4

Buddy System

Musky

Making sure that there is a healthy and sustained fishery for all to enjoy requires resource managers. Managing waterbodies for fish means creating, maintaining, and improving environments favorable to all stages of a fish's life cycle. We all play a role in managing Wisconsin's fisheries, because we all live in watersheds that support fish. Keeping fish in mind when making decisions about when and where we apply fertilizer, how we dispose of hazardous waste, or where we place cattle fences makes us all fish managers. The primary agency for managing fish in Wisconsin is the Department of Natural Resources (DNR). The DNR manages habitat improvement projects; studies, protects and restores fish populations; monitors fish health; staffs hatcheries; stocks fish; and enforces fishing regulations on Wisconsin waters, all of which are public.

Restoration Nation

The Wisconsin DNR Bureau of Fisheries Management protects, maintains, and improves fish habitat. One of the jobs fisheries staff have is to partner with other DNR bureaus and concerned groups, like angler clubs, to improve fish habitat through restoring our streams, lakes, and wetlands.

The Route to Trout: Stream Restoration

Early 20th century farming practices harmed local watersheds in western Wisconsin's Driftless Area, where clean, cold creeks wind through valleys flanked by steep hills. When farmers removed trees and native grasses to plant crops, loose soil flowed downhill, depositing as much as 12 to 15 feet of soil in some creeks over the years. Water quality worsened, stream temperatures increased, and flooding became more frequent and severe.

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?

No matter what actions your restoration team takes, it is important that your team understands both the habitat needs of a fish during all phases of its life and the root causes of the habitat loss. If your team restores a stream, but does not address the cause of the erosion, for example, the stream will just need to be restored again later.

Lessons Learned

Wisconsin has over 2,700 trout streams with some natural reproduction. The DNR wants to improve and sustain these populations, believing the thrill and challenge wild trout offer will always be valued by anglers. Protecting natural spawning areas is today's biggest challenge for Wisconsin habitat improvement. The ultimate goal of habitat improvement is a completely self-sufficient stream with large populations of wild trout maintaining themselves.

Perhaps the best lesson to learn from all of our restoration work is that it is much easier to prevent habitat loss by making thoughtful land use decisions than it is to restore degraded habitats. We have also learned that it is better to use natural structures and processes to restore streams, lakes, and rivers than it is to install artificial habitat structures. We may never be able to recreate the full complexity of a natural system after it has been altered.

Stream Improvement Techniques

When seeking to improve a trout stream, fishery biologists focus on making habitat meet the needs of the trout. Areas for them to address might include the following: lack of shelter (cover) or living space for fish, lack of sunlight due to overgrowth of vegetation, siltation due to erosion of streambanks, water that is too warm because a stream is too shallow. Fishery experts have developed many solutions to such concerns.

PROBLEM	TECHNIQUE
Bank Erosion	Plant vegetation on bank and buffer. Exclude or modify livestock grazing. Put stabilizing structures in place. Re-grade the slope of the bank.
Lack of Sunlight	Plant native shrubs and grasses. Remove non-native trees and plants.
Over-widened/ Shallow Streams	Use log jams to deepen pools. Use gravel to narrow a stream channel.
No Shelter	Place materials like wood and boulders. Install LUNKERs.

Installing a LUNKERS.

LUNKERS!

Little Underwater Neighborhood Keepers Encompassing Rheotactic Salmonids are crib-like wooden structures that imitate an undercut bank. LUNKERS provide shelter for fish while stabilizing the streambank. They were developed in Wisconsin by DNR trout stream biologist David Vetrano and work well for restoring fish habitat in Midwestern streams.

Taking Stock

In the first scene of this booklet, you were asked to think about what factors might determine whether or not to stock walleye and yellow perch in Linnie Lake. These decisions are actually a part of the job description of DNR fisheries biologists who manage this resource for the common good (more about that later.) The DNR uses science to determine what goes into (stocking quotas) and comes out of (bag limits) Wisconsin's lakes.

Hatchery
a place where eggs are hatched

Fish Nurseries

Nature provides the best fish **hatchery** (a place where eggs are hatched) and stocking program. In a healthy aquatic ecosystem, all of the elements are in place for a productive fishery: the eggs hatch on their own and fish grow to normal adult sizes in healthy numbers. Not all of our lakes and streams, however, have healthy fisheries. In some instances, we need to supplement and enhance fisheries through artificial hatcheries and wild releases (stocking programs) in order to provide anglers with fish to catch or to reintroduce species after a habitat has been restored. Wisconsin has been stocking hatchery-raised fish since the late 1800s. Today, anglers help fund state-operated hatcheries through license sales, trout and salmon stamps, and taxes on fishing tackle, boats and boat fuel.

Many egg collection facilities, hatcheries, and fish rearing stations are open to the public for tours during certain times of the year. Check the Website for information on locations, hours and visitation policies, **dnr.wi.gov/fish/hatchery/hatcheries.**

Who pays? You do!

Anglers fund a large share of the fisheries habitat work the DNR does through the Sport Fish Restoration (SFR) fund. This fund is generated by a 10% federal tax collected on fishing gear, tackle, baits, motors, and motor boat fuel. The tax money is divided among states for education programs, fisheries habitat work, stocking, and fishing access development. Each state's share of funding is based in part on how much water a state has and how many licenses are sold. Wisconsin is near the top in both categories! Anglers also support fisheries programs through the purchase of licenses and stamps, which you'll learn more about later.

Wisconsin Fish Hatcheries

Wild Rose State Fish Hatchery opened an education center in 2008 as part of a three-phase renovation project.

When stocking a waterbody, a biologist has to consider more than just the physiology and habitat requirements of a species of fish. Ecological balance, cost, and angler needs are also important considerations. Biologists stock a waterbody for one or a combination of the following reasons:

1. **Rehabilitation stocking.** Rehabilitation stocking is a top priority for biologists. In this type of stocking, biologists reintroduce a species of fish that used to exist in a waterbody, but that was extirpated or became too scarce to effectively reproduce. This method of stocking usually follows a catastrophic natural event like a winterkill, disease, or dam failure. It can also follow human-caused events like overfishing or chemical spills. The species is re-introduced to the waterbody with the goal that it will soon become a self-sustaining population again. The DNR is currently using rehabilitation stocking to return lake sturgeon to many rivers and lakes in Wisconsin.

2. **Research and Evaluation stocking.** In this type of high-priority stocking, biologists experiment with putting different species or sizes of fish in a waterbody to determine the most cost-effective or most successful way to manage the lake. For example, biologists are experimenting with stocking small walleye fingerlings (young fish) instead of large walleye fingerlings to see which size is more likely to survive.

3. **Recreation stocking.** Recreation stocking either creates or maintains a fishing opportunity that did not previously exist. A wide array and volume of fish are stocked in urban waters, for example, to provide local residents with the opportunity to fish. If these waters were not stocked, limits on the number of fish caught would have to be lower. Coho and Chinook salmon are stocked in the Great Lakes partly to provide a recreational fishery.

4. **Remediation stocking.** Sometimes an event extirpates or severely lowers a fish population, such as the loss of spawning habitat or the invasion of an exotic species. If the event that caused the problem cannot be readily fixed, the DNR will use remediation stocking to maintain a species of fish that is ecologically or recreationally valuable. For example, the draining of wetlands has greatly reduced northern pike spawning habitat in some areas of Wisconsin. The northern pike are necessary to maintain a predator/prey balance in many inland lakes. Even if the drained wetlands will not be restored, the DNR will continue to stock northern pike as a last resort to maintain a fishery. The stocking of once-abundant lake trout along the offshore reefs of Lake Michigan is also an example of remediation stocking.

Photo: Alisa Santiesteban, July 2009.

Wisconsin DNR Fisheries technician Tom Burzynski stocks young lake sturgeon into the Milwaukee River, a tributary of Lake Michigan, below the Thiensville Dam. The sturgeon were raised at a streamside rearing facility, located at Riveredge Nature Center in Newburg, Wisc. Learn more about this exciting rehabilitation project and take a tour of the facility on the DNR's Website: **dnr.wi.gov/fish/lakemich/LakeSturgeon**.

5. **Introduction stocking.** When a fish is placed in a newly created waterbody, like a small pond or reservoir, or when a species is put in a waterbody it has not previously inhabited, the DNR has conducted an introduction stocking. The DNR generally discourages introductions unless done on a new pond or reservoir where the species could soon develop a self-sustaining population. Stocking of muskellunge into southern Wisconsin lakes to expand musky range could be considered introduction stocking, because it is unlikely muskies occurred in these lakes prior to European settlement.

Managing the Commons

Moratorium
a period of time when a certain activity is not allowed

Fish, like air and water, are a resource held in common by all citizens. In other words, no one person owns it, but all share it. The "tragedy of the commons, "a phrase coined by Garrett Hardin in 1968, refers to unsustainable rates of use or abuse of a resource held in common. Fisheries biologists attempt to manage the commons by considering how many fish anglers and commercial fishermen should be allowed to harvest (keep) from Wisconsin's waters to ensure a fair, equitable and sustainable distribution of the resource.

Sustainable Harvest Rates

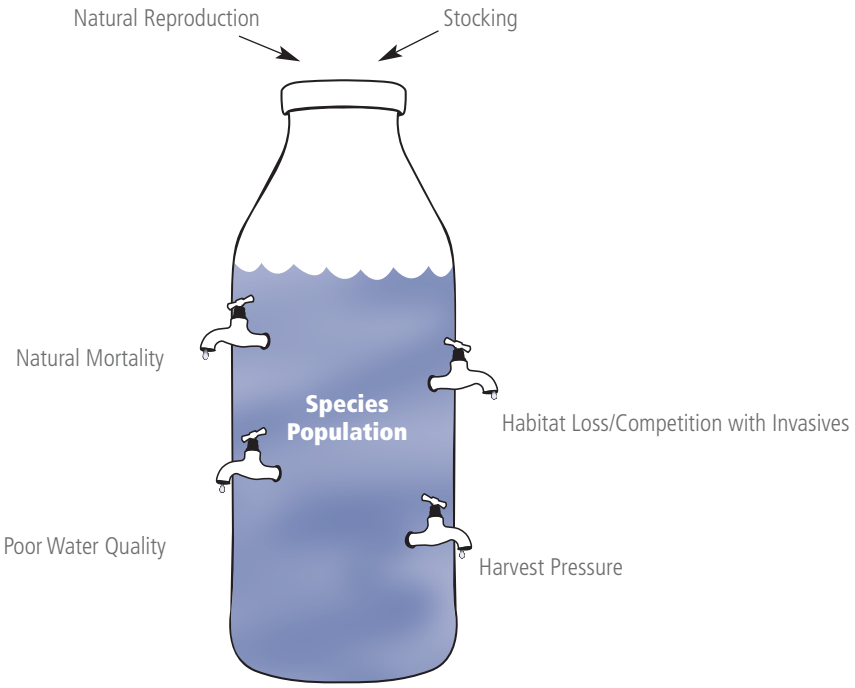
Imagine if every single angler and commercial fishermen were able to harvest as many fish as they wanted, regardless of species. Overfishing, especially on smaller lakes and with popular fish, could rapidly eliminate certain fish populations. Historically, many species of fish suffered because of overharvest. To sustain our diverse fish populations, and the ecosystems they are a part of, the DNR makes. Although some lakes, regions, and fish have special **regulations**, in general the DNR defines how many fish of a certain species you may catch in one day from all waters as the "total daily bag limit."

Occasionally fisheries managers may recommend a **moratorium** (a period of time when a certain activity is not allowed) on fishing for a certain species of fish in a certain lake to allow its population to grow. Whether fish managers are restoring streams, putting fish in the water, or regulating how you take them out, they have a fascinating job that mixes science and policy to help create a sustainable fishery.

The Dam Problem

Dams have had an enormous effect on stream habitats; about 3,700 were built in Wisconsin to grind flour, saw lumber, and power other early Wisconsin industries. Dams **fragmented** (divided) fish communities and blocked fish movement essential for reproduction during spawning time. Paddlefish, sturgeon, and other river species that swim upstream to spawn declined in population, partly as a result of dam construction. Dams also created stagnant millponds that became clogged with algae. To remedy some of these problems, Wisconsin has been leading the nation in dam removal. As of 2008, about 100 dams have been removed. Dam removal projects are major community efforts the DNR supports. Once a community removes a dam, it is rewarded with a return of cool sparkling waters and native catchable fish.

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.

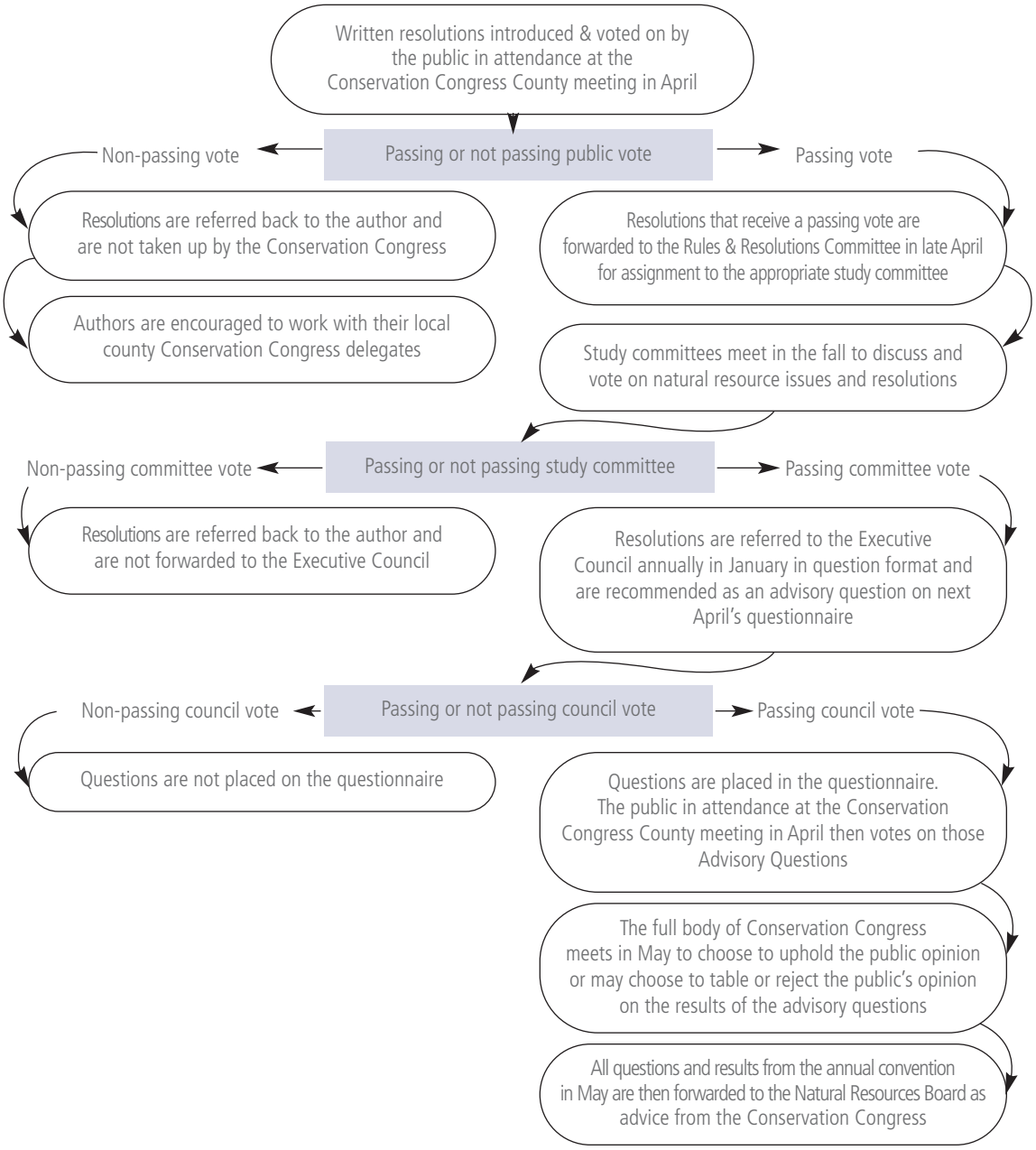
Making Decisions

Who is responsible for making sure that our fisheries stay healthy? Everyone. But who actually recommends, for example, whether a bottled water business can be built at the headwaters of a trout stream? That would be the **Natural Resources Board** (NRB). The NRB makes policy decisions for the Department of Natural Resources. The governor appoints the board's seven members, whom the state Senate must approve. NRB members make environmental and natural resource decisions based on science and citizen input.

Policy Process

The **Wisconsin Conservation Congress**, an independent citizen advisory body defined in state statutes, advises the NRB on natural resource issues. Wisconsin citizens elect delegates to serve on the Conservation Congress. You must be 18 years old to be a delegate or to vote for a delegate to the Congress, but people of any age may propose and vote on rule changes. Hearings where these proposals are brought to a vote occur the second Monday in April in every Wisconsin county every year. If you feel strongly about a natural resource issue, use Wisconsin's citizen input opportunities to help the NRB make a decision to present to legislators!

The Conservation Congress Resolution Process



How to Write a Resolution

Each year the Conservation Congress accepts written resolutions from the public in each county regarding natural resource issues of statewide concern. The public introduces these resolutions during the Conservation Congress county meeting held annually in conjunction with the DNR Spring Fish and Wildlife Rules Hearings in April.

1. Resolution Content

In order for a resolution to be accepted for further consideration by the Conservation Congress and for public vote at the annual Conservation Congress county meeting, all resolutions introduced must meet the following requirements:

1. The concern must be of statewide impact.
2. The concern must be practical, achievable and reasonable.
3. The resolution must have a clear title.
4. The resolution must clearly define the concern.
5. Current state statutes and laws must be considered, with reasonable cause for change being presented.
6. The resolution must clearly suggest a solution to the concern and a description of further action desired.

NOTE: If the resolution defines an unresolved concern at the local county level, or district level within your Congress district, please make sure to indicate whether or not you have already spoken with local department staff and your local county congress delegates.

2. Resolution Format

- Resolutions must total 250 words or less and be typed or legibly hand-written on one side of an 8 ½ x 11 sheet of white paper. No attachments or additional sheets will be accepted for the same resolution.
- The author's name, mailing address, county, telephone number and signature are required at the bottom of the resolution.
- Only the individual author or designated representative may present the resolution within the county. The author or designated representative must be present at the time the resolution is introduced.
- No one may introduce more than two resolutions during the Congress portion of the Spring Hearings.
- Written resolutions not meeting the above criteria and/or verbal resolutions will not be accepted.
- Provide the Congress County Chair with TWO COPIES of the resolution for submission at the beginning of the evening, one to be part of the official record and the other to be posted for public viewing.
- Individuals attending the meeting may vote on the resolution being introduced within the county.

3. Sample Resolution

Title: Spring Dinosaur Hunting Season

The Problem: Dinosaurs are a threat to agriculture across the state, especially in April and May, because they make deep footprints in newly planted farm fields, damaging the emerging crops. The problem is aggravated in southern Wisconsin, because dinosaurs are migrating across the state line to avoid hunting pressure in Illinois. There is already an overpopulation of dinosaurs in Wisconsin. At present, state law does not permit dinosaur hunting at any time during the year. We feel that Wisconsin law should be consistent with Illinois, which permits dinosaur hunting in the spring. Wisconsin farmers are suffering significant crop damage because of dinosaur incursions.

BE IT RESOLVED, that the Conservation Congress at its annual meeting held in Buffalo County on April 16, 2007 recommends that the Conservation Congress work with the Department to take action to correct this situation by introducing rule change allowing a spring dinosaur hunting season.

Name of Author: Fred Flintstone
Name of Organization (optional): Private Citizen
Address: W12345 State Road 3
City, State, Zip Code: Bedrock, Wisconsin 54231
Name of the County Introducing In: Buffalo
Telephone Number (including area code): 123-456-0789

4. DNR Rules Process

A lengthy internal process begins at this point that includes an environmental analysis, legal review, public hearings, a public comment period, review by the Natural Resources Board, and finally, action by the Legislature where it is made law or rejected.

Hot Topics

Resource policy is rarely developed or changed without controversy. Wisconsin citizens often feel strongly about how natural resources should be managed. Every year the Conservation Congress hears debates about several hot topics. In the past, citizens have debated manure management, large livestock operation site approval, and, as mentioned above, bottling spring water near the headwaters of a trout stream. Check out the Conservation Congress on the DNR's Website to discover some of this year's topics. Citizen resolutions, Advisory Committees' notes, and the annual Spring Hearing Questionnaire describe the topics.

Choose a hot topic, research it, and develop a resolution on it that could be introduced to the Conservation Congress in the spring. Use the outline on the next page to guide the process. Keep the following questions in mind: Who are the stakeholders? What role should science have in determining policy? Who and what will be affected by this resolution?

As you work through your resolution, consider this quote from the Wisconsin Conservation Congress publication, *Democracy in Wildlife Regulations*, "In the final analysis, no matter what the commission or the department believes to be in the best interest of the state, if the citizenry is not in accord, any program set up would eventually be doomed to failure. The birds, animals and fish belong to the people of the state." Do you agree or disagree with this quote? How does your opinion of this quote relate to your resolution?

Forward Thinking

At the start of Iroquois council meetings council members would invoke this declaration: "In every deliberation we must consider the impact on the seventh generation." When making a decision, a representative spoke for the needs of those who would follow 150 years, or seven generations, from that moment. How can we learn from this idea?

Great Conservationists

Fishing is an amazing way to enjoy the outdoors, learn about the natural world, spend time with family and friends, explore the state, and catch fabulous food. But maintaining a healthy fishery requires our attention and care. The future of fishing in this state rests in the hands of those who regularly use it. If you think fishing is a valuable and important pastime, it's up to you to make your voice heard and your opinions matter.

Through the ages individuals have made decisions and developed personal ethics that are helpful in guiding our own decisions today. Great thinkers since ancient times have heard a call for stewardship of the earth and all of its inhabitants. Native Americans and leaders of religious movements continue to reflect on the spiritual aspects of water resources and fish and recognize that the health of the water is linked to humankind's existence. Modern leaders from around the world have stepped on the path of environmental activism, bringing awareness of natural resources to a society increasingly unaware of them, yet just as dependent on them.

Through the Eyes of Another

Research the environmental views of an artist, or a scientific, civic, or spiritual leader. What were his or her contributions to the environment? What evidence did you find to support these contributions (art, books, speeches, projects, public service)? What struggles or challenges did he or she encounter in protecting natural resources? Did his or her commitment to the environment erode or strengthen over time? In what way? Explain his or her beliefs about what responsibility people have to protect the environment.

Wise Elders

Each of the following leaders had different viewpoints about why and how we should care for the earth. As a caretaker of the earth yourself, you can learn from their experiences. Choose one of the quotes below to reflect on in a one-page response. Do you agree or disagree with the quote? Why? If you disagree with the quote, do you know of another quote that better matches your feelings about conservation? If you agree with the quote, what can you do in your own life to support it?

1) *"We abuse the land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."* - Aldo Leopold, Wisconsin ecologist, wildlife biologist, angler, and hunter.

2) *"The human race is challenged more than ever before to demonstrate our mastery—not over nature but of ourselves."* - Rachel Carson, marine biologist and nature writer.

3) *"We all have to take responsibility for the direction we are going. In our schools we are focusing on numbers and letters but we need, from the earliest times, to get across the concept that we are connected to nature and that we are trying to find a space to sustain ourselves."* - Sylvia Earle, marine biologist, National Geographic Explorer-in-Residence and *Time Magazine*'s first Hero for the Planet.

4) "*The most important environmental issue is one that is rarely mentioned, and that is the lack of a conservation ethic in our culture."* - Gaylord Nelson, Governor and State Senator of Wisconsin and founder of Earth Day.

5) *"The conservation of natural resources is the fundamental problem. Unless we solve that problem, it will avail us little to solve all others."* - Teddy Roosevelt, U.S. President, Nobel Prize winner, conservationist, and rancher.

> "The economy is a wholly-owned subsidiary of the environment, not the other way around." Gaylord Nelson

Swimming Upstream

You too can be a great conservationist! There are direct and indirect paths to helping protect our natural resources. Some people choose to dedicate their lives to natural resources in careers at conservation organizations like the DNR.

The future of fishing in this state rests in the hands of those who regularly use it.

If you are planning a career in natural resources, check the DNR Website for a sampling of jobs in the field. If you see one that looks great, interview someone in that job to find out what skills you should be getting while still in school.

You can also check university Websites to see what types of courses they offer for people interested in our natural resources.

You don't need a career in conservation to be a conservationist. No matter what career you choose, artists, economists, cashiers, mathematicians, and flight attendants, to name a few, can all advocate and volunteer on behalf of our natural resources. There are many ways to stay involved with and learn more about Wisconsin's fish and waters. Here are a few suggestions:

- Take a friend fishing. One of the best ways to gain support for the resource is to introduce others to it.
- If you like trout fishing, or are interested in starting, contact Trout Unlimited to see if they have a chapter near you. You could help with a restoration effort or meet others who want to help trout.
- Start a fishing club at your school or join one in your community.
- Speak up! Write letters to your representatives and senators about your resource concerns and vote as soon as you are eligible.
- Get outside. Being an active observer is the first step to working for the changes you would like to see.

It's not always easy to improve our natural resources, but neither is it to swim upstream and plenty of fish do it every year. Keep your eyes on the water and your mind open. Even if you don't continue fishing, you will continue to live in a world where water resources and aquatic wildlife will play a role in the health and stability of our planet. Don't lose touch with the water in your world!

Cheap Date

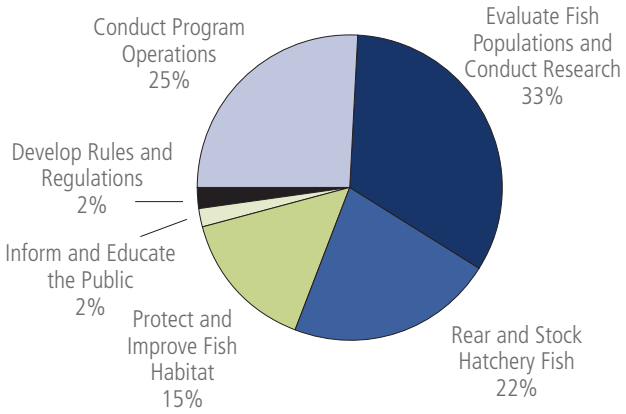
Take your date or a pal fishing! After a small annual investment, you can fish 365 days a year with whomever you want. Many Wisconsin communities are situated on or near fishable waters. Pack a picnic, call a friend or two, hop on your bike, and head for the water's edge.

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:



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

Data from 2006 DNR Fishing Report

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***.

Glossary

Adaptation
a physical, chemical, or behavioral change made by a species or an individual organism which improves its relationship to its environment

Assessment
the action of determining the amount or value of something

Atmospheric deposition
nonpoint source pollution that travels through the air and is deposited on land and water

Bag limit
the number of fish of a certain species from a certain body of water that an angler can keep on a single day

Barbels
slender, whisker-like taste receptors found on certain fish, such as catfish, bullheads, and sturgeon; used to find food

Benthic Zone
the bottom of a lake

Bioaccumulation
the build-up of substances, such as pesticides or other toxins, in an organism

Biomass
the total mass of live plants and animals in a given area

Chordate
animal that belongs to the phylum Chordata (has a notochord for at least part of its life cycle)

Conservation Congress
the citizen group that suggests regulation changes to the Natural Resources Board

Consumer
an organism that cannot produce its own food and must eat other organisms to survive

Degraded
lowered to a less desirable or less diverse level

Dichotomous key
a system of classification used to identify organisms by moving from broad differences to specific distinctions

Dissolved oxygen
molecules of oxygen mixed into water

Distal
located away from the central point or origin

Distribution
the range, or geographic locations, of an organism

Dorsal
located on the back of an animal

Dynamic
continually changing

Ecology
the study of the interrelationship between environments and organisms

Ecotone
a transition area between two different ecological communities

Ecosystem
closed communities of interdependent plants, animals, and non-living factors

Effluent
waste material released into the environment

Emergent
near-shore plants rooted in shallow water with most vegetative growth above water

Epilimnion
the top layer of lake water, often warmest in the summer and frozen in winter

Erosion
the process of soil and other natural materials being worn away

Eutrophic
characterized by having a high level of nutrients; often used to describe a lake or pond with low oxygen and thick plant growth

Eutrophication
the process of adding nutrients to a waterbody

Exotic species
species that live in environments where they are not native

Extirpate
a species that has disappeared from part of its native environment, but is not extinct

Fingerling
a young fish

Floating leaf
plants rooted in the lake bottom; their leaves and flowers float on the water surface

Fragmentation
the process of dividing landscapes or watersheds into parcels that are isolated

Fry
newly-hatched fish

Harvest
to gather, catch, hunt, or kill for human use, sport, or recreation

Hatchery
a place where eggs are hatched, either human-made or natural

Headwaters
the origin, or beginning, of a stream or river

Hypolimnion
The bottom layer of lake or pond water

Inferior
located nearer the lower extremity of a body

Invasive species
an exotic species that tends to spread, causing environmental or economic harm

Land cover
the visible features on a landscape

Land use
the cultural and economic activities that take place on a landscape

Lateral
located on or near the side of the body

Lateral line
a canal along the side of a fish containing pores with sensory organs that detect vibrations

Limiting factor
a factor in the environment that limits the growth, abundance, or distribution of organisms in an ecosystem

Limnetic zone
the open-water zone away from shore where light is abundant

Littoral zone
the shallow area of a lake or pond where plants are able to grow

Marsh
a wetland that is rich in plant life, especially grasses and cattails; excellent fish spawning habitat

Medial
located near the middle (mid-line) of the body

Mesotrophic
characterized by having a moderate amount of nutrients

Moratorium
the suspension of an activity for a period of time

Morphology
the shape or structure of an organism

Mouth
the end of a stream or river, where it empties into another waterbody

Native species
a species that lives in its natural environment

Natural Resources Board
a group of citizens selected by the governor which makes policy decisions for the Wisconsin DNR

Natural selection
the process that results in the survival and reproductive success of individuals or groups best adapted to their environment

Neurotoxin
a poison which affects the brain or nervous system

Niche
the specific role an organism or a population plays within an ecosystem

Nonpoint source pollution
contamination that comes from many sources across a landscape; often carried into waterbodies by runoff

Notochord
a flexible, primitive backbone that provides support in chordate embryos. As vertebrates (the highest class of chordates) develop, the notochord is replaced by spinal vertebrae.

Oligotrophic
characterized by having few nutrients

Persistent organic pollutant
a contaminant that does not break down easily or quickly in the environment

Physiology
the study of the functions of living organisms

Phytoplankton
microscopic floating plants

Poikilotherm
an organism that cannot regulate its own body temperature; the temperature of the organism matches that of the surrounding environment

Point source pollution
a particular, identifiable source of contamination

Primary producer
an organism which creates its own food through photosynthesis

Profundal
deep dark lake zone below the limnetic zone

Proximal
located near the center of the body

Public Trust Doctrine
a body of common law that protects navigable waters for the common good

Redd
the nest or spawning ground of a fish

Regulation
a rule dealing with details or procedures

Restore
to repair damage (in this case, to an ecosystem)

Rheotactic
orienting upstream

Rule of 10
a law of nature that says that approximately 10 percent of available energy passes from one trophic level to the next and the rest is lost as heat

Runoff
precipitation not absorbed by the soil; often carries nonpoint source pollution with it into a waterbody

Spawn
to produce and deposit eggs (generally refers to fish, amphibians, and mollusks)

Stakeholder
a person who has an interest in a decision, but is not responsible for making that decision; for example, a private landholder may be a stakeholder in a decision the county makes about the stream running through her property

Stewardship
the careful and responsible management of something

Stock
the act of putting quantities of fish in a lake, stream, or other waterbody for recreational or scientific purposes

Stratify
to become layered; lakes are stratified by temperature

Stressor
an action or agent that puts stress on an organism

Submerged
rooted plants that grow entirely underwater, although some leaves may float above water. They grow from near shore to the deepest part of the littoral zone.

Substrate
the layer of material, such as clay or gravel, found on the bottom of a waterbody

Superior
located higher on a body, nearer the upper extremity

Sustainable practices
the use and management of a resource that meets the needs of the present generation without compromising the ability of future generations to meet their own needs

Swim bladder
the swim bladder (also gas bladder or air bladder) is an internal gas-filled organ allows a fish to control its buoyancy and depth in the water.

Taxonomic groups
a group of closely related plants or animals

Terrestrial
land-based, not aquatic; as in a terrestrial organism or habitat

Thermocline
a layer of water in a lake in which the temperature change is most abrupt; found below the epilimnion

Thermoregulate
to maintain a constant body temperature; humans thermoregulate, fish do not

Tragedy of the Commons
unsustainable rates of use or abuse of a resource held in common

Tributary
a stream or river that flows into a larger stream or waterbody

Trophic level
feeding position in the food pyramid; primary producers are the lowest trophic level

Ventral
located opposite the back, on the front or belly

Vertebrates
animals with backbones

Watershed
a region or area that all drains to the same body of water

Wetland
an area that is a transition between an aquatic and a terrestrial environment; saturated for at least one period of time each year

Zoning
division of a city (or other region) into sections reserved for certain purposes (homes or businesses)

Notes

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Special thanks to the many angler education instructors who have helped to guide our program efforts over the years and have taken the time to introduce youth to Wisconsin's fishery.

With all due respect to 19th Century French sculptor, Auguste T. Rodin, we are using playful renditions of his masterpiece, *The Thinke*r to lead us through these guides. The Philadelphia Museum of Art houses the original sculpture and notes on their Website that "Rodin was faithful to nature in his work."
We hope these words and your experiences outdoors will inspire you to do the same in your work and play.