW program provides training to students who monitor physical and chemical conditions of local rivers using standard operating procedures. The scientific data are used by the MN Pollution Control Agency to assess the state's surface waters. RW teams have collected data at over 150 sites on rivers, streams, and agricultural ditches in the Red River Basin.

Clean Water Funds enable IWI to build on this solid watershed education foundation by providing additional learning opportunities that complement the core physical and chemical monitoring done by RW teams with our resource agency partners. These new learning opportunities provide a more comprehensive understanding of watersheds, promoting land and water stewardship to protect and improve Minnesota's valuable natural resources.

The Red River Watershed Management Board is committed to continue building this program and did receive matching Clean Water Funds in 2016 to continue this project into 2016/2017 and beyond.

Progress toward meeting each of the objectives reported herein provides evidence that the River Watch Project is making substantial headway towards meeting its goals of developing program rigor and consistency, increasing awareness of watershed connections, and providing STEM watershed education activities. 2016 project activities will continue to develop the critical thinking and human resource capacity of our youth which is critical to protecting and improving the natural resource capital of Minnesota.

**River Watch Site Map**



## ATTACHMENTS AND APPENDICES

Attachment A: Mussel Collection and Reference Materials

Attachment B: Program Evaluation – Directive Response

Attachment C: Program Evaluation – 2015 River Watch Teacher Survey

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*Appendix I: River Explorers 2013-2015 Trip Summary*

<b>2013-15 River Explorers' Trips</b>				
	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>TOTAL</b>
<b>River Watch Trips -RW Teams</b>				
# of Trips	9	11	10	30
Total Participants	106	124	122	352
River Miles	35	44	38	117
Total River Miles	409	495	445	1,349
<b>Other River Trips - Community</b>				
# of Trips	8	9	10	27
Total Participants	219	259	144	622
River Miles	27	39	35	101
Total River Miles	622	818	477	1,917
<b>River Watch and Other River Trips-Totals</b>				
# of Trips	17	20	20	57
Total Participants	325	383	266	974
River Miles	62	83	73	218
Total River Miles	1,031	1,313	922	3,266

*Appendix II: 2015 River Watch Forum Planner***\*\*\* Online Registration Deadline – End of Day-Thursday, March 12th \*\*\*****Tuesday, March 17<sup>th</sup> RW Forum at UofMN-Crookston****8:30 Registration & Display Viewing****9:30 Opening Assembly~Welcome****2:30 Adjournment**

**Parking:** It will be spring break on the UMC campus thus all parking lots are available to use. Parking Lot A is recommended for convenient access to Forum activities. Campus map at [http://www1.crk.umn.edu/prod/groups/crk/@pub/@crk/documents/content/crk\\_content\\_369822.pdf](http://www1.crk.umn.edu/prod/groups/crk/@pub/@crk/documents/content/crk_content_369822.pdf)

**Refreshments:** A continental breakfast during registration/setup and noon meal will be provided.

**On-site Check-in** will begin at 8:30 a.m. with opening ceremonies beginning promptly at 9:30.

**Pre-registration and Concurrent Sessions:**

Concurrent sessions will require everyone to **individually** pre-register your topic choices online. Teachers, please distribute the online registration link to everyone from your team who will be coming to the Forum: insert 2015 [link](#) here. Review the description of concurrent session topics and grid showing the schedule in this planner (pages 3-4). Your RW team can split up and individually choose which topics are of interest to them. Select just ONE entry from within EACH of the two session timeslots by clicking on the topic you wish to attend. The sessions will be filled on a “first come-first served” basis and will not let you register once it is filled, so please register as soon as possible to best ensure attending the topics you most desire. When you arrive your name tag will include the concurrent sessions that you chose to attend.

**Posters:** Posters will be judged for both **People’s Choice** and **Judges Choice**—with three prizes given for each method. For “People’s Choice”—each RW team will be given two ballots to use for selecting their choices for best posters which will be tallied with ballots by the public at large. For **Judges Choice**—teams of judges will review each poster and visit with RW team representatives. RW teams are asked to have 2-3 students at your poster to provide a brief (up to 2 minutes) oral introduction and highlights of your team’s activities. A schedule will be provided of time slots when you can expect your poster to be judged and thus when your presenting students should be available at your poster. Easels will be available to set your posters on. If you have additional display needs (such as table or electricity) please let us know as soon as possible.

**River Stories Video Contest:** A reminder to send your videos in by March 9<sup>th</sup> for consideration in the River Stories Video Contest. Details and entry instructions were emailed to all and are on the [IWI website](#) with other Team Challenge Resource information. Send entries and any questions to Wayne Goeken at [wayne@iwinst.org](mailto:wayne@iwinst.org). **Entries due by midnight, March 9<sup>th</sup>, 2015.**

All for now. Looking forward to an exciting Forum! If you have any questions, contact Wayne Goeken at [wayne@iwinst.org](mailto:wayne@iwinst.org) / 218-280-0516 or Danni Halvorson at [danni@iwinst.org](mailto:danni@iwinst.org) / 218-280-0515.

*International Water Institute  
presents 20<sup>th</sup> Anniversary*



**River Watch**  
Citizen Monitoring Program

**Red River Basin River Watch Forum ~ 2015**

***Tuesday, March 17, 2015  
University of Minnesota-Crookston Campus***

8:30 *Registration. Set-up Displays. Continental Breakfast. (Bede Conference Center)*

*Posters from each River Watch team in Bede Conference Center for viewing throughout the day*

9:30 *Welcome-Bede Conference Center– Danni Halvorson, Director, IWI Center for Watershed Education*

9:40 *What’s Your Watershed IQ? – Andy Ulven, IWI Education Specialist*

10:00 *Blazing Your Own Trail – Natalie Warren – Founder, Wild River Academy*

10:40 *Announcements and First Door Prize Drawings*

11:00 *First Concurrent Session*

11:30 *Second Concurrent Session*

**12:00 *Lunch (Brown Dining Hall) and Display Viewing and Voting***

1:00 *River Watch Jeopardy – River Watch Team Finalists*

1:15 *River Story Video Contest Winners Premiere*

1:30 *Master Door Prize Drawings*

1:40 *River Watch Story—Making Connections~Making a Difference*

2:00 *Awards ~ Recognition of Excellence for Schools and Partners*

2:30 *Adjournment*

*~Public Welcome ~*



**2015 River Watch Forum Concurrent Session Descriptions:**

**River Story Posters: View and Vote~** River Watch teams share stories about the watersheds that they call home. History, recreation, research, legend, lore, and more blend to weave stories of a fluid landscape. Vote on best displays. **Evelyn Ashiamah**-International Water Institute (Bede Ballroom, limit 40/session)

**Stream Table~** Explore impacts of stream flow, erosion, sediment deposition and land use. Try your hand at creating river meanders and trying to make water “behave.” Figure out where the fast and deep waters run. **Karen Terry**-Univ. of MN Extension Water Educator (Northern Lights Lounge, limit 20/session)

**River Watch →About Us~ (TEACHER/ADMIN SESSION)** Overview of River Watch monitoring program and variety of related watershed science opportunities for schools, individuals, and communities to get involved. Making connections and partnerships to make it happen. **Danni Halvorson**- IWI/ (Dowell 100, limit 25. 11:00 session only)

**Working Lands ~** Promising research and advances being made to provide for food, economic livelihood and healthy communities while also protecting and improving our natural communities. Stewardship that works for all. **Alice Klink**-Wetlands Restoration Biologist, USDA-NRCS-Fergus Falls (Dowell 101, limit 30/session)

**Paddling Connections ~Think Global~Paddle Local!** Keep the big picture in mind but explore your local waters. Invite family and friends to explore with you. Stay in touch with community members on things you see and always work to keep rivers clean and fun! See how to connect and contribute to your watershed and community through paddling. **Natalie Warren**-Wild River Academy (Dowell 106, limit 40/session)

**Climate Change Impacts on River Ecosystems?~**Warmer water temperatures and more intense storm events have immediate and long-term impacts on river ecosystems. Learn about the many connections, impacts and the need to explore alternatives for a sustainable future. **Bruce Paakh**-MPCA (Dowell 121, limit 30/session)

**“Natural” Career Opportunities~** Career ideas often start in high school and can create a pathway through college coursework and internships, and can lead you to landing your dream job! Don’t be afraid to contact local organizations and businesses when looking for experience. A panel of recent River Watch alumni will share how they decided on college, summer jobs, and their career opportunities and tips on entry into the field.(Dowell 125, limit 30/session)

**Red River Fisheries~**Out with the dams—in with the fish. Find out how fish have responded to dam modifications in the Red River Basin and why/where this might mean better fishing for you! **Jamison Wendel**-Red River Fisheries Specialist, MN DNR-Detroit Lakes (Dowell 200, limit 40/session)

**Wildlife & Water ~**Our river corridors often provide some of the best remaining habitat for wildlife. Find out what to look for on your sampling and paddling outings and how citizen scientists can help document wildlife and critical habitat in your watershed. **Christine Herwig**-Nongame Wildlife, MN DNR-Bemidji (Dowell 206, limit 40/session)

**Aquatic Invasive Species~**Discover the latest science related to zebra mussel suitability to Red River Basin rivers and Hawley River Watch team’s pumpkinseed sunfish dissection to see if zebra mussels are part of their diet. **Moriya Rufer**, RMB Environmental Labs and **Joe Courneya**, Red River Basin Commission (Dowell 207, limit 30/session)

*Appendix III: Project Relevant Document Web Citations*

<b>Citation #</b>	<b>Page</b>	<b>Title</b>	<b>Web Reference</b>
1	3	MN DNR Natural Heritage Information	<a href="http://www.dnr.state.mn.us/nhnrp/nhis.html">http://www.dnr.state.mn.us/nhnrp/nhis.html</a>
2	4	River Resource Condition Reports	<a href="http://www.arcgis.com/apps/PublicGallery/index.html?appid=e3b8c64d0f854c0ba0f59d20ad3c4fad">http://www.arcgis.com/apps/PublicGallery/index.html?appid=e3b8c64d0f854c0ba0f59d20ad3c4fad</a>
3	4	Stream Tables and Ground Water Models	<a href="http://www.iwinst.org/education/resources/stream-tables-and-ground-water-models">http://www.iwinst.org/education/resources/stream-tables-and-ground-water-models</a>
4	5	Fall Kick-Offs and River Watch Forum	<a href="http://www.iwinst.org/education/river-watch-forum/team-resources">http://www.iwinst.org/education/river-watch-forum/team-resources</a>
5	5	2015 River Watch Forum Posters	<a href="http://www.iwinst.org/education/river-watch-forum/school-water-quality-posters">http://www.iwinst.org/education/river-watch-forum/school-water-quality-posters</a>
6	5	April/May 2015 Newsletter	<a href="http://www.iwinst.org/wp-content/uploads/2015/04/RWRendez_Issue-21-Final.pdf">http://www.iwinst.org/wp-content/uploads/2015/04/RWRendez_Issue-21-Final.pdf</a>

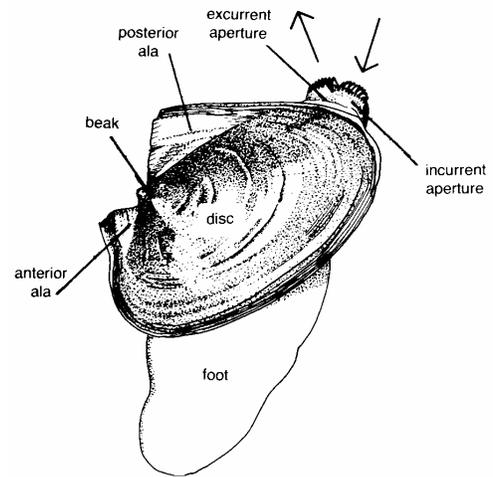
## WHAT IS IN A NAME? MUSSEL IDENTIFICATION

### OBJECTIVE

Students will use descriptive language to develop names for freshwater mussels.

### METHODS

Students are provided freshwater mussel shells (or pictures of freshwater mussels) and instructed to work in teams to develop names that concisely describe the mussels



### BACKGROUND

Identifying freshwater mussels may seem intimidating, especially when you are first introduced to them. However, many of the common and scientific names are very descriptive of the mussel shell's exterior shape, color, texture, size or in some cases the type of habitat a mussel is found in. The following two examples illustrate how descriptive language has been used to name mussels: the threeridge has three ridges on its shell and the group of mussels called heelsplitters have a sharp wing, or **posterior ala**, that quite literally could cut someone's heel if stepped on.

**Grade Level:** K - 12

**Subjects:** Social Studies, History, Language Arts

**Duration:** 30 to 45 minutes

**Group Size:** Any

**Setting:** Classroom

**Key Vocabulary:** mussel, shell

**Materials:**

- mussel shells
- mussel identification book or access to internet

Some common names of mussels are based on the similarity of the mussel's shape to an item that was used in the 1800's. For example, the pocketbook was given its name because it looks like a small purse, also called a pocketbook, carried by women of that era. Other mussels named after items commonly used in the 1800's include: washboard, snuffbox, spike (after a railroad spike), and spectacle case. The common names of other mussels are based on the resemblance they have to plants, animals, or parts of animals: pigtoe, monkeyface, fawnsfoot, deertoe, butterfly, and mapleleaf. However, the same mussel may have several different common names, which is why biologists often refer to mussels, and other plants and animals, by their scientific, or Latin, name, thereby eliminating any confusion.

### MATERIALS

- Freshwater mussel shells or pictures of freshwater mussels. (See "Making a Freshwater Mussel Collection" at the end of this activity and the list of Wisconsin's threatened and endangered mussels in the appendix to avoid collecting protected species)
- Water (optional)

## PROCEDURE

1. Place students into groups of 2-4.
2. Choose one shell to demonstrate to the students how they should use descriptive language to develop a name for the mussel.
3. Have the groups develop a descriptive name for each mussel. Water can be used to wet the surface of the mussel shell to make coloration and features more obvious
4. Hand out mussel identification books or keys to the groups and have them look up the mussels in the book or key to compare the names given in the book to the names they developed.

## ASSESSMENT

Have students make a Beany Baby™ mussel by using cloth and fabric paint then sewing the pieces together. Place beans inside and finish sewing shut. Accompany each Beany Baby™ mussel with a placard listing the mussel's name, reason for name (if known), identifying characteristics and artist's name.

## EXTENSIONS

1. Take a field trip to a local stream before the activity to collect freshwater mussels. See "Making a Freshwater Mussel Collection" below. Consult the list of Threatened and Endangered species since it is illegal for a person to possess a Threatened or Endangered species without proper state and federal permits.
2. Have students interpret the scientific, or Latin, names of the mussels and compare them to the descriptive names they developed for the mussels.

## FIELD GUIDES AVAILABLE FOR IDENTIFICATION OF FRESHWATER MUSSELS

Cummings, Kevin S., and Christine A. Mayer. 1992. Field Guide to Freshwater Mussels of the Midwest. Champaign, IL: Illinois Natural History Survey. (Manual 5). This book is also available electronically at:

[http://www.inhs.uiuc.edu/chf/pub/mussel\\_man/cover.html](http://www.inhs.uiuc.edu/chf/pub/mussel_man/cover.html)

Oesch, Ronald D. 1984. Missouri Naiades: A guide to the Mussels of Missouri. Jefferson City, MO: Missouri Department of Conservation.

A bibliography of other mussel field guides can be found on the internet at:

[http://fly.hiwaay.net/~dwills/bks\\_id.html](http://fly.hiwaay.net/~dwills/bks_id.html)

## MAKING A FRESHWATER MUSSEL COLLECTION

The following excerpt on how to make a mussel collection is from, Field Guide to Freshwater Mussels of the Midwest, by Kevin S. Cummings and Christine A. Mayer, Illinois Natural History Survey, Manual 5, Champaign, Illinois, December 1992.

*"Before collecting mussels it is advisable to contact the Department of Conservation or the Department of Natural Resources to find out whether there are any restrictions and to obtain any permits that may be required. Because of the rarity of many of the native species, live mussels should never be collected without prior permission. One can still build a nice collection by taking only shells and returning all live mussels to the stream or lake.*

*Perhaps the best place to begin looking for shells is along the bank of a medium-sized or large river when the water is at its lowest level (usually July to September). Although a few species can withstand some dessication, most are found in permanently flowing streams or lakes that contain water year-round.*

*Mussels can be found in a variety of habitats but are most abundant on shoals, where they live in gravel or a mixture of sand, mud, and gravel. A wide variety of shells can often be found along the shore in piles or "middens" left by muskrats or raccoons. The simplest and possibly the most effective method of collecting mussels is by hand-picking along the shore or in the stream. A small net bag or old potato sack makes a good container for holding shells in the field.*

*For your specimens to have scientific as well as aesthetic value, you need to keep accurate labels and records of field observations. After specimens are collected, a label should be made immediately and placed in the bag with the specimens; it should include the following information: the name of the body of water, road or bridge crossing, distance and direction from the nearest town, the county and state, the date, and the name of the collectors. Other information, such as water temperature, depth, current velocity, bottom type, and time spent collecting, can be recorded in a field notebook. Locality data should be written in pencil or india ink on a good grade of label paper so the label will not mold or disintegrate in the bag. Specimens without sufficient locality data are essentially worthless, so it is extremely important to accurately label specimens...*

*Once collected, the shells should be cleaned with warm water and a brush or teflon scrub pad to bring out the true colors and other markings needed for identification. After cleaning, locality data or a numbering system used to tie that specimen to a particular locality should be written directly in the shell with a pencil or india ink. If, after cleaning, you still have trouble identifying your specimen, you can often send it to a specialist for verification. Prior arrangements should be made with the curator of a museum before sending specimens for identification..."*

### THREATENED AND ENDANGERED MUSSELS OF THE UPPER MISSISSIPPI RIVER

The table below is for informational purposes. Listings of species may change, therefore, before collecting any shells, please check with your state natural resource agency.

The following mussels are protected and are illegal to have in your possession.

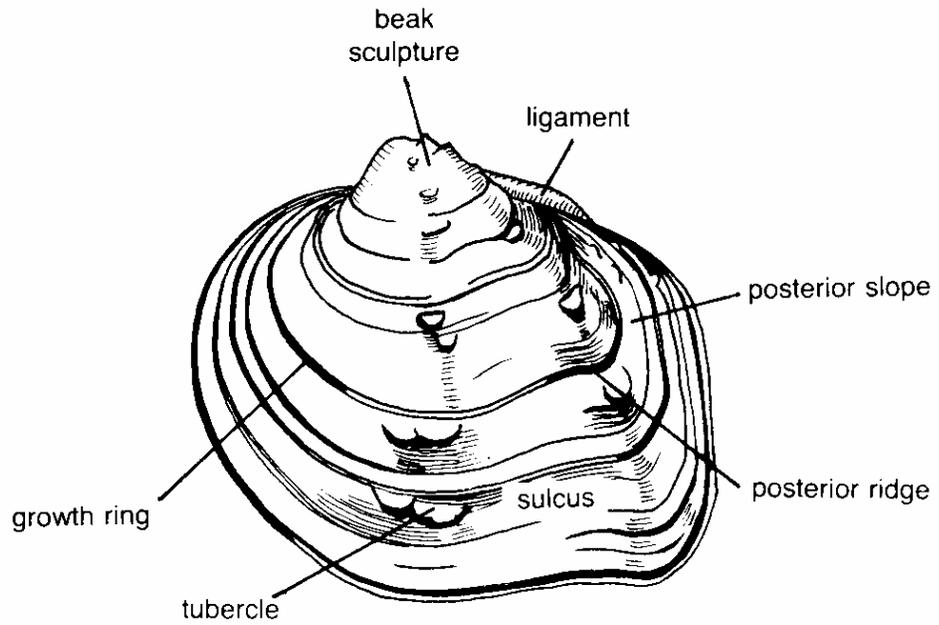
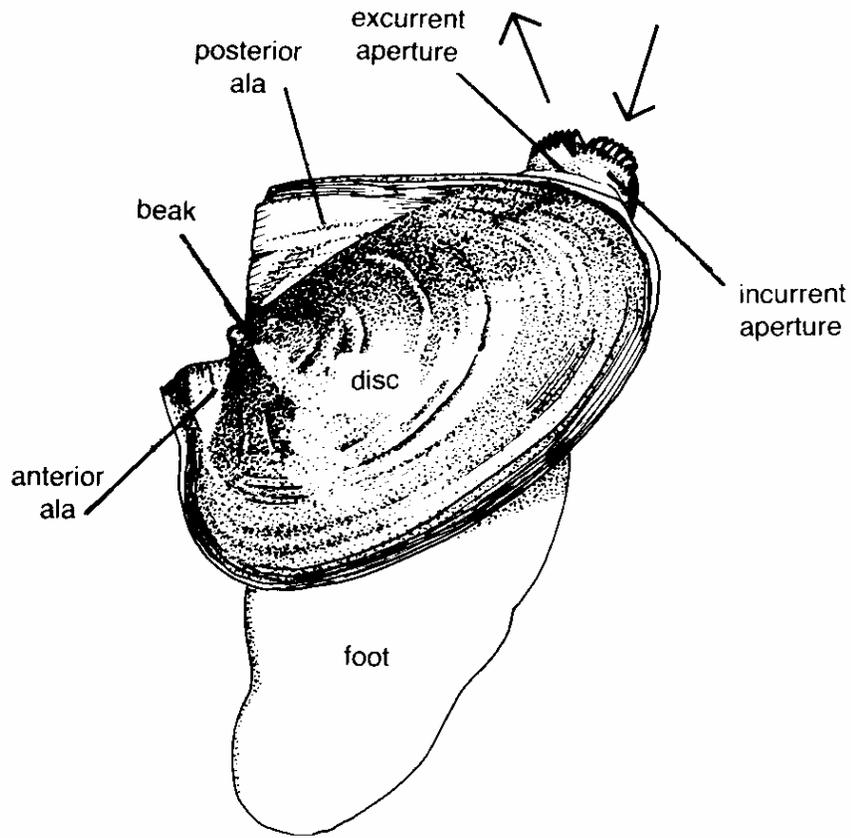
Common Name	Scientific Name	July 1999 State and Federal Status					
		WI	MN	IA	IL	MO	FED
Mucket	<i>Actinonaias ligamentina</i>		T				
Elktoe	<i>Alasmidonta marginata</i>		T				
Slippershell	<i>Alasmidonta viridis</i>	T		ET			
Cylinder	<i>Anodontooides ferussacianus</i>			ET			
Rock Pocketbook	<i>Arcidens confragosus</i>	T	E				
Spectacle Case	<i>Cumberlandia monodonta</i>	E	T	ET			
Purple Wartback (Purple Pimpleback)	<i>Cyclonaias tuberculata</i>	E	T	ET			
Fanshell	<i>Cyprogenia stegaria</i>				E		E
Butterfly	<i>Ellipsaria lineolata</i>	E	T		ET		
Elephant Ear	<i>Elliptio crassidens crassidens</i>	EX	E			E	
Spike	<i>Elliptio dilatata</i>				ET		
Curtis Pearlymussel	<i>Epioblasma florentina curtisii</i>					E	E
Snuffbox	<i>Epioblasma triquetra</i>	E	T		ET		
Ebony Shell	<i>Fusconaia ebena</i>	EX	E	ET		E	
Pink Mucket	<i>Lampsilis abrupta</i>					E	
Wavy-rayed Lampmussel	<i>Lampsilis fasciola</i>				E		
Higgins' Eye	<i>Lampsilis higginsi</i>	E	E			E	E
Yellow Sandshell	<i>Lampsilis teres anodontooides</i>	E	E				
Slough Sandshell	<i>Lampsilis teres teres</i>	E					
Creek Heelsplitter	<i>Lasmigona compressa</i>			ET			
Washboard	<i>Megalonaias nervosa</i>		T				
Bullhead (Sheepnose)	<i>Plethobasus cyphus</i>	E	E		ET	E	
Clubshell	<i>Pleurobema clava</i>				E		E
Round Pigtoe (Curtis Pigtoe)	<i>Pleurobema coccineum</i>		T	ET			
Fat Pocketbook	<i>Potamilus capax</i>					E	E
Kidneyshell	<i>Ptychobranhus fasciolaris</i>				E		
Rabbitsfoot	<i>Quadrula cylindrica</i>				E		
Winged Mapleleaf	<i>Quadrula fragosa</i>	E	E			E	E
Monkeyface	<i>Quadrula metanevra</i>	T	T				
Wartyback	<i>Quadrula nodulata</i>	T	E				
Salamander Mussel	<i>Simpsonaias ambigua</i>	T	T				
Strange Floater	<i>Strophitus undulatus</i>			ET			
Buckhorn (Pistolgrip)	<i>Tritogonia verrucosa</i>	T	T	ET			
Ellipse	<i>Venustaconcha ellipsiformis ellipsiformis</i>	T	T	ET			
Rainbow Shell	<i>Villosa iris</i>	E			ET		

E = Endangered

T = Threatened

EX = Extirpated from that state

ET = Reference did not differentiate between endangered or threatened



External Anatomy of a Freshwater Mussel

## Red River of The North Mussel Guide

Scientific Name	Common Name	Beak Sculpture	Color	Shape	Misc	Similar Species	Hosts
<i>Lampsilis siliquoidea</i>	fat mucket	Multiple fine wavy lines	Yellow to brown, often with fine green rays	Elongate	Sexually dimorphic	<i>L. cardium</i> <i>P. grandis</i>	Bass, sunfish generalist
<i>Lampsilis cardium</i>	plain pocketbook	Three/six course wavy ridges, sometimes closely spaced	Yellow, turning darker with age, frequently with green rays	Oval to round, inflated	Sexually dimorphic	<i>L. siliquoidea</i>	Bass, Walleye, & possibly other fish predators
<i>Strophitus undulatus</i>	creeper	Two/three small course concentric ridges	Brown to black, with green posterior rays in younger individuals	Oval to elongate	Stout shell	<i>P. grandis</i> <i>A. ferussacianus</i> <i>L. siliquoidea</i>	Generalist (numerous sp.)
<i>Pyganodon grandis</i>	giant floater	Two/three nodulous double loops	Tan, brown, or olive	Oval to elongate, often inflated	Shell thin but stout	<i>P. lacustris</i> <i>S. undulatus</i> <i>L. siliquoidea</i> <i>A. ferussacianus</i>	Generalist (numerous sp.)
<i>Pyganodon lacustris</i>	lake floater	Unequal double looped lines, variable	Light yellow to light brown, pale, or greenish, shiny	Similar to <i>P. grandis</i> but anterior end more round and without a keel	Shell fragile and flexible	<i>P. grandis</i> <i>A. ferussacianus</i>	Generalist (numerous sp.)
<i>Anodontoides ferussacianus</i>	cylindrical papershell	Two/three very small concentric ridges	Light tan to brown	Oval when young becoming elongate with age	Thin shell	<i>P. grandis</i> <i>S. undulatus</i> <i>P. lacustris</i>	Generalist (numerous sp.)
<i>Lasmigona compressa</i>	creek heelsplitter	Double loops progressing into interrupted wavy lines	Light brown, green rays in younger shell	Elongate, posterior end has notable double angle	Shell laterally compressed, broad posterior ridge	<i>L. siliquoidea</i> <i>L. complanata</i> <i>L. costata</i>	Generalist (numerous sp.)
<i>Lasmigona costata</i>	fluted shell	Two/three very course and widely spaced ridges, slightly draw up in middle	Light brown, light green rays when young	Elongate	Flutings on posterior slope, Periostracum cloth like	<i>L. compressa</i> <i>L. complanata</i>	Generalist (numerous sp.)

Scientific Name	Common Name	Beak Sculpture	Color	Shape	Misc	Similar Species	Hosts
<i>Lasmigona complanata</i>	white heelsplitter	Course double loops	Tan or light brown when young becoming dark brown/black with age	Rounded when young becoming elongate with age, winged, compressed, posterior end often with double angle	Faint flutings (low ridges) on wing	<i>P.alatus</i>	Generalist (numerous sp.)
<i>Potamilus alatus</i>	pink heelsplitter	Minute inverted V shaped lines, usually indiscernible	Brown or greenish with green rays when young, becoming dark brown/black with age	Rounded or oval with a prominent wing	Sexually dimorphic	<i>L.complanata</i>	Freshwater Drum (sheephead)
<i>Ligumia recta</i>	black sandshell	Minute inverted V shaped lines, usually indiscernible	Black to greenish, shiny, dark green rays in younger individuals	Elongate	Sexually dimorphic	NONE	Walleye
<i>Fusconaia flava</i>	Wabash pigtoe	One/two very small concentric ridges	Light to dark brown	Triangular	Shell thick, periostracum cloth like	NONE	Minnow Generalist
<i>Amblema plicata</i>	threeridge	One/two very small concentric ridges	Olive when young becoming brown/black	Rounded when young, becoming oval with age	Heavy, thick shell, multiple undulating ridges on posterior 2/3 of shell	NONE	Generalist (numerous sp.)
<i>Quadrula quadrula</i>	mapleleaf	Small pustules	Light to Dark brown, green rays in younger individuals	Rounded, truncate posterior	Shell thick, pustules on posterior 2/3 of shell with a distinct central furrow (sulcus)	NONE	Channel Catfish, possibly bullhead catfish

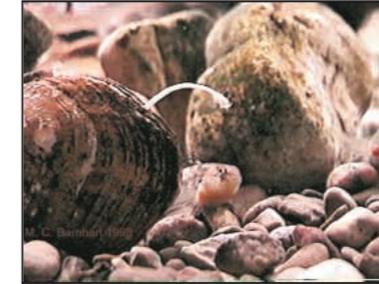
## Species to watch for

Scientific Name	Common Name	Beak Sculpture	Color	Shape	Misc	Similar Species	Hosts
<i>Utterbackia imbecillis</i>	Paper pondshell	Very weak double loops	Light brown or greenish	Elongate, hinge line straight, umbos not elevated above hinge line	Shell thin, very compressed laterally in first growing season, then becoming inflated	<i>P.grandis</i> <i>A.ferussacianus</i> <i>S.undulatus</i> <i>P.lacustris</i>	Generalist (numerous sp.) & Facultative (no host needed)

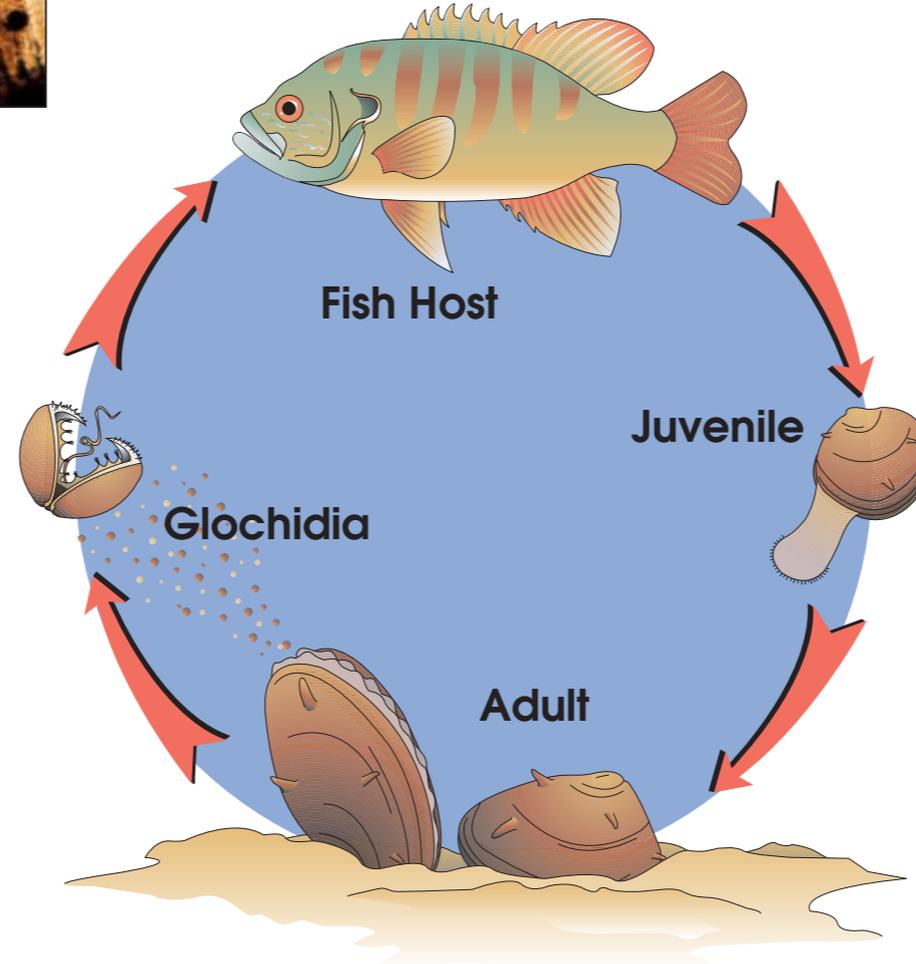


# Life Cycle of a Freshwater Mussel

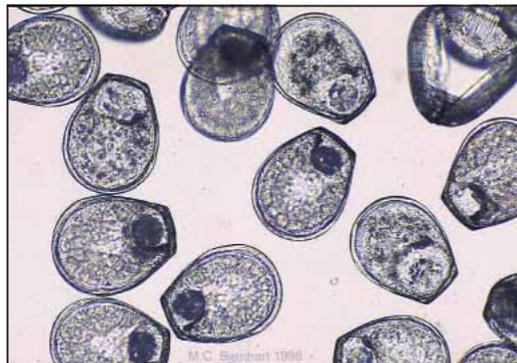
The glochidia of freshwater mussels are parasitic and must attach to the gills or fins of a suitable host fish. Glochidia usually die within a couple of days after release from the female's gills if they don't attach to the right host fish. Some female mussels use specialized behaviors and structures such as conglutinates (packet of glochidia) in an attempt to release their glochidia directly onto fishes.



The fertilized eggs develop into larvae called glochidia, which resemble pac-man. The glochidia are microscopic in size and are held in the female's gills for future release into the water column. Females with mature glochidia are noted as gravid and can usually be identified by an inflation or color change of the gills.



4). If a glochidium attaches to the proper host fish, it will remain on the fish for a couple weeks to a few months while it transforms into a juvenile mussel. Once mature, the juvenile mussel will drop off the fish and settle into the substrate of the stream where it feeds and grows. If successful, the juvenile will mature into an adult and the process will repeat itself.



Each year fresh water mussels reproduce as males release sperm into the water column. As the sperm passively drift with the water currents, it may enter females as they are siphoning and fertilize her eggs.

River Watch Teacher Responses to, **“Please provide me with a one paragraph response that describes how you view River Watch as an educational tool.”**

*Educator Response #1*

River watch teaches kids how to actually apply science to learning about the natural world. You can lecture to them all year long about scientific methods and the importance of learning about the natural world and not make the educational gains that you do from one day collecting and analyzing data in the field. In addition, river watch makes it possible to turn students into contributors. These kids are actually collecting scientific data that is used to make water quality decisions. When they learn that their work matters they stop seeing science as this huge body of facts and gigantic vocab terms that they have to memorize and start seeing it as it actually is. A way of learning how the world around us works and what our place in it is.

*Educator Response #2*

I believe River Watch is an excellent educational tool that allows students an opportunity to retrieve and use data that has importance to more than just their school work. As a science major myself, witnessing the students putting together presentations on the rivers that they are studying is a valuable asset to learn and possess for when they advance onto their post-secondary education. This also allows for students to see how the materials instructed in a classroom setting have importance in the real world. I have been very impressed with the commitment and support I have received from the staff that is part of the program.

*Educator Response #3*

River Watch has been a part of our science program at Stephen-Argyle Central since 1999. We view this program as an "extra" that we offer to interested students. We do not do any of the work in class but we do you class time to go out and collect our samples. Our Forum work is all done before school.

From an educational standpoint I feel River Watch has been very beneficial to our students (and myself as a teacher). I have had great networking opportunities that have helped me as a teacher. My students have been provided with many opportunities that would not have been possible such as Forum presentations, International Water Conference presentations, real-world science in regard to important sampling and listening and learning from professionals in the areas of water. It has been a fantastic program at SAC.

*Educator Response #4*

River Watch is a great "hook" to get students involved in school. Some join for an occasional day out of class, but it soon becomes much more to them. In the field, they learn the obvious -- field science experience focused on water resources -- as well as the less obvious -- for example, to count on their teammates (and the responsibility of being counted on by them), and to make connections between their knowledge of attitudes and practices within their community and observations made on the river. The River Watch Forum (and presentations to community groups and fellow students) afford experiences in many other areas. Students work on segments of a group project during preparation for the Forum, not only completing their section but also assisting teammates when queried for

information, or volunteering information they come across that might be useful to the others. One or two students usually coordinate the project each year, gaining experience in project planning, setting deadlines, coordinating group work input, moderating group interaction and keeping members focused on the project goal. Presentation skills are learned and tested as students present to water resource professionals at the Forum, experts and community lay people at watershed board meetings, government officials at state legislative hearings, community members at school board meetings, and children during elementary school programs that the team members initiate, plan and execute. River Watch has offered my students the opportunity for real-life practice of a wide variety of lifelong skills. Several have voiced the opinion that they never would have had those opportunities without River Watch involvement. Some also had their interest in science and their confidence in their abilities in scientific areas boosted to the point of majoring in science disciplines. (A recent grad comes to mind who had complained as a sophomore about not "being good at this math and science stuff" who has gone on to major in wildlife management in college -- at UM Crookston, no less!) River Watch offers a rich palette of opportunities for all students -- it's so much more than just "going out to watch the river."

*Educator Response #5*

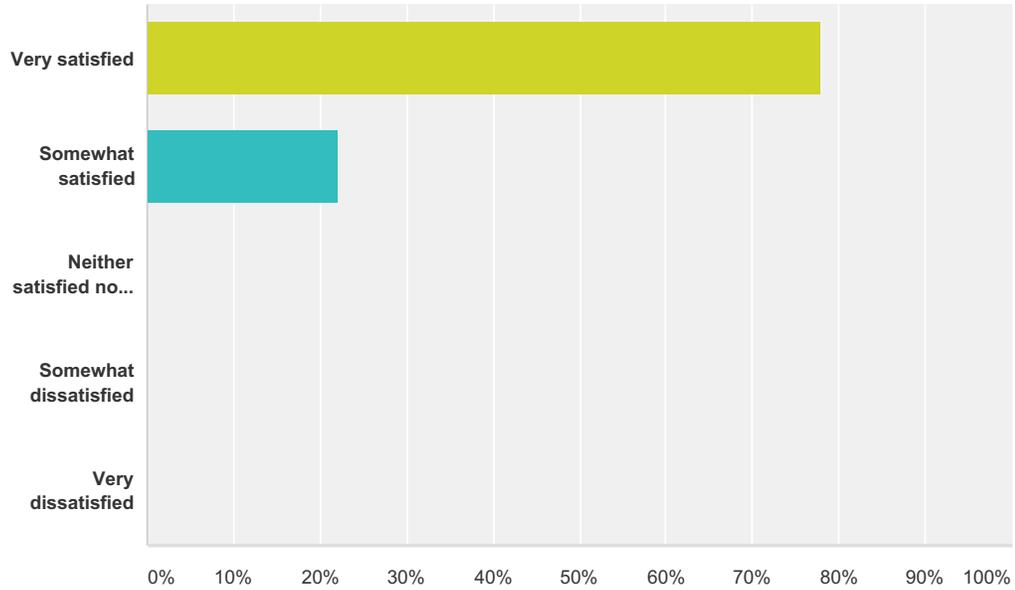
River Watch is a two part educational tool. In the fall, it is a way to get interested students out into the environment and learning about water quality and its importance. In the spring, students in my environmental science class learn about the Middle River and prepare a poster on a particular topic relating to the Middle River. Then both my environmental science class and the fall's interested students work together to complete the water quality sampling.

*Educator Response #6*

I view the RW program as opportunity for students in our school to take science in another direction other than classroom science. We do not have a science club so it helps fill that need. Students going out in the field and sampling usable data is an excellent part of it.

### Q1 Overall, how satisfied or dissatisfied are you with the River Watch program offerings?

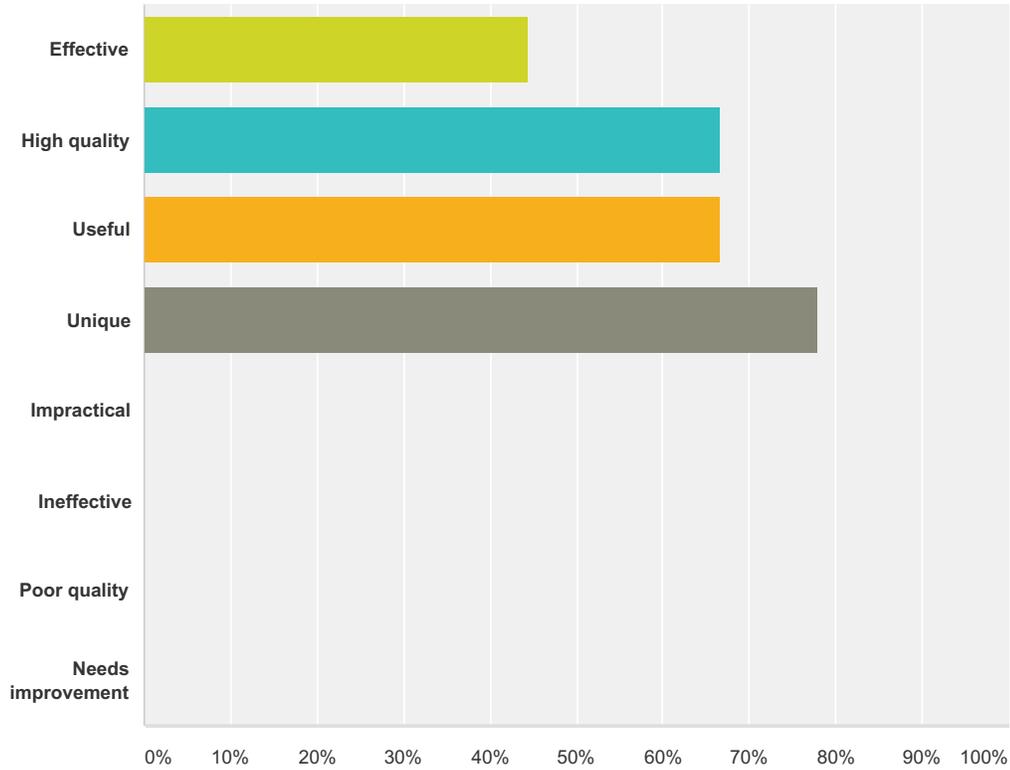
Answered: 9 Skipped: 0



Answer Choices	Responses
Very satisfied	77.78% 7
Somewhat satisfied	22.22% 2
Neither satisfied nor dissatisfied	0.00% 0
Somewhat dissatisfied	0.00% 0
Very dissatisfied	0.00% 0
<b>Total</b>	<b>9</b>

**Q2 Which of the following words would you use to describe River Watch? Select all that apply.**

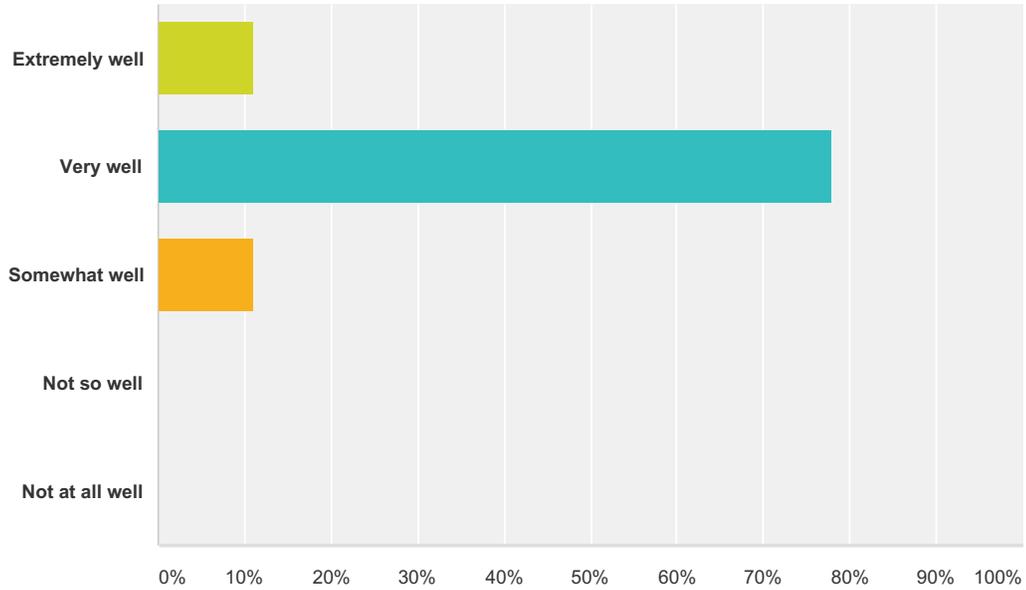
Answered: 9 Skipped: 0



Answer Choices	Responses
Effective	44.44% 4
High quality	66.67% 6
Useful	66.67% 6
Unique	77.78% 7
Impractical	0.00% 0
Ineffective	0.00% 0
Poor quality	0.00% 0
Needs improvement	0.00% 0
<b>Total Respondents: 9</b>	

### Q3 How well do the River Watch program offerings help you meet your educational needs?

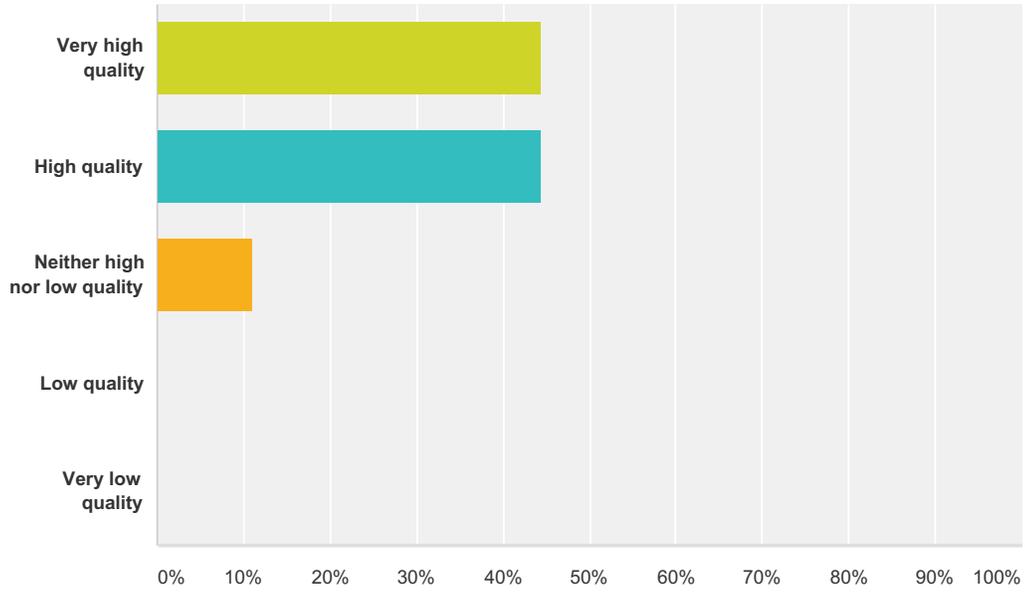
Answered: 9 Skipped: 0



Answer Choices	Responses
Extremely well	11.11% 1
Very well	77.78% 7
Somewhat well	11.11% 1
Not so well	0.00% 0
Not at all well	0.00% 0
<b>Total</b>	<b>9</b>

### Q4 How would you rate the quality of the watershed science activities that River Watch offers?

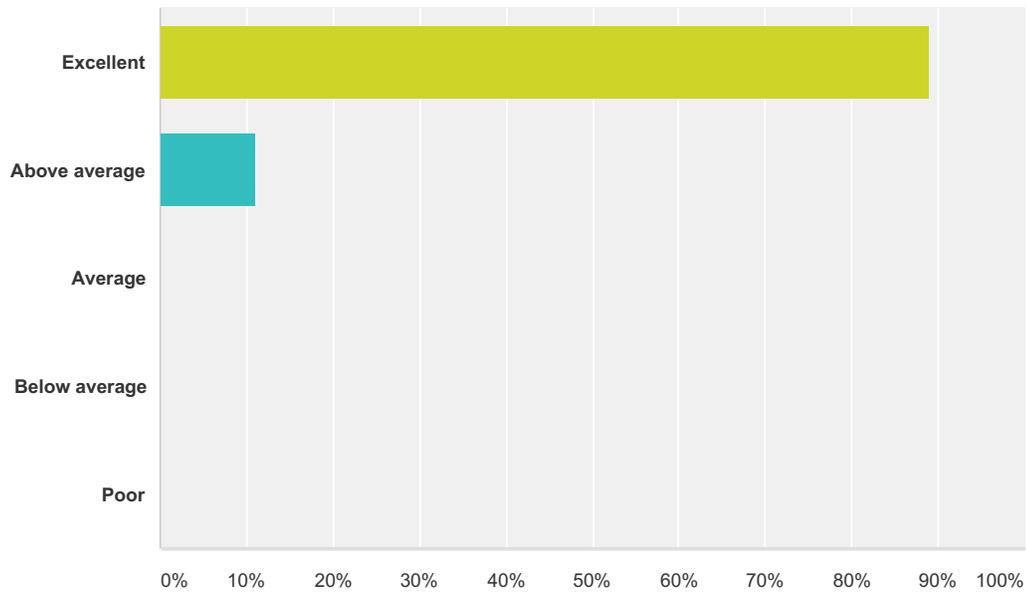
Answered: 9 Skipped: 0



Answer Choices	Responses	Count
Very high quality	44.44%	4
High quality	44.44%	4
Neither high nor low quality	11.11%	1
Low quality	0.00%	0
Very low quality	0.00%	0
<b>Total</b>		<b>9</b>

### Q5 How would you rate the staff that assist you with your River Watch activities?

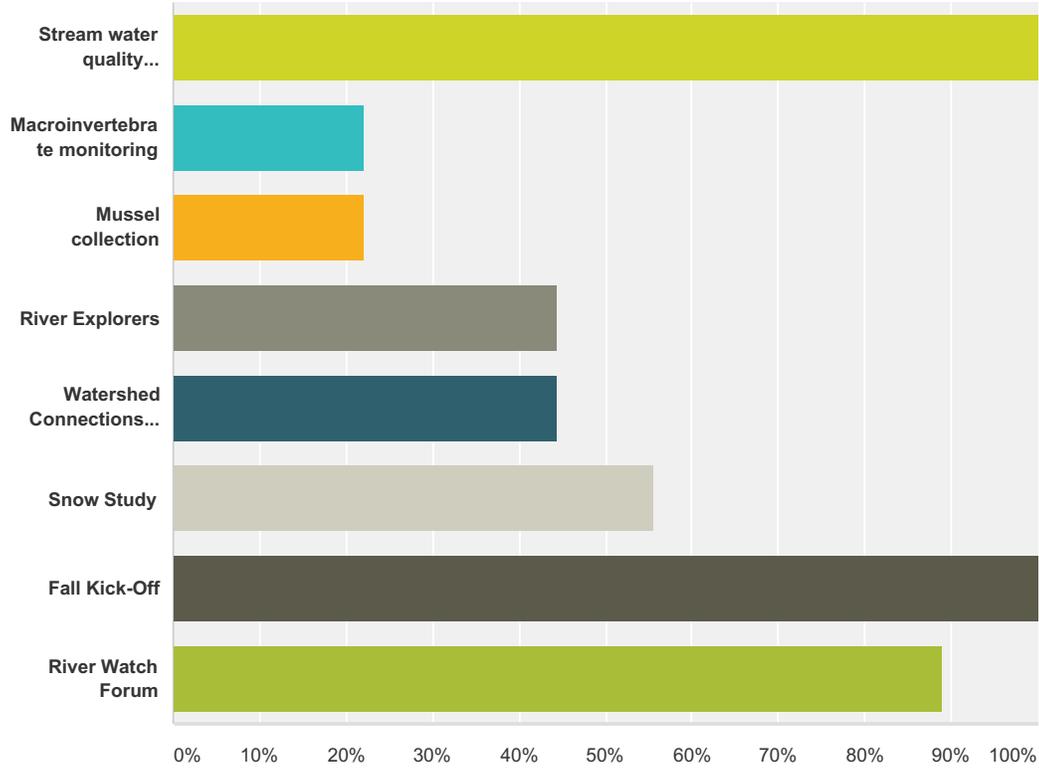
Answered: 9 Skipped: 0



Answer Choices	Responses
Excellent	88.89% 8
Above average	11.11% 1
Average	0.00% 0
Below average	0.00% 0
Poor	0.00% 0
<b>Total</b>	<b>9</b>

### Q6 Which of the following River Watch program offerings have you participated in? (check all that apply)

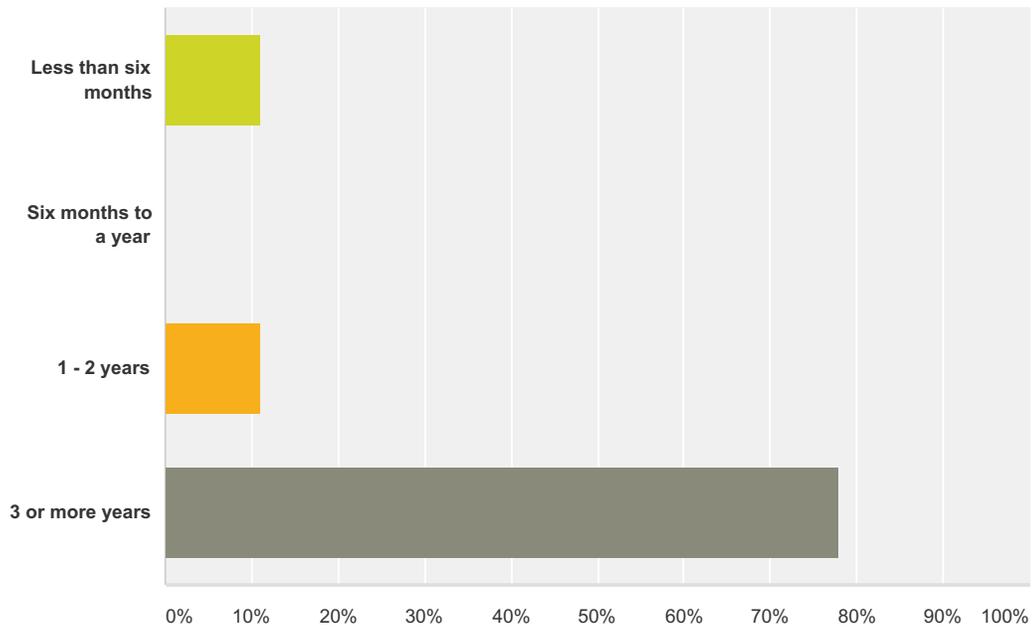
Answered: 9 Skipped: 0



Answer Choices	Responses
Stream water quality sampling	100.00% 9
Macroinvertebrate monitoring	22.22% 2
Mussel collection	22.22% 2
River Explorers	44.44% 4
Watershed Connections (stream tables, groundwater models)	44.44% 4
Snow Study	55.56% 5
Fall Kick-Off	100.00% 9
River Watch Forum	88.89% 8
<b>Total Respondents: 9</b>	

### Q7 How long have you used River Watch programs to educate students?

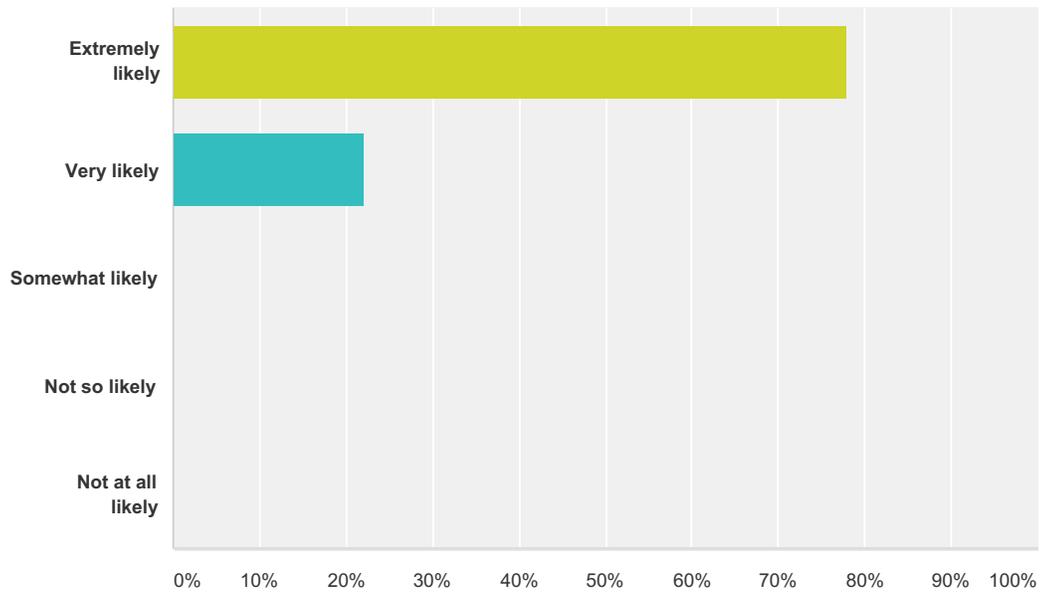
Answered: 9 Skipped: 0



Answer Choices	Responses
Less than six months	11.11% 1
Six months to a year	0.00% 0
1 - 2 years	11.11% 1
3 or more years	77.78% 7
<b>Total</b>	<b>9</b>

### Q8 How likely are you to use any of the River Watch programs again?

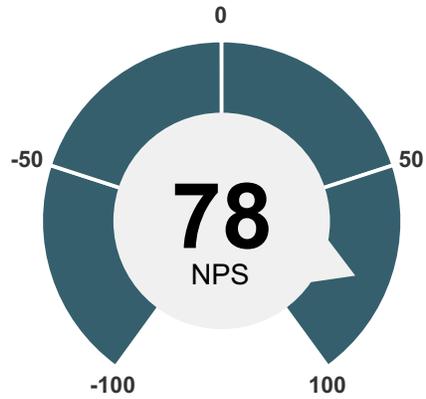
Answered: 9 Skipped: 0



Answer Choices	Responses
Extremely likely	77.78% 7
Very likely	22.22% 2
Somewhat likely	0.00% 0
Not so likely	0.00% 0
Not at all likely	0.00% 0
<b>Total</b>	<b>9</b>

### Q9 How likely is it that you would recommend River Watch to a friend or colleague?

Answered: 9 Skipped: 0



Detractors (0-6)	Passives (7-8)	Promoters (9-10)	Net Promoter® Score
0 0	22% 2	78% 7	78

**Q10 Do you have any other comments, questions, or concerns?**

Answered: 6 Skipped: 3