SAV… It's What's for Dinner

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Overview: Students plot SAV acreage and canvasback and redhead duck populations to analyze the link between bay grass and waterfowl.

Objectives:

Students will be able to:

- Correlate the decline of SAV to the decreasing populations of canvasback ducks and other waterfowl.
- Understand that some species of waterfowl have been able to change their dietary habits to compensate for the loss of SAV.

Grade Level: Middle School

Subject Areas: Life science, environmental science, mathematics

Duration: 45 minutes

Materials:

- Student worksheet
- Computers with graphing program (Excel) or graph paper and colored pencils
- USGS article, *Diving Duck Distribution, Abundance, and Food Habits in Chesapeake Bay* by Perry, Osenton and Lohnes

Maryland Voluntary State Curriculum:

Middle School	1.C.1.a	Organize and present data in tables and graphs and identify the relationships they reveal.
Grade 6	3.D.1	Explain that in any particular environment, the growth and survival of organisms and species depend on the physical conditions.
	3.F.1.a	Explain that populations increase or decrease relative to the availability of resources and the conditions of the environment.
Grade 7	3.E.1	Explain that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.
	6.B.1	Recognize and describe that environmental changes can have local, regional and global consequences.
Grade 8	3.D.1.B	Recognize that adaptations may include variations in structures, behaviors, or physiology.

Teacher Background:

Submerged aquatic vegetation is important to the Bay ecosystem for a number of reasons. The roots, rhizomes and stolons help reduce erosion and provide shelter for benthic invertebrates. The leaves provide shelter, support and an increased oxygen supply for many species of aquatic animals. The plants are also a source of food for a large number of aquatic invertebrates and fishes, and for other birds and mammals that visit aquatic habitats. SAV also uses dissolved nutrients for growth, which helps reduce algae blooms by making the nutrients unavailable for the algae. But one of its most overlooked functions is its food value for many species of waterfowl, including canvasbacks and redhead ducks. The tubers and seeds are especially nutritious, but leaves, stems and roots are also eaten.

Canvasback ducks (*Aythya valisineria)* traditionally depended on the tubers of wild celery (***Vallisneria americana***) for food during migration and over the winter. This relationship is reflected in their scientific names. The canvasback's large webbed feet are adapted for diving and their bills are designed for digging the tubers out of the substrate. In the late 1930s, studies showed that four-fifths of the food eaten by canvasbacks was plant material.

In the early 1950s there were 225,000 canvasbacks wintering in the Chesapeake; this represented one-half of the entire North American population. By 1985, there were only 50,000 ducks wintering here or one-tenth of the population. Canvasbacks were extensively hunted around the turn of the century, but federal hunting regulations restrict their harvest, so hunting was ruled out as a cause for the decline. Scientists have now concluded that the decline in duck populations was due to the decline in SAV acreage.

An interesting thing has happened, however. While nowhere as common as they once were, the population of canvasbacks has stabilized and is even increasing slightly. Studies have now shown that by the 1970s four fifths of the ducks' diet was made up of Baltic clams, which are very common in the Bay. The ducks have been able to adapt to the decline in SAV by changing their diet! Unfortunately, redhead ducks, which also feed on SAV tubers, have not been able to adapt, and their population remains low.

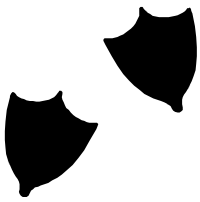
Activity:

1. Engage students in a brainstorming discussion. Record answers on the board or have students take notes.

   - Write the words "canvasback duck" and "wild celery" on the board and ask the students if they see any connection between these words.
   - Then write the words "Aythya valisineria" and "Vallisneria americana" on the board.
     - Explain that these are the scientific names for the canvasback duck and wild celery. Is there a connection? *They should come to the conclusion that canvasbacks probably eat wild celery.*
     - How about "redhead ducks" and "redhead grass"? *The connection is the same. Both species depended on SAV as a main component of their diet.*
   - The students should know that the amount of SAV has declined significantly in the Bay. Tell them that they are going to find out what impact the decline in SAV has had on the populations of canvasback ducks and redhead ducks.

2. Allow students to complete the "SAV: It's What's for Dinner" student worksheet. They will graph the data given to them, using a computer spreadsheet or by hand, using colored pencils and graph paper.

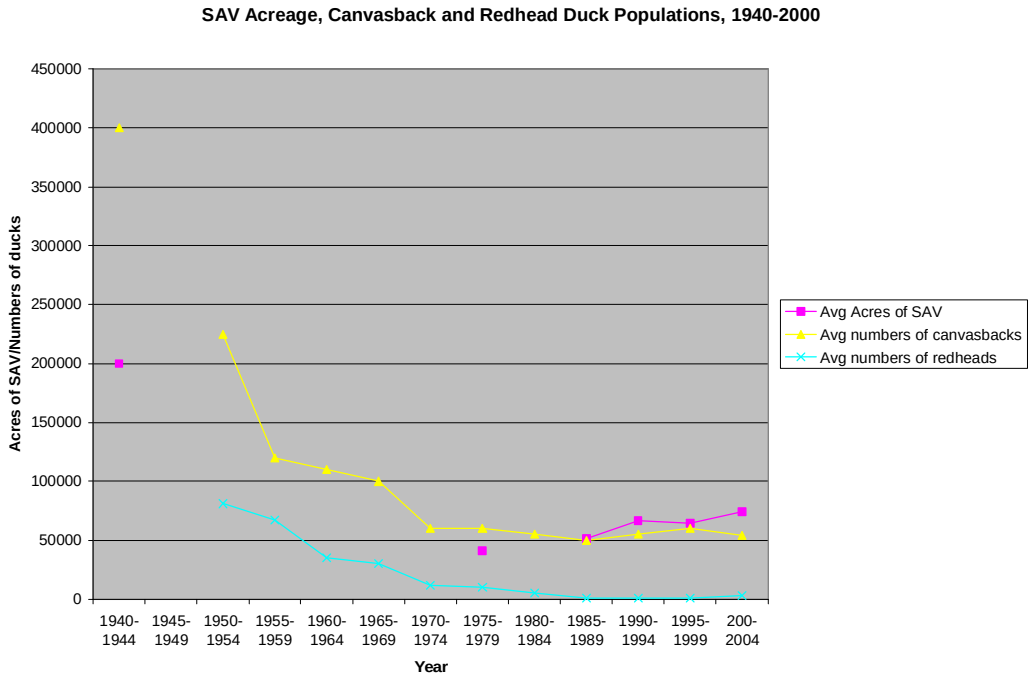
3. Have students read the article *Diving Duck Distribution, Abundance, and Food Habits in Chesapeake Bay* by Perry, Osenton and Lohnes in order to determine if and how canvasbacks and redhead ducks have adapted to the decline of SAV.



Extensions…

Students might want to research other waterfowl to see if their diets have changed. For example, Canada geese and tundra swans have learned to feed on corn and other grains left after harvesting.

Answers to Student Worksheet:
Sample Graph:



Analysis:

1. Does your graph support your hypothesis? Why or why not? *On the whole, student graphs should show that SAV acreage decreased from 1940 until about 1980, then slowly started to recover. Although neither duck species is as common as it once was, the population of canvasbacks is holding steady and is even increasing slightly. The population of redhead ducks, on the other hand, is still very low.*

2. Read the article *Diving Duck Distribution, Abundance, and Food Habits in Chesapeake Bay* by Perry, Osenton and Lohnes. How have canvasbacks and redhead ducks adapted to the loss of SAV? *The canvasback's diet has changed from depending on SAV to depending on clams. They have gone from being primarily herbivores to being primarily carnivores. The redhead's diet has not changed. They still rely on SAV and so their populations have not recovered. This information can be found in the second paragraph of the article under "Results". Remind students to focus on canvasbacks and redhead ducks.*

3. Both canvasbacks and redhead ducks are migratory; they winter in the Chesapeake but breed farther north. What other factors may have contributed to the decline in those populations? *Loss of habitat on the breeding grounds, loss of suitable habitat along migration routes, disease, the birds may have gone somewhere else where there was plenty of SAV.*

SAV… It's What's for Dinner
Student Worksheet

Both canvasback ducks and redhead ducks depend on the nutritious seeds and tubers of SAV, especially wild celery and redhead grass, to get them through the winter. As you know, the number of acres of SAV has declined significantly in the Chesapeake Bay. In 1937, there were approximately 200,000 acres of SAV. By 1978, there were only 41,000 acres left.

What effect might this loss of SAV have had on the populations of canvasbacks and redhead ducks? You are going to graph the acres of SAV and the duck populations to see if there is a correlation. You may make your graph using colored pencils and graph paper or you may use a graphing program on the computer.

State your hypothesis:
How are the populations of canvasbacks and redhead ducks affected by loss of SAV?

Procedure:

Use the following data to graph the acres of SAV and the populations of canvasbacks and redhead ducks from 1940 to 2004 on a single graph.

Table 1. Average number of acres of SAV in the Chesapeake Bay:*

Year	Acres of SAV
1940-1944	200,000
1945-1974	No information
1975-1979	41,000
1980-1984	No information
1985-1989	51,500
1990-1994	66,500
1995-1999	64,200
2000-2004	74,200

* Data averaged from http://www.chesapeakebay.net/pubs/statustrends/88-data-2002.xls

Table 2. Average number of canvasback ducks in the Chesapeake Bay:**

Year	Average number of ducks
1940-1944	400,000
1945-1949	No information
1950-1954	225,000
1955-1959	120,000
1960-1964	110,000
1965-1969	100,000
1970-1974	60,000
1975-1979	60,000
1980-1984	55,000
1985-1989	50,000
1990-1994	55,000
1995-1999	60,000
2000-2004	54,000

**Data averaged from http://www.pwrc.usgs.gov/resshow/perry/foodhabits.htm and the Mid-Winter Waterfowl Survey

Table 3. Average number of redhead ducks in the Chesapeake Bay:***

Year	Average number of ducks
1940-1944	No information
1945-1949	No information
1950-1954	81,000
1955-1959	67,000
1960-1964	35,000
1965-1969	30,000
1970-1974	12,000
1975-1979	10,000
1980-1984	5,000
1985-1989	1,000
1990-1994	1,000
1995-1999	1,000
2000-2004	3,000

***Data averaged from http://www.pwrc.usgs.gov/resshow/perry/foodhabits.htm and the Mid-Winter Waterfowl Survey

Analysis:

1. Does your graph support your hypothesis? Why or why not?

2. Read the article *Diving Duck Distribution, Abundance, and Food Habits in Chesapeake Bay* by Perry, Osenton and Lohnes. How have canvasbacks and redhead ducks adapted to the loss of SAV?

3. What, in particular, has happened to redhead ducks?

4. Both canvasbacks and redhead ducks are migratory; they winter in the Chesapeake but breed farther north. What other factors may have contributed to the decline in those populations?