Unit 4
People, Land, and Water

Importance of Iowa' s Aquatic Resour ces

Water Supply

Millions of residents rely on water from impoundments and rivers for public use, industrial supplies, power plant cooling, and wastewater treatment. In Iowa, surface water supplies about 20 percent of the state's drinking water. Water is used for irrigation of crops in the Mississippi and Missouri River valleys, but irrigation is not common in other areas. Iowa rainfall generally is adequate for corn and soybeans, our two major commercial crops.

"Waste" water that has been used by people is treated and released into rivers throughout the state. Discharges of waste water must be closely regulated to protect water quality for water supplies downstream as well as for fish and other animals living in our rivers.

Recreation

Iowa's aquatic resources are important to many of the outdoor activities we enjoy. Two of the most popular outdoor recreational activities are swimming and fishing. Boating, waterfowl hunting, and a host of other recreational pursuits also are dependent on our waters. Good water quality and a healthy aquatic ecosystem are essential to maintain fish, ducks, and furbearers, as well as "watchable wildlife." Boaters and swimmers enjoy the aesthetic values of a healthy ecosystem.

Fishing, trapping, and hunting are considered to be "consumptive" forms of recreation because animals are taken from the resource. Nationwide, fishing ranks second in importance as an outdoor activity. According to a 1996 U.S. Fish and Wildlife Service survey, Iowa anglers (462,000) over the age of 16 fish 6.9 million days and spend $339 million each year. The overall contribution to Iowa's economy as a result of fishing is $650 million annually.

ACTIVITY	Percent Participating	Expenditures
Wildlife watching	38%	$191 million
Fish	14%	$229 million
Hunt	4%	$213 million
Fish and Hunt	9%	
Wildlife related (all)	**47%**	**$743 million**

Source: 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation by the US Fish and Wildlife Service Division of Federal Aid

Swimming, boating, canoeing, bird watching, photographing wildlife, and many other "nonconsumptive" activities do not involve removal of wildlife from the resource. The economic benefits wildlife related activities bring to state and local economies is astounding. More than one million Iowans participate (47% of Iowa's population) in hunting, fishing, wildlife watching, or other wildlife related activities. Annually, they spend $743 million on food and lodging, transportation, and equipment.

Pollution and Flood Control

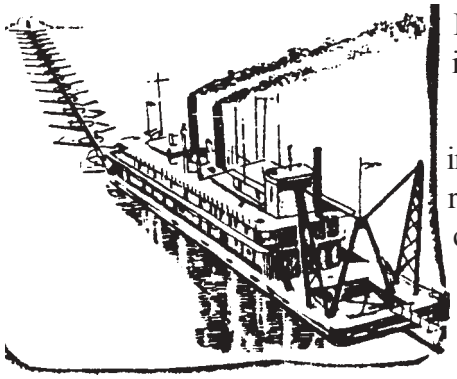
Wet soils of riparian areas and other wetlands help maintain and improve water quality in streams, rivers, and lakes. Water quality is greatly impacted by land use practices. Runoff carrying potential pollutants such as silt, fertilizer, and animal waste, can be absorbed and used by aquatic plants before it enters the water system. Pollutants may be retained by wet soils long enough for bacteria to break them down into harmless compounds.

Wet soils store excess water, releasing it slowly over time into streams, lakes, and groundwater to prevent downstream flooding. Studies in the Midwest have shown flood levels in watersheds with 30 percent wetland coverage were reduced by 80 percent compared to watersheds without wetlands. Prevention of flood damage can result in considerable savings. Nationally, clean up and repairs from flooding costs about $1 billion annually. The record Iowa flood of 1993 most likely would have had less impact on downstream residents had sizable numbers of wetlands been present upstream.

Plants in riparian and lakeside areas hold soil in place with their roots, absorb wave energy, and slow stream or river currents. This reduces undercutting and collapsing of streambanks and lake shorelines, which adversely affect water quality by adding sediment to the water.

Navigation

The Missouri and Mississippi, like most large rivers in the U.S, are major modes of transportation. The Mississippi is very important to commercial navigation. Barges carry mainly petroleum products, agricultural commodities, and coal. In the late 1800s, Congress authorized the Army Corps of Engineers (Corps) to build thousands of wing dams to drive the river into a narrower, deeper channel (six feet) to carry barges. A system of 29 locks and dams from Minneapolis (including two at St. Anthony Falls) to St. Louis created a 9-foot-deep channel for barge traffic serving the Midwest. Total shipments to and from the Rock Island District (Guttenburg, Iowa to Saverton, Missouri) was 48 million tons in 1990.



Dredging is used to maintatin a nine-foot navigation channel.

The Corps of Engineers is conducting a study to assess infrastructure improvements for navigation on the Mississippi and Illinois rivers to allow more barge traffic. The final report is slated for completion in 2004. The study also will look at environmnetal sustainability, recreation needs, floodplain habitat, and watershed effects. Current operation and maintenance costs on the Mississippi River for transportation is $140 million per year.

Barges on the Missouri make their way up and down the river about eight months out of the year. According to the Missouri River Master Water Control Manual Review and Update, some 480,000 tons of goods are carried between Omaha, Nebraska and Sioux City, Iowa, which provides economic benefits of $4.2 million to the state.

Commercial Harvest

In 1996, Iowa's commercial harvest of freshwater mussels was 358,012 pounds, down from 1991's harvest of over 1.2 million pounds. Turtle harvest in 1996 was approximately 2,200 pounds, the bulk of which was snapping turtles. Commercial fishing in Iowa is done almost exclusively on the Mississippi. Close to three million pounds of fish are removed from the river along Iowa's border each year by commercial fishing. Commercial fishing for the length of the Mississippi was valued at $1.7 million per year in the 1980s.

A few other products harvested from aquatic habitats and associated riparian or wetland areas include timber (e.g., oaks, black walnut, cottonwood); nuts (e.g., walnut, hazelnut); and even wild rice from the backwaters of the Mississippi.

Electrical Generation

The dam at Keokuk is the only one on an Iowa river used to generate electricity, but dams in the upper reaches of the Missouri (upstream from Iowa) are used for this purpose. The Cordova nuclear power plant upstream from the Quad Cities, uses river water for cooling. The electricity generated is used by many homes, businesses, and industries.

Biodiversity

Aquatic ecosystems are among the most diverse in the world. The Mississippi River corridor is home to a wide array of fish and wildlife species and is a migration corridor for 40 percent of North America's waterfowl and shorebirds. Many species of waterfowl, amphibians, and other wildlife depend on wetlands for food, shelter, and to raise their young. In the United States, 190 amphibians species, 5,000 plant species, and one-third of all native bird species depend on aquatic habitats. In Iowa, approximately 700 plant and animal species use aquatic habitats. Water sources also are essential for terrestrial animals.

Culture

People always have been closely associated with water sources for drinking, food, and transportation. Iowa waters are no exception. Portions of the Upper Mississippi River are thought to have the highest density of cultural sites in North America–a study by the Great River Environmental Action Team identified over 1,000 anthropological and nearly 4,000 historic sites in the Rock Island District. The Missouri was used by the Dakota, Iowa, Oto, Winnebago, Fox, and Pottawattamie Indian tribes as well as early Euro-American explorers. The natural lakes of northwest Iowa also were centers of cultural activity for native and prehistoric Americans.

Issues Facing Our Aquatic Resources

Water quality in all surface waters has been affected greatly by alterations in the landscape–largely brought about by agriculture. Changes to land draining to lakes and streams (watersheds) often occur far from the affected body of water, thus cause and effects are not readily apparent. Nonpoint pollution is the greatest factor impacting the quality of Iowa's waters.

Physical characteristics of Iowa's waters also have been changed drastically. Stream channelization and drainage of wet soils have had drastic impacts on water quality. Euro-American settlers and their descendants considered these "improvements" essential for agriculture, flood control, and transportation. (See the narrative of *Unit 1* for more information.)

For example, point source pollution (e.g., sewage effluents, drainage pipes) is negligible in amount when compared to the nonpoint source pollution (silt, fertilizer, chemicals, etc. washed from a large area of land) entering Iowa's waters. The following paragraphs describe some of the major problems facing Iowa's aquatic resources as a result of human actions.

Erosion and Sedimentation

The number one water pollutant in Iowa is silt (very fine soil). Human activities have severely deteriorated aquatic ecosystems and limited recreational opportunities. Non-point source pollution originates from numerous small sources and is responsible for more than 60 percent of the nation's water pollution. In urban areas it comes from construction sites, streets, landfills, parking lots, lawns, golf courses, and poorly maintained septic systems. Rural sites include overgrazed pastures, animal feedlots, unmanaged agricultural fields, and poorly managed and eroding stream corridors.

Sediment originates from erosion in the watershed of a river, marsh, or lake. Soil is carried to bodies of water by surface runoff, wind, or streambank erosion. Erosion is a natural process, but is accelerated greatly by human activity.

Silt decreases the amount of light that enters the water, hence aquatic plants and algae suffer. It adds to bottom sediments, clogs the gills of small aquatic animals such as insect larvae, smothers fish eggs, and interferes with sight feeders such as bass, which are unable to locate prey. Damage from erosion exceeds $54 million annually in Iowa. Silt is a major pollutant in 85 of the159 impaired waters in Iowa.

Fertilizers (nitrogen)

Manufactured fertilizers containing nitrogen and phosphorous are used for crop production. An estimated 30 to 50 percent of nitrogen used in Iowa is applied as fertilizer on agricultural land. Over 3.4 million tons of fertilizer were used in 1996 on corn and soybeans. This is down from a high of almost four million tons in 1981, but the amount used in 1996 was the highest since 1984. (In 2001, there were over 22 million acres of row crops in Iowa; 12 million acres of corn and 10.7 million acres of soybeans.)

Nitrogen is by far the most prevalent nutrient and most recognized contaminant in Iowa's groundwater. High levels of nitrates enter groundwater from infiltration, sinkholes, poorly constructed wells, seepage from septic tanks, waste lagoons used by municipalities, or animal feedlots, making water unfit for drinking. High levels are dangerous to human and animal health. In drinking water, it is converted to nitrite and prevents blood from carrying oxygen. This causes brain damage and suffocation in both infants and newborn livestock.

The EPA has established an allowable limit of ten parts per million (10 nitrate molecules per one million water molecules) in drinking water. Currently, approximately 18 percent of the rural population in Iowa uses water with nitrate levels exceeding the drinking water standard *Levels of nitrates in* ***surface water supplies*** *rarely exceed EPA standards–consumption advisories are issued when this occurs.*

Sources of nutrient enrichment in Iowa waters include sewage, runoff from livestock waste, discharge from food processing industries, commercial fertilizers, and natural sources such as leaves and decaying aquatic plants. Some nutrients are beneficial to the ecosystem because they increase growth of plants and algae which are food and cover for smaller animals that are important forage for fish and other larger animals.

Overgrowths of algae ("blooms") sometimes cover the entire surface of a body of water, blocking sunlight from reaching the bottom. Blooms can reduce sunlight entering the water which slows photosynthesis in submergent plants, resulting in reduced oxygen in the water and increased carbon dioxide from decomposition as the plants and algae die. This can result in fish (and other species) kills. Blooms usually occur when there is excess phosphorous in the water, which causes excessive algal growth.

Animal Waste

Besides acting as nutrients, large amounts of animal wastes entering a body of water can be toxic to fish and other aquatic animals. Over 1 million fish died in kills caused by manure discharge between 1997 and 2001 in Iowa. Fish kills have increased drammatically in the past few years.

Contaminants

Pesticides (herbicides, insecticides, etc.) are an important part of Iowa's agriculture but heavy use can negatively impact aquatic ecosystems. The greatest threat to aquatic systems is from aerial applications because of overspray and drift. Most pesticides are applied in the spring or early summer. This coincides with rains and reproduction and growth of plants, insects, amphibians, and fish as well as waterfowl and mammals that may eat them. Timing of some pesticide applications greatly affects the impacts they may have on aquatic resources.

High levels of **Coliform bacteria** are used as an indicator that other disease-causing bacteria might also be present. They are found in drinking water supplies when contaminants enter the well directly from the surface (e.g., shallow groundwater supplies in proximity to leaky septic tanks or sewers, animal feedlots, etc.). Over 40 percent of *private* drinking water supplies are considered to be "unsafe" because levels of this bacteria are high. ***Public water supplies*** *are not considered to be at similar risk because they have stricter well construction standards and are monitored regularly and chlorinated.*

The most widely-used agricultural **herbicides** such as atrazine, cyanazine, metolahclor (Dual), and alachlor (Lasso) are the most commonly detected pesticides in Iowa groundwater. Results of a recent water quality study of *private* wells, showed that 13.6 percent had detectable concentrations of atrazine above the U.S. EPA maximum level of 3 mg/l (three milligrams of atrazine per liter of water).

Heavy metals (e.g., aresenic, cadmium, copper, lead, mercury, and zinc) are seldom a problem in Iowa waters. Groundwater problems which do exist are attributed to point sources such as landfills, battery recycling, and scrap yards.

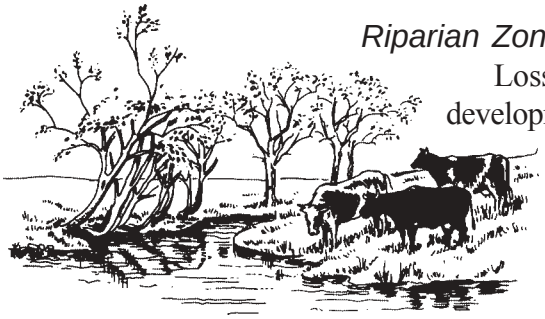
Destruction of Habitat

Iowa has lost much of its original habitats. Within 100 years of Euro-American settlement, ninety-five percent of Iowa's wetlands were drained or filled. Seventy percent of the forests were cleared, and more than ninety-nine percent of the prairies were plowed. Soils were exposed and natural vegetation along rivers and streams was removed. The result was a drastic increase in erosion in the watershed and sediments entering our waters. Other land "improvements" included straightening stream channels, removal of streamside vegetation (channelization) to reduce the land they occupied, and tiling of wetlands (and wet soils) to increase agrigultural productivity. The quality of aquatic habitats has been further reduced by the use of chemical fertilizers, improper storage and/or use of animal wastes, and development.

Wetlands

Historically, the Prairie Pothole Region provided an important stopover site for thirty species of shorebirds who arrive to eat aquatic life in shallow ponds, temporarily flooded by spring runoff. Another ten species remain in the area. To date, the Prairie Pothole Region has lost about 50 percent of its wetlands, with some areas having lost as much as 90 percent. Iowa has lost 98 percent of its prairie potholes. Related to this loss is the decline in shorebird populations over the last two decades; a decline of 60-80 percent in some species. Without adequate food at their stopover sites the birds cannot reach the breeding grounds to reproduce. Wetlands (including near shore areas in lakes and river backwaters) also are important nurseries for fish.

Riparian Zones



Loss of riparian zones has impacted Iowa streams and rivers. Urban development, highways, cropland, etc., are squeezing wildlife into smaller areas. Sections of rivers that are bare, unshaded, sediment-laden channels are poor habitat for fish and other aquatic organisms. Areas void of a vegetative zone provide insufficient cover and food for upland game, songbirds, and other wildlife, especially in winter.

Lakes, Rivers, and Streams

When large amounts of sediment are deposited in a lake, stream, or river, it is called **sedimentation**. The result of erosion and deposition of Iowa's valuable topsoil into lakes and streams is very damaging. Sedimentation reduces the depth of lakes and streams. Deposited soils cover valuable habitat and choke out many essential parts of the ecosystem. They kill aquatic plants because sunlight cannot reach them and reduce fish habitat by filling holes and crevices where fish seek shelter. Excessive amounts of sediment in rivers cover rock and gravel substrates so invertebrates can't cling to the rocks, eliminating food for fish. In both lakes and rivers, sedimentation smothers fish spawning sites for species like walleye and trout.

Many Iowa lakes, both natural and constructed, have lost several feet of depth due to sedimentation. This build up of silt reduces the lake's storage capacity. A 1994 siltation survey of Lake Red Rock indicated it had received more than 100,000 acre-ft. of silt, which was about 50 percent of the lake's volume at normal pool level. Filling in of smaller lakes and ponds increases the possibility of winter kills and invasion of aquatic plants. As sediment fills in river channels it makes the channel wider and shallower, which results in an increase in water temperature and the probability of damaging floods.

Navigation

Dams have cut the Mississippi River into sections, creating a series of deep pools preventing the migration of fish. Unable to ascend the river to spawn, the skipjack herring has all but disappeared from the river above Keokuk, Iowa. The ebony shell, once the upper Mississippi's dominant mussel, has nearly disappeared because the larval form needs a ride on the gills of the skipjack herring to complete its life cycle.

Navigation dams also acerbate sedimentation problems. Suspended sediment increases the turbidity of the water, decreasing light penetration for aquatic plants. This has caused some plant species (e.g., wild celery) to disappear from certain sections of the river . Sediment continues to fill in backwaters, reducing wintering and spawning habitat for bluegill, crappie, and largemouth bass. Waterfowl habitat is decreasing and many furbearers have disappeared. Biologists see general signs of decline the length of the Mississippi. It is estimated that at least one-fourth of the backwater habitat of the Mississippi River has been lost due to sedimentation since the locks and dams were constructed.

Questions have been raised about whether navigation should continue on the Missouri River upstream from Omaha, Nebraska. Natural features of the river have been almost eliminated with manipulation of the river into a navigation channel, yet the value of recreation on the river is over $80 million/year while the economic benefit of navigation is valued at about $7.5 million/year. Current debate includes suggestions to utilize the six dams in the upper reaches of the Missouri to support recreation rather than navigation.

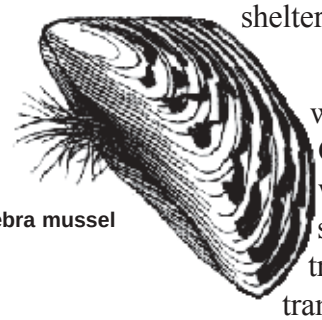
Introduction of Exotic Species

Organisms introduced into habitats where they are not native are exotic species. Although their impacts are not nearly so profound in Iowa as in more southern areas of the United States, a few species have had impacts worthy of note.

Eurasian watermilfoil

Eurasian watermilfoil was introduced into Iowa in the early 1990s. The aquatic plant forms thick stands, out-competing or replacing native vegetation. Dense mats in shallow areas can interfere with recreation such as fishing, boating, and swimming. It does, however, provide shelter for many aquatic species. This plant can reproduce by stem fragments transported from one body of water to the next by boats, motors, trailers, or even birds.

Another alien, **purple loosestrife**, is found along roads, drainage ditches, and lake shores, and invades prairie wetlands and some Mississippi River backwater areas. Its dense roots choke out native plants and threatens the existence of rare wetland plants in many instances. This noxious weed provides no cover, food, shelter, or nesting places for waterfowl and other wetland birds.



Zebra mussel

Zebra mussels are a recent invaders since the mid 1980s. These mollusks were transported to the Great Lakes in the ballast water of ships from the Caspian and Back Seas in Russia. They attached to the hulls of barges and were carried to the Mississippi River and other major rivers east. They are small, but colonies can clog water intake systems of power plants, water treatment facilities, and cooling systems of boat engines. They too can be transported easily in bait fish buckets and livewells or attached to boat hulls, engines, and trailers. (See the supplemented activity, "Aquatic Roots" for more information.)

Improving Our Aquatic Resources

People can have *positive* impacts on aquatic resources. Following are some ways human actions are helping to protect or enhance aquatic ecosystems:

Watershed Improvements

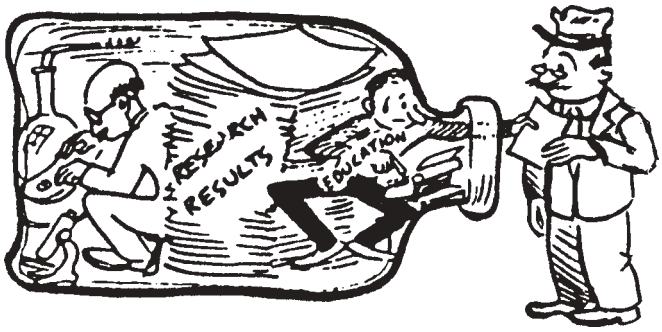
Funds through the U.S. EPA Clean Lakes Program combined with local grants and private donations have funded water quality projects to improve, protect, and restore water bodies and watersheds. All projects include efforts to improve soil conservation in the lake watershed and reduce soil entering the lake. Projects often provide financial assistance to landowners to help them reduce soil loss and to keep livestock waste and chemicals out of the water. Practices being used include terracing, grass waterways, contouring, strip cropping, rotational grazing, and minimum tillage. Iowans are making a difference by participating in over 50 water quality projects across the state. Such efforts have reduced the average rate of soil erosion from 7.5 to 5.4 tons/acre/year during the decade from 1982 to 1992. This resulted in a soil savings of 52.5 million tons of soil per year. (These are averages; soil erosion is less in some areas than others and loss of valuable top soil remains a serious problem in some watersheds.)

Fisheries Management

Fisheries management personnel work with all stakeholders to help assure the quality of Iowa's aquatic resources aren't compromised. Management teams conduct lake and stream surveys, angler surveys, and fish kill investigations as well as fisheries renovation and population manipulation projects, habitat improvement projects, permit reviews, and special management projects and public outreach. Eight fish hatcheries produce and stock 130 million fish each year into Iowa's lakes and streams.

Research

Six fisheries research teams are involved in over 20 long term projects designed to solve major problems impacting Iowa's aquatic resources. Projects include evaluations of methods of fish rearing and transportation, fish stocking strategies, impacts of soil erosion and sedimentation on fish and fishing, and impacts of harvest on fish populations as well as assessments of the value of stream habitat for stream fish and of critical habitats on the well-being of Mississippi River fish.



Research is necessary to understand those factors that impact aquatic resources and identify strategies to reduce those impacts and maintain or improve the quality of our waters. Success of these efforts depend on several agencies and organizations working together because solutions often are outside the authority of the DNR.

Monitoring

DNR biologists and other agency personnel monitor our resources to assess long term changes in fish and wildlife populations from changes in habitat. Monitoring also is used to assess how management activities benefit resources where they are applied.

Long Term Monitoring

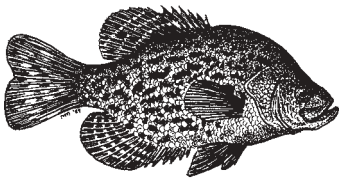
The **Long Term Resource Monitoring Program** (LTRMP) on the Mississippi River was authorized by Congress and initiated in 1987. It was designed to address resource problems such as navigation impacts, sedimentation, water level fluctuations and quality, lack of aquatic vegetation, and reduced fish populations in addition to monitoring invertebrate populations and land cover/use. State agencies work in cooperation with the U.S. Geological Service (USGS), U.S. Fish and Wildlife Service (FWS), and the U.S. Army Corps of Engineers (Corps). Six field stations collect data. Monitoring provides information to river managers and decision makers to help them understand and determine resource trends and impacts and develop management strategies for this unique ecosystem.

Wetlands are monitored through the **National Wetlands Inventory** which began in 1974. This project was established through the Emergency Wetlands Resources Act, which directed the FWS to generate information about the characteristics, extent, and status of the nation's wetlands. Aerial, color infra-red photography and digitizing are used to map wetland acreage. Status and trend reports on our nation's wetlands are produced at ten year intervals. These show

types of wetlands lost and current land use in those areas. They play a major role in the development of federal policies regarding wetland conservation. These maps are sold through the USGS (1-800-USA-MAPS).

Monitoring Safety of Fish for Consumption

Fish tissue monitoring is conducted in Iowa by the DNR as part of the Environmental Protection Agency (EPA) Regional Ambient Fish Tissue Program (RAFT). Some contaminants not in use anymore still persist in the environment, but levels are decreasing each year. Widespread occurrence of chlorodane, dieldrin, PCBs, and metabolites of DDT have been found. Despite this widespread occurrence, very few areas in Iowa exceed federal guidelines. Pesticides such as trifluralin, chlopyrifos, and alachlor (Lasso) have been detected in fish, but don't present a health risk to consumers.



Iowa fish are safe to eat!

Several species are sampled and analyzed: carp, channel catfish, walleye, crappie, and largemouth bass. Along with the DNR and EPA, several other agencies within the state conduct routine fish contaminant monitoring. Edible portions of these fish are analyzed by certified labs and results compared to U.S. Food and Drug Administration (USFDA) standards. Since 1985, about 43 lakes and an estimated 150 river locations have been monitored by collection of more than 525 samples. Fish consumption advisories are posted wherever it is confirmed USDA standards are exceeded.

Only two consumption advisories exist in the state as a result of this monitoring: 1) No fish caught from Cedar Lake in Cedar Rapids should be eaten. 2) Channel catfish from the Ottumwa Lagoon in Ottumwa should not be eaten.

Water Quality

Monitoring **water quality** can provide information about how to sustain or improve aquatic ecosystems. There are many water quality parameters and several methods for testing each. Certain parameters are measured by local treatment plants to assure water is safe to drink and by sewage treatment plants to assure contaminants have been removed before the water is released into rivers. Fisheries biologists also collect water quality data because these indicate whether or not fish (and other animals) can live in a body of water.

Following are some water quality parameters which are measured to provide an indication of water quality:

Dissolved Oxygen (DO) is essential to aquatic plants and animals. Cooler water such as trout streams tend to hold more oxygen (6 ppm—parts per million) than warmer streams (5 ppm). Consistently high DO measurements usually indicate healthy, stable aquatic systems capable of supporting a diversity of aquatic life. The main contributing factor to changes in DO levels is the build-up of organic wastes. Decay of organic wastes consumes oxygen and often is concentrated in summer, when aquatic animals require more oxygen to support higher metabolisms. Depletion of DO can cause major shifts in the kinds of aquatic organisms found in water bodies. DO measurements are made by performing a chemical test on water samples.

Temperature affects the physical, biological, and chemical processes that occur in aquatic systems. More oxygen can be dissolved in cooler water. In warmer water the rate of photosynthesis in plants increases as does the metabolic rates of some animals and the sensitivity of organisms to toxic wastes, parasites, and diseases. Increased growth and subsequent decay means a higher demand on the dissolved oxygen in the water. Measurement of temperature changes can help detect sources of thermal pollution (warm water entering a cooler body of water) and help determine the suitability of habitat for organisms that are more sensitive to temperature variation.

Fecal coliform bacteria can indicate *pathogenic* (disease causing) organisms in water. Coliform bacteria are found in waste from warm-blooded animals. Fecal coliform are not pathogenic, but are directly associated with disease-causing bacteria, viruses, and parasites which are difficult to count. High levels of fecal coliform mean there is a greater probability that pathogenic organisms are present. Fecal coliform measurements are done using sterile techniques to grow coliform colonies from water samples.

pH is the measurement of the hydrogen concentration in the water (determining whether water is acidic or basic). pH runs on a log scale from zero to 14 with seven being neutral, zero being the most acidic, and 14 being the most basic (alkaline). Iowa waters are slightly basic. Acid rain, caused by nitrogen oxide and sulfur dioxide emissions from burning fossil fuels, can cause water to become more acidic, but Iowa soils are rich in calcium carbonate ($CaCO_3$) which gives the water a high buffering capacity–sort of like an antacid tablet. pH is determined from a chemical test of a water sample or by using litmus paper.

Volunteerism

Volunteers can be instrumental in monitoring aquatic resources. Several IDNR Wildlife Diversity Program surveys are conducted largely by volunteers. *Frog and Toad Survey* volunteers listen for these amphibians at certain times of the year across the state. Frogs and toads are very sensitive to water quality conditions and the absence of a species may indicate problems. The survey also helps biologists monitor population trends. The Wildlife Diversity Program also has volunteer monitoring surveys for colonial waterbirds, raptors, and peregrine falcons. These help managers determine management needs of these species.

NatureMapping is a volunteer program to learn more about location and habitat association of Iowa vertebrates. Workshops are available to educators and other potential volunteers.

IOWATER is a volunteer water quality monitoring program. Volunteers monitor several water quality parameters. Volunteers are trained in workshops statewide.

Monitoring might also include inventories of aquatic vegetation, wildlife, or watershed uses of the water body. Samples of plants and animals in aquatic resources can be observed, identified, and counted. Watershed uses can be mapped and monitored from year to year. Plants often are surveyed by using transects or quadrants. (The number of each plant species recorded along a designated line within a sample area is a transect. Counting and identifying the plants within a randomly chosen, sample area is quadrant sampling–e.g., those within a tossed hula hoop.) Animals are monitored using uniform, random sampling techniques. Usually, several locations can be chosen for sampling. These locations are marked, so sampling can be repeated in the same location from year to year. This information provides species diversity and species richness indices used to help evaluate the health of an aquatic ecosystem.

Individuals wanting to go beyond monitoring can get involved in the DNR's *Adopt-a-Program.* Individuals or groups can adopt a body of water, park, or other natural area and monitor, maintain, or improve it!

Check out the *Resource Guide* for more information about specific volunteer opportunities.

General Conservation Practices

General conservation practices improve our resources. Waste of materials which require water for their manufacture or waste of water processed for drinking, increases demands put on our lakes and rivers both when water is drawn from the source, and when waste water is processed and added to a system.

Following is a list of "Basics to Benefit Aquatic Resources!"

- If you farm, use good soil conservation practices.
- Reduce fertilizer and pesticide use on the farm as well as on lawn and gardens–application rates of these can be ten times as much in urban as in rural areas–MORE is not necessarily BETTER, and these can greatly impact local streams and lakes.
- Reduce your use of water in the home–take shorter showers, turn off water when shaving or brushing teeth, wash dishes only when the sink or dishwasher is full.
- Purchase materials with less packaging and recycle plastic, glass, metal, and newspapers. This reduces use of water for packaging, as well as use of landfills.
- Reduce your use of electricity–electricity is produced by hydropower or burning of fossil fuels which must be harvested from the earth and can contaminate water in processing or transport.
- Get involved! Beautify a lake, river, or stream near you. Help to improve habitat or reduce soil erosion in the watershed. Invite others to get involved too!

Federal Regulations and Programs

The **Sport Fish Restoration Fund** was established to provide funding for the maintainence and improvement of the nation's fisheries resources. The money is obtained from a tax placed on fishing tackle and gas used in boats. Annually, Iowa receives $3.5 million dollars from this fund and the money is used to maintain and improve fishing in Iowa and educate the public about the state's aquatic resources – issues impacting them and ways to improve them.

The **Clean Water Act** is the primary federal law, enacted in 1972, that protects our nation's waters, including lakes, rivers, aquifers, and coastal areas. It's primary objective is to restore and maintain the integrity of the nation's waters. Its goals are to eliminate the discharge of pollutants and achieve water quality levels safe for fishing and swimming.

The Act was designed to provide standards, technical tools, and financial assistance to address causes of pollution and poor water quality, including municipal and industrial wastewater discharges, polluted runoff from urban and rural areas, and habitat destruction.

Section 404 of the Clean Water Act regulates the discharge of dredge and fill material in navigable waters. Permits are needed for these activities and are issued by the U.S. Corps of Engineers. Section 319 directs efforts designed to decrease nonpoint source pollution and Section 314 provides the necessary incentives to maintain and restore the quality of the nation's lakes. Today, our nation's water quality has improved dramatically as a result of a cooperative efforts by federal, state, tribal, and local governments implementing pollution control programs established by the Clean Water Act.

Left out of the Clean Water Act were many activities that affect waters through agricultural production. The **1985 Farm Bill** helped fill this gap by providing two federal programs–the *Swampbuster* Provision and *Conservation Reserve Program* (CRP). Both of these programs have helped reduce silt in Iowa rivers and streams by reducing erosion from farm land.

The "Swampbuster" provision was one of the first conservation programs of the U.S. Department of Agriculture (USDA) to operate fully apart from the traditional conservation goal of enhancing farm productivity. Under the 1985 Food Security Act (P.L.99-198) this program made it difficult for farmers to drain wetlands and then plant crops if they wish to receive any farm program benefits. It protects waters by saving wetlands.

The Conservation Reserve Program (CRP) is a voluntary effort that allows producers to bid to retire highly erodible land from annual production for 10 years (or more in some instances) in return for annual rental payments and provides cost-share and technical assistance to install approved plantings. Its primary focus is to control erosion, but wetlands, prairies, and floodplains subject to scour erosion are gained through the program. The reduced erosion of soil also provides fantastic benefits to streams and lakes.

The **Wetlands Reserve Program** (WRP) is a voluntary program which offers landowners financial support for wetland restoration and protection projects. The program is administered by the Natural Resources Conservation Service (NRCS). WRP authorizes the Federal government to obtain conservation easements from land owners, and provide cost-share payments for wetland rehabilitation practices. WRP allows and encourages tree plantings, primarily focusing upon wetland rehabilitation. These areas often are in river corridors and benefit the river as well as providing flood control downstream by creating areas where rivers can flood.

A **wetland easement** is a perpetual agreement by a landowner and the U.S. Fish and Wildlife Service (FWS). The IDNR assists the FWS with this program. The landowner receives a single lump sum payment not to drain, burn, level, or fill wetlands covered by the easement. Normal farming practices such as cropping, haying, grazing, or working wetlands when they are dry of natural causes are not restricted. A property must have wetlands of value to waterfowl and be located in a county which has been approved for the easement program to be eligible.

The **Prairie Pothole Joint Venture (PPJV)** is a cooperative effort between state, federal, and county agencies and conservation organizations. The goal in Iowa is to raise two million dollars each year to protect 2,700 acres of wetlands and surrounding uplands through acquisition and easements. Since 1987, over 27,000 acres of wetland and associated uplands have been acquired in Iowa at a cost of $25 million. Money also funds creation and restoration of habitat for waterfowl and other wildlife associated with wetlands.

The **Partners for Wildlife Program (PWP)** improves and protects wildlife habitat on private lands through alliances between the FWS, IDNR, and other organizations and individuals, while leaving the land in private ownership. Under PWP, private landowners sign an agreement with the FWS for restoration, creation, and enhancement of wetlands and associated habitat.

North American Wetlands Conservation Act Grant applications are submitted through the North American Wetlands Council for projects which: 1) protect, enhance, restore, and manage an appropriate distribution and diversity of wetland ecosystems and other habitats for migratory birds and other fish and wildlife; 2) maintain or improve migratory bird populations distributions; or 3) sustain an abundance of waterfowl and other migratory birds consistent with the international migratory bird treaties and agreements.

The purpose of the **Service Challenge Cost-Share Program (SCCSP)** is to increase awareness and participation of local communities for conservation of important fish, plant, and wildlife resources on private and public lands. It also enhances public lands and their use, maintains FWS lands, and is used for research.

State Legislation and Programs

A **fishing license** is required for Iowans 16 years of age and older and non-residents who are at least 14 who fish on land other than their own. Funds from fishing licenses are directed at efforts to maintain and improve the quality of Iowa's sport fishing. Activities of the Fisheries Bureau of the DNR include lake construction and management, habitat restoration projects, fish stocking, research, and public education.

Angling and hunting regulations are based on information gathered by biologists who study fish and game populations. Boat ramp and beach construction on public waters is determined by potential impact on the environment as well as public convenience.

The biggest threats to aquatic ecosystems from recreational uses are misuse and abuse by careless people. It is essential that recreationists obey rules and regulations designed to protect the integrity of the ecosystem. Abide by all rules posted at recreational areas and obey the *Iowa Hunting, Fishing and Trapping Regulations.*

The **Groundwater Protection Act** was adopted by the Iowa legislature in 1987, and focused on reducing potential contamination from industrial and agricultural chemicals and preserving drinking water quality. Private wells are tested each year for water quality. The Act also states wells no longer in use should be plugged.

Resource Enhancement and Protection(REAP) was enacted in Iowa in 1989, to enhance and protect Iowa's natural environment. Funding is allocated for conservation education, land acquisition, soil and water conservation, park development, and other environmental projects.

Each county conservation board receives an allocation for open space acquisition and cost-share for soil conservation is available through local Soil and Water Conservation Districts. County conservation boards also may submit grant applications for specific sites to obtain easements. Areas protected or enhanced include prairies, woodlands, stream corridors, wetlands, and other natural areas.

Private Programs

The Izaak Walton League is a non-profit conservation organization that works to protect America's soil, woods, waters, and wildlife. The League heads the ***Save Our Streams*** program which teaches volunteers how to monitor, protect, and restore waterways in their community.

The mission of the Iowa Natural Heritage Foundation's ***Wetlands for Iowa*** program is to protect and restore Iowa wetlands. This is accomplished through consultations with landowners, holding and managing conservation easements on privately owned lands, and funding partnerships with state and local agencies and other nonprofit conservation organizations to acquire environmentally sensitive property for public use.

The ***Iowa Buffer Initiative*** is a program of Trees Forever designed to promote new technology which can help control erosion and increase wildlife habitat while reducing nonpoint source pollution. The goal of the program is to place technology for a variety of riparian management techniques in the hands and on the ground of rural landowners. For each year, through 2002, Trees Forever is developing ten highly visible demonstration sites to showcase riparian management techniques and ten projects in areas of high need.

Teacher Aids

Posters: Aquatic Life, Life In A Stream
Audiovisual Program: People, Land and Water

Other Materials

Audiovisual Programs:

(contact your local area education agency for availability)

Aging of Lakes
The Best Fishing: It's in *Your* Hands!
A Freshwater Algal Bloom
Iowa's Precious Waters
Lakes: Aging and Pollution

"Restoring America's Streams" Izaak Walton League of America, 28 min.VHS Izaak Walton League of America, Stream Doctor™ Project, 707 Conservation Lane, Gaithersburg, MD 20878-2983; 1-800-BUG-IWLA

Popular Literature:

MacGill-Callahan, S. 1991.And Still the Turtle Watched.A turtle carved in rock on a bluff over a river by Native Americans long ago, watches with sadness the changes over the years.

Mendoza, G. 1990.Were You A Wild Duck Where Would You Go?A wild duck narrator looks at the past when the environment was bountiful, searches through today's polluted environment for a home, and encourages saving and restoring the environment for the future.

Protecting Rivers & Seas.EDC. (ages 7- 10) An introduction to the basic ecology and conservation issues of today. Facts are presented and suggestions made as to how we can all help solve these problems.

Pex, D.R. 1994.What is a Watershed?.America Clean Water Foundation (750 1st Street, NE Suite 911, Washington, DC 20002 (202/898-0902). (elementary) Take a hawk's eye view tour of a watershed.

Wood, D. 1992.Old Turtle. Pfeifer-Hamilton. (ages 6 and up) An enchanting fable that promotes a deeper understanding of the Earth and our relationship with all beings who inhabit it.

Demonstration Models:

Stream Table and EnviroScape - contact IDNR, Aquatic Education Program, 2473 160th Road, Guthrie Center/IA 50115; Phone: 641/747-2200; Email: AquaticEd_Info@dnr.iowa.gov for a listing of local organizations/agencies which have models available for loan.

Other:

National Watershed Network - Know Your Watershed (http://www2.ctic.purdue.edu/kyw/)
Iowater homepage (www.iowater.net)

WILD Aquatic Activities (grade level)

Alice in Waterland (5-8)
Aquatic Roots (5-8)
Aquatic Times (5-8)
Blue Ribbon Niche (5-8)
Designing a Habitat (5-8)
Dragonfly Pond (5-8)
Glass Menagerie, The (9-12)
Migration Headache (5-8)
Plastic Jellyfish (K-4)
Riparian Retreat (5-8)
Something's Fishy Here! (5-8)
To Dam or Not to Dam (5-8)
Water Canaries (5-8)
Water We Eating? (K-4)
Water Wings (5-8)
Wetland Metaphors (5-8)
What's in the Air? (5-8)
What's in the Water? (5-8)
Where Does Water Run? (5-8)

** Supplemental information provided for italicized activities.*