

<b>Lesson Title: Lawnmowers of Northern Lakes: Rusty Crayfish, an Aquatic Invader</b>	<b>Date:</b> 04/24/2017
<b>Topic:</b> Great Lakes Watershed & Aquatic Invasive Species in Lake County Region/Potential Impacts	
<b>Prepared By:</b> Adapted by Sonja Smerud, Lake County Soil & Water Conservation District	
<b>Target Audience:</b> 4 <sup>th</sup> Grade or 9 <sup>th</sup> Grade, depending on depth of study	
<b>Summary:</b> Students will learn what aquatic invasive species are and then participate in a game that simulates competition for habitat and resources. Students will identify and discuss rusty crayfish as an example of an invader with serious impacts on the Great Lakes ecosystem.	
<p><b>MN Grad Standards:</b>  4.3.4.1.1 – Describe how the methods people utilize to obtain and use water in their homes and communities can affect water supply and quality.</p> <p><b>This may also relate (with extension) to:</b>  9.4.2.1.2 Explain how ecosystems can change as a result of the introduction of one or more new species.  9.4.4.1.2 Describe the social, economic, and ecological risks and benefits of changing a natural ecosystem as a result of human activity.</p>	<p><b>Environmental Education Standards:</b>  <i>Next Generation Science Standards: Crosscutting Concepts: Cause and Effect</i> – Students identify and test causal relationships and use these relationships to explain change. Students understand events that occur together with regularity might or might not signify a cause and effect relationship.  <i>Environmental Literacy Scope &amp; Sequence:</i> In social and natural systems that consist of many parts, the parts usually influence one another. Social and natural systems may not function as well if parts are missing, damaged, mismatched, or misconnected.</p> <p><b>With extension, this may also relate to: NAAEE Learner Guidelines Grades 9-12: Strand 2.2 The Living Environment, A) Organisms populations and communities</b> – Discuss the relationship of habitat changes to plant and animal populations. Explain how diversity of characteristics among organisms of a species increases the likelihood of the species surviving changing environmental conditions. <b>C) Systems and connections</b> – Discuss the interactions among organisms and their environments. Explain ecosystem change with respect to variables such as climate change, the introduction of a new species, and human impacts. Describe how adding a species to, or removing one from, an ecosystem may affect other organisms and the entire ecosystem.</p>

<p><b>Lesson Outcomes:</b></p> <p>Students will:</p> <ol style="list-style-type: none"> <li>1. Define the term “aquatic invasive species.”</li> <li>2. Name and visually recognize some invader (non-native/exotic) species of the Great Lakes.</li> <li>3. Understand and analyze the positive and negative impacts of invader species on the Great Lakes ecosystems.</li> <li>4. Explain the ways in which invader species could be introduced into the Great Lakes.</li> <li>5. Recognize key identifying features of rusty crayfish.</li> <li>6. List two ways in which humans can introduce and/or spread rusty crayfish.</li> </ol>	<p><b>Assessments:</b></p> <p>Ongoing assessments: Fist to 5 on vocabulary (habitat, aquatic invasive species, non-native species, native species). Students can identify a Rusty Crayfish.</p> <p>Final assessment: Maps student fill out of rusty crayfish infestations and pattern of spread. Each map will also include one of the following questions they should answer:          What is an aquatic invasive species?          List two ways aquatic invasive species can disrupt a natural system.          Describe two characteristics you can use to identify rusty crayfish.          Brainstorm two ways people can manage existing AIS populations.          What can you do to prevent AIS from establishing in lakes around here? Name two things.</p>
<p><b>Summary of Tasks/Activities:</b></p> <ol style="list-style-type: none"> <li>1. Introduction of Teacher/why I’m here – 3min</li> <li>2. Introduce BRIEFLY topic of non-native/exotic species to the class.             <ol style="list-style-type: none"> <li>i. Define aquatic invasive vs. non-native – 2min</li> </ol> </li> <li>3. Have you heard of any AIS before? (zebra mussels, rusty crayfish, spiny waterflea, smelt). Pass around specimens. How have you heard about them? Have you seen any? – 5min</li> <li>4. Today we are going to talk about rusty crayfish. Have you seen a rusty crayfish? Native crayfish? Discuss ways to distinguish rusty crayfish from native species. – 2min</li> <li>5. Invaders! Musical Chairs from Project WET – 20min             <ol style="list-style-type: none"> <li>i. Arrange chairs (or defined squares/area if outside) in a curving line to represent a stream or a circle to represent a lake. Chairs represent habitat for different aquatic species. [Review: what are components of a habitat? Space, water, food, shelter]</li> <li>ii. Select three students to be aquatic invasive species and give them a red strip of paper/cloth, all other students receive green paper, representing native species. For this lesson, have students can be specific species, i.e. rusty crayfish (invasive) and native (virile or calico crayfish).</li> <li>iii. For the first round, all students succeed in finding habitat in their environment (finding a chair). As with musical chairs, students circle the area and must find a chair when the music stops playing.</li> <li>iv. For the second and preceding rounds, students should leave their strips of paper on the chair.</li> <li>v. Explain invasive species may have a competitive advantage over native species [Review discussion in classroom: why? Generalist, reproduce quickly, aggressive]. Allow the aquatic invasive species group to closely circle the chairs, while native species stay 6 feet away.</li> <li>vi. Native species can only sit in chairs with a green strip of paper, while invasive species can sit in any chair. If a native species can’t find a green chair, they must sit on a red chair and become an invasive species. Once a student becomes invasive, they remain</li> </ol> </li> </ol>	

invasive through the rest of the game. If an invasive species sits in a green chair, that habitat then also becomes a red chair (invasive).

- vii. Record the species trends (rusty crayfish vs. native crayfish species) for each round on a graph. Play enough rounds so that almost all the chairs are taken by aquatic invasive species students. Connect the graph points at the end, showing non-natives (red) with a positive correlation and native species (other color) with a negative correlation.
6. Back in the classroom... The data they graphed is similar to the data we are trying to collect. How do invasive species affect native populations? What do you think will happen to the calico or virile crayfish after rusty crayfish have infested the area? (Rusty crayfish are like the “lawnmowers” of the water) – 5min
7. Discuss (TPS): do you believe an invasive could eliminate native species? (lionfish can eat the entire native fish population on coral reefs) – 2min
8. Now, our data collection focuses more on presence/absence of species and simply mapping them geographically. Discuss: where do you think there are rusty crayfish in the area?– 2min
9. Show EDDMaps of Rusty crayfish in the Midwest and/or map of Lake County. Pass around crayfish maps of the area. Do you recognize these places? – 2min
10. What trends can we see? Each student receives a printout of the reported rusty crayfish infestations in the Midwest. How can this help us decide where Rusty crayfish came from? Have students draw an arrow on the map indicating the path they think rusty crayfish may have taken to get here. (Rusty crayfish are native to the Ohio River Valley and were probably introduced by anglers as bait). Students should write in the margins of the map how they think rusty crayfish moved waterbodies (anglers, boats, some may say ballast) – 8min
11. Have students draw a dot on their maps with a different color where they think we might see rusty crayfish next. – 4min
12. Conclude & What can you do: review with students the principles of “clean, drain, dry” and importance of prevention of AIS in this area (when they’re out fishing, how their family can help, monitoring). – 5min
13. *Final Assessment*: Rusty Crayfish worksheet

#### **Key Questions to Ask:**

How does introduction of a non-native species affect the dynamic balance of native ecosystems?

Positive changes resulting from non-native species? Negative?

Why should people be concerned about exotic species?

What factors favor population growth of a species?

What biotic and abiotic factors influence species survival?

What are examples of good and bad decisions people can make with regard to exotic species?

Why do exotic species sometimes out-compete native species? (Reflect)

Who should decide which species should be protected? What should this decision be based on? (Generalize)

What actions can you take to prevent the spread of non-native species? (Apply)

- Invading species can change present ecosystems in sometimes unpredictable ways that may be beneficial or detrimental.

**Materials/Equipment:**

Classroom

Chairs (or outside space able to delineate specific spaces)

Colored red and green paper strips (at least 20 of each color/2 per student)

Music/speakers > AIS songs & playlist

Map for each student of rusty crayfish invasions in the area (to be printed)

Markers

Projector and/or printouts of Lake County AIS infestations/EDDMaps

**References:**

“Invader Species of the Great Lakes” in Earth Systems – Education Activities for Great Lakes Schools: Life in the Great Lakes, Courtesy Wisconsin SeaGrant

Materials and “Attack Pack” courtesy Great Lakes Aquarium

Project “WET” Curriculum and Activity Guide 2.0

**Take Home Tasks:**

*Optional additional activity:*

How are other invasive species introduced? Any ideas? – 2min

Matching card game: Divide students into groups of 3-4, distribute aquatic invasive species cards – 8min

- i. Have students match each exotic species to its corresponding cards.
- ii. Have students check answers with their sheet.
- iii. Based on what you know about these AIS, how do you think they were introduced?

Students prepare presentation of an invader based on one of the cards they matched & present to the class.

*Optional activity to precede Invaders! (Part II) Activity:*

Project WET Invaders! Habitat Activity (Part I)

Have students stand around a 40 foot playing area (outside, a gymnasium). Defined area should already have squares outlined in the dirt/placed (2 fewer squares than students). Explain to students that most of them are native animal species, and the squares represent everything they need to survive. [Review: what four components of a habitat might be good to survive? Space, water, food, shelter)].

Two students receive “predator” cards – once students reach a habitat square, they are ‘safe’ from being tagged and being out by the predator.

Game ends when most students have found a habitat (or are tagged).

Ask: was it difficult to find habitat? Did most native species survive? What did they observe regarding competition for habitat?

Create a class summary: native species compete for habitat and resources in the natural world, not all species survive as there may not be sufficient resources or habitat, native species are lost to predation or die from injury or age

*Optional Activity to precede follow Invaders! (Part II) Activity:*

Students in groups of 4 or so receive a clay pot and markers. Have them draw a picture on the pot of a favorite place that involves water.

Ask for volunteers from each group to explain the drawing. Line the pots up and take a photo.

Explain that natural events (floods, fires, hurricanes, and tornadoes) and human activities (mining, agriculture, construction, industry, invasive species spread) affect ecosystems. Restoration is one solution to those problems. List: why is it important to restore ecosystems? Erosion control, flood control, conservation of biological diversity, conservation of water quality and quantity.

Explain they will now experience first hand how easy or hard it is to restore something. After it has been changed – Distribute a paper bag to each group and have the students place their pot in it and close the bag securely then drop the bag on the ground, breaking it (not throwing it!).

Students should trade bags with another group. Sometimes ecosystems must be repaired by someone other than the original inhabitants, or even the people that caused the damage.

Distribute glue and paper plates to students to put the pot back together again. Man pieces will be large enough to work with, some won't – just like in real restoration efforts.

Line up the photos and take an "after" picture.

TPS: Discuss successes and failures. Emphasize some parts can be restored well, and some cannot.

Remind students that even ecosystems that haven't been altered by human activities are in a constant state of dynamic, natural change.

Summarize: why are ecosystems altered? Why are they difficult to restore? How do (rusty crayfish) alter an ecosystem? What will be hard to restore? Do you students believe there is a future where we don't alter human ecosystems?

How can we maintain the integrity of ecosystems? (inventory plant and animal species, monitor water quality, employ best management practices, outreach and prevention, etc).