# Manoomin Mystery

*Where it was, where it is today, and how we can ensure it will be here in the future.*

## Overview:

Students will analyze the effects of predators, sulfate levels, and neglectful human practices on manoomin (Ojibwemowin language for "wild rice"). Students will learn about the life cycle of manoomin and traditional harvest methods. They will observe change over time in the St. Louis River Estuary by comparing a satellite image of the St. Louis River Estuary with a historical hand drawn map of the same area to see where wild rice has historically been found. Finally, they will be presented with real life scientific data affecting manoomin growth today. Students will apply reading, writing, group work, and inquiry-based scientific methods to solve the mysteries presented to them.

***Grade Level:*** 3-5, 6-8, 9-12. As written, this lesson is appropriate for fourth grade students with suggestions for adaptation for various learners.

**Subject(s):** Science, Social Science/History, Language Arts, Math

**Topic(s):** Water, STEM, Plants, Human Culture, Animals

**Great Lakes Literacy Principles (http://greatlakesliteracy.net/):**

- Natural forces formed the Great Lakes; the lakes continue to shape the features of their watershed.
- The Great Lakes influence local and regional weather and climate.
- Water makes Earth habitable; fresh water sustains life on land.
- The Great Lakes support a broad diversity of life and ecosystems.
- The Great Lakes and humans in their watersheds are inextricably interconnected.
- Much remains to be learned about the Great Lakes.
- The Great Lakes are socially, economically, and environmentally significant to the region, the nation, and the planet.

## Table of Contents



What do I already know about the learners themselves, what they have done before, what they will do after, and where they are located?

## Materials:

- 1 kit box
- 1 lesson plan
- 2 Cedar Rice knockers
- 1 Bag of Unprocessed Wild Rice
- 1 Example of a Minnesota DNR Rice Harvesting Permit
- 2 Jars of processed Manoomin (Hand Harvested & Paddy Farmed)
- 3 Laminated stalks of Wild Rice from Kilner Bay, Pokegama Bay, and Landslide Bay
- 4 Envelopes titled "The Mystery of Wild Rice in Kilner Bay"
  Containing 4 animal suspect cards and a scanned image of wild rice with "Predator Damage"
- 4 Envelopes titled "The Mystery of Wild Rice in Pokegama Bay"
  Containing 4 human suspects and a scanned image of wild rice with "Boat Damage"
  Each envelope contains:
  - Overview of the scientific problem to be solved.
  - 3 yellow suspects and a scanned image of the wild rice.
  - 1 red conclusion card
- 5 Pieces of additional wild rice literature
  - Mazina'igan article
  - *Wild Rice Ecology, Harvest, Management*
  - *The Good Berry*
  - *The Right to Hunt and Gather Therein – Understanding Chippewa Treaty Rights*
  - *Real Wild Rice* – David Martinson
- 3 Different posters
  - 7 Laminated Posters - *How Wild Rice Lives Posters*
  - 2 Posters - *How Wild Rice Lives (*with information about the impacts)
  - The Ways Map *of Treaties and Tribal Lands* of Wisconsin
- 5 Different photographs of Wild Rice
  - 2 Different laminated pictures of Wild Rice in the floating leaf stage
  - 2 Laminated large photographs of Wild Rice
  - 1 Photograph of Mannomin that was seeded into the St. Louis River Estuary
- 4 Different maps
  - 3 Historic maps of the St. Louis River Estuary
    - 1 Historic Map of Allouez Bay in the St. Louis River Estuary
  - 3 Satellite Maps of the St. Louis River Estuary
- WR Detectives Graphic Organizer

### Not Included:

- Packets for Wild Rice Journaling
- Dry Erase Markers

### Additional Resources for lesson extension:

- 4 Envelopes titled "A Water Chemistry Mystery." containing "Wild Rice and Sulfate"

## Preparation ahead of teaching

1. Take time to read through *The Right to Hunt and Gather Therein – Understanding Chippewa Treaty Rights.* You do not need to teach all the history of Chippewa Treaty Rights, however, it is helpful to know what ceded territories mean and the rights of settler folk on territories ceded by Indigenous peoples.
2. If you would like to collect student work, make copies of the graphic organizer one per student.
3. At the front of the room lay out what you will need for the Manoomin Observations and Memories, so it is readily accessible in the order needed.
4. If teaching indoors, students will be working in groups of 2-4 for most of the lesson. Group tables/desks together for ease of passing out "Wild Rice Mystery Envelopes" when students arrive making sure they don't open them.
5. Create groups of students to work together on the mystery.
6. Creating an additional writing sheet may help them finalize their evidence into a written paragraph. A lesson plan to support the teaching of a written extension is included in the kit.

What do I already know about the learners themselves, what they have done before, what they will do after, and where they are located?

# Lesson plan

## Manoomin Observations & Memories: Invitation (10 min.)

1. Whole group. Pass out parched manoomin and invite students to pay attention to what they notice about it. Have a few students share observations out loud. AFTER they have shared observations, share that they have been observing wild rice (manoomin in Ojibwemowin, and Psiŋ in Dakota).
2. In groups of 2-4 have students write a list of what they know about wild rice and how they have experienced it. Student answers may vary but could include having eaten wild rice before, it grows in water, it is dark, it is a food traditionally important to Ojibwe peoples.
3. Looking at the manoomin in your hand OR at the pictures of the laminated wild rice, have students made observations about what they notice about the wild rice plant. What do you notice about the plant that could help it to grow in water?
4. Invite students to point to where they think freshwater is outside. Anticipate pointing in many directions! Ask: *What are you pointing to? Why do you think it's that way?* Students may be pointing to a puddle, creek, Lake Superior, the St. Louis River, or other water they know. Connect water locations to the importance of water to wild rice since it grows on the water. Wild rice grows best in shallow water (1-3 feet) where the bottom is soft and not rocky. *Which water locations students pointed out may be good for wild rice?*
5. Pass out the St. Louis River Freshwater Estuary satellite maps. Connect the map to water they may have pointed to or discussed above. Invite students to try to find their current location on the map to orient themselves. Wild rice likes the bottom and water depth condition in lots of places in the estuary.

## What could be happening to the wild rice? Exploration (10-15 min.)

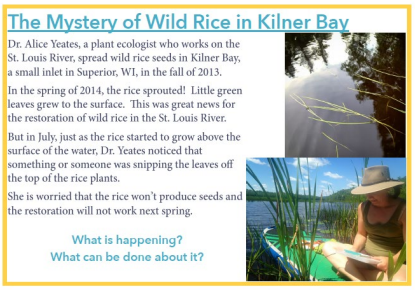
1. The wild rice mysteries are all about detecting what has changed in the estuary and WHY. Who or what did it?
2. First let's look for evidence of change overall. Give students a copy of each map (satellite image of the estuary and hand-drawn map). First have students "line up" the maps to orient them the same way and to identify that they are both maps of the same area. Then, ask them to compare the two to see what changes have occurred in the St. Louis River Estuary from 1824 to today. *NOTE: The fine print under the title on the 1824 Bayfield map says, "wild rice and rushes line the banks of the river." The shading in horizontal lines on this map indicates thick areas of plants in the estuary. No rice is visible on the satellite image. Wild rice used to line the entire St. Louis River estuary. Today it can mainly be found in Pokegama Bay.*
    a. What's different between the two maps? What has changed?
    b. Why might these changes have happened?
    c. In what ways do you think this has impacted wildlife?
    d. Where do you think the wild rice *could be* on either of these maps?
3. Wild rice is one thing that has changed in the estuary. You've seen manoomin grains earlier in the mystery. *Have you ever seen the whole plant that the rice grows from?* Show the laminated rice plants so students can observe that the plant looks like a tall grass, with roots under water.
4. *Today you will be working to solve the mysteries of why the manoomin, or wild rice, is disappearing.*

# Mystery work (45 - 55 min. total)

## Setting the Stage— (7 min)

### Small Group Work: Situation Cards and Predictions

1. Each small group gets ONE mystery. Pass out one of the two "Wild Rice Mystery" envelopes to each of the group as well as the Wild Ride Detective graphic organizer.
2. Be sure to encourage students to look at the picture of the wild rice stand in their packet *NOTE: The Situation Cards start each mystery and are shown here:*


The Mystery of Wild Rice in Kilner Bay

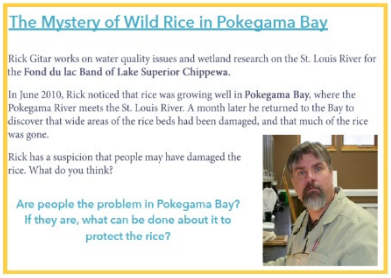
Dr. Alice Yeates, a plant ecologist who works on the St. Louis River, spread wild rice seeds in Kilner Bay, a small inlet in Superior, WI, in the fall of 2013.

In the spring of 2014, the rice sprouted! Little green leaves grew to the surface. This was great news for the restoration of wild rice in the St. Louis River.

But in July, just as the rice started to grow above the surface of the water, Dr. Yeates noticed that something or someone was snipping the leaves off the top of the rice plants.

She is worried that the rice won't produce seeds and the restoration will not work next spring.

What is happening?
What can be done about it?

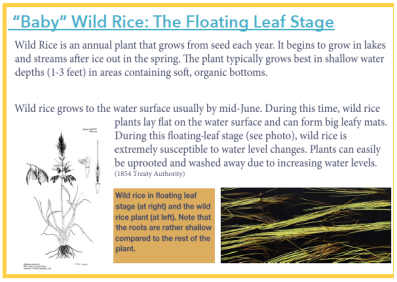

The Mystery of Wild Rice in Pokegama Bay

Rick Gitar works on water quality issues and wetland research on the St. Louis River for the **Fond du lac Band of Lake Superior Chippewa.**

In June 2010, Rick noticed that rice was growing well in **Pokegama Bay**, where the Pokegama River meets the St. Louis River. A month later he returned to the Bay to discover that wide areas of the rice beds had been damaged, and that much of the rice was gone.

Rick has a suspicion that people may have damaged the rice. What do you think?

Are people the problem in Pokegama Bay?
If they are, what can be done about it to protect the rice?


"Baby" Wild Rice: The Floating Leaf Stage

Wild Rice is an annual plant that grows from seed each year. It begins to grow in lakes and streams after ice out in the spring. The plant typically grows best in shallow water depths (1-3 feet) in areas containing soft, organic bottoms.

Wild rice grows to the water surface usually by mid-June. During this time, wild rice plants lay flat on the water surface and can form big leafy mats. During this floating-leaf stage (see photo), wild rice is extremely susceptible to water level changes. Plants can easily be uprooted and washed away due to increasing water levels. (1854 Treaty Authority)

Wild rice in floating leaf stage (at right) and the wild rice plant (at left). Note that the roots are rather shallow compared to the rest of the plant.

3. Explain the use of the graphic organizer: to understand the mystery and gather evidence (clues) about each of the suspects.

4. Each group will start by reading the situation cards in each of their envelopes and completing the top half of the first page of the graphic organizer "Setting the Stage"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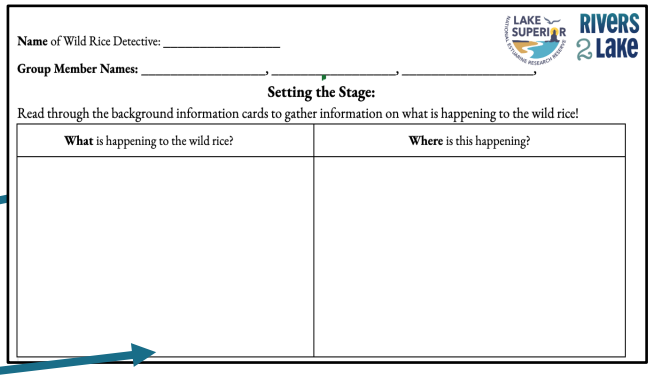
1


**Name** of Wild Rice Detective: _____

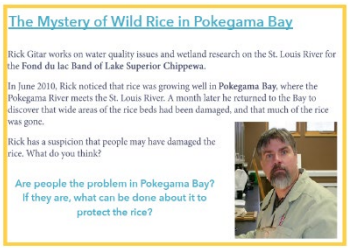
LAKE SUPERIOR RIVERS 2 LAKE

**Group Member Names:** _____, _____, _____

**Setting the Stage:**

Read through the background information cards to gather information on what is happening to the wild rice!

| **What** is happening to the wild rice? | **Where** is this happening? |
|---|---|
| | |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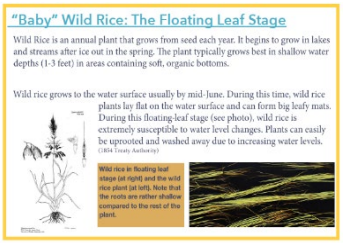
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Wild rice in floating leaf stage (at right) and the wild rice plant (at left). Note that the roots are rather shallow compared to the rest of the plant.

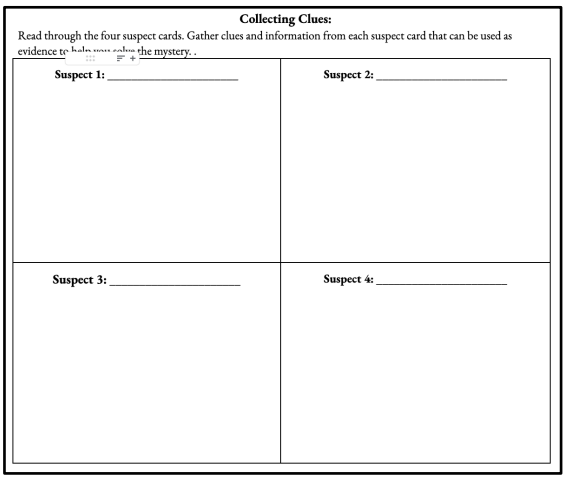
### Whole Class: Sharing the Situations

*What are we thinking so far?* Have groups share out to the class some of their predictions for the loss of wild rice in the estuary and write their predictions on the board. (You can use this to formatively assess whole groups' thinking.) This could be done as a whole class where some groups are sharing predictions from *#1 The Mystery of Wild Rice in Kilner Bay* and some are sharing predictions from *#2 The Mystery of Wild Rice in Pokegama Bay*. Or it could be done in two smaller groups where students are only hearing predictions from small groups working on the same mystery.

## Collecting Clues or Evidence (15-20 min):

### Small Group Work: Read about suspects and note clues or evidence

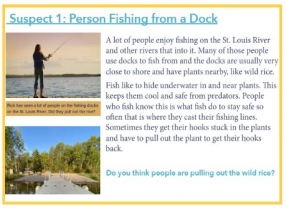
1. Students take turns reading one of the suspect cards out loud while other students in the group write down evidence and clues on their own graphic organizer that might be important to solving the mystery.
    a. "The Mystery of Wild Rice in Pokegama Bay" begins with Person Fishing from Shore
    b. " The Mystery of Wild Rice in Kilner Bay" begins with Common Merganser



**Collecting Clues:**

Read through the four suspect cards. Gather clues and information from each suspect card that can be used as evidence to help you solve the mystery. .

| | |
|---|---|
| **Suspect 1:** _____ | **Suspect 2:** _____ |
| **Suspect 3:** _____ | **Suspect 4:** _____ |

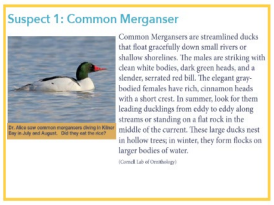


Suspect 1: Person Fishing from a Dock

A lot of people enjoy fishing on the St. Louis River and other rivers that into it. Many of those people use docks to fish from and the docks are usually very close to shore and have plants nearby, like wild rice.

Fish like to hide underwater in and near plants. This keeps them cool and safe from predators. People who fish know this is what fish do to stay safe so often that is where they cast their fishing lines. Sometimes they get their hooks stuck in the plants and have to pull out the plant to get their hooks back.

Do you think people are pulling out the wild rice?



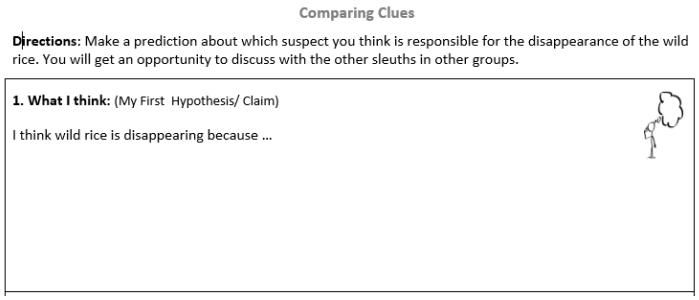
Suspect 1: Common Merganser

Common Mergansers are streamlined ducks that float gracefully down small rivers or shallow shorelines. The males are striking with clean white bodies, dark green heads, and a slender, serrated red bill. The elegant gray-bodied females have rich, cinnamon heads with a short crest. In summer, look for them leading ducklings from eddy to eddy along streams or standing on a flat rock in the middle of the current. These large ducks nest in hollow trees; in winter, they form flocks on larger bodies of water.

(Cornell Lab of Ornithology)

## Comparing Clues: (10 min)

After the groups have read through the 4 suspect cards, have students respond with a hypothesis for what is happening to the wild rice in the "What I Think" box shown to the right.



**Comparing Clues**

**Directions**: Make a prediction about which suspect you think is responsible for the disappearance of the wild rice. You will get an opportunity to discuss with the other sleuths in other groups.

**1. What I think:** (My First Hypothesis/ Claim)

I think wild rice is disappearing because ...

### Whole Class: Suspects and Ideas So Far

1. Have groups share out to the class some of their predictions for the changes to wild rice in the estuary and write their predictions on the board.

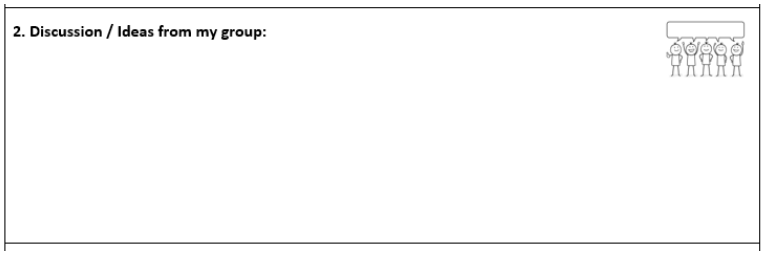
    *NOTE: Use this section of the lesson to formatively assess the whole groups' thinking. It also helps students keep track of what they're thinking and why. Depending on responses and understanding so far, the educator can provide feedback to assist reflection.*

    *Suggested methods of whole class or large group prediction sharing include:*
    - *Partner pair share with other students in other groups that worked on the same mystery.*
    - *A four corners activity where students physically go to a corner (or any classroom location) that represents their suspect. Once there, students share evidence that supports their claim with the other students who chose that location/suspect.*
    - *Group silent brainstorm. Prep Two large sheets, one for each mystery, divided into quadrants labeled with each suspect. Students can write down evidence or counter evidence they found on sticky notes and can add their sticky to the class silent brainstorm*

Students can then go read the evidence and counterevidence posted by other students working on the same mystery.

- *Consider how to record and organize student thoughts as they hear from classmates who had the same AND a different mystery. Or if it works, consider students actively listening to predictions from people who had the same mystery as them.*

2. While students are sharing in their groups, have them write down the thoughts, questions, or ideas that they hear or think of during their small group discussion in the "Discussion/Ideas from my group box" shown here.




## Reflecting on our thinking: (5 mins)

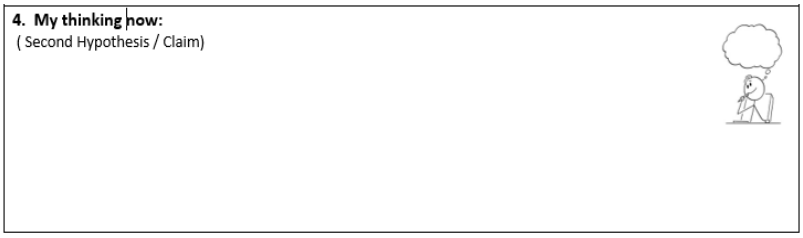
1. Detectives need to be confident when working to solve mysteries and this often means revisiting the suspects, situation cards, and wild rice images, to evaluate the evidence that was initially collected.

2. After students have shared in their groups and *listened* to ideas from classmates, have them write new questions they may have about suspects. These new questions can help them think about information that may be missing or gather new information they may have missed. Did they hear something they didn't consider? What about even more evidence that connects to their own prediction? Students will write these in box 3 "Question I still have" shown here:

3. Have students reread the suspect cards individually to try and find evidence that could answer the new questions they wrote down in box 3.


- *NOTE: To scaffold this activity further you can have your students look for counter evidence that might help them rule out a suspect.*
- *Additionally you can foster research skills by asking your students to share out any questions they still have and discussing where they might go to find answers for those questions. For example: In "Mystery of Wild Rice in Kilner Bay" the clues do not specify what commen mergansers eat. Finding outside information may support students in gathering evidence or counterevidence to support their thinking.*

4. "My thinking now": When detectives solve mysteries sometimes their thinking may change. Give your students an opportunity to talk to members in different groups (working on the same mystery) to share evidence and explain their thinking.

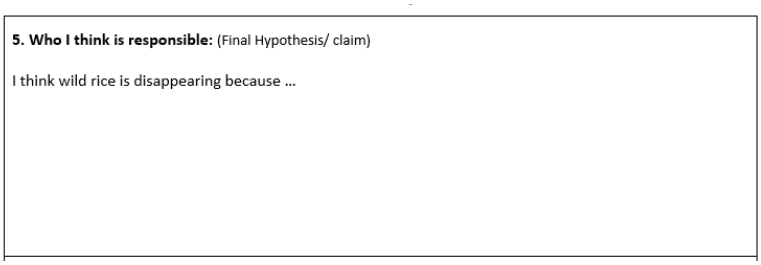



- Once they have shared with others outside of their group and have had more time to think through the situation, they will construct a second hypothesis / claim.
- Students will write their second claim/hypothesis in box 4 shown here, "My thinking now."
- *NOTE: It can be important to remind students that changing their hypothesis isn't required and doesn't mean that their initial hypothesis was incorrect. It is important to think through options that challenge our original thinking*.

## Revisit Suspects: (5- 10 mins)

### Small Group OR Individually: Making a claim to solve the mystery.

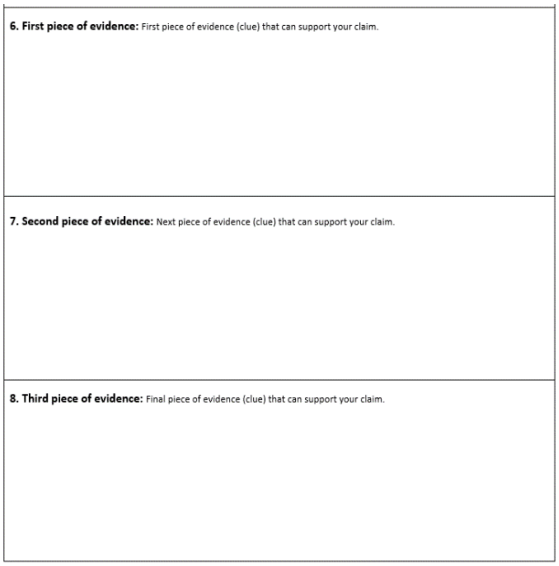
5. Students will apply their understanding of the information from the suspect cards to state a claim about what they believe is happening to the wild rice to write a final hypothesis / claim for which suspect they believe to be responsible for the disappearance of the wild rice.
    - Encourage students to go back to the situation card(s) and images of the rice to remember the story...does your hypothesis still match with the situation and clues?




    - Be sure to encourage students to revisit the image of the wild rice. They might be able to gather more information by looking at where the wild rice plant is damaged.

6. Then students will support their claim about the suspect they chose using evidence that they collected from the first page of the graphic organizer "Collecting Clues"
    - Make sure to tell your students that they need to not only state the evidence in each box but also explain how that evidence supports their claim about the suspect they chose.
    - They will be stating and explaining three different pieces of evidence.

    After students have written out their three pieces of evidence, they should have completed boxes 6-8 shown here.




Bruce Savage
(Anishnaabe from Fond du Lac)
knocking rice into a canoe.
Photo courtesy of Dan Cornelius

## Wrap-Up and Next Steps (25-70 min)

All parts of the wrap-up are important to include in some form. The time variation allows for student reading or work time as part of the concluding steps of the mystery.

### Sharing student solutions (10 mins.)

1. It may be exciting for your students to share their detective work and solutions with other students in the class that completed the different mystery.
2. Have each student, with their graphic organizer, match up to another student from the opposite mystery group so that they can explain the mystery that they solved here on the St Louis River.
3. Each pattern pair will have 3-5 minutes to share about their mystery.
4. Students may find it easier to share by talking through the steps that they took to solve the mystery, sharing their initial thoughts, and then how their thinking changed as they discussed and revisited clues!
5. Each partner pair will present the overview of the situation, their final hypothesis, and answer any questions their fellow detective/ scientist might have about their evidence.

## Significance of manoomin and these mysteries (10-30 mins.)

1. Prior to sharing the correct "solution" with your students, spend some time discussing the importance of maintaining the manoomin, or wild rice, stands in the St. Louis River Estuary.
2. Discuss and demonstrate the traditional harvest methods of wild rice using the images and the cedar rice knockers.
    - Harvesters usually use a non-motorized canoe with a push pole or paddles for power. Rice is collected using two stick sticks called bawa'iganaak.

      The **bawa'iganaak** made from cedar are used to pull the rice stalk towards the canoe and then tapped to cause the rice to fall into the boat.

    - Mature seeds fall into the canoe but seeds that are not ready to be harvested stay on the stalk.

    - When wild rice is harvested from the plant and not yet parched / roasted it is called **ashki-manoomin**

    - Show students wild rice, the equipment used to harvest the rice and the sample permit. Rice provided in the kit has been parched (heated over fire) but not husked. If you choose to give the students a piece of rice, they can remove the husk and eat it, even though it is uncooked.

3. This lesson kit includes reading materials on manoomin importance and harvesting including:
    - Good Berry Brochure from Great Lakes Indian Fish & Wildlife Commission (GLIFWC)
        - Describes the cultural significance of manoomin as well as differences between wild harvested and patty cultivated wild rice and the steps of harvesting, processing, parching, and winnowing wild rice.
    - Wild Rice Brochure from GLIFWC and the WI and MI DNR
        - Describes the ecological and cultural significance of manoomin as well as the life stages of wild rice plants throughout the year.
        - This brochure briefly discusses how rice is harvested and processed as well as some of the management practices that are used to restore its abundance in Minnesota and Wisconsin wetland ecosystems.
    - Mazina'igan Floating on Air and Water from GLIFWC
        - Describes the aerial methods used to monitor wild rice stands as well as efforts to reseed lake rice beds.

We suggest incorporating these resources as part of this lesson, and doing so at the end where students have the experience of the mystery in common.

4. Once your students have had an opportunity to read through additional materials on wild rice harvesting, ask them to share some connection they might have to the mystery they just completed.
    - How do the manoomin harvesting methods relate to the mysteries we just looked at?
    - Manoomin is a very nutritious and important food source for many people and a food that requires a lot of care and love to grow and harvest.
    - Have students read through the materials to learn more about the benefits that manoomin provides to the ecosystem.

### Sharing solutions & calls to action (5-30 min):

People rely on food to be able to live and survive. Manoomin has been a staple food for as long as Ojibwe people have been living here along the St. Louis River. It is important that wild rice be protected because it is a plant that not only keeps people healthy but also helps to keep waters healthy.

1. Teachers have discretion in sharing a correct "solution" or choosing to focus on the process of how students solved their mystery. The "mystery solutions and additional considerations" section describes each situation in more detail, correct aspects of each answer, and the most ecologically "correct" solution.

2. Each mystery has a call-to-action extension where students construct something that they can use to teach about their mystery and the behaviors that humans can take to help preserve the stands of wild rice in the St. Louis River Estuary.

# Mystery Solutions & Additional Considerations

The "mystery solutions and additional considerations" section describes each situation in more detail, correct aspects of each answer, and the most ecologically "correct" solution.

## #1: The Mystery of Wild Rice on Kilner Bay

Well-established rice beds can survive being eaten by various wildlife species; small, sparse beds may not. Large goose or muskrat populations may pose significant challenges to wild rice. Temporary control of these species may be beneficial. Carp can also cause problems by uprooting plants and increasing water turbidity that limits early plant development, but in this scenario, geese were tearing off the tops of the wild rice as you can tell by looking at the plant. Dr. Yeates discovered this using very complicated science – she sat on her dock and watched until she saw geese come by and eat the rice!

## #2 The Mystery of Wild Rice in Pokegama Bay

Minnesota is a national leader in numbers of recreational boaters and anglers, with approximately 863,000 registrations for recreational watercraft. Although wild rice provides habitat for spawning fish and their offspring, stands of wild rice can be very frustrating for anglers to fish. Recreational boaters

often consider wild rice to be a nuisance because it can be difficult to motor through. The strong stems of erect plants are easily tangled in propellers and may require removal by hand, often by forcibly cutting the tightly wrapped stems. As a result, wild rice plants are often removed by boaters near docks, in navigational channels, and in other high-use areas. Removal can be direct or incidental due to cutting by propellers or dislodging by excessive wave action. (Asplund 2000, Tynan 2000).

Important to note! A misconception might be that people harvesting rice might contribute to its disappearance either with boats or with the use of bawa'iganaak to harvest the rice. Remind the group that the harvesting methods don't disturb the rice since canoes can gently move through the water. Sometimes when a rice head is knocked, some of the rice kernels may fall into the water and not the boat. The fallen kernels help re-seed the rice bed. Harvesting does not typically disrupt the whole plant nor its roots.

Suggested notes on the other suspects:

- Canoeing is overall gentler than boats with motors. Canoes can float through or around rice and if they go over the rice, it can stand back up. If a paddle gets stuck in the stems, people can usually jostle the paddle out because it does not get twisted around it.
- Ore boats are far too large for the Pokegama river, and shipping lanes do not extend to the Pokegama Bay
- Fishing from shore *could* pull up some plants but would not make a whole stand disappear as quickly as Rick Gitar saw it disappear. People fishing should be careful of course, but if their line snags on a couple rice plants, they should not worry.

### Mystery Set #3: Wild Rice and Sulfate:

Although sulfate is not directly toxic to wild rice, it can be converted to sulfide which is toxic. The MPCA study and research commissioned by the Minnesota Chamber of Commerce (Fort, 2013) both show that sulfate is not directly toxic to wild rice. However, sulfate in the surface water can be converted by bacteria to sulfide in the sediment pore water of the rooting zone of the wild rice. Sulfide dissolved in the sediment pore water has the potential to affect rooted plants. The MPCA Study demonstrated that elevated sulfide concentrations are toxic to wild rice seedlings. Sulfide effects on plants are also well established in the scientific literature. Laboratory hydroponic experiment data showed deleterious effects of sulfide on seedling plant growth when sulfide exceeded the range of 150 to 300 micrograms per liter.

## Clean Up

If using the kit, clean off all laminated sheets and return all “Wild Rice Mystery” supplies to the correct envelopes, all kit supplies to the kit and the kit to the library in a prompt manner.

## Extensions:

1. Have groups compare their answers with the other groups with the same mystery. Did they come to the same conclusion? Why or why not? Have students debate until they come up with a united answer to present to the class.

2. Do small group sharing instead of large class sharing. Have students match up with the other two mystery groups and share their findings. Which of these factors do they think affects wild rice growth most? Which factors do humans have most control over?

3. Start the lesson with video clips of wild rice harvesting to pique student interest early on.
    a. https://www.youtube.com/watch?v=Zs8UyGlL3iU
    b. https://www.youtube.com/watch?v=cTuQlk9MFAM
    c. https://www.youtube.com/watch?v=bcpxRhX3WPw

# Resources:

The Great Lakes Indian Fish and Wildlife Commission (or GLIFWC) represents eleven Ojibwe tribes in Minnesota, Wisconsin, and Michigan who reserved hunting, fishing and gathering rights through treaties. They offer excellent educational materials, many of which are free. GLIFWC releases a quarterly newspaper that can be accessed on their website.
Link: https://data.glifwc.org/mazinaigan/

The Ways is a series of personal stories from Native communities around the central Great Lakes. This online resource features videos, digital media and interactive maps exploring Native culture and language. Stories featuring Lake Superior fishing and wild rice relate closely to the St. Louis River Estuary.
Link: https://pbswisconsineducation.org/story/manoomin/

# Connections to standards & guidance

## Suggested MN Science Standards:

### Grade 3:

3.1.1.2.4 - Construct reasonable explanations based on evidence collected from observations or experiments.
3.1.3.2.1 - Understand that everybody can use evidence to learn about the natural world, identify patterns in nature, and develop tools. For example: Ojibwe and Dakota knowledge and use of patterns in the stars to predict and plan.
3. 1.3.2.2 - Recognize that the practice of science and/or engineering involves many different kinds of work and engages men and women of all ages and backgrounds.

### Grade 4:

4.1.2.1.1 - Describe the positive and negative impacts that the designed world has on the natural world as more and more engineered products and services are created and used.

### Grade 5:

5.1.1.1.3- Understand that different explanations for the same observations usually lead to making more observations and trying to resolve the differences.

5.1.1.1.4 - Understand that different models can be used to represent natural phenomena and these models have limitations about what they can explain. For example: Different kinds of maps of a region provide different information about the land surface
5.1.1.2.2 - Identify and collect relevant evidence, make systematic observations and accurate measurements, and identify variables in a scientific investigation.
5.1.3.4.2 - Create and analyze different kinds of maps of the student's community and of Minnesota. For example: Weather maps, city maps, aerial photos, regional maps, or online map resources.
5.4.4.1.1 - Give examples of beneficial and harmful human interaction with natural systems. For example: Recreation, pollution, wildlife management.

### Grade 7:

7.1.1.2.3 - Generate a scientific conclusion from an investigation, clearly distinguishing between results (evidence) and conclusions (explanation).
7.1.1.2.4 - Evaluate explanations proposed by others by examining and comparing evidence, identifying faulty reasoning, and suggesting alternative explanations.
7.4.4.1. - Describe ways that human activities can change the populations and communities in an ecosystem.

### Grade 8:

8.1.3.4.1 - Use maps, satellite images and other data sets to describe patterns and make predictions about local and global systems in Earth science contexts. For example: Use data or satellite images to identify locations of earthquakes and volcanoes, ocean surface temperatures, or weather patterns.

## Environmental Scope and Sequence:

Benchmarks Addressed:

- In social and natural systems that consist of many parts, the parts usually influence one another. (3-5)
- Social and natural systems may not function as well if parts are missing, damaged, mismatched or misconnected. (3-5)
- Social and natural systems can include processes as well as things. (6-8)
- Social and natural systems are connected to each other and to other larger or smaller systems. (6-8)
- The interaction of social and natural systems can create properties that are different from either individual system. (9-12)
- Feedback of output from some parts of a managed social or natural system can be used to bring it closer to desired results. (9-12)
- It is not always possible to predict accurately the result of changing some part or connection between social and natural systems. (9-12)

## Great Lakes Literacy Principles:

- Water makes the Earth habitable; fresh water sustains life on land.
- The Great Lakes support a diversity of life and ecosystems.
- The Great Lakes and humans in their watersheds are inextricably interconnected.
- Much remains to be learned about the Great Lakes.

- For more information about the Great Lakes Literacy Principles, visit: http://greatlakesliteracy.net/

## Next Generation Science Standards:

- 3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

# References: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Tynan, T. (2002). *Testing the Effects of Motorboats on Wild Rice (Zizania palustrus var. interior*). Wild Rice Research and Management, Great Lakes FIsh and Wildlife Commission publication.129-205

*Delicious • Nutritious • Manoomin*

# MANOOMIN~WILD RICE

## *The Good Berry*

# Manoomin ~The Good Berry

## *An Historic Staple in the Ojibwe Diet*

Known as manoomin, which translates into ***'the good berry'*** in Ojibwe, wild rice has played a major role in the lives of Ojibwe people. According to Ojibwe oral tradition, centuries ago the Ojibwe were instructed to find the place where "the food grows on the water" during their long migration from the East coast. This ultimately led them to the shores of Lake Superior and the northern inland lakes of the Michigan, Wisconsin and Minnesota where flowing fields of manoomin were found in abundance.

Seen as a special gift from the Creator, manoomin became a healthy staple in the Ojibwe diet. When finished correctly, wild rice could be stored for long periods of time to be available when other foods were not. Besides being basic to the traditional diet, manoomin also developed importance culturally and spiritually and remains an important element in many feasts and ceremonies today.

*Ripening manoomin (wild rice).*

*Poling through a wild rice bed.*


*Hand-harvested, true wild rice ready for market.*

## *Low Fat, Low Calorie Nutrition*

Manoomin is an aquatic grain, or a cereal. A truly healthy natural food, uncooked wild rice contains more than 12 percent protein and is richer in protein than white rice and most other grains. Gluten free, low in fat, manoomin is also a good source of minerals, such as iron, potassium and phosphorus, as well as vitamins like thiamine, riboflavin and niacin. Wild rice contains more niacin, also known as vitamin B, than brown rice. In fact, manoomin has more overall nutrition than any other food once available to the native diet. (See nutritional information on the back of this brochure.)

## *Delicious, Unique Taste Treat*

Known for its unique nutty taste, manoomin offers a touch of excitement to menus with its unusual flavor and texture. As a dish, it can easily stand alone or be served in combination with a variety of other foods. Manoomin adds texture and piques the taste buds with its wild, nutlike flavor.

Because of its relative scarcity and the labor intensive harvesting procedures, it is more costly than white or brown rice and is frequently classified with "gourmet" food items. While somewhat expensive per pound, a little manoomin goes a long ways – tripling or quadrupling in bulk when cooked.

# Taste of the wild

## *Real Wild Rice vs. Paddy Wild Rice*

Many consumers confuse paddy-grown wild rice with the true wild rice, hand-harvested from northern lakes and rivers. Frequently, the wild rice offered for sale in local grocery stores or at roadside markets is paddy-grown rice – a different product than the true wild rice taken from naturally growing stands of manoomin. Paddy grown rice has larger, darker (almost black) kernels, takes longer to cook and lacks the distinguishing nutty flavor and fragrance found in native wild rice. Paddy rice is farmed in large rice paddies and mechanically harvested. Commercially grown, paddy wild rice comes mostly from large paddy fields in Minnesota and California.

***Paddy wild rice and true wild rice differ in flavor, color, texture, and cooking time. Paddy rice is darker in color, usually black or almost black, and requires more cooking time.***

Carefully hand-harvested, true wild rice is lighter in color, has a softer kernel and generally cooks more quickly than its paddy-grown counterpart.

## *Wild Rice Retailers and Rice Finishers*

Some of the best sources of real wild rice are small tribal retailers. Some retailers will also "finish" wild rice for private harvesters for a fee or in-kind payment. Listings of wild rice retailers and finishers are provided on an insert at the back of this brochure.

***For information about harvesting your own wild rice, contact the Great Lakes Indian Fish & Wildlife Commission (GLIFWC) or your tribal or state department of natural resources.***

| Nutrient | Units | 1.00 X 1 cup<br>164g |
|---|---|---|
| **Proximates** | | |
| Water | g | 121.25 |
| Energy | kcal | 166 |
| Energy | kj | 694 |
| Protein | g | 6.54 |
| Total lipid (fat) | g | 0.56 |
| Ash | g | 0.66 |
| Carbohydrate, by difference | g | 35.00 |
| Fiber, total dietary | g | 3.0 |
| Sugars, total | g | 1.20 |
| Sucrose | g | 0.54 |
| Glucose (dextrose) | g | 0.33 |
| Fructose | g | 0.33 |
| **Minerals** | | |
| Calcium, Ca | mg | 5 |
| Iron, Fe | mg | 0.98 |
| Magnesium, Mg | mg | 52 |
| Phosphorus, P | mg | 134 |
| Potassium, K | mg | 166 |
| Sodium, Na | mg | 5 |
| Zinc, Zn | mg | 2.20 |
| Copper, Cu | mg | 0.198 |
| Manganese, Mn | mg | 0.462 |
| Selenium, Se | mcg | 1.3 |
| **Vitamins** | | |
| Vitamin C, total ascorbic acid | mg | 0.0 |
| Thiamin | mg | 0.085 |
| Riboflavin | mg | 0.143 |
| Niacin | mg | 2.111 |
| Pantothenic acid | mg | 0.253 |
| Vitamin B-6 | mg | 0.221 |
| Folate, total | mcg | 43 |
| Folic acid | mcg | 0 |
| Folate, food | mcg | 43 |
| Folate, DFE | mcg_DFE | 43 |
| Vitamin B-12 | mcg | 0.00 |
| Vitamin B-12, added | mcg | 0.00 |
| Vitamin A, IU | IU | 5 |
| Vitamin A, RAE | mcg_RAE | 0 |
| Retinol | mcg | 0 |
| Vitamin E (alpha-tocopherol) | mg | 0.39 |
| Vitamin E, added | mg | 0.00 |
| Vitamin K (phylloquinone) | mcg | 0.8 |

## Easy to Prepare, Versatile

True wild rice does not require pre-soaking or extended cooking times like its paddy-grown counterpart. It needs to be rinsed and then cooked, normally adding about four cups water or liquid per cup of rice. Cooking until tender may take about 20 to 45 minutes, depending on the desired texture of the final product.

Wild rice can be used either as a side dish or a main course; it can be served straight or as an ingredient in many possible combinations. Meat and manoomin mixtures make delicious casseroles. It is also a tasty component in many soup recipes and can be served cold with a selection of meats, veggies and/or fruits to compose sumptuous salads. Used in breads, pancakes, muffins and popular as a dressing for the Thanksgiving turkey, leftover wild rice is rarely wasted because it's a marvelous addition with so many culinary possibilities.

*Restored rice beds on Lac Vieux Desert in Upper Michigan.*


*Unfinished wild rice is used to reseed select waters, including Lac Vieux Desert's Rice Bay.*

## Management:

While Native Americans have traditionally respected and protected the important wild rice fields in northern lakes and rivers, development following European immigration to the Great Lakes region has taken its toll on wild rice stands. Some historic rice fields no longer exist, and others are far less abundant. The valued plant has suffered from environmental changes such as water level fluctuations from dams, the use of motorized boats tearing up the fragile stalks and the introduction of exotic plants. Consequently, GLIFWC, an intertribal organization representing eleven Ojibwe bands in Michigan, Minnesota and Wisconsin, has pursued the protection and enhancement of wild rice beds since 1984. GLIFWC works with a wide coalition of other natural resource interest groups to restore historic wild rice beds, protect existing beds, and establish new rice beds. Besides being an important food source for the people, many species of wildlife, especially ducks and geese, also depend on it for food and habitat. Protection of native manoomin translates into sound habitat and watershed management.

GLIFWC performs annual surveys of important rice beds to measure abundance and provides public information on proper harvesting techniques and management practices.

# Harvesting and Processing Manoomin

Traditional methods used by the Ojibwe people to harvest manoomin are still used today. The same is true for finishing the harvested rice, although some have mechanized aspects of finishing and will even finish rice for others for a charge. (See insert card for a list of finishers.)

*The description of the traditional Ojibwe harvest of wild rice that follows is based on an account written by Lac du Flambeau high school students, Jeff Allen, Raelle Allen, Gabrielle Poupart, and Bill Eckerstorfer, regarding the gathering of manoomin.*

***Knocking rice into the bottom of a canoe.***

# Manoominike ~ Wild Ricing

Manoomin, called "wild rice" outside the Ojibwe culture, has played a central role in tribal life. It has spiritual attributes, and its discovery is recorded in legends. It is used in ceremonies and as a major food source. Traditionally, its harvest promoted social interaction in late summer each year. In August our people moved to their manoomin camps for harvest. Once manoomin ripened most energy was focused on harvesting. Manoomin was our main food source.

# Manoominikewin (Making Rice)

Harvesting wild rice is also called knocking the rice. Canoes are the best watercraft to use because their shape and smoothness causes the least harm to the rice plant. The only tools needed for harvesting manoomin are those required to move the canoe through the plants and ricing sticks to thresh the kernels into the canoe.

***Ricing sticks are made of lightweight wood, often cedar. The long poles used to propel the canoe have a forked prong to minimize damage to plant roots as the canoe is poled through wild rice beds.***

Harvesters used canoe paddles to get to the wild rice beds, but long poles were used to move through the rice beds. These traditional forked poles were used because they protected the plants' root systems. Every harvester owned a pair of ricing sticks, also called knockers. The sticks measured about three feet in length. Lightweight wood was necessary for making the knockers so the ricer's arms would not tire, and the plant would not be damaged. A very smooth and light stick, hardly noticeable in the hand, was desired.

The technique used for knocking was simple: the sticks were held in each hand, and the harvester reached to the side and pulled in as many stalks as he or she could over the edge of the canoe and knocked the kernels into the bottom of the canoe. Special care was taken to clean the canoe and wear clean clothing prior to and while harvesting manoomin. The same method and implements are used today.

***Drying rice is cleaned of stalks, leaves and insects prior to parching.***

# Drying

Freshly harvested rice must be dried almost as soon as it comes off the lake. If not, it tends to mold quickly. Rice was carried to the campsites in bark trays where it was to be spread out to dry. Freshly harvested rice continues to ripen, but must have air, sun, and sometimes heat to rid it of moisture before roasting. Rice was dried on woven mats, animal skins, layers of grass or sheets of birch bark sewn together called apakwaan. While spread out, the rice was picked over to remove

pieces of stalks, leaves, and insects. If all the rice could not be dried immediately, it was preserved in its green state by keeping it in water for up to a week. Holes were dug in the soil by lakes, and rice stored this way in earlier times.

## Parching

Parching or roasting the kernel was an important step in preserving this food for later use. This process served several functions: it reduced the amount of moisture in the grain so it could be preserved; it destroyed the germ so it would not re-sprout, and it loosened the hull from the grain. The grain can be left unparched for a while, although our ancestors preferred it parched as soon as possible after harvest.

Our ancestors originally parched rice using woven rush mats and scaffolds. A stick scaffolding that spanned the fireplace supported the mats. The rice was turned constantly until roasted brown. The mats were woven tightly, making it difficult for the rice to fall through. It is said that these mats would glow red in this process. As the kernels separate from the seed shells in parching, the grain takes on a golden, then brownish yellow hue, and then changes to a glossy, dark brown to black color.

*Parching manoomin.*

After European contact, large cast iron kettles acquired through trade were used for parching. The kettle was placed over a kindling wood fire, and the rice added to the kettle. Once over the fire, it was stirred constantly so it would not scorch. The rice would pop like popcorn if it was not stirred.

## Hulling

After parching, the manoomin was hulled to remove the tight fitting chaff from the rice kernel. The traditional method for this involved hard labor. A small pit was dug in the earth, and the manoomin was "danced" with special moccasins. An average treading pit measured about 18 inches in depth and two to three feet in diameter. The sides were lined with wooden slats, and a block of wood was placed at the bottom. In Ojibwe the pit is called a bootaagan. After European contact, wooden and then metal buckets were used in this process. The pit was lined with deer hide. The moccasins had no beadwork on them. The bottom of the moccasins could not touch the ground because they were involved in processing this food. The moccasins were knee high to protect the huller's legs from the sharp barbs that are on the hulls. Proper treading required great strength and was difficult. To assist in this process, two poles forming a V-shaped railing were erected for the huller to hold onto while he or she danced on the rice, preventing too much weight from being placed on the rice.

*Dancing parched rice to remove the kernel from the shell.*

## Winnowing

Hulled manoomin was cleaned of its chaff before being stored or cooked. Traditionally, the rice would be taken to high ground or a rock outcropping near a lake so the wind could aid in this process. For winnowing our people used a birch bark tray called nooshkaach-inaagan. The birch bark was heated, cut, folded, shaped then sewn with basswood fiber. The rim was made of ash and lashed to the edge of the tray.

A covering was placed on the ground, and the rice gently tossed in the air. With the action of the tosser and the aid of the wind, the chaff was blown away and the rice kernels fell back in the winnowing basket. This method also helped grade the rice. The chaff blew away, the broken rice fell on the covering on the ground, and the full kernels remain on the tray. Once cleaned the rice was ready for storage.

*Winnowing wild rice.*

## Nutrition Facts

Serving Size 1 cup 164g (164 g)

| Amount Per Serving | |
|---|---|
| **Calories** 166 | Calories from Fat 5 |
| | % Daily Value* |
| **Total Fat** 1g | 1% |
| Saturated Fat 0g | 0% |
| Trans Fat | |
| **Cholesterol** 0mg | 0% |
| **Sodium** 5mg | 0% |
| **Total Carbohydrate** 35g | 12% |
| Dietary Fiber 3g | 12% |
| Sugars 1g | |
| **Protein** 7g | |

| | | | |
|---|---|---|---|
| Vitamin A | 0% | • Vitamin C | 0% |
| Calcium | 0% | • Iron | 5% |

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs

©www.NutritionData.com

*For current regulations contact:*
State or tribal natural resources departments or the Great Lakes Indian Fish and Wildlife Commission

Great Lakes Indian Fish & Wildlife Commission

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# Floating on air & water

## GLIFWC duo shores up manoomin preview

By Amy Cottrell, Wetland Ecologist & Kathleen Smith, Ganawandang Manoomin

For the first time, GLIFWC's new manoomin team began navigating the waters of the Ceded Territory this summer. GLIFWC hopes to become familiar with the location and history of the waterbodies to be able to speak for the manoomin.

While visiting the manidoo gitigaan, GLIFWIC's manoomin teams observed and collected on-ground data, including the status of other mashkikiwan (medicinal plants). Studying patterns of abundance in different species can provide insight into how a community functions and the role manoomin plays in the ecosystem.

For GLIFWC, manoomin ground surveys began in mid-July and aerial surveys began first week of August. Data collected on ground includes abundance estimation, stalk density, stand height, tiller counts, water depth, sediment composition, herbivory, and brown spot presence.

From the air, they snapped photos of the entire waterbody and as well as of narrower wild rice beds. The manoomin team also collected data from Burnett, Polk, Douglas, Washburn, Vilas, Iron, and Forest counties in Wisconsin from water with cultural importance and higher priority.

*Arial photo of Minong Flowage, August 4, 2022. (AC photo)*

In general, wild rice appears to be average or below average on most waters. Some level of predation has been documented on most waters, and they observed intense browsing from waterfowl. Higher evidence of predation was seen in manoomin beds on Dilly and Allequash lakes and the Minong flowage. There have been a few exceptions to the general trend thus far including Pacwawong Lake, which contains thick, dense, tall beds of wild rice through much of the lake. New data from Island Lake also looks promising.

*The view from a canoe. GLIFWC's new manoomin team covered the Ceded Territory over land, on the water, and in the air to evaluate wild rice resources for the coming season. Little Turtle River Flowage on July 11, 2022. (A. Cottrell photo)*

Manoomin there is quite abundant, with lots of exposed seed heads, seemingly on track for a good harvest. Male flowers were seen floating on water surface, having fallen off after pollination. The beds here extend into the Manitowish River. So far, most waters are looking average from the air. None of the waters GLIFWC photographed were completely void of wild rice, but GLIFWC says that doesn't mean these waters are harvestable. With enough cloudless sunny days, surveys will continue through August. They say they need clear skies to get the migizi (eagle) point of view.

# Manoomin preview 2022

## Manoomin considerations for harvesters

Giimiigwechiwendam, (we are thankful) to all those that had previously responded and sent in their past harvester summary surveys. Harvest summary surveys are sent out after the wild rice season. Data gleaned from these are appreciated and help us better understand harvest pressure, priority waters, wild rice abundance or lack thereof, and harvester opinions. In effect these data help manoomin and allow us to better assist harvesters.

A reminder that the updated list of date-regulated waters is official under NR 19.09 (4) and is in effect for harvest season this year. Make sure to check GLIFWC's Manoomin Outlook website *data.glifwc.org/manoomin.harvest.info* prior to harvesting on date-regulated waters. Consult with your local rice chiefs for any further concerns.

Need help processing your manoomin? You can get to know other ricers and see how they process rice by building a community of knowledge. Or you can attend a manoomin camp. Over Labor Day weekend, Keweenaw Bay Indian Community (KBIC) is holding a rice camp open to everyone. It may be a bit of a trek to Baraga, Michigan but, it is one opportunity of learning from knowledge holders how to process this precious gift.

All of this work is very important to Anishinaabeg. Elders tell stories about when they were young teenagers, they would hit the rice fields to sustain their way of life. They would knock all day and come back "nut brown," they say. It was important to bring home sustenance and it was important as it was a way of making money to pay for school clothes. How some things have changed. As we continue to build our relationship with communities and with the manoomin, we will do our best to give a voice to the medicines as they cannot speak for themselves

### Manoomin knocker & push-pole workshop

**When:** August 31 & September 1 9:00 AM–5:00 PM, September 2 9:00 AM–Noon
**Where:** Ojibwa Recreation Area, Baraga, Michigan
**Registration is recommended:** *forms.gle/KZxqJxh95FH5mXvM8*
**For more information:** Erin Johnston, ***ejohnston@kbic-nsn.gov***
***Please bring your own food and water for the day***

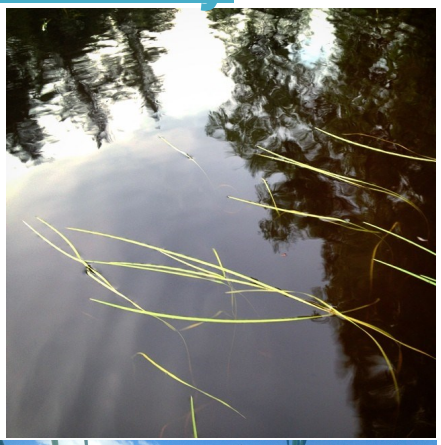
# The Mystery of Wild Rice in Kilner Bay

Dr. Alice Yeates, a plant ecologist who works on the St. Louis River, spread wild rice seeds in Kilner Bay, a small inlet in Superior, WI, in the fall of 2013.

In the spring of 2014, the rice sprouted! Little green leaves grew to the surface. This was great news for the restoration of wild rice in the St. Louis River.

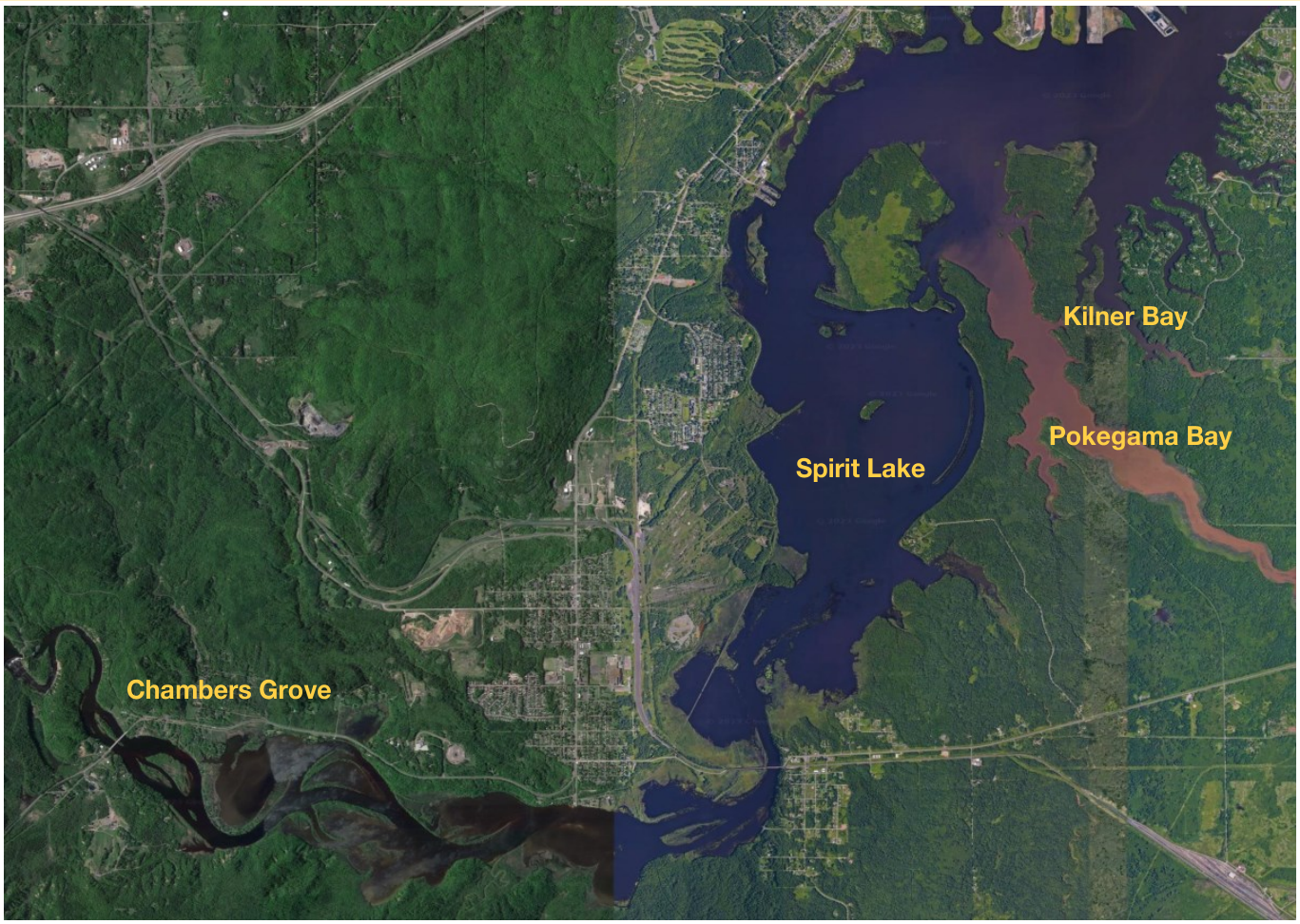
But in July, just as the rice started to grow above the surface of the water, Dr. Yeates noticed that something or someone was snipping the leaves off the top of the rice plants.

She is worried that the rice won't produce seeds and the restoration will not work next spring.



**What is happening?**
**What can be done about it?**

1




2

# Suspect 1: Common Merganser

Dr. Alice saw common mergansers diving in Kilner Bay in July and August. Did they eat the rice?

Common Mergansers are streamlined ducks that float gracefully down small rivers or shallow shorelines. The males are striking with clean white bodies, dark green heads, and a slender, serrated red bill. The elegant gray-bodied females have rich, cinnamon heads with a short crest. In summer, look for them leading ducklings from eddy to eddy along streams or standing on a flat rock in the middle of the current. These large ducks nest in hollow trees; in winter, they form flocks on larger bodies of water.

(Cornell Lab of Ornithology)



# Suspect 2: Beaver

These large rodents move with a waddle on land but are graceful in the water, where they use their large, webbed rear feet like swimming fins, and their paddle-shaped tails like rudders. These attributes allow beavers to swim at speeds of up to five miles an hour. They can remain underwater for 15 minutes without surfacing, and have a set of transparent eyelids that function much like goggles. Their fur is naturally oily and waterproof.

Beavers are among the largest of rodents. They are herbivores and prefer to eat leaves, bark, twigs, roots, and aquatic plants.

(National Geographic)

Dr. Alice heard from a homeowner near Kilner Bay that beaver had been chewing on trees in their yard. Did the beaver eat the wild rice plants

# Suspect 3: Canada Goose

Canada geese have been seen and heard in Kilner Bay. Droppings (scat) have also been found on docks. Are geese eating the rice?

A familiar and widespread goose with a black head and neck, white chinstrap, light tan to cream breast and brown back. Their numbers have increased in urban and suburban areas in recent years; they are often considered pests.

Canada geese are primarily herbivores, although they sometimes eat small insects and fish. Their diet includes green vegetation and grains. The Canada goose eats a variety of grasses when on land. It feeds by grasping a blade of grass with the bill, then tearing it with a jerk of the head. The Canada goose also eats beans and grains such as wheat, rice, and corn when they are available. In the water, it also feeds from silt at the bottom of the body of water. It also feeds on aquatic plants, such as seaweeds.

(Cornell Lab of Ornithology)



# Suspect 4: Common Carp

The common carp is a large omnivorous fish. Native to Europe and Asia, it was intentionally introduced into Midwest waters as a game fish in the 1880s. Common carp are one of the most damaging aquatic invasive species due to its severe impacts in shallow lakes and wetlands. Their feeding disrupts shallowly rooted plants, muddying the water.
(Minnesota DNR)

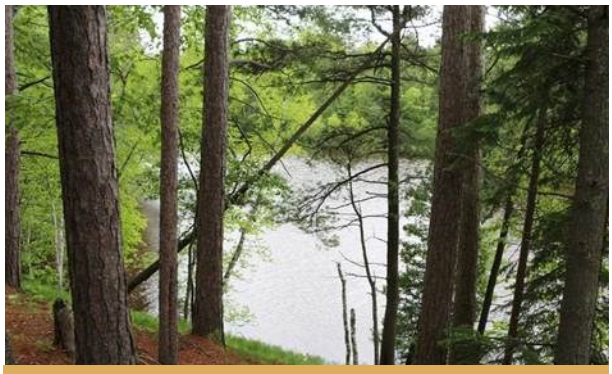
This quote is from a research paper published in 1983:

"Carp have a negative effect upon aquatic vegetation... It is generally agreed that carp destroy aquatic vegetation by uprooting plants."


Carp are known to be in the St. Louis River by people who fish and researchers who study there. Are they the problem for the rice in Kilner Bay?

# Can You Solve This Science Mystery?

1) As a group, read the Suspect cards. You may use the guidebooks to learn more about the animals that may be eating the wild rice.
2) Make a hypothesis (best guess) based on the available evidence: **Who is eating the wild rice in Kilner Bay?**
3) As a group, come up with one idea for how Dr. Alice Yeates could protect the wild rice and continue the restoration in Kilner Bay.



Kilner Bay, a great site to restore wild rice to the St. Louis River...or is it?

## Restoration is:

: the act of bringing back something that existed before

: the act or process of returning something to its original condition.

7

# The Mystery of Wild Rice in Pokegama Bay

Rick Gitar works on water quality issues and wetland research on the St. Louis River for the **Fond du lac Band of Lake Superior Chippewa.**

In June 2010, Rick noticed that rice was growing well in **Pokegama Bay**, where the Pokegama River meets the St. Louis River. A month later he returned to the Bay to discover that wide areas of the rice beds had been damaged, and that much of the rice was gone.

Rick has a suspicion that people may have damaged the rice. What do you think?

**Are people the problem in Pokegama Bay?**
**If they are, what can be done to protect the rice?**

1

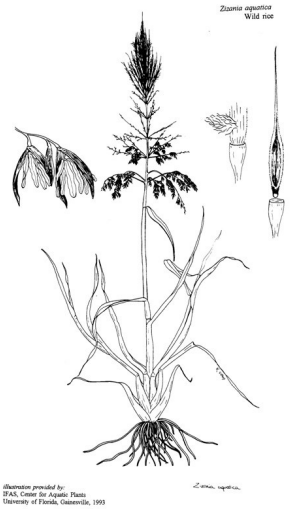

**The last large stands of wild rice in the Lower St. Louis River grow in Pokegama Bay, in the Superior Municipal Forest.**



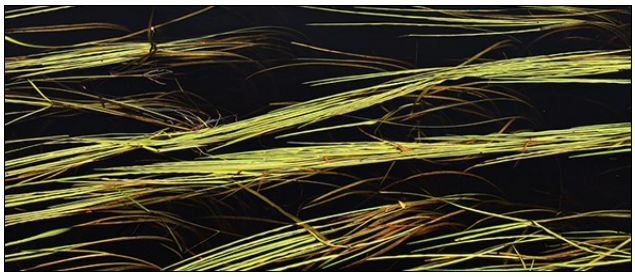
# "Baby" Wild Rice: The Floating Leaf Stage

Wild Rice is an annual plant that grows from seed each year. It begins to grow in lakes and streams after ice out in the spring. The plant typically grows best in shallow water depths (1-3 feet) in areas containing soft, organic bottoms.

Wild rice grows to the water surface usually by mid-June. During this time, wild rice plants lay flat on the water surface and can form big leafy mats. During this floating-leaf stage (see photo), wild rice is extremely susceptible to water level changes. Plants can easily be uprooted and washed away due to increasing water levels. (1854 Treaty Authority)

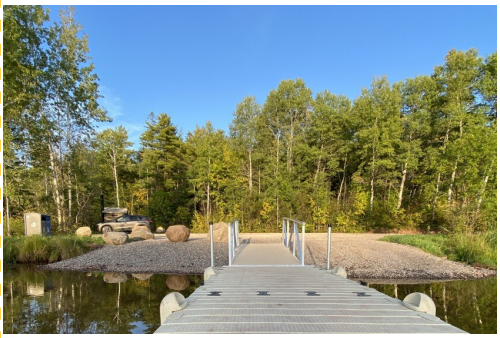



**Wild rice in floating leaf stage (at right) and the wild rice plant (at left). Note that the roots are rather shallow compared to the rest of the plant.**



# Suspect 1: Person Fishing from a Dock

Rick has seen a lot of people on the fishing docks on the St. Louis River. Did they pull out the rice?



A lot of people enjoy fishing on the St. Louis River and other rivers that flow into it. Many of those people use docks to fish from and the docks are usually very close to shore and have plants nearby, like wild rice.

Fish like to hide underwater in and near plants. This keeps them cool and safe from predators. People who fish know this is what fish do to stay safe so often that is where they cast their fishing lines. Sometimes they get their hooks stuck in the plants and have to pull out the plant to get their hooks back.

**Do you think people are pulling out the wild rice?**



# Suspect 2: Canoe

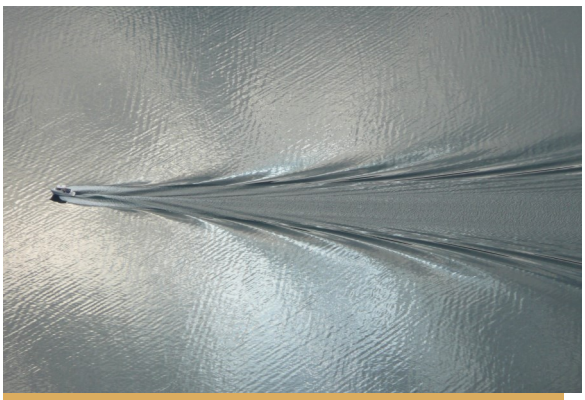
The St. Louis River is a great place for canoeing. People travel from lots of different places to canoe here. Are canoeists pulling up the wild rice?

Canoes are a great way to explore the St. Louis River estuary and especially Pokegama Bay. In fact, a lot of people prefer to travel on the water in a canoe.

One benefit of canoes is that they are quiet and small. This means they don't scare animals away and can fit in a lot of places other boats cannot. This also means they can easily go through plants but sometimes those plants get pulled out by the boat or the paddles.

**Are canoeists pulling out the rice?**

## Suspect 3: Motor Boat



Look at the waves behind that boat. Do you think that is enough to pull up a wild rice plant?

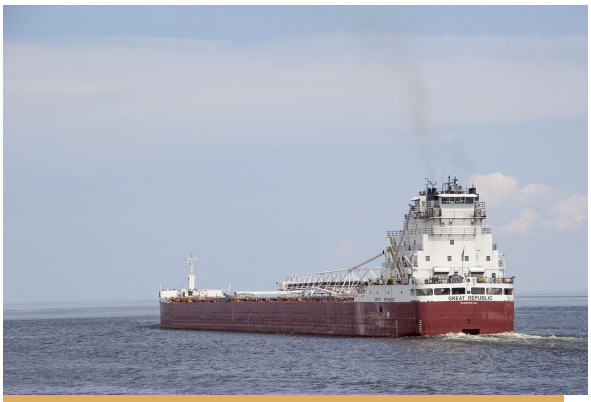
Motor boats are a very popular way to get around on water. Often they can be seen driving through the waterways here, including Pokegama Bay.

When boats travel through the water they create waves of water behind them called a **wake**. Sometimes those wakes are powerful enough to uproot plants that are in the water.

**Are motor boats pulling out the rice?**



## Suspect 4: Ore Boat



Ore boats churn up a lot of water when their engines are running. Are they the problem for the rice in Pokegama Bay?

Ore boats are a common sight in the St. Louis River estuary. Sometimes called thousand footers, these huge boats have huge engines to move them through the water.

These boats are so large they need a lot of space on the water to move around and make turns.

Like the motor boats, the ore boats create a very large wake that is capable of uprooting plants.

**Are ore boats pulling out the rice?**

## Can You Solve This Science Mystery?

1) As a group, read the information on wild rice's floating leaf stage and people.
2) Study the suspect cards to get more information about how people might be damaging the wild rice with their activities on and around the water.
3) Make a hypothesis (best guess) based on the available evidence to answer this question: What is damaging and causing the wild rice to disappear in Pokegama Bay?
4) As a group decide on a way that you could help Rick keep people from damaging the wild rice.



## A Water Chemistry Mystery: Wild Rice and Sulfate

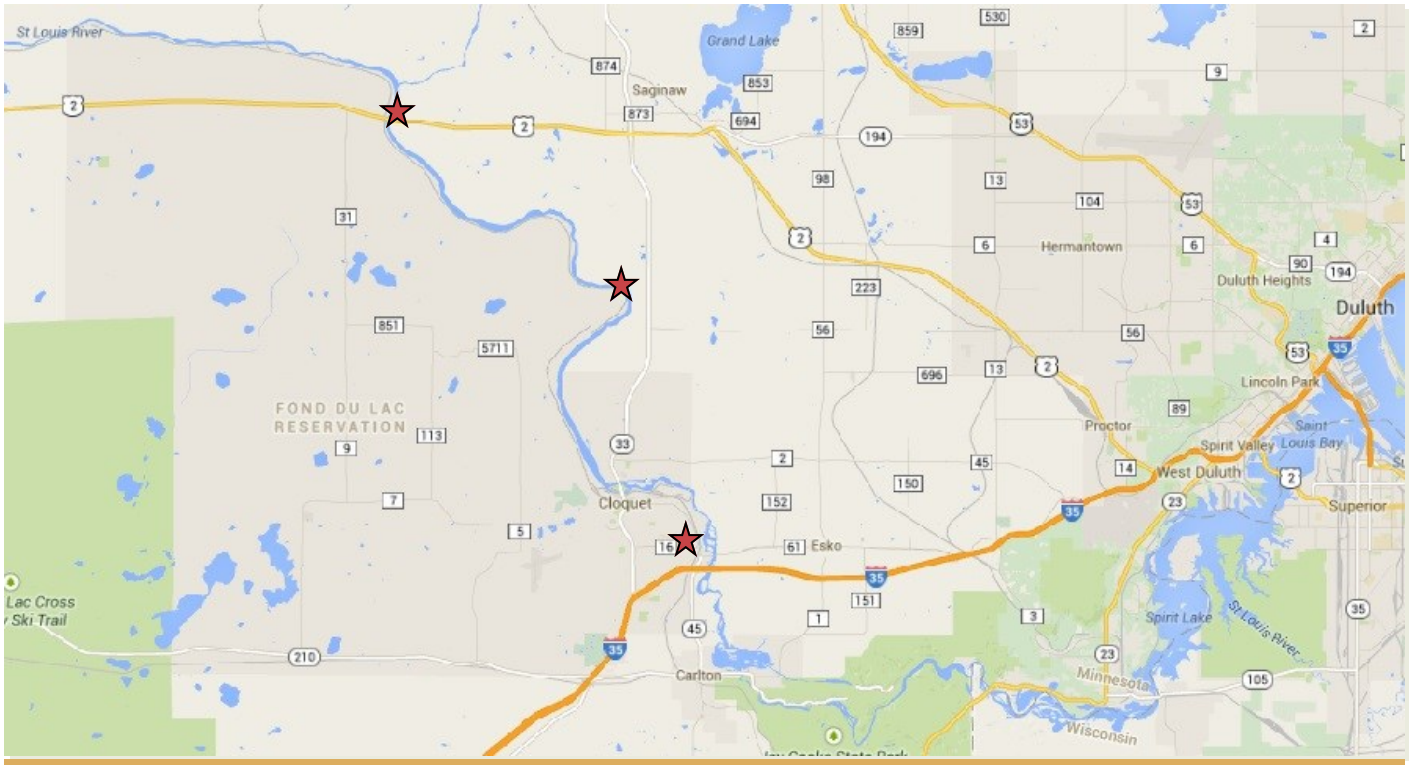
Kari Hedin monitors water quality for the **Fond du Lac Band of Lake Superior Chippewa**. She collects water and tests it to look for pollution and other problems.

The Fond du Lac Band is concerned about a lack of wild rice in the St. Louis River. They suspect that one of the problems might be a chemical called **sulfate** in the water.

Wild rice may disappear if there is too much sulfate in the water. Kari collected data on sulfate in the St. Louis River near the reservation in several places.

Could sulfate be causing the disappearance of wild rice?

What can be done about it?




**The Fond du Lac Reservation is bordered by the St. Louis River on it's east side. Red stars show where Kari Hedin took water quality samples to test for sulfate. The river flows down from the Reservation to Lake Superior.**



# 1. Understanding Sulfate and Wild Rice

Sulfate (a form of the element sulfur) occurs naturally but also runs off into water from mines, wastewater treatment plants, and other industrial sources.

**Dr. John Pastor**, a biologist at the University of Minnesota Duluth, says it's not the sulfate itself that harms wild rice. Bacteria living in the muck at the bottom of lakes and rivers change sulfate into sulfide, which scientists have long known interferes with plants' ability to grow.

**Dr. Pastor studies the effects of sulfate on wild rice in Duluth.**

**Dr. Pastor and other researchers have found that wild rice is negatively affected by greater than (>) 10 mg/L of sulfate in water.**

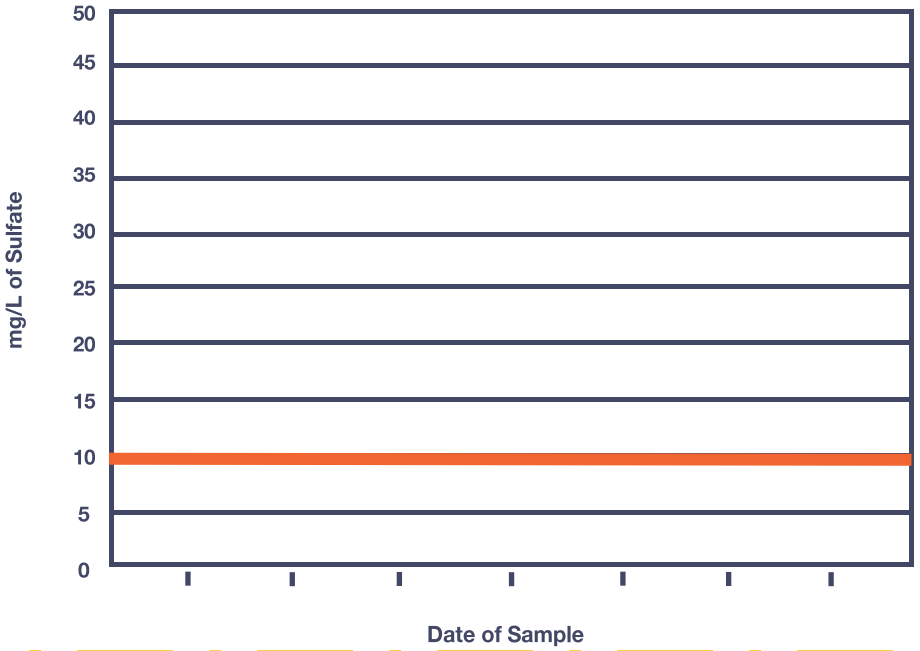
Minnesota has a law that does not allow more than **10 mg/L** of sulfate in the water.

**Is the standard for sulfate working to protect wild rice?**

# DATA: Sulfate in the St. Louis River, Sample 1

The data below was collected on the St. Louis River at Sample Point 1. Add the dates and the amount of sulfate to the chart to see if the samples meet Minnesota's required **10 mg/L** limit on sulfate. **It is marked on the graph with an orange line.** **Will wild rice grow at this spot?**

| Date | Sulfate (mg/L) |
|---|---|
| 7/6/2009 | 21 |
| 7/26/2010 | 30 |
| 9/28/2011 | 17.9 |
| 8/8/2012 | 13.6 |
| 8/13/2013 | 17.6 |

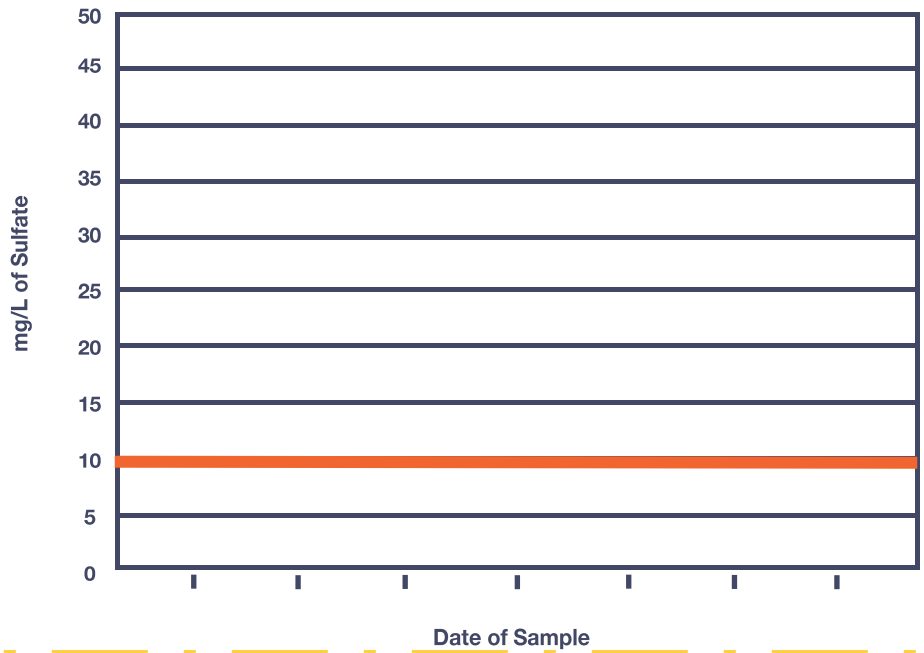





# DATA: Sulfate in the St. Louis River, Sample 2

The data below was collected on the St. Louis River at Sample Point 2. Add the dates and the amount of sulfate to the chart to see if the samples meet Minnesota's required **10 mg/L** limit on sulfate. **It is marked on the graph with an orange line.** **Will wild rice grow at this spot?**

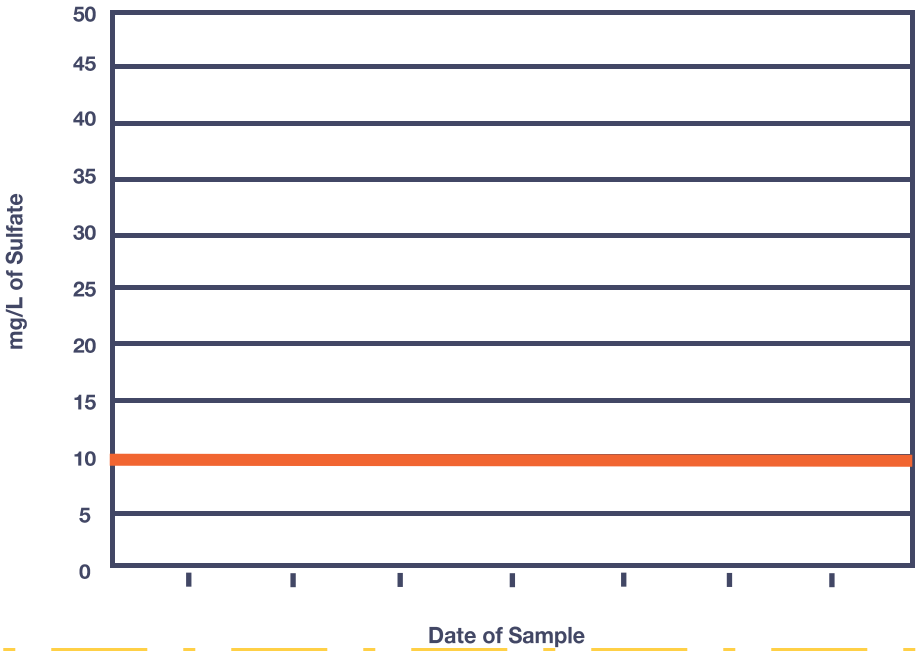
| Date | Sulfate (mg/L) |
|---|---|
| 7/8/2009 | 24 |
| 7/29/2010 | 23.7 |
| 10/10/2011 | 26.1 |
| 8/13/2012 | 15.3 |
| 7/31/2013 | 17.1 |



# DATA: Sulfate in the St. Louis River, Sample 3

The data below was collected on the St. Louis River at Sample Point 3. Add the dates and the amount of sulfate to the chart to see if the samples meet Minnesota's required **10 mg/L** limit on sulfate. **It is marked on the graph with an orange line.** **Will wild rice grow at this spot?**

| Date | Sulfate (mg/L) |
|---|---|
| 7/9/2009 | 36 |
| 8/16/2010 | 23.3 |
| 10/10/2011 | 45 |
| 8/13/2012 | 20.8 |
| 8/1/2013 | 21.9 |





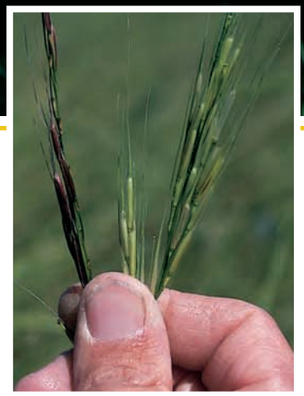

# Can You Solve This Science Mystery?

1) As a group, read the information on wild rice and sulfate
2) Use the data on sulfate in the St. Louis River to complete the tables.
3) Make a hypothesis (best guess) based on the available evidence to answer this question:

**Is sulfate a problem for wild rice growing in the St. Louis River?**

4) As a group, come up with **one** question you have about sulfate in the St. Louis River. Come up with **one** way you might do research or collect information to find the answer to that question.

**Wild rice grows at the very top of the St. Louis River watershed. What might sulfate levels be like there?**



## Need More Information?

For harvest regulations or management information contact one of the agencies listed below. For additional copies of this brochure, contact the Great Lakes Indian Fish and Wildlife Commission.

**Wisconsin DNR**
**101 South Webster Street**
**Box 7921**
**Madison, WI 53707**
**(608) 266-2621**
**TDD: (608) 267-6897**
**Website: www.dnr.state.wi.us**

**Minnesota DNR**
**500 Lafayette Road**
**St. Paul, MN 55155-4040**
**(888) 646-6367**
**Out of State: (651) 296-6157**
**TTY: (800) 657-3929**
**Website: www.dnr.state.mn.us**

**Great Lakes Indian Fish and Wildlife Commission (GLIFWC)**
**P.O. Box 9**
**Odanah, WI 54861**
**(715) 682-6619**
**Website: www.glifwc.org**

This brochure was created with the assistance and support of the following:

Great Lakes Indian Fish and Wildlife Commission (GLIFWC)

Wisconsin Department of Natural Resources (WDNR)

Circle of Flight

Minnesota Department of Natural Resources (MDNR)

U.S. Fish and Wildlife Service (USFWS)

North American Waterfowl Management Plan

# WILD RICE

Ecology • Harvest • Management

## Ecological Significance

Wild rice is important in the ecology of many lakes and streams. Its nutritious seeds have long been recognized as a valuable waterfowl food. Within its core range in Minnesota and northern Wisconsin there may be no food more important to waterfowl, being readily and heavily consumed by mallards, blue-winged teal, ring-necked ducks, wood ducks and other species. Wild rice also benefits breeding waterfowl, providing roosting and loafing areas to adults, and essential brood cover for the young.

Wild rice's other ecological contributions are often less appreciated. From the muskrat that feeds on a tender spring shoot, to the invertebrate that lives on the fall's dying straw, wild rice benefits a wide range of species because of the food, cover, or physical structure it adds to the environment. The habitat it provides species ranging from moths to moose and snails to rails adds to the biological diversity of the wetlands where it is found.

Wild rice can also help maintain water quality by binding loose soils, tying-up nutrients and slowing winds across shallow wetlands. These factors can increase water clarity and reduce algae blooms. Wild rice is an ecological treasure.

## Cultural Significance

To the Anishinaabe (Chippewa or Ojibwa) it is ***manoomin***, a term derived from "Manitou," meaning Great Spirit and "meenum," meaning delicacy. It is the "food that grows on water," whose presence fullfilled the prophecies foretold in the story of the Anishinaabe's migration from the east. Considered a special gift from the Manitou, this "spirit food" has been a central component of Native American culture in the rice region for hundreds of years, featuring in the lives of the Dakota and the Menominee (who took their name from this plant) as well as the Ojibwa. The August, or Rice Making Moon, signaled the harvest season, which was a time for celebrations of thanksgiving. Its distribution influenced inter-tribal battles and the placement of Indian reservations.

Manoomin had great importance to early European explorers as well. Their journals contain many references to the plant they found growing on the lakes and riverways they traversed. As a staple food of the voyageurs, it helped the regional fur trade flourish.

Because of its significance, wild rice's presence in Wisconsin and Minnesota is well documented. Current maps of the historic rice range are dotted with names originating from this plant. Numerous lakes, rivers or towns are named Rice or Manoomin, or bear related names such as "Poygan," derived from the Menominee word for gathering rice. It is believed that no other plant has contributed to more geographic names in all of North America!

## A Historic Decline

Unfortunately, many historic rice beds have been lost. Rice can be hurt by pollution, large boat wakes, exotic species, and other factors. Especially damaging are changes in water levels. The lakes and rivers which support rice have frequently been dammed, and even small increases in depth can destroy the habitat for this species. Although it is impossible to measure exactly how many acres of rice have disappeared, it is clear the loss has been substantial.

## Habitat Requirements

***Water Flow:*** Rice does best in the presence of flowing water, with rivers and flowages being optimal examples. Rice also does well in lakes that have an inlet and outlet. In lakes with relatively little flow, rice may persist, but will typically vary more in abundance from year-to-year.

***Water Depth:*** This is perhaps the most critical element. Rice grows in about 0.5-3 feet of water, with 1-2 feet being optimal.

***Water Clarity/Color:*** Clear water is preferred, as very dark or turbid water limits sunlight penetration and may hinder early plant development. However, rice beds can be supported on moderately stained waters, particularly where water depths are limited to about 2 feet or less.

***Water Fluctuations:*** Generally annual fluctuations should not be too great, and water levels during the growing season should be stable or gradually receding. However, too much stability in water level over many years may be detrimental. The loss of year-to-year fluctuations, as may occur where water levels are artificially controlled, may lead to perennial plants out-competing rice. Some natural fluctuations should be maintained, even if it means an occasional poor year for rice.

***Sediment Type:*** Several inches of soft organic muck is considered optimal. However, rice is fairly tolerant and beds exist on a wide variety of bottom types including sand and gravel. Extremely soft or flocculent bottoms may be unsuitable, but moderately flocculent sites may be a preferred habitat niche.

## THE LIFE CYCLE





Wild rice is an annual aquatic grass. Its life cycle is fairly simple: The seed drops off the plant in August or September and usually sinks rapidly into the sediment near the mother plant. The seed remains dormant in the mud until spring when warming water and low oxygen conditions stimulate germination. Although most seed will usually germinate the first spring, some may remain dormant for five or more years. This extended dormancy allows wild rice to survive occasional crop failure.

Next the plant goes through several distinct growth phases. By late May and early June the plant is in the **submerged leaf stage** during which a cluster of 1-4 underwater basal leafs form. By mid-June the plant is in the **floating leaf stage**, when ribbon-like leaves lay flat on the water's surface. This is generally considered the most critical stage; the plant is buoyant and high winds or a rapid increase in water levels can uproot or drown entire beds.

By the end of June one or more **aerial shoots** have begun to develop. These shoots will continue to grow into August, reaching a height of 2-8 feet above the water. Multiple shoots, up to 10 or more, are most common where the water is shallow and the plant density is low.

As early as late July, **flowering** begins. Both male and female flowers develop on the same stalk, the female above the male. The female flowers open first, followed 3-4 days later by the male flowers. The pollen is wind-borne. This timing difference in flower opening promotes cross pollination.

In August and September the seeds develop and mature. Seeds on a single stalk reach maturity over a 10-14 day period, with the highest seeds maturing first. Ripening is also affected by sediment type, water depth, weather, and other factors. Ripe seed drops into the sediment, unless harvested by humans or wildlife. An acre of good rice beds can yield over 500 pounds of seed.

This gradual, uneven ripening means rice can be harvested repeatedly during the season, which may extend for up to 3-4 weeks on a particular lake. Different water bodies will also ripen at slightly different times, so the harvest season may last six weeks if fair weather holds.

Rice abundance can vary widely from year to year, especially on the most "lake-like" beds. The rule-of-thumb for lake beds: A typical four year period will include a bumper year, two fair years, and a bust (see photos left and right).

*Totogatic Lake 1996 - a bust year.*

*Totogatic Lake 1995 - a bumper crop.*

# Ecology · Harvest · Management

## Human Harvest

Harvesting wild rice can be a deeply rewarding experience. A fall day spent gathering this grain can yield a year's worth of memories to be relived each time the harvest is savored. The grain is nutritionally rewarding as well. Low in fat but high in protein, fiber, B vitamins and minerals, manoomin is nutritionally higher than white rice, oats, barley, wheat or rye. Gatherers of the wild crop often enjoy knowing their harvest hasn't been treated with commercial fertilizers, herbicides or insecticides.

Harvest typically begins in mid to late August and peaks 2-3 weeks later. The timing of the peak will vary from site to site. However, there is consistency from year to year, with river beds generally being earlier than lakes, and with the same lakes being relatively early or late each season.

Harvest methods haven't changed much in the last century. Allowable harvest techniques vary slightly from state to state, but all reflect traditional tribal methods, requiring the rice to be harvested from canoes or small boats with the use of smooth, wooden ricing sticks.

Generally, two people rice as a team. One moves the canoe through the rice bed using a long push-pole while the other "knocks" the grain. The knocker uses one ricing stick to bend the rice stalks over the boat, and the second to lightly stroke the seed heads, dislodging the ripe grain. It's important to knock gently. If the seeds don't drop with a gentle stroke, the rice isn't sufficiently ripe. Try a different site, or come back in a couple of days. Excessive force will only break the stems, preventing them from being harvested again.

Seed size, like ripening dates, varies by location but is quite consistent from year-to-year at each site. Seed size does not affect the flavor or quality of the rice.

A ricing trip may yield anywhere from a few pounds of rice to more than 200! But since even intensive hand harvesting removes only about 15% of the annual yield, abundant seed remains for wildlife and to reseed the bed.

Freshly harvested rice (referred to as "green" rice) can be used for sowing, but if your goal is food for the table, the rice will need to be finished. Finishing rice involves reducing the moisture content through parching, and removing the sheath that covers the seed. Traditional finishing is labor intensive and involves parching, "dancing" to loosen the hulls, and winnowing the rice (see photos). Some people greatly enjoy this part of the process while others prefer to have professionals, who have mechanized parts of the process, finish their rice for them.

Scattered across rice country are places you can bring your green rice for finishing. Finishers may charge a fee, or may keep a portion of your rice (typically 20%) in lieu of payment. A hundred pounds of green rice usually yields from 35-60 pounds of finished rice. The color of finished rice may vary from green-grey to black, but the color is more influenced by finishing techniques than by the origin of the seed.

### *Delicious Yet Easy to Cook*

The unique, nutty flavor of wild manoomin is unmatched. It cooks in only 30-40 minutes, and since cooked rice yields 3-4 times its dry weight, a little goes a long way. Manoomin is highly versatile. You can start your day with it cooked as a breakfast cereal or in muffins or pancakes. Have it for dinner in soups, side dishes or casseroles, or "pop" it for a nutritious and tasty bed-time snack. Hundreds of recipes can be found in general or specialty cookbooks, or even on the Internet! Explore various cooking techniques and recipes, or come up with your own!

### *A Few Words about Cultivated or Paddy-grown Wild Rice*

Paddy-grown wild rice is commonly found in supermarkets and road side stands at a significantly lower price than hand-harvested, wild grown manoomin. Although it may appear quite similar to natural wild rice, it is a fairly different product. Paddy rice differs genetically and may be grown commercially using fertilizers, herbicides or insecticides. It is also mechanically harvested and is often finished somewhat differently than natural wild rice. If you are interested in natural wild rice, check the label; Wisconsin and Minnesota require cultivated wild rice to be labeled as such.


*Freshly harvested rice*


*Finished rice*


*Seeding*


*Research*


*Successful test seeding*


*Aerial surveys are used to monitor abundance*

## Management

Although wild rice has declined in abundance from historic levels, there is hope this trend may be reversed. A growing interagency effort is underway to manage and restore wild rice. Tribal, state, federal and private natural resource organizations and interested individuals are working to promote this special resource. Public support is essential for these efforts to succeed. With your help, we can try to ensure that manoomin remains a viable part of our wetland ecosystems.

### *Wild Rice Management Can Take Several Forms:*

***Abundance Monitoring*** is important to determine whether or not rice is continuing to decline in abundance. Because of the high variability in abundance from year-to-year, only long term studies will answer this question. Abundance monitoring can also be used to direct harvesters to the most productive stands and save unnecessary trips to waters with poor stands.

***Restoration and Enhancement*** includes seeding rice at historic sites and introducing rice to sites with suitable habitat, such as artificial impoundments. It can also involve restoration of historical habitat conditions (such as water levels) or protection of rice beds from negative environmental impacts.

***Harvest Monitoring*** can occur on individual waters or across broad areas. It can help biologists determine if wild rice abundance is adequate to meet the human demand or be used to monitor the effectiveness of restoration efforts. In Wisconsin, a sample of state and tribal harvesters are surveyed each year to estimate harvest. Contemporary annual harvest estimates from off-reservation waters within the state have varied from 34,000 to over 110,000 pounds.

***Research*** can increase our understanding and appreciation of this unique plant. It may also improve our ability to restore lost beds or increase the likelihood of success when introducing rice at new sites. Current research includes efforts to understand the genetic variability of wild rice.