

Hook, Line & Thinker Worksheets

Science Guide

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NAME _____

Educated Angler

Use the space below to list five facts you have learned about fish anatomy or physiology and how each could help you catch a fish.

1. _____

2. _____

3. _____

4. _____

5. _____

NAME _____

You do the Math...

1. What is the total weight of biomass (living plants and animals) required to sustain that 10-pound walleye for a year? Show and label your work.

2. If 7,300 solar units are equal to the amount of energy required to sustain a pound of plants, how many solar units does it take to sustain a 10-pound walleye?

3. What factors influence the amount of energy a fish requires to maintain its weight or grow? In other words, what could cause that 10-pound walleye to starve?

NAME _____

Steady State?

Use the worksheet below to fill in your population dynamics results as you participate in a simulated food chain with different limiting factors. Your teacher will provide you with a nutrient game board and cards representing algae, shiners, and smallmouth bass. At the end of a round, record the time that each population crashed and the number of uncovered cards of each color.

1. Each Round lasts exactly five minutes.
2. The Start Time is the time at which a trophic level begins growing (begin laying down cards).
3. The Production Rate is the time interval between laying cards down. It represents the combination of the feeding, growing, and reproducing rates for that trophic level. For example in Round 1, green algae lay down one card at the beginning (t=0) and lay down one card every 5 seconds for the entire 5 minutes. Shiners start after 10 seconds (t=10), and lay down one card every 10 seconds. Bass start after 20 seconds (t=20) and lay down one card every 30 seconds.
4. You may only place your cards on top of the species you consume. If there are no more cards for you to put yours on top of, your species dies of starvation.
5. At the end of five minutes, record the number of cards remaining uncovered (still alive and feeding) and/or when the trophic level crashed.

		ROUND 1		ROUND 2A		ROUND 2B		ROUND 2C	
TROPHIC LEVEL	CARD COLOR	START TIME	PRODUCTION RATE	START TIME	PRODUCTION RATE	START TIME	PRODUCTION RATE	START TIME	PRODUCTION RATE
Green Algae	Green	0	5	0	5	0	5	0	2
Common Shiner	Yellow	10	10	20	3	10	15	10	5
Small-mouth Bass	Purple	20	30	25	20	20	10	20	10

		ROUND 1		ROUND 2A		ROUND 2B		ROUND 2C	
TROPHIC LEVEL	CARD COLOR	CRASH TIME	NUMBER OF CARDS	CRASH TIME	NUMBER OF CARDS	CRASH TIME	NUMBER OF CARDS	CRASH TIME	NUMBER OF CARDS
Green Algae	Green								
Common Shiner	Yellow								
Small-mouth Bass	Purple								

1. Which round of the game does each of these phrases describe?

Primary Producers are the limiting factor: _____

Predators are the limiting factor: _____

Nutrients are the limiting factor: _____

Steady State: _____

2. Which of the rounds describes what can commonly happen in an oligotrophic lake? How would you change the model to reflect a eutrophic lake?

3. What would happen in Round 1 if the round continued for another five minutes? Why?

4. Why did all the trophic levels crash in Round 2A?

5. Name two ways a steady state could be restored for Round 2A:

6. What limits the growth of algae in Round 2C? Predict what would happen to the shiners and the smallmouth bass if this game were to run another five minutes.

7. If you were planning to stock fish in a lake, what could you learn from these rounds?

8. What are some of the assumptions and limitations of this food chain model?

NAME _____

Prime Real Estate

Which of the following environments would most likely have good trout habitat based on dissolved oxygen? Which of these could host a catfish?

1. A fast-moving, unpolluted stream _____
2. A small pond with lots of vegetation _____
3. A large slow-moving, muddy river _____
4. Lake Michigan _____
5. Lake Superior _____

NAME _____

Coming Up for Air

Watch the demonstration of the layers in a summer lake and then answer the following questions:

1) Where does most of the heating occur in a lake? _____

2) What is the effect of wind on a summer lake? _____

3) How does layering affect fish living in the lake? _____

4) Given all that you have learned about temperature and oxygen, what could climate change mean for aquatic species? For anglers? _____

5) Design a 10-year experiment that would allow you to determine the layering in your own local lake and whether or not it is changing as a result of climate change. What type of equipment would you need? Where would you take measurements and when? How would you know if you were getting a good sample of the lake? _____

FISH KNOWLEDGE

Vocabulary Review

Fill in the blank using the words below.

1. Because a fish's body temperature nearly matches that of its environment, it is called a _____.
2. The lowest level on a _____ pyramid is composed of those who make their own food, or the _____.
3. Layers of warm and cool water are _____ in water-bodies just like the layers of vinegar and olive oil in salad dressing.
4. The weight of all living plants and animals in an ecosystem is its _____.
5. The _____ marks an area of rapid temperature change in a lake.
6. A fish nest is called a _____.
7. The _____ layer of a lake is where most of the heating occurs.
8. Each fish's adaptations help suit the fish to its particular _____ in an ecosystem.
9. Scientists use morphology to classify organisms into _____ groups to build family trees and trace evolutionary history.
10. _____ are wetlands that are usually wet year-round and are hospitable to fish.

Word Choices

stratified	taxonomic	marshes	biomass	redd
consumers	dorsal	niche	bayous	primary producers
ventral	poikilotherm	trophic	epilimnion	thermocline

NAME _____

A Salmo Scenario...Imagine If

Each group has a reason for not wanting Icthy to gain control of the entire lakefront property. Each also has reason to believe that their own proposed uses of the land would serve the community better, while still protecting the landscape and enticing Icthy.

Think back to what you have learned about fish habitat, water pollution, and the aquatic-forest ecotone, as well as your organization's goals, to determine the reasoning behind your group's opposition to the sale. Develop a proposal for an alternate solution to getting Icthy to come to Salmo while also including your own interests. Be sure to anticipate the arguments Icthy will use against you in advocating for ownership of the entire lake. Is compromise possible?

NAME _____

News Flash! Asian Carp Approaching Wisconsin!

While resource managers are trying to control the exotic invasive species currently in Wisconsin, others are working their way into our lakes. One of the greatest threats to Wisconsin and the Great Lakes is the Asian carp.

These enormous fish, which can weigh up to 100 pounds, were brought to the United States intentionally by catfish farmers who used them to clean algae out of their ponds. In the 1990s, many rivers near the Mississippi River flooded,

connecting the catfish ponds to river systems. Asian carp made their way into the Mississippi River and from there began swimming up the Illinois River toward Chicago and Lake Michigan.

If the carp make it into the Great Lakes, they could significantly change the ecosystem. Asian carp are big eaters and rapid reproducers. They will compete with Great Lakes game fish for food and could end up a dominant species in the Lakes. Managers are trying to stop their advances. Do a quick Internet search: Where is the Asian carp now?

Invasive Aquatic Species

List five aquatic invasive species that live in Wisconsin. What's the impact of each? How are we trying to control them?

1. _____

2. _____

3. _____

4. _____

5. _____

NAME _____

Sea Lamprey Control Methods Survey

Read the article on the next pages to answer the following questions:

- 1) How do scientists count sea lamprey in their different life stages? Of the three assessment methods described—larval, parasitic-phase, and spawning-phase—which of these do you think provides the most accurate data about the sea lamprey population? Why do you think so?

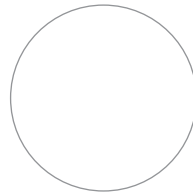
- 2) Suppose you are a scientist trying to assess parasitic adult sea lamprey using the help of local commercial and sport fishermen. What kinds of information would you want the fishermen to record for you? Why would it be worth their time to help you?

- 3) How effective has TFM been at controlling lamprey without hurting other species? Why? State at least three reasons.

- 4) Describe at least three advantages or benefits of using sea lamprey barriers when compared to the use of TFM.

- 5) According to the fact sheet, about 25,000 male sea lamprey are caught each year in traps. If you had the choice between destroying these lamprey or sterilizing and then releasing them, which would you choose? State a reason to support your answer.

6) If you were managing the Great Lakes fishery, which method of sea lamprey control would you devote the most time and money to—lampricides, sterile males, or barriers? Why? Make a pie graph showing how you would divide your funds.



7) Do you think it will ever be possible to eliminate all the sea lamprey in the Great Lakes? Why or why not?

8) In 2008 the Great Lakes Fishery Commission spent over \$18 million dollars on sea lamprey management. Do you think this is a worthwhile investment? Why or why not?

9) Why is it important for scientists to study other invasive species? Why is it important for us to try to prevent the introduction and spread of new invasive species?

10) Could any of the methods used for sea lamprey control be used on other invasive species? Why or why not?

Gilbert Creek Case Study

One hundred years after farming began in the Driftless Area, a local stream, Gilbert Creek (located twelve miles west of Menomonie), remained choked with silt. Its water was murky and warm, and invasive tree species lined its banks rather than the deep-rooted prairie grasses that once anchored soil in place.

In 2002, brook trout laid eggs in the North Branch of Gilbert Creek, but fish survey crews did not find any newly-hatched trout in 2003. The eggs were likely smothered by silt or killed by high water temperatures. If fishing were to continue in Gilbert Creek, something had to be done. Work with your team to develop a plan to restore trout habitat to Gilbert Creek, using the following questions for direction.

1) Who are the **stakeholders** in the Gilbert Creek restoration, and what do they want?

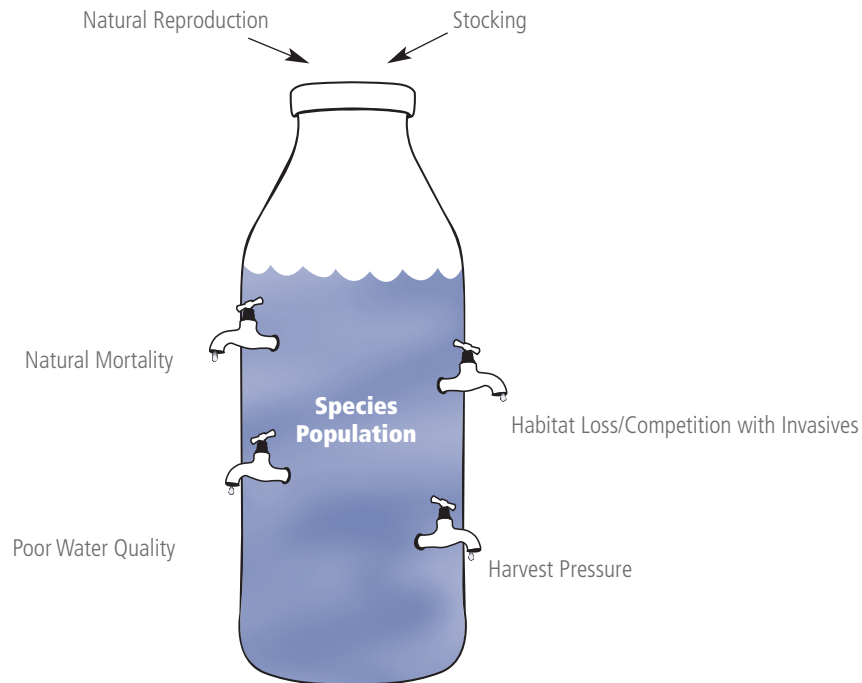
2) Considering the needs of the stakeholders, what are your goals for the project?

3) What are the constraints?

4) Using the stream improvement techniques on the next page and your own inspiration, decide some of the measures you will take to restore the stream.

5) How will you know if the steps you have taken succeeded in meeting your goals? What might you continue to monitor after your project is done?

Bottle Model



Look at the Bottle Model diagram above. This model represents the interaction among ways in which species are removed from and added back to Lake Michigan.

- 1) Explain what you think the model illustrates about the factors that bring fish into the lake and that take fish out of the lake.

- 2) Describe an event that could make one faucet flow faster, and name the affected faucet.

- 3) If the event you described above did happen, what would happen to the population level in the bottle? Would the population be able to return to its original level after the event? How?

Balancing Act

Your teacher will provide you with instructions to play a game that illustrates the way that people, fish populations, and laws interact and influence each other. In the game, you will represent some of the people—lawmaker, scientist, anglers, and commercial fishermen—who influence and are affected by fisheries regulations. You can play a similar on-line version, The Fish Game, by the Cloud Institute, that demonstrates how individual actions affect a resource held in common, sustainabilityed.org/games/.

After you have played 10 rounds of Balancing Act, answer the following questions.

- 1) Summarize the results of the game. What trends did you see in the beanfish population over time?

- 2) Of the factors that increase and reduce species in the water, which can we control? Look back at the Bottle Model and record here the factors that people can control. Under each factor, provide an example of an action that you, or others, do or could do to decrease the flow of the faucet.

- 3) What would happen to the fishery if commercial fishermen or anglers “cheated” on their fish counts when fisheries scientists weren’t watching?

- 4) Describe three events, actions, or decisions in the game that most influenced the health of your fishery.

- 5) List and explain three things that you would do differently if you were to play Balancing Act again. How do you believe these actions would affect the outcome of the game?

6) Because this was a game, or a model of a real-life process, there were many things that were not quite realistic. Even so, this game should have given you a good sense of the challenges, cooperation, and compromise involved in fisheries management. What other factors might influence populations and catches in real life that this model does not account for?

7) This game deals with a very real issue: the role of laws in fisheries management. Think about how laws or regulations affected the commercial fishermen and anglers in your game. How did the regulations affect the fish population? Write a persuasive paragraph to a classmate explaining whether or not you think we need laws, such as those you saw in the game, to manage fisheries. Use examples and evidence from the Bottle Model, the game, and any other knowledge you have to support your perspective.

Cheap Date

Take your date or a pal fishing! After a small annual investment, you can fish 365 days a year with whomever you want. Many Wisconsin communities are situated on or near fishable waters. Pack a picnic, call a friend or two, hop on your bike, and head for the water's edge.

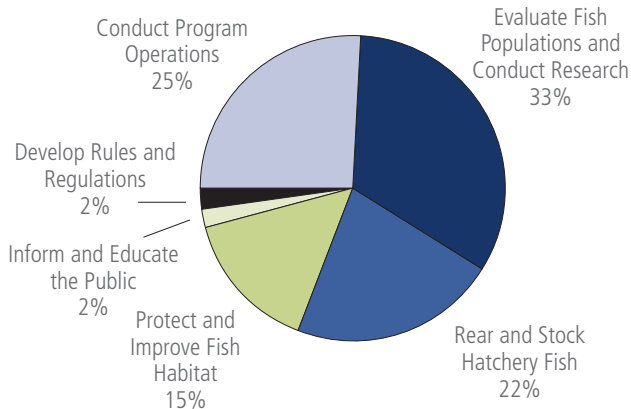
Compare the cost of a day of fishing to other leisure activities.

Consider total costs of participation and how often you can use your investment. Here are some examples:

ACTIVITY	MINIMUM REQUIREMENTS	COST	ONE-TIME USE OR OPPORTUNITY	MULTIPLE USES OR OPPORTUNITIES
Fishing	License & Stamps Rod Reel Bait Tackle Other:			
Prom	Ticket Clothes Dinner Flowers Special Transportation Other:			
A night out Several options: movie, food, gasoline. List what you would do.				
A night at home Several options: games, music, snacks. List what you would do.				

Where does your license money go?

Money collected through the Sport Fish Restoration Fund and fish license fees funds the fisheries program at the Department of Natural Resources. Within the fisheries program, the money gets divided into many different projects, illustrated in the pie chart below:



A love of fishing has inspired generations of anglers to pay close attention to natural resources. Invite a friend to join you in enjoying the beauty and excitement that fishing offers. Maybe he or she will become a *great conservationist*.

All that for less than the cost of one night on the town!

Data from 2006 DNR Fishing Report

PEOPLE KNOWLEDGE

Vocabulary Review

Fill in the blank using the words below.

1. A _____ is where fish eggs are taken to provide suitable habitat for hatching.
2. The process by which contaminants fall to the ground in rain or snow after traveling long distances in air currents is called _____.
3. _____ can be accelerated by human activity and damage fish spawning habitat when loose soil is carried into a waterbody.
4. PCBs are called _____ because they do not break down in the environment.
5. When communities consider the long-term environmental and cultural effects of their land use decisions, they are designing for _____.
6. _____ is the build-up of substances, such as pesticides or other toxins, in an organism.
7. An action or agent that negatively affects an organism is called a _____.
8. The process by which fish habitat is deliberately improved by land managers and concerned citizens is called _____.
9. Dams can _____ fish habitat and communities by blocking fish movement between the above dam and below dam areas.
10. Water (rain and snowmelt) that flows over land into a water body is called _____.

Word Choices

sustainability	persistent organic pollutants	erosion
fragment	weathering	bioaccumulation
hatchery	atmospheric deposition	restoration
runoff	enduring chemicals	stressor

Select a fish you would like to learn more about. Use this worksheet to profile the fish as you work through the different sections of this booklet. If each of your classmates selects a different fish, your classroom will know how to catch just about anything!

Profile of a Swimmer

Common Name(s): _____

Scientific Name: _____

SENSE	FEATURE AND DESCRIPTION	IMPORTANCE TO FISH (HIGH, MEDIUM, LOW)
Sight		
Smell		
Hearing		
Taste		
Touch		

Identifying Characteristics: _____

Natural Food: _____

Habitat Description: _____

Niche (role): They feed on the bottom and are active at night.

Spawning habits and habitat: _____

Environmental stressors: _____

Tackle and Bait: _____ Bag Limit: _____

Is there a health advisory for this fish? if so, where? _____

Any restoration or stocking efforts for this fish? _____

Good to eat or simple recipes? _____

Other interesting facts about this species (list 5): _____

Sources: _____

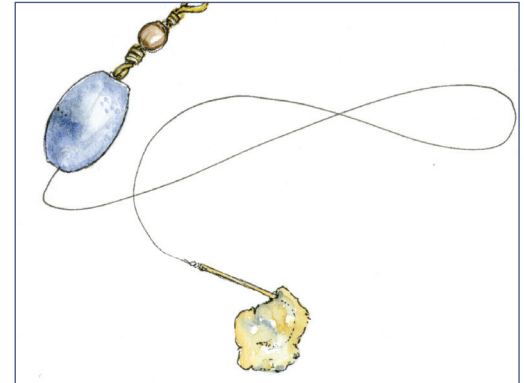
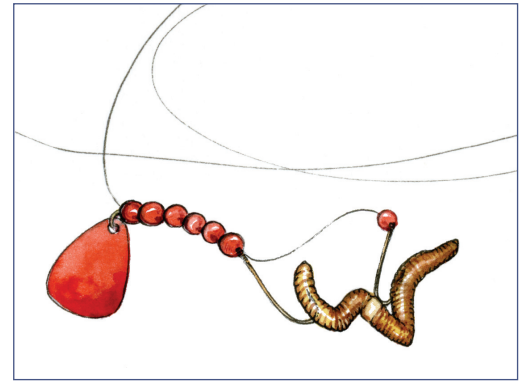
NAME _____

Get Rigged

The combination of tackle used at the end of your fishing line is called terminal tackle. The type you use will correspond to the type of fish you want to catch.

What combination of tackle would you rig up for use on a bluegill? How about a walleye? A catfish? Consider where you will find your fish, what it likes to eat, and what method of casting will work best for the fish. As you go through this activity, take notes on the tackle your classmates used:

Terminal Tackle Set-ups



Top: light terminal tackle for bluegill: bobber, split-shot, and artificial bait.
Middle: medium set-up for walleye: spinner, beads, worm harness.
Bottom: heavy terminal tackle set-up for bullheads and catfish: sinker, artificial natural-scented bait.

NAME _____

Catch and Keep?

Use this chart as the basis for a fishing journal. Record your paper "catch" and whether or not you could keep your fish:

	SPECIES	LENGTH	DATE	LOCATION	BAG LIMIT	LEGAL?	WILL KEEP?
1	<u>Bluegill</u>	<u>7"</u>	<u>2/14</u>	<u>Wilson Lake, Iron County</u>	<u>25</u>	<u>Yes</u>	<u>Yes</u>
2							
3							
4							
5							
6							

Bag Limit Scavenger Hunt!

Use the regulation book or go online (dnr.wi.gov/fish/regulations/dailybag.htm) to find out:

1) What is the total daily bag limit on largemouth and smallmouth bass during summer months?

2) What is the total daily bag limit on muskellunge?

3) What is the daily bag limit for panfish on Sawdust Lake in Bayfield County?

4) What's the difference between "daily bag limit" and "possession limit"? ?

5) Why can't you keep a slender madtom?

6) Suppose that you go to a lake that has a bag limit of three for walleye and you catch three walleye. Later that day you want to go to another lake that also has a three-fish bag limit on walleye. What do you do?

7) If you have questions about the fishing regulations, who do you call in your area?

NAME _____

Safety First!

Ethics are a close second. Fishing can be relaxing and sociable, a quiet personal escape, or an exciting group adventure. Regardless of your goals for your fishing trip, safety and outdoor ethics should always be a consideration when you pack your gear.

Gearing Up

Think about the environment you will be in while you are fishing. What are three dangers you might face?

- 1) _____

- 2) _____

- 3) _____

Think about the types of gear that you could bring that would help you to avoid these dangers or allow you to address them if they happen. Make a list below.

- 1) _____

 - 2) _____

 - 3) _____

-

Cheap Date

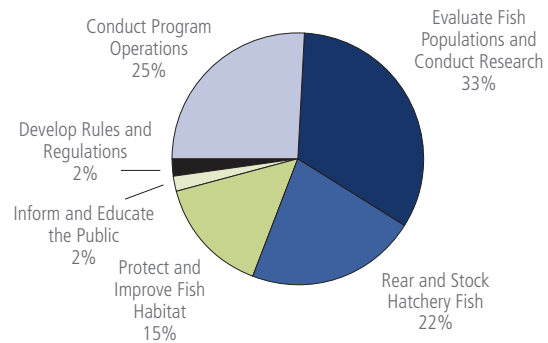
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Prom	Ticket Clothes Dinner Flowers Special Transportation Other:			
A night out Several options: movie, food, gasoline. List what you would do.				
A night at home Several options: games, music, snacks. List what you would do.				

FIELD KNOWLEDGE

Know Before You Go/Making the Catch

Vocabulary Review

Fill in the blank using the words below.

- The _____ knot is an angler's old standby and works well to tie a smaller line to a hook or lure.
- Treating others as you would like to be treated is an example of _____ behavior.
- With _____ gear, the reel is designed to store line (not to cast or retrieve) and the rod is long and limber.
- _____ is a process used to clean fish that leaves them boneless.
- Water you can float a canoe down during at least one day of the year is considered _____ by the State of Wisconsin.
- People who own homes next to a natural body of water are considered _____ landowners.
- A _____ is a type of feather lure that takes on lifelike movement in the water.
- Many species of fish are regulated by " _____," which define the number of a species you may catch in one day.
- CPR for fish stands for _____, a series of actions an angler can take to improve a fish's chance of surviving release.
- The combination of tackle used on the end of a fishing line is called _____ tackle.

Word Choices

marabou	filleting	riparian	universal
terminal	fly-fishing	ethical	consider proper release
careful piscivore release	improved clinch	total daily bag limits	navigable

Fishing Journal

Date & Time

Location (DETAILED)

Weather Details

AIR TEMPERATURE: _____

WATER TEMPERATURE: _____

SKY: Clear Partly Cloudy _____ % Cover Overcast

WIND: Direction _____ Calm Breezy Windy

PRECIPITATION: None Drizzle Hard Rain Snow

Catch

1 SPECIES: _____ SIZE: _____ KEPT?: _____
BAIT: _____ METHOD: _____
LOCATION OF CATCH (CURRENT, WAVES, STRUCTURE): _____

2 SPECIES: _____ SIZE: _____ KEPT?: _____
BAIT: _____ METHOD: _____
LOCATION OF CATCH (CURRENT, WAVES, STRUCTURE): _____

3 SPECIES: _____ SIZE: _____ KEPT?: _____
BAIT: _____ METHOD: _____
LOCATION OF CATCH (CURRENT, WAVES, STRUCTURE): _____

4 SPECIES: _____ SIZE: _____ KEPT?: _____
BAIT: _____ METHOD: _____
LOCATION OF CATCH (CURRENT, WAVES, STRUCTURE): _____

Next Time Bring:

Special Notes: (INSECT HATCH, SPAWNING, ETC)

