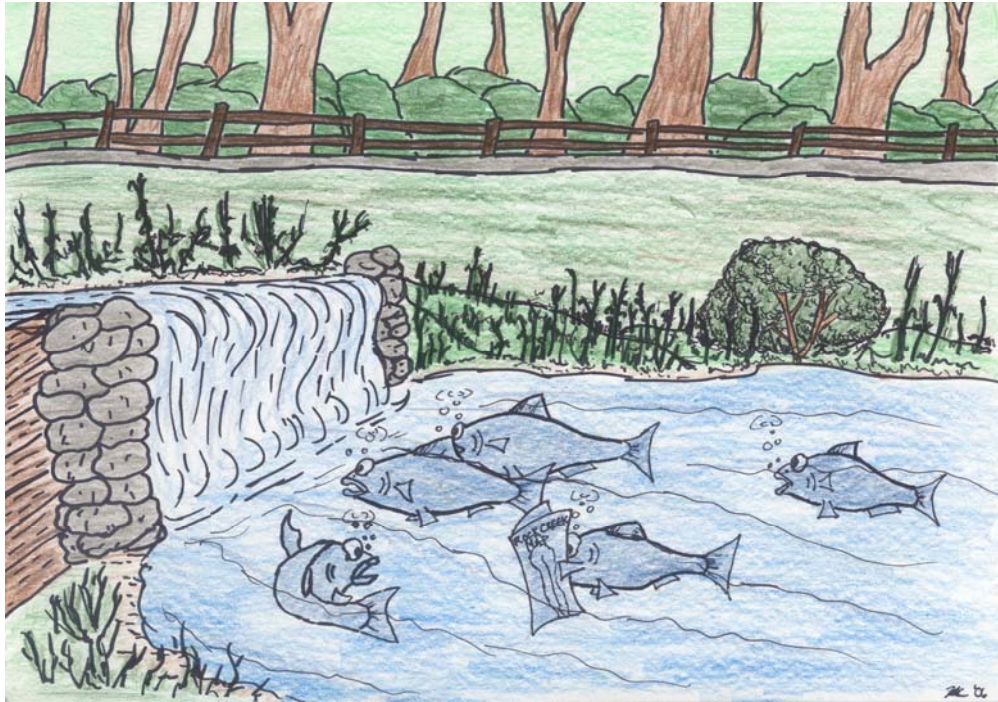


# Herring Highway Curriculum Module

A Study of a New Fish Passage for River Herring at Rock Creek Park

## Student Worksheets

Name: \_\_\_\_\_



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## Pre-Conceptions Survey: How much do you know about fish?

	Question	Your Response	Correct ???	Correct Answer
1	Which group of vertebrates has the most species?			
2	What branch of zoology is the study of fish?			
3	Is the plural of fish fish?			
4	Do fish breathe air?			
5	Do fish sleep?			
6	How can you tell the age of a fish?			
7	How long do fish live?			
8	How do fish swim?			
9	What fish are the fastest swimmers, and how fast can they swim?			
10	Which fish swims the slowest?			
11	Can fish swim backwards?			
12	Do fish chew their food?			
13	Can fish distinguish color?			
14	Why do fish sometimes have a strong odor?			
15	Do all fish produce offspring by laying eggs?			
16	Is there much salt in fish?			
17	Do fish travel very far?			
18	How much electricity can an electric eel discharge?			
19	Sometimes fish swim in groups and at times are called schools of fish. A group of jellyfish is called a smack. What is a group of herring called?			
20	What is a herring?			
21	What is a herringbone pattern, and what does it have to do with fish?			
22	What does the phrase "red herring" mean?			

How many did you answer correctly? \_\_\_\_\_



# Lesson 1 – Task 1

## Design a Way For Fish to Get Past the Dam

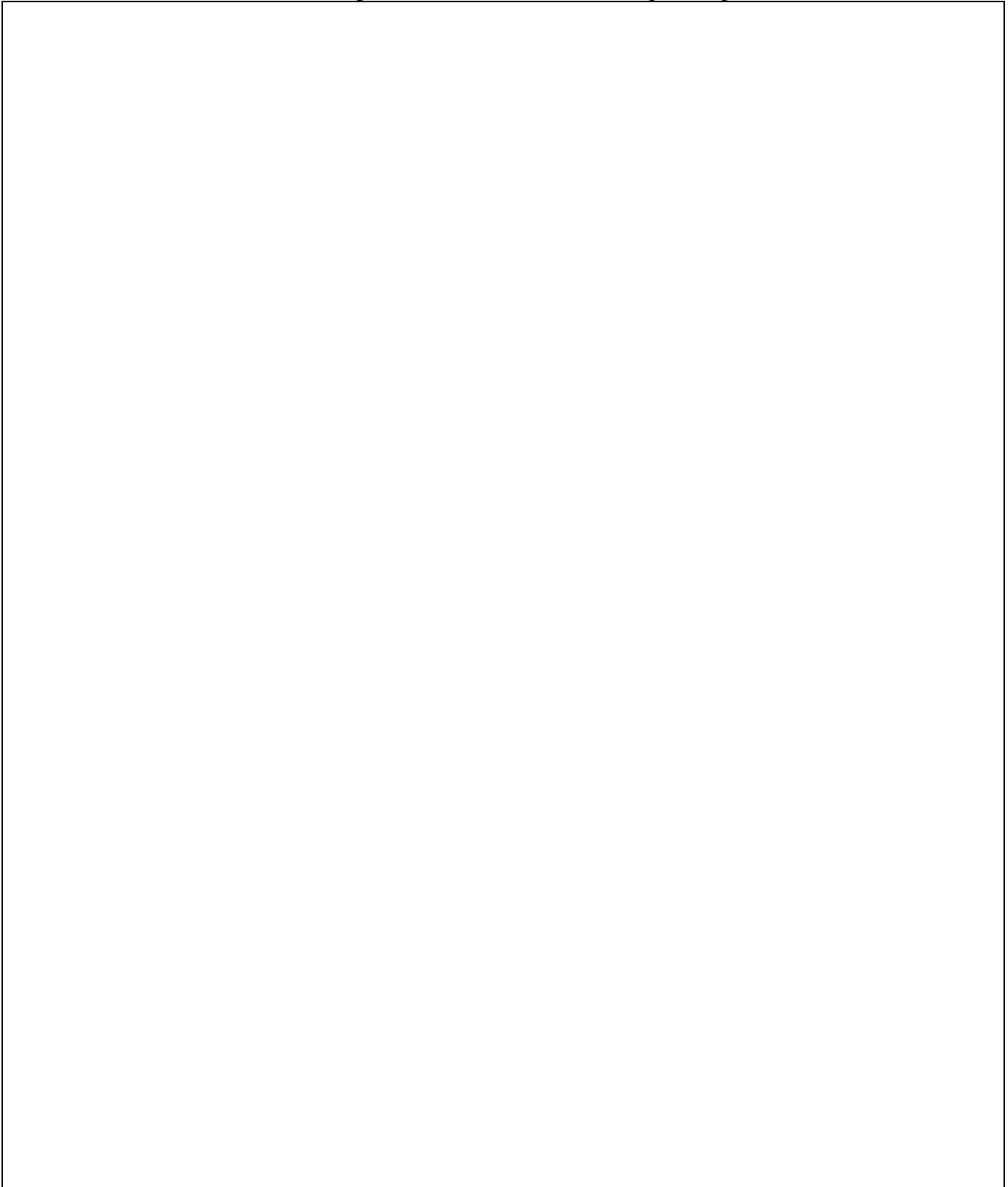
	Grading Criteria	Points Possible	Self-Score	Peer Score	Teacher Score
1. Design a Fish Passage	<p><b>Plan</b> shows that your Fish Passage addresses herrings'</p> <ul style="list-style-type: none"> <li>• inability to jump over obstacles</li> <li>• need for resting areas</li> <li>• need for adequate flow of water</li> </ul>				
	<p><b>Drawing</b> includes the following, CLEARLY LABELED:</p> <ul style="list-style-type: none"> <li>• waterway</li> <li>• the dam</li> <li>• fish passage</li> <li>• direction of water flow</li> </ul>				
2. Analyze Your Design	<p><b>Analysis</b> includes explanation of <b>WHY</b> you believe your fish ladder design would work</p>				



# Lesson 1 – Task 1

## Design a Way for Fish to Get Past the Dam

Space to Draw Your Fish Passage Design



# Lesson 1 – Task 2

## Analyzing Fish Ladders

How does your design compare to the Denil fish ladder design?

Why do you think your design would work for fish?



## Lesson 2 – Task 3

### Create a “Foldable” for the River Herring Life Cycle

(Completed on a separate 8 ½ x 14 inch paper)



Eggs



Fry with yolk sac



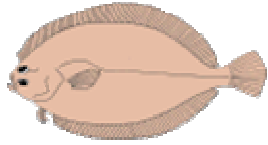
Juvenile



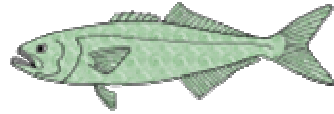
Two-year old herring



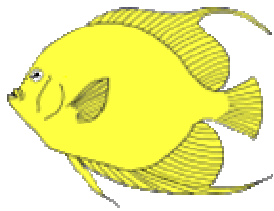
**Lesson 3 – Task 4**  
**Basic Fish Anatomy**



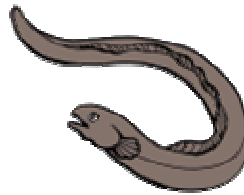
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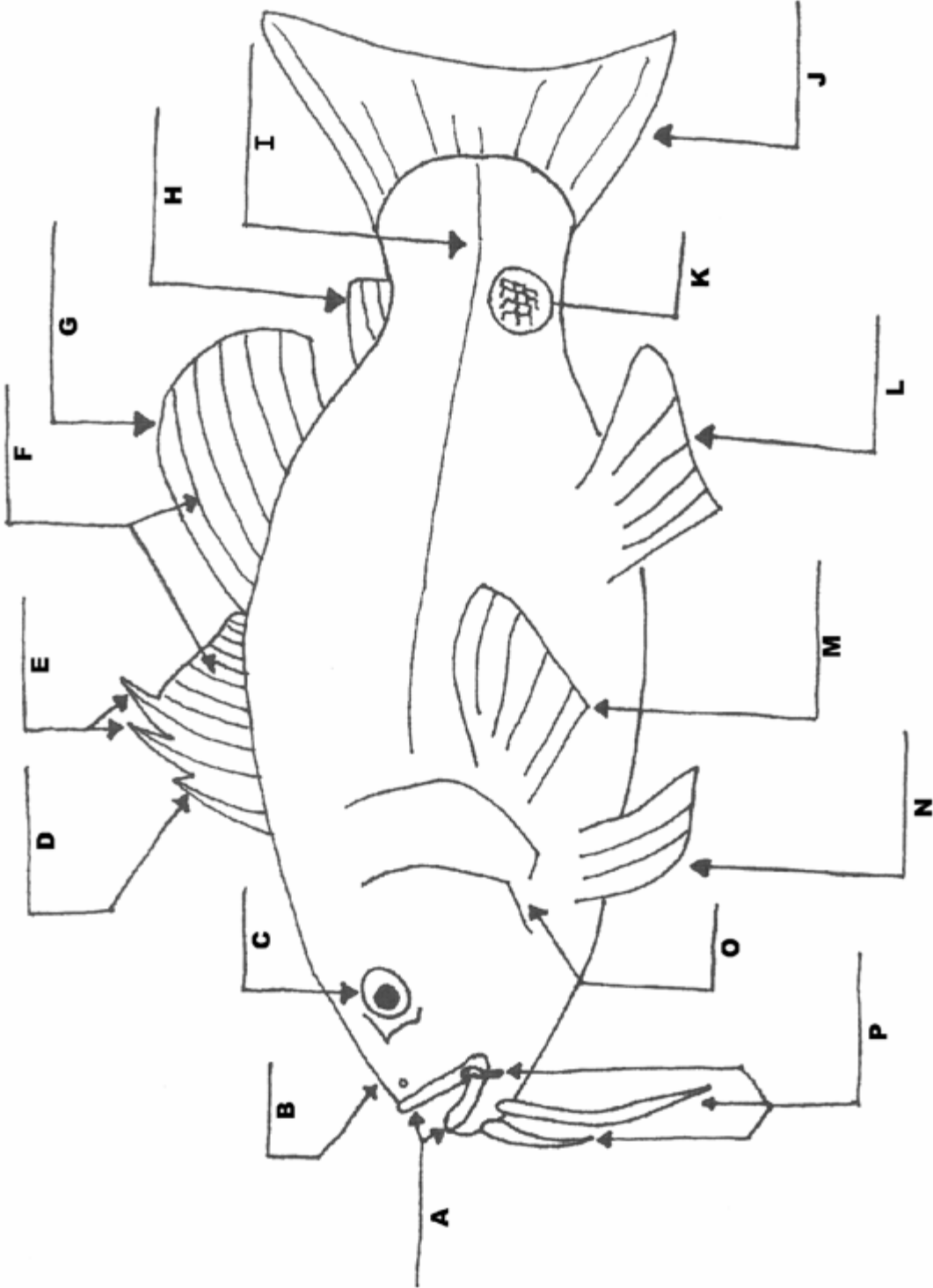
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**Lesson 3 – Task 4**  
**Basic Fish Anatomy**





## Lesson 3 – Task 4

### Basic Fish Anatomy

#### Fish Body Part Chart

Body Part	Description & Use
Adipose Fin	The single adipose fin is a tiny fin found between the dorsal and caudal fins on some fish.
Anal Fin	This single fin is located underneath the body, just in front of the caudal fin. The anal fin helps to stabilize the fish while it is swimming, keeping the fish level in the water and preventing it from rolling. Some fish have long anal fins used for propulsion.
Barbels	Barbels are whisker-like projections near or on the jaws of fish. Barbels house taste buds for finding food in murky waters where it is difficult to see clearly or at all.
Caudal Fin	The single caudal or tail fin is used for propulsion and steering. Fish that have forked caudal fins are fast swimmers. Fish that have rounded caudal fins are fish capable of quick action like predators. Large, elongated caudal fins are often used to attract mates.
Dorsal Fin	The single dorsal fin is located on the back of the fish and serves to help balance the fish while swimming, preventing it from rolling.
Eyes	Eyes are the visual sensory organs used to help fish locate food and avoid predators.
Gills	<p>The gills are the organs by which fish breathe. Through the gills, fish are able to absorb oxygen and give off carbon dioxide. Like the lungs, the gills have a large area for gas exchange.</p> <p>Water passes through the mouth and over the gills of the fish. As the water passes over the gills, oxygen enters the fish's bloodstream and is carried throughout its body. The nostrils of a bony fish are used for smelling and not for breathing. Some species have altered gills and other organs so that they can breathe air directly from the atmosphere and extract the oxygen.</p>
Gill Opening	Agnathas (jawless fish), sharks and rays have gill slits and no hard protective gill covering
Gill Operculum	A stiff gill cover, called an operculum [oh-PUR-kyuh-luhm] that protects the gills in most fish. This is the hard flap that you have to lift up to see the gills inside.

*continued on next page*



## Lesson 3 – Task 4

### Basic Fish Anatomy

#### Fish Body Part Chart (continued)

Body Part	Description & Use
Jaw	<p>The jaw is the bone structure that creates the mouth opening.</p> <p>There are three common mouth positions in fish:</p> <ul style="list-style-type: none"> <li>• Surface-feeding fish usually have an undershot, upturned (superior) mouth with a larger bottom jaw, for feeding on insects.</li> <li>• Mid-water feeding fish have a terminal mouth, with jaws that are roughly equal in size, and which is usually considered the “normal” fish mouth.</li> <li>• Bottom-feeding fish generally have an underslung (inferior) mouth, with a larger upper jaw.</li> </ul>
Lateral Line	<p>The lateral line organ is a line of fluid-filled ducts (small holes) located just under the scales. The lateral line senses vibrations in the water. This helps fish detect predators, find food, and navigate more efficiently. Many fish species can navigate without vision in darkness or muddy water using just the lateral line. The Blind Cave Fish relies entirely on its lateral line system.</p>
Pectoral Fin	<p>The paired pectoral fins are located near the gill cover and are used to help the fish steer and brake. These fins have been adapted, in the case of some bottom-dwelling species, so fish can prop themselves up or even walk around above or below water. Sometimes the pectoral fins have spines for defense.</p>
Pelvic Fin	<p>The paired pelvic fins are located under the body in front of the anal fin. The pelvic fins help keep the fish level in the water. Sometimes these fins are modified as long, thread-like fins used as an organ for feeling, like fingers.</p>
Rays	<p>Small supports in between the webbing of fins</p>
Scales	<p>Small protective pieces that cover the fish skin and protect the body. Some fish, like catfish, have bony plates which serve the same purpose. Other species have very small scales or no scales at all.</p>
Soft Dorsal Fin	<p>The soft dorsal fin located between the dorsal fin and the tail. This fin doesn't have any spines. In some fish that have a soft dorsal fin, it will be fused to the dorsal fin. Many fish do not have a soft dorsal fin.</p>
Snout	<p>The snout is the area above the mouth, usually containing the area around the nostrils.</p>
Spines	<p>A specific type of ray in some fins that ends in sharp projections. Spines are used mainly for defense from predators.</p>



**Lesson 3 – Task 5**  
**ID Your Fish**

Slide #	Characteristics	Drawing
Example		
1		
2		



Slide #	Characteristics	Drawing
3		
4		
5		



Slide #	Characteristics	Drawing
6		
7		
8		





## Lesson 4 – Task 6

### Swim for Your Life

After you finish playing the game, return to this page and record the eggs that survived the journey.

<b>Swim for Your Life Datasheet</b>					
<b>Location on the Board</b>	<b>#</b>	<b>Perils</b>	<b>% Fish Destroyed</b>	<b># Remaining fish</b>	<b>Cause</b>
<b>Spawning Ground (Where the Journey Begins)</b>	1.	Storm			
	2.	Antifreeze			
	3.	Acid Rain			
	4.	Soaring Temperatures			
	5.	Silt			
	6.	Salt			
	7.	Organisms			
	8.	Cattle			
	9.	Favorable			
	10.	Optimal			
<b>Stream to Ocean</b>	1.	Lack of Food and Shelter			
	2.	Bridge Construction			
	3.	Pesticides			
	4.	Chlorinated Water			
	5.	Microbe Attack			
	6.	Low Dissolved Oxygen			
	7.	Fertilizers			
	8.	Birds			
	9.	Restoration			
	10.	Conservation Legislation			

*continued on next page*



**Swim for Your Life Datasheet** *(continued)*

Location on the Board	#	Perils	% Fish Destroyed	# Remaining Fish	Cause
<b>River to Ocean</b>	1.	Power Plant			
	2.	Low Dissolved Oxygen			
	3.	Petroleum			
	4.	Bluefish			
	5.	Starvation			
	6.	Storm Surge			
	7.	Herring Gulls			
	8.	Leeches			
	9.	Restoration			
	10.	Optimal			
<b>Ocean</b>	1.	Purse Seines			
	2.	Starvation			
	3.	Haul Seines			
	4.	Gill Nets			
	5.	Fishing Trawlers			
	6.	Tuna Fish			
	7.	Bluefish and Striped Bass			
	8.	Gulls and Terns			
	9.	Escapes Predators			
	10.	Optimal			

*continued on next page*





**Swim for Your Life Datasheet** *(continued)*

Location on the Board	#	Perils	% Fish Destroyed	# Remaining Fish	Cause
<b>River to Spawning Grounds</b>	1.	Pond Nets			
	2.	Gill Nets			
	3.	Wrong Fork			
	4.	Haul Seine			
	5.	Predator Fish			
	6.	Carried Off Course			
	7.	Low Dissolved Oxygen			
	8.	Changing Conditions			
	9.	Traps or Predators			
	10.	Optimal			
<b>Stream to Spawning Grounds</b>	1.	Stream Blockages			
	2.	Changes in Stream			
	3.	Stream Alterations			
	4.	Anglers			
	5.	Mud and Sediment			
	6.	Snags and Gang Hooks			
	7.	Chemical poisoning			
	8.	Predators			
	9.	High Citizen Awareness			
	10.	Optimal			

