Subject: Science and Technology

Concepts: Using coding as a tool to study salmon ecosystems

Key Vocabulary:
- Coding
- Drones
- Ecosystem
- Ecology

Skills
- Coding
- Critical thinking
- Creativity

Materials (Supplied by NCRL)
- Drones
- Spheros
- Ipads
- Mock river ecosystem

Next Generation Science Standards (NGSS)
ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment

Computer Science
1B-AP-10. Create Programs that include sequences, events, loops and conditions.
Make the connection from coding small robots to becoming an ecologist who studies salmon habitat with use of drones

Objectives
Students will: 1) use block code to program robots, move them in a mock stream from point A to point B, and be able to reiterate how coding robots could lead to a profession as an ecologist who studies salmon habitat.

Suggested Procedure
1) Explain salmon migration and barriers they may come across. Tell them they are going to be coding robots because some robots are used to study salmon habitat.
2) Demonstrate how to use Sphero (aim, speed, heading, seconds) by coding it to roll forward and then back with the roll command.
3) Have the students use the roll commands to make the Sphero move down the mock river from point A to point B, pretending that the spheros are salmon trying to migrate to their breeding habitat.
4) Reiterate to them that they are using the robots because they are practicing coding like ecologist use when flying drones over salmon habitat.

Teacher References: Definitions
Block coding: Allows users to create a program by dragging and dropping block of code.
Drone or UAV (unarmed aerial vehicle): A flying robot that can be controlled by a remote control or by coding
Ecosystem: a biological community of interacting organisms and their physical environment
Ecology: the branch of biology that deals with the relations of organisms to one another and to their physical surroundings
**Estuary:** A mixture of freshwater and saltwater. This is where the river meets the sea.

Pre-activity #1: Introduction to block coding

Coding can sound intimidating but it can actually be pretty easy to learn with block coding. What is block coding? In a coding interface, users can use block code as opposed to writing their own code script. Block codes are almost like puzzle pieces that users can drag and drop in whatever order they would like. This is a pretty good description of block coding.

Teach children how to become familiar with block coding by using Scratch. There are block coding programs out there but this is one of my favorites and is easy to learn. This online tutorial shows you step by step how to create an animation to move, dance and change colors.

1) On the Scratch home page, click create
2) Click tips
3) Click on the top option that says "Getting Started with Scratch" and follow the step-by-step instructions to make your own program.
4) See if you can modify your code to create your own personal program. You can even make games.
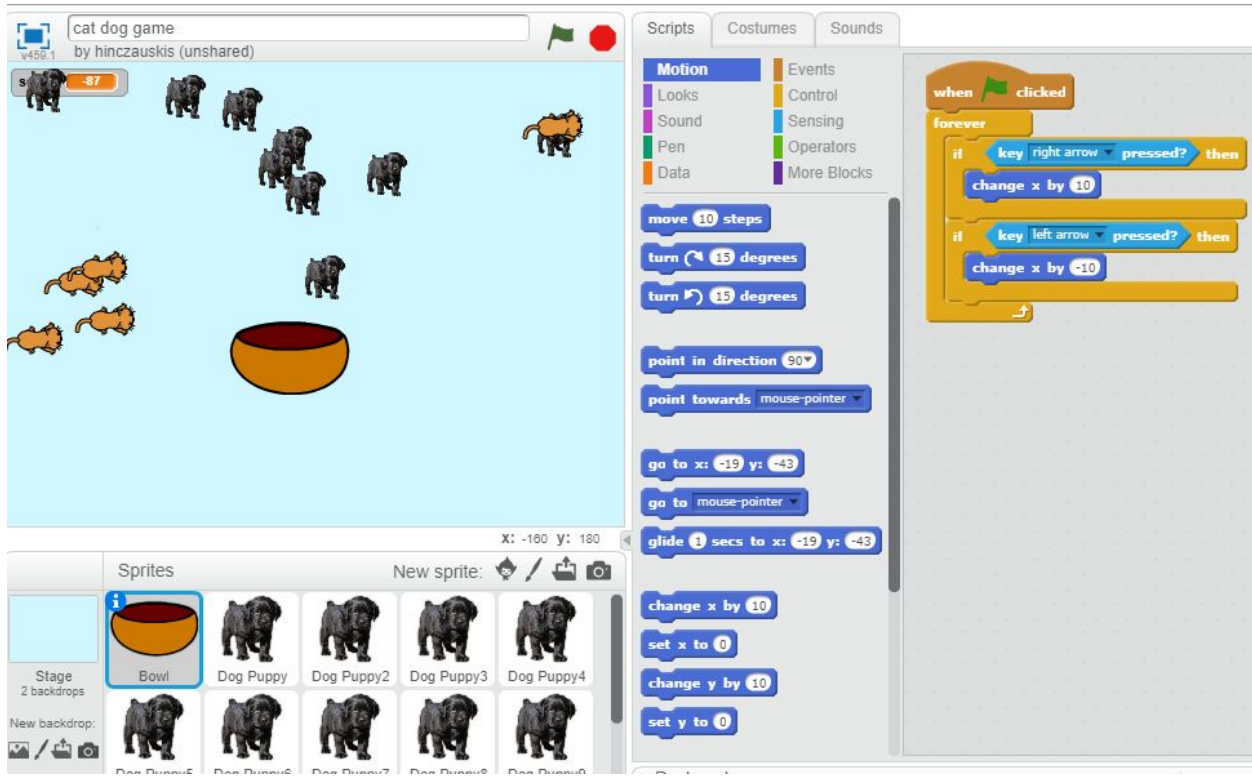
Pre-activity #2: Salmon Migration and Human Interaction

Adapted from http://www.naturesweb.ie/Spring%20Newsletter%202006%20Page%204.pdf

Salmon are born in a river ecosystem and eventually make their way to the ocean (using an estuary as an adjustment zone). On their long journey to and from the ocean salmon have a lot of barriers. Out of all the salmon that make this journey, about 2 % live to adulthood (http://www.5counties.org/salmoncycle.htm). Some of these barriers are human caused and some are natural. Can you think of any natural or human caused barriers that salmon may encounter?

Natural	Human caused
● Birds ● Bears ● Bigger fish and other marine animals ● Waterfalls ● Diseases	● Dams ● Fishermen ● Oil spills ● Garbage pollution ● Logging ● Erosion ● Run off ● Traffic

Is there anything we can do do to help protect salmon and their habitat?
Yes, we can help protect and restore steams that have been logged out and eroded, find ways that increase fish survival when faces with dams, decrease pollution and fishing efforts, and educate others about salmon.

Materials:
Salmon ecosystem
100 little salmon to tape on the ecosystem
Box or bag with lists of salmon deaths
- 500 eggs were not fertilized and therefore cannot develop
- 60 eggs are dead when they were crushed from gravel by tractors eroding the shore
- A new apartment complex washed mud and other debris into the river suffocating alevins
- 500 fry were eaten by bigger fish in the river
- Birds ate 40
- 260 salmon died due to pollution
- Once in the ocean 1550 were eaten by larger fish
- Seals had 100 salmon meals
- 590 salmon were caught by fishermen
- Land mammals ate 80 salmon on their trip back up the river
- 10 salmon were physically exhausted from fish ladders and died
- 3 salmon were crushed by rocks trying to make it up a waterfall

Draw on the board or have a big print out of a river ecosystem all the way to the ocean. Have barriers such as oil spills, fishermen, predators and dams. Each salmon actually represents 50 salmon so kids will have to do a little math to figure out how many salmon they have to remove from the ecosystem.

How many salmon made it back to their spawning habitat?
How many salmon were killed by natural causes?
How many salmon died due to human causes?