

Maritime Shipping on the Great Lakes:
Lesson Plan #2: The Link between the Lake Erie Water Snake and the Round Goby

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Topic: Biology and Maritime Shipping on the Great Lakes
Target Grade: 10th grade biology (general level)

Lesson Overview

This lesson is designed to provide the student with more detailed information on the round goby and the Lake Erie water snake (LEWS). The information will help the student determine the reasons for the changes in the diet of the LEWS and also allow them to examine real-world data on the diet taken at different time periods. This will enable the student to analyze data and make statements about cause and effect of the changes in the LEWS diet.

Objectives

After this lesson, students will be able to

1. Describe the life histories and background on the round goby and LEWS.
2. Analyze LEWS diet data from different time periods and graph the changes that have taken place.
3. Discuss the effects of the introduction of the round goby into the western basin of Lake Erie on the diet of the LEWS.

Ohio Content Standards addressed in this lesson:

**Benchmark F: Explain the structure and function of ecosystems and relate how ecosystems change over time.*

Grade Ten -Diversity and Interdependence of Life

15. Explain how living things interact with biotic and abiotic components of the environment (e.g., predation, competition, natural disasters and weather).

17. Conclude that ecosystems tend to have cyclic fluctuations around a state of approximate equilibrium that can change when climate changes, when one or more new species appear as a result of immigration or when one or more species disappear.

**Benchmark G: Describe how human activities can impact the status of natural systems.*

Grade Ten - Diversity and Interdependence of Life

18. Describe ways that human activities can deliberately or inadvertently alter the equilibrium in ecosystems.

Materials Needed

handouts of background information on LEWS and round goby, graph paper (25 sheets), rulers (25), class pack of colored pencils

New Vocabulary Words

1. invasive species- a species which is both non-native (or alien) to the ecosystem and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
2. exotic species-an introduced species that is not indigenous to the place or area

where it has been introduced accidentally or deliberately by human activity.

3. round goby (*Neogobius melanostomus*)- a small fish in the family Gobiidae that is predatory, spiny-finned and has pelvic fins that are united in a suction disk that clings to rocky surfaces. It was introduced to the Great Lakes in the 1990s.
4. Lake Erie water snake (*Nerodia sipedon insularum*)- a subspecies of the northern water snake that is endemic to the western basin of Lake Erie (especially the island region). The snake is nonvenomous and may be solid, banded light or dark and is federally threatened and state (Ohio) endangered.

Background Information

LEWS is a nonvenomous, endemic snake species to the island area of the western basin of Lake Erie. Seemingly the snake has benefited from the introduction of the round goby. It is an unusual situation when an exotic/invasive species benefits an endemic species. Prior to the introduction of the round goby, the LEWS would consume mostly native fish (like smallmouth & largemouth bass) that were young or small in size (most likely less than 6 inches in length). The data shows that LEWS has converted over to mostly a round goby diet. This is not so amazing in that the round goby is a bottom dweller, and the right size to be consumed by the LEWS. The LEWS had previously been losing population due to human persecution and habitat loss. Human persecution was a problem because the snake has a habit of basking in the sun along the rocky shoreline typical to the Lake Erie islands area. This disturbed some people because they are large and rather ferocious looking even though they are not venomous. However, the snakes do bite when disturbed and do draw a lot of blood with their sharp teeth (it is actually a rather painless bite, but it does look bad and bleeds a lot). People in the islands area got into the habit of killing the largest of the snakes which are also usually pregnant females. Habitat loss is a problem because of the development of the shoreline for human habitation. However, another documented problem is the disturbance of hibernation sites, which are often times further away from the water and tend to be used by the snake in multiple years. When hibernation sites are disturbed, snake mortality would also increase. All of these factors lead to the loss of population and the need to add the species to the federally threatened and state endangered list of species.

The round goby is native to the Black and Caspian Seas. This is a freshwater environment, although somewhat brackish in nature. The round goby is also considered invasive in other parts of Europe because it has been introduced in a similar way to other bodies of water in Europe.

Pre-Assessment:

The quiz that was to be used after the PowerPoint Presentation may be helpful. This way the students have a matrix into which assimilate the data for this lesson. This lesson is actually an activity that has grown out of the information compiled in the presentation. Also it may be helpful to question students as to some effects of invasive species in the environment. This activity presents a twist on this in that the effect of the invasive species is actually positive.

Focus Question:

What effect does the presence of the round goby have on the Lake Erie water snake?

Attention-getter

Skins of the Lake Erie water snake should be passed around the classroom or mounted so the student can see the impressive size of these snakes. Some females may reach up to 5 feet in length. It would be nice to have an actual LEWS to show the class but this may not be possible.

Activity

This is designed as a graphing activity with analysis questions to follow that will help guide the student to see how the diet of the LEWS has changed and how this will effect the species over time as they continue to consume an exotic species.

Safety

Safety for this activity is minimal in that it requires the student to graph data and could actually be done in just about any classroom setting.

Assessment

Students will complete the graph and the analysis questions following. It may be a good idea to have a full classroom discussion following the activity during a separate class period to bring closure to the assignments and make sure students understand the unique interactions that result from the introduction of the new species to the Great Lakes. The main purpose of this assignment is to evaluate the negative and positive effects of a specific invasive species and the effects it has in its environment.

Extension

It would be a good idea for students to visit an area where snakes are kept and discuss the diets of other types of snakes. This will allow the students to see that as a top predator, snakes are fairly flexible in what they consume. It may also be interesting to expand the lesson to the discussion of the concept of biological magnification and what will happen to top predators who consume animals with toxins and the possibility of effecting the species long term. What will happen to LEWS if they are consuming round gobies with high concentrations of PCBs, mercury, etc. in their tissue? What has happened to historic populations of top predators who have consumed prey with high levels of toxins? What will happen to the LEWS if the round goby population were to be drastically reduced? This would be a good connection to make to transition into another area of ecology.

Resources

LEWS (Lake Erie water snake) NEWS, June 2003, Volume VII, a publication of the U.S. Fish & Wildlife Service and Ohio Dept. of Natural Resources (Division of Wildlife) available at www.fws.gov/midwest/reynoldsburg/endangered/pdf/lews7.pdf

http://www.oplin.org/snake/fact%20pages/water_snake_lake_erie/water_snake_lake_erie.html

[/wiki/Image:Roundgoby.jpg/wiki/Image:Roundgoby.jpg](#)

Data from: King, R.B., Ray J.M., and Stanford, K.M. 2006. Gorging on gobies: beneficial effects of alien prey on a threatened vertebrate. *Can. J. Zool.* 84: 108-115.