UNIT IV

WATER RESOURCES FOR OUR FUTURE

LESSON 25

AQUATIC INFORMATION AND MANAGEMENT

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LESSON 25

Aquatic Information and Management

Lesson Objectives

Following this lesson students will:

1. Understand the major effects that human activities have had on fish resources.

2. Recognise forms of pollution and encroachment.

3. Know how increased fishing pressure and use of the waters affect fish and fishing.

4. Be able to discuss bag and size limits, seasons, and other management techniques for increasing fishing potential and distributing the catch.

5. Know what is meant by "exotic species" and the effects they can produce.

6.Have some insight into the conflict between commercial and recreational anglers.

Materials for the Lesson

1. Overhead transparencies and photocopies of the graphics from the appendix.

2. Materials from local or national conservation organisations that concentrate on the topic of this lesson.

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TEACHING STRATEGY

Lesson Content Outline	Classroom Procedure
	This lesson has the potential for you to utilise one or more guest speakers. A fisheries' biologist or a biology teacher, The local conservation officer, a commercial fisherman, a building contractor, a manager from a large manufacturing facility, and others, all have the potential to contribute to the content of this lesson. If you have major problems in your local area and have a class of older students, this lesson could be expanded to several sessions.
	1. Introduce the class to the lesson objectives.
Effect of Human Activity A. Habitat Degradation 1. Encroachment 2. Pollution a. acid rain b. toxins c. runoff	2. Lead an initial discussion that can centre on the following topics: A. Humans being attracted to water, B. Volume of waste, its treatment, and effects on water, C. Growth in fishing pressure, D. Effects of industrial, housing, and other developments, E. All deal with encroachment – and habitat degradation - discuss these terms, what they mean, and identify local examples. Include problems created by water storage dams, flood mitigation works etc..
B. Management of Fragile Systems	
	3. Discuss pollution in all its many forms, including littering, the burning of fossil fuels (acid rain), waste disposal - industrial, human, toxic, etc. and the major problems these cause to aquatic resources. Include the use of pesticides, insecticides, and fertilisers on farmland.
	4. Discuss why management of fragile aquatic systems is a major issue today and what steps are being taken to improve previously polluted water - the Brisbane River might be a good example to use here.
II. Fishing Pressure A. More Anglers, More Sophistication B. Limits	5. Discuss the large number of anglers today and their increasing sophistication. How does this affect the resource? What can each person do to help?
C. Seasons	6. Discuss the role of size and bag limits, minimum and maximum size limits, fishing seasons and the role of effective enforcement of fisheries regulations. What can we do as individuals in addition to following these regulations ourselves? What would happen if they didn't exist and/or weren't enforced?
III. Endangered Species	7. Discuss the role of management to avoid endangered species and what effect the introduction of an exotic species can have on the aquatic environment, including other native species of fish.

IV. Exotic Species

V. Commercial/ Recreational Conflicts

8. The conflict between commercial and recreational fishermen occurs mostly in salt water areas. In these areas, heated arguments have occurred over the resource and its use and/or misuse. Aboriginal people, by cultural practices and claim to historic rights through native title have become embroiled in some of these conflicts. Students should know why this occurs and what has been done.

INTRODUCTION

Nothing can enter an environment without changing it. Alterations may be inconsequential and hardly noticeable, or of major or even catastrophic proportions. In the case of water resources, the effect of human activities has been dramatic. In the early development of this country, settlements began on the banks of rivers, estuaries and along the ocean shores. To this day, home sites along any waterway, natural or man made, are sold at a premium. The expansion of transportation systems, superior highway networks, and human preferences have caused an influx of people to seek this habitat and, in the process, sometimes have destroyed what they came to enjoy.

Today's civilization creates waste faster than it can be treated, resulting in an adverse effect on all types of water. Fish resources suffer from poisons and other "cancers" in the system. At the same time, the working habits of people continue to change with increased leisure time and a shorter working week. Predicably, fishing continues to reign as one of the most popular pastimes, with millions taking to the waterways.

As pressure increases on the habitat and the resource, solutions must come from aquatic research and successful management. Conflicts mushroom among user groups. Some species have been threatened with extinction. There are those who believe that the introduction of exotics may provide the answer, but that can be an approach filled with danger for native species.

The student of angling cannot live in a vacuum, concerned only with the immediate gratification of catching fish. The angler must be totally aware of the situation as it exists today and the prognosis for the future. Quality fishing tomorrow centres on sound management practices now.

NARRATIVE

The Effect of Human Activities on Fish Resources

Man has always gravitated to water. In one sense, it is the essence of life and absolutely vital to survival. Equally important to the early settlers, waterways formed the original transportation network of this great land. Villages and towns were built in strategic places to take advantages of waterborne commerce. Farmers and graziers relied on the flow of this critical commodity. During the industrial revolution, water became a source of power and a necessary ingredient in the manufacturing process. Today, huge quantities of water are utilised in manufacturing processes.

In colonial days the supply of fresh water and the bounty of the oceans seemed endless. An untapped inventory of new territory and untouched sources of water lay just over the horizon. Through the years, few people expressed concern as the fish resources in river after river disappeared. Along the East Coast, runs of barramundi disappeared from many rivers. Bass no longer journeyed upriver due to the building of weirs and dams. Populations of jungle perch dwindled as pollution destroyed the clear, pristine waters so necessary to their survival.

Most folks were too busy earning a living to care. Who could have battled giant companies that dumped waste in streams or taken on municipalities who used flowing water to wash away their sewage. It has been said that a conservationist is someone who lives downstream from a polluter. However, Australia was not ready to do anything about the loss of resources. For one thing, the knowledge of what was happening was never broadly disseminated. Leisure time was a luxury and fishing was often a method of bringing home food rather than a source of relaxation and pleasure. If a beach or river did not yield enough fish, it was easy enough to go somewhere else.

Angling pressure was not a major concern.

Far-sighted scientists and conservationists pointed out that human encroachment and disregard for waterways were destroying fishery resources. Further research dictated the need to develop techniques for managing fish and water. Research into breeding started in an effort to replace dwindling fish populations. Efforts often fell short because managers, politicians, and anglers did not fully understand that the habitat had to be improved before stocking would be effective.

Originally, legal minimum size limits came. The theory was that small fish should be returned to the water until they grew and possibly spawned at least once. In southern trout fisheries, catches were limited by establishing seasons and allowing fishing only during part of the year. At the same time, bag limits were set so that each person could catch only so many fish per day. Fisheries management today is a much more exact science than it was then, but those first efforts were necessary to make people aware of the problems. Now, dedicated scientists are trying to salvage what is left and improve conditions through newly developed techniques and understanding.

Habitat Degradation

No part of Australia has been totally immune to habitat degradation. In the wet tropics, as well as the south east, timber getting has had an adverse effect on water resources and fish populations. Timber harvesters originally had to rely on the rivers in their work, leaving debris and trees that often altered the natural flow of streams. Clear cutting and over harvesting make it easy for rain water to carry silt and dirt downhill to the nearest river, changing the clarity of normally clear streams. Silt damages the production of plant life and can destroy the eggs of sensitive species.

Although the ultimate concern of the angler focuses on the water and fish resources, land use is often the source of the problem. Without proper management of an entire watershed, individual creeks and rivers suffer. Tea tree swamps once covered a substantial portion of coastal areas. Many of these remained flooded for large parts of the year with fish populations relying on the abundance of dead organic material and the production of green plants in these areas. Unfortunately, to make farming easier, many of these swamps were drained. In the Burdekin River plain, for example, only one-fifth of the original wetland habitat remains. Clear-cutting of trees and draining through irrigation canals, were the culprits. Supposedly unproductive swampland has been turned into farms where sugar cane became the staple crop, followed by rice. At a time when agricultural interests are not making a profit out of growing certain crops because of an over abundance, valuable habitat has been lost forever.

In the name of flood control, many areas pock-marked with canals and meandering rivers have been "straightened" through irrigation canals, a process that destroys precious habitat and fish resources. A typical example is the coastal plains that are now the Gold Coast. Originally covered with tea tree swamps, mangroves and she oaks, the coastal area was cleared and canal developments replaced the swamps. Channels were dredged and wetlands drained. Pollution, caused by rubbish from storm drains, now occurs. Fertilisers from lawns and nutrients from sewage farms leach into waterways. Developers are continually attempting to claim more land and dredge canals, although impact statements have already shown the damage that has already been done. The canals drain directly into the Nerang River which in turn flows through the seaway into the Coral Sea.

The mixing of fresh and salt water in the estuaries has been changed. This has had a debilitating effect on many salt water species that rely on these nursery grounds for production of their young. Without the steady flow of fresh water, high salinity occurs further inland, destroying organisms that are not salt tolerant. It is a fragile system in which even minor changes signal serious results. Such playing with nature is a dangerous game with broad consequences.

Encroachment

About two-thirds of the marine species rely on estuaries for survival during a portion of their lives. Even those that remain in deep water often feed on fish that require an estuary. When the first fleet stepped ashore at Sydney, the coasts of this country provided unpolluted resources in abundance in the form of plant life, free flowing water, and a natural environment that fostered the population growth of salt water species.

From that time, the inventory of this precious habitat began to decline. It has continued to diminish steadily, but in recent years, the demise of this productive zone has occurred at an alarming rate. Pollution is one factor, but dredging, filling, retaining walls, canals and other construction projects have created serious conditions. Frequently, dredging has been done to recover sand and shells for land fill, material for concreting and canal developments. The building of lock gates and weirs has destroyed the natural flow of water and eliminated certain trees and plants critical to fish production. No example is more vivid than the destruction of mangroves with their tangled roots that not only help to filter the water, but also provide a haven for countless species of juvenile fish and crustaceans.

People enjoy living on the shores of dams, impoundments, rivers and bays. As a result, waterfront property brings premium prices. Owing to their recreational and tourism attraction, cabins and cottages are now established at dams, impoundments and estuaries that were once natural and untouched; even streams entice families to seek solace on their shores and build either permanent or summer residences. The simple fact that humans reside at the water's edge spells "encroachment" in capital letters. Trees and plants are cut for a better view. Marinas, jetties and retaining walls often replace the natural shoreline and the resulting environmental changes are seldom for the better.

Those who are fortunate enough to live near the water are not about to give it up. One can surmise that even more people will move to these surroundings if the opportunity is there. Right now, the task is to limit construction and to ensure that critical habitats are preserved in their natural state if recreational fishing is to continue. The draining of wetlands and swamps and the building of edifices may improve the tax structure of a community, but it destroys extremely valuable habitat.

Pollution

Pollution is a natural adjunct of human habitation. Indiscriminately discarding unwanted items is a basic form of pollution. Littering not only destroys the beauty of our aquatic resources, but also can harm fish. Incidents of small fish becoming trapped in discarded drink cans and plastic bottles, and larger fish being gilled on the plastic holders for six-pack drinks and discarded balls of tangled fishing line have been recorded. Everyone can do something about this problem of litter by eliminating waste, and encouraging others to carry out all items brought into an aquatic environment. According to most experts, this is a serious problem but, relatively speaking, less serious than the damage from acid rain, toxins, and even runoffs from farms.

When fossil fuels are burned or sulfide minerals are smelted, sulfur dioxide and nitrogen oxides are given off as by-products and enter the atmosphere through smokestacks, aircraft jet engines or from the exhaust pipes of automobiles. When these emissions mix with water vapour in the air, they form acids that eventually find their way back to earth in the form of rain, snow, sleet, dew, and even as dry particles. The term "acid rain" describes such precipitation that has a particularly high acid content. Acidity is measured on a scale of 0 to 14. The lower the number the more acidic the solution. A pH of 7.0 is considered neutral and is neither acidic nor alkaline. Natural rain is slightly acidic because carbon dioxide and water in the atmosphere have a pH of 5.6. Any pH below that number indicates the presence of acid rain.

Acid rain is a worldwide problem because it is carried aloft for great distances before returning to earth. Electricity utilities create a significant percentage of these emissions, but other manufacturing processes also do their share. Of course, aircraft and automobiles add to the problem. As a result waterways, dams and impoundments in Australia and other countries have become contaminated in some form because of acid rain, an extremely debilitating form of pollution causing multiple reactions.

Acid also enters the water from acid sulfate soils. These naturally occurring soils form in flood plain areas and old sea beds along many areas of the Australian coastline. These soils contain the iron pyrite mineral. The soil is normally waterlogged, but when it is drained and dredged for development of buildings or irrigation channels, oxygen from the air reacts with the exposed iron pyrite and sulphuric acid is formed. This acid is washed into the water with the next lot of rain.

Increased acidity in a dam, impoundment or stream may attack the reproductive systems of fish and can kill or deform the fry, which are often more vulnerable than the eggs. Acid rain also plays havoc with the food chain and destroys plants, plankton, and other organisms that provide food for baitfish. The acid may also weaken bones of fish and cause metal poisoning resulting in fish kills. Metal poisoning can occur when the acidic water dissolves certain metals such as aluminium and hold them in solution. Ulcers known as red spot form on fish that have been exposed to acidic waters.

Within the next 15 years, countless dams, impoundments and miles of waterways may be lost permanently to acid rain if drastic steps are not immediately taken to reduce sulfur dioxide and nitrogen oxide emissions. It must be remembered that acid rain has far reaching effects. Pollution in one area can be carried hundreds or even thousands of miles and dropped in places that have not seen a smokestack, jet aircraft or automobile. The dams and impoundments most affected are usually clear and situated in granite or sandstone basins. Fortunately, dams and impoundments in limestone areas, our most productive lakes, are less affected, as lime is mixed with the soils on development sites and farmlands to kill the sulphuric acid content.

Waste Disposal

Waste disposal becomes an ever increasing problem in most nations of the world. One of the primary reasons that industry locates on a waterway is to facilitate waste disposal. Whatever the by-product and no matter how toxic the effluent, disposal is simply a matter of pumping waste overboard and letting the water carry it away, regardless of consequences. It doesn't take a sophisticated scientist to know that cyanide, sulfide wastes, acids, and other chemicals make it difficult for most organisms to survive.

Metals in solution are often incorporated into deadly waste. Fish have trouble surviving lead at 0.3 parts per million or copper and zinc at 0.5 ppm. Metals damage gills and mucous membranes and the fish suffocate. Ammonia and chlorine cause congestion of membranes and nervous spasms. Fluorine results in death through a nervous disorder. PCBs, mercury, and dioxin are also common toxic contaminants. These contaminants persist for a long time in aquatic systems, accumulate in fish, and can be hazardous to humans who ingest them.

When major fish kills are reported through the news media, people shake their heads and then forget about the tragedy within a day or two. Industrial waste (runoff), acid sulfate soils and municipal sewage are the primary culprits. The toxic conditions need exist for only a few minutes to destroy a stream. Even in the few cases when a company must make restitution for damage to fish stocks, it is a pittance compared to the long term loss of the resource.

Farming today goes beyond putting seeds or small plants into the ground and hoping they will grow. It is a sophisticated process in which nutrients are added to aid growth and pesticides are

applied to reduce or eliminate damage by insects. Crops may blossom because of this increased care, but the process also pollutes nearby lakes, streams, and rivers. Ground water as well as rainwater and snowmelt runoff carries both the nutrients and the pesticides into these waterways. The pesticides are poisonous and have an immediate and disastrous effect on various fish species. Excessive nutrients work a bit more slowly, but are also deadly.

The introduction of nutrients causes green plants to grow faster. Populations of algae and other microrganisms expand rapidly into dense populations. One such algae bloom is Lyngbya, more commonly known as fireweed, that recently spread very rapidly over the waters of Moreton Bay. In the process of eutrophication (also caused by untreated or partially treated sewage), there are not enough consumers to eat the producers. Increasing quantities die and the decomposers go to work. This depletes the oxygen and causes stress on gamefish, often resulting in fish kills or at least in forced migration.

Management of Fragile Systems

The days of nature maintaining water systems and totally providing for fish resources have lapsed into history. These fragile environments have lost their cushion and are now dependent on man for proper management and control. Basically, man has caused the problem and is now having to find the solution. The answers are slow in coming and equally difficult to administer.

Major sources of pollution must be stopped if fisheries are to exist. Even when massive fish kills do not occur, damaging the water reduces the carrying capacity at all levels of the pyramid. Acid rain, toxic waste, and runoffs of nutrients and pesticides have a frightening finality.

Hatcheries can only do so much toward replenishing fish stocks. To maintain adequate fish stocks, there must be natural spawn and natural growth. The put and take fisheries that occur with hatchery are a management measure. The stocking of dams and impoundments has become very successful because anglers can expect to catch a fish. Anglers may prefer to catch native fish, but hatchery fish that have been introduced into the wild are usually indistinguishable from the wild native fish. Fisheries' scientists can identify the differences by viewing the scale patterns under a microscope. Hatchery fish have finer ring patterns on their scales which enables the scientists to record whether the hatchery fish are compatible with the natives and not overwhelming them.

Even the oceans and estuaries of the world are fragile ecosystems that require attention and monitoring. For the first time, people are learning that the oceans are not endless wells with unlimited resources. Instead, they are capable of very finite production that depends on water quality and favourable conditions. Moreton Bay is a case in point. Formerly a tremendous source of fish, prawns and oysters, the ecosystem has been polluted to the point of severely diminishing these populations. However, aquatic ecosystems have shown that they can be resilient. Many bodies of water have been restored to excellent fisheries.

Fishing Pressure

Fishing pressure has increased significantly. Not only have more people taken up the recreational pursuits of fishing, but also they have more time in which to enjoy their hobby. Statisticians report that more than 5,000,000 Australians fish. It is estimated that over 880,000 Queenslanders fish in either, fresh, salt or both, water environments. Fishing ranks high on the list of recreational activities and continues to grow in popularity. Satisfying this desire in the populace is another matter. Management of the resource becomes extremely important, particularly in areas close to major population centres. Even remote regions bear careful watching. Light aircraft, helicopters and remote camps make these areas relatively easy to reach. No area, from Cape York to the Kimberley, is remote enough to discourage fishermen from testing the waters.

With masses of anglers pursuing every species imaginable, solitude on the water has become much more elusive. The days when one can fish all day without seeing another person are the exception rather than the rule. Increased pressure by anglers, whether afoot or aboard a boat, often forces fish to change their feeding habits or migratory routes. It is difficult for a fish to feed when people are tramping through their habitat from daybreak to dark. Regrettably, there are areas where shallow water species no longer invade in great numbers, because boat traffic has increased to the point of become frightening. Anglers have considered different fishing techniques on the weekends from those during the week because the fish have been pushed further back into cover with more anglers and other recreational users on the water.

More Anglers, More Sophistication

Not only has the number of anglers increased, but also the typical fisherman today is much more sophisticated. The reasons are twofold: technological advancements in equipment and techniques plus improvements in the dissemination of information. Casting has been made easier with rods made from Space Age materials and reels that boast extensive features. Lures span a wide range, including an arsenal of soft plastics and special scents, which can be applied to remove human odour or to entice fish.

Small boats contain sophisticated electronics, including depth sounders which paint a picture of everything below the bottom, trace it out on graph paper, or show it via a liquid crystal display. A global positioning system (GPS) is a navigation device that puts the angler within a metre of a targeted position in large bodies of water. Water temperature is monitored electronically and pH and oxygen meters can tell the condition of the water. Water clarity gauges relay information on turbidity and suggest the best colour lures for the water conditions. Two way radio communications puts anglers in touch with one another so that those who do not find the fish can be directed to the best areas.

The boats, themselves, are sophisticated fishing platforms. Not only do they house the electronic gadgetry, but also they are fast, sea worthy, and tailored to do a specific job. The introduction of the centre console boat for marine use changed the entire character of the offshore fishery, opening it to people of moderate means. Prior to the advent of that boat design, only wealthy people could afford repeated trips to blue water. The centre console brought that type of fishing within reach of average income anglers.

The media expanded its contribution as more magazines and periodicals have appeared on the scene and focused on the how-to and where-to of fishing, leaving general interest stories to the major publications. Newspapers expanded their coverage and radio became another vehicle to tell people where, when, and how to fish. At the same time, television stations hired fishing reporters to cover the local area.

National and regional television programs illustrating techniques have grown in their appeal, each media imparting knowledge to the average angler, only visually. From that stage, the process shifted to videotape focusing on the how-to aspects. The angler can now learn to fly cast, tie knots, make rods, catch barramundi, whiting or yellowbelly and do a hundred other things while sitting comfortably in the lounge room watching an expert perform. All of this has helped to lure more anglers to the sport and to make them more sophisticated.

In many parts of the country, fishing courses aimed toward a technique or species are commonplace, usually taught by a local expert. The continuing education division of at least one major university makes its staff available each year to teach fishing techniques. If an angler wants to improve, he has more options today than ever before. For example Sunfish Queensland offers three day angler education clinics which include theory and practical content, for children and adults.

Limits

Size limits and bag limits are two tools of fisheries' managers to protect the spawning stock and to make sure that the population can renew itself. At times, however, there are upper level size limits preventing the taking of more than one fish over a certain size. This is particularly effective where the larger fish are the primary spawners. The theory is to allow one trophy, but prohibit anglers from keeping most of the spawning fish.

Changing size or bag limits sometimes has a measurable effect on the fishery. The key, of course, lies in enforcement. If these laws are not enforced, the results leave much to be desired. Most fresh and salt water species are managed with minimum legal size, bag limits and closures. Some salt water fish have been declared recreational fish only as a management practice to reverse the decline in the species.

Anglers tend to keep and kill more than they need, sometimes selling the excess to pay for fuel and other angling costs. These people reason that there are millions of these species in the ocean and that their catch is negligible when compared to the total. What they fail to see is the cumulative catch. By releasing unneeded fish or adhering to a limit, more of the species may be saved to spawn.

Closed Seasons

Closed seasons are another management tool to help maintain specific fish populations at renewable levels. This may be done simply to relieve pressure during part of the year or may be targeted to the spawning season. For example, in salt water, a closure applies to the barramundi for a period of three months when the fish are spawning and easy to catch. Likewise in freshwater, a closure applies to the taking of Australian Bass for a period of three months. The spanner crab fishery is closed for a period of one month to allow the congregations time to spawn in that peak period.

Closed Waters

Closed waters are set down in the regulations for specified distances upstream and downstream of weirs. This is particularly important when water levels are low and fish, congregated at the bottom of the weir, are easy to catch. The regulations show that a person must not take or have in their possession fish from closed waters.

Closed Areas

All along the Queensland coast there are closed areas to the taking of all gastropods or bivalve molluscs, (pippies and cockles).

Endangered Species

Few, if any, gamefish species are listed as endangered, but many have become species of serious concern. The southern blue fin tuna is becoming endangered due to the demand by overseas fishers. Ocean fish farms for the raising of tuna for overseas markets have become a very successful alternative food resource. Concerns now are raised about the quantity of baitfish needed to feed these fish farms. Figures have been quoted that 19,000 tonnes of slimy mackerel are needed to feed the fish, which then places a demand on the stocks of slimy mackerel. State and Commonwealth Governments can place regulations on the taking of tuna and other species within territorial waters but beyond that the overseas hunters are waiting to take anything that falls on their long lines or drift nets.

Disastrous management has placed the taking of spanish mackerel and other mackerel species in jeopardy. The use of personal water craft for the rapid placement of a ring net around a school of mackerel ensures that most of the school is taken. Recent fisheries' regulations have recognised the decline in fish stocks and banned the ring netting of mackerel. Drift netting has caused a terrible waste in the capture of mackerel. Because the drift netting is mainly in Northern Queensland, the water temperature may be in the high 20°C and fish caught in the net for a period of time

before retrieval, begin to deteriorate, and these excellent table fish have to be thrown away.

With modern methods and particularly the entry of sophisticated commercial gear, such as ring netting and drift netting, into a fishery, populations can be wiped out in a matter of months. The balance is so delicate that constant monitoring is necessary to prevent a serious decline of any species. The same attention must also be given to baitfish because, without the food source, the population of gamefish dependent on that bait will also decline. A recent regulation banned the purse seine fishery of the blue pilchard. Much of Queenslands sports and recreational fishing rely on the annual run of pilchards along the Queensland coast, which attract marlin, sailfish, mackerel and tailor. To establish a blue pilchard fishery would certainly end these fish.

Population dynamics apply to a species over its entire range and to a species in specific waters. If murray cod are lost in a river that one fishes regularly, it does not really matter how abundant they are in another waterway. Lakes devoid of legal size silver perch are frustrating to look at, and even more irritating to fish. "Endangered" should not really be the criterion to monitor. Rather, the key is to detect trends in declining populations and to take remedial steps before the situation deteriorates drastically.

Introduction of Exotic Species

Fishery managers are now aware of the consequences of introducing fish species into new waters. The total system must be studied in an attempt to determine the effect before the species is put into those waters. The yellowbelly, bass, silver perch and murray cod in our rivers have been a delight for most anglers. The carp has not been so well received. In the 1900s, European carp were introduced into irrigation canals in the southern waterways of the Murray Darling river system, for the purposes of clearing the irrigation canals of weed growth. The carp cleaned out the weed but continued to follow the waterways up into Queensland river systems and have now spread into rivers and streams east of the Great Dividing Range. Tiliapia have become another major noxious pest in the waterways competing with our native fish. These prolific mouthbreeders have replaced native fish in many dams.

Education programs offered by the Department of Primary Industries, Queensland Fishery Service, Local Governments and Sunfish Queensland reach out to the general public with posters, and visits, to explain the dangers of releasing aquarium fish into our waterways. Species such as swordtails and guppies are the main dangers to the native fish.

Conflict of Commercial and Recreational Fisheries

Recreational and commercial fishermen have conflicting interests in salt water fisheries. The majority of fresh water fish are protected from commercial exploitation, making the market limited. Such is not the case on the oceans where a middle ground does not exist and conflicts occur.

For many species, the total recreational catch is significant and has an important effect on the resource. However, the problem is compounded by sophisticated commercial fishing gear that can almost wipe out a population very quickly. Traditional hook and line commercial fishermen worked on their effort not very different from the methods used by recreational anglers. Suddenly, a handful of long lines and drift-net commercial fishers, using spotter planes to pinpoint schools, entered the fishery. Stocks of popular fish can drop to disastrous levels.

The problem focuses on the political ability of government agencies and the willingness of politicians to shut down a fishery in order to protect the resource while the necessary studies are undertaken. Concern should be directed toward the resource, not those who argue about it.

While heated arguments rage, the fishery must be protected. Those who want to continue killing the species argue that there is no conclusive, scientific data

showing that what they are doing is harmful. Courts and governing bodies have sometimes followed this rhetoric and sided with it. The only meaningful answer lies in operating intelligently with the best information available or closing the fishery to everyone until sufficient data can be generated from which responsible decisions can be reached. In fisheries management this is termed the "precautionary principle".

LESSON 26

FISHERIES MANAGEMENT

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LESSON 26

Fisheries Management

Lesson Objectives

Following this lesson students will:

1. Understand why hatcheries are important, the benefits of stocking, and stocking methods.

2. Understand why fishing regulations are necessary.

3. Realise why habitat management is necessary.

4. Know the role of surveys and research in angling and fisheries management.

5. Understand how law enforcement impacts fisheries' management.

6. Be aware of funding sources for fisheries management.

7. Be familiar with the background and conflict of waterway allocation.

8. Understand some current and potential management problems.

Materials for the Lesson

1. Any materials available from the Department of Primary Industries, Queensland Fisheries Service, Environmental Protection Agency, Department of Transport, Queensland Boating and Fisheries Patrol, Queensland Parks and Wildlife Service, Department of Natural Resources, and local or national conservation groups.

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TEACHING STRATEGY

Lesson Content Outline	Classroom Procedure
	Due to the nature of this lesson, the local conservation officer would be a valuable resource person to present much of the materials, specifically what is being done in the area and in the state.
	1. Introduce students to the lesson objectives.
I. Hatcheries and Stocking A. Costs B. Size of Fish	2. Management is all those things that protect, enhance, improve, or maintain fisheries and fishing areas. Ask the students if they can identify anything that has been done in their area to manage fishing or fishing areas. Discuss several activities that could be included, such as buffer zones, special limits, limitations on water use, etc., and indicate that they will all be discussed in this lesson.
	3. Indicate that hatcheries and aquaculture are major methods of insuring that adequate numbers of fish will be available. Ask if anyone has visited a fish hatchery or aquaculture centre and if so, what they saw and heard there. Discuss the role of hatcheries and aquaculture in fisheries management, the costs involved, and the sizes of fish when they are stocked.
II. Fishing Regulations A. Bag and Size Limits B. Minimum and Maximum Size Limits C. Catch and Release D. Other Regulations	4. Fishing laws and regulations are important in fisheries' management. Even though these may have been discussed previously, review your state's fishing regulations and why they are necessary. Also discuss the role of "catch and release" in management programs and what effect this can have on the resource, which species should be released, and how properly to release fish without harming them.
III. Habitat Management A. Stream Improvements B. Lake Improvements C. Artificial Reefs D. Weed Control	5. Ask students if they know of any activities to improve fish habitat in their area. They could mention dams, impoundments, etc., or reefs in salt water. Discuss activities that are possible, and how many local groups can get personally involved. Discuss certain problems with habitat such as run off, too many weeds, acid rain, loss of buffer zones, watershed maintenance, and management techniques employed to overcome these problems.
IV. Surveys and Research A. Role of Surveys B. Tagging C. Anglers Surveys D. Biological Surveys and Research	6. Discuss how surveys provide information on the needs of anglers, the fish harvest, and the condition of fish populations and how this information is used to manage the resource more effectively.
V. Funding A. PPV Funds and Licences B. Other	7. Discuss funding sources for fisheries management, explaining that most funds are derived from user taxes and fees, e.g. PPV funds and Licences.

VI. Waterways Allocation A. Human Water Needs 1. Industrial 2. Commercial 3. Farming 4. Recreational B. Commercial/Sport Fishing	8. There is a constant and increasing demand for water and its use from many sources. Discuss the industrial, commercial, farming, and recreational demands placed on our aquatic resources. Often water resources have multiple uses. For instance, dams and impoundments for recreational use by anglers, and boating; water storage reservoirs for cities and township, and for home waterfront building sites. In addition, commercial and recreational fisherman are often in conflict.
VII. Problems A. Depletion of Genetic Strains B. Over harvesting C. Loss of Habitat	9. Discuss the role of fisheries' management in dealing with the problems of depletion of genetic strains, over harvesting, and loss of habitat. Ask the students to develop a list of things they can do to assist in fisheries' management.

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INTRODUCTION

Fisheries' management is basic to the long term use of waterways, and to fish as a renewable resource; one that can be enjoyed by millions of anglers for years to come. Fisheries' management addresses three major areas:

(1) controlling fishing areas through habitat enhancement, watershed protection, and waterways stabilisation,
(2) improvement of fishing through structure additions, weed and pH control, stocking of easily raised and renewable species,
(3) the management of anglers' activities through gear restrictions, size limits, bag limits, and closed seasons.

Effective management comes with research and education to inform the public of the rationale behind management tools, including surveys, stocking, and hatchery operations, allocation of water use, and concern for over harvesting of fish populations.

Government funding limits the use of management and management tools by biologists, waterways engineers, and professional fisheries' managers. Most funding is in essence a "user tax" since it is paid by fishermen through boat registration fees (Private Pleasure Vessel PPV), and impoundment fishing licences.

It is important to understand how these PPV fees benefit anglers and boating facilities. It is also important to realise that management and conservation are closely related, since conservation involves the preservation of fisheries and fisheries' habitat, while management involves the best planning and action for fisheries' maintenance and enhancement.

NARRATIVE

General

Management of fishing and fisheries areas involves a number of methods. These include:

(1) hatcheries and stocking of popular commercial and recreational species,
(2) establishment and enforcement of regulations to prevent overfishing,
(3) management and enhancement of streams, lakes, impoundments and reservoirs to stabilise populations,
(4) surveys to determine angler needs and wants,
(5) delegate waterway allocations to user groups including not only sport and recreational use but also to industry, farming and commercial purposes,
(6) research to address specific fisheries management problems and issues.

Management protects, enhances, improves or maintains fisheries and fishing areas. This includes such diverse activities as protection of National Parks or forests serving as a buffer zone to prevent agricultural run-off, unique minimum and maximum legal size limits of certain fish species, catch and release regulations, protection of fish of certain species and size, and regulations limiting water use by some groups to protect the resource. All of this must be funded, with most of the funding coming from special "user taxes" such as the personal pleasure vessel (PPV) levy component in boat registrations.

Hatcheries, Aquaculture and Stocking

Early attempts at raising fish for food can be traced back to the Orient and early Roman times, but fish culture for sport purposes began in Europe prior to 1850. At that time fish hatcheries could be found for a number of species, even though at the same time, breeding and hatching trout in this country was still a novelty. Hatcheries might seem to be the solution for all fishing problems, since stocked fish from hatcheries could be raised to fill every angler's needs and wishes.

Hatcheries and stocked fish, however, can be expensive and are not always practical or possible. At one time there were hatcheries only for freshwater fish and these were mainly for trout and salmon. They were established in Tasmania. Trout hatcheries were also successfully established on the Tablelands of northern New South Wales. The raising of fingerlings for

restocking is an expensive program and restocking groups throughout Australia are continually raising funds to purchase fingerlings for their particular river, dam or impoundment. Each hatchery must be an accredited site and the fingerlings are supplied free of diseases. Some of the species available from hatcheries are Australian bass, barramundi, eel-tailed catfish, golden perch (yellowbelly), Mary river cod, silver perch, sleepy cod, sooty grunter, southern saratoga, and red claw crayfish. The Department of Primary Industries allows only the restocking of fish that occur naturally in a particular area.

Since 1972, salt water fisheries research centres have been established at specific places along the Queensland coastline. The Department of Primary Industries controls these centres, and each has laboratory buildings and facilities for raising fish and crustacean stocks. Scientists in these centres perform examination of fisheries samples and other scientific analyses. The centres have successfully reared many juvenile marine species. Of these the most common are whiting, bream, and flathead. These have been released into local waterways and continue to grow and spawn. Crustaceans such as mud crabs, sand crabs, and prawns have also been a major achievement of the research centres.

Aquaculture is becoming an important part of the fisheries. Wild fish stocks have been declining and the demand for fresh seafood has been met by the introduction of fish stocks raised for market by aquaculture methodology originally researched by the scientists at the fisheries' centres. People who wish to establish an aquaculture farm are required to meet stringent regulations for the control of water quality and pollution of natural waterways by the discharge of their pond water. Along the Queensland coast the aquaculture farms meet the need to supply fish and prawns to their local area.

Fingerlings, as the name implies, are grown and released for stocking when they reach about 75mm to 120mm in length. They are more expensive to rear to that size, but it may be more economical for most species. The mortality rate would be lower with these fish than with fry, but higher if they were raised to adult fish size. The optimum size for stocking will vary with each species and situation, but usually fish 150mm to 200mm or longer will have low mortality rate if handled carefully. Obviously the larger the fish the more expensive it becomes for the restocking groups.

There are problems associated with rearing fish in hatcheries. Under the crowded conditions of a hatchery, cannibalism can cause large losses. The fish also become trained to feed on hatchery food and need time to make the transition to wild conditions. In addition, there is greater opportunity for disease or fungus to develop. Fortunately, hatchery managers have learned to control most of these problems in association with scientists from the Fisheries' Research Centre. Stockings of smaller fish are more cost effective and accepted by the fishing community, especially if time and conditions for growth in the wild are provided.

Fishing Regulations

Many popular game species such as barramundi and mangrove jack would be in danger of being depleted rapidly without regulations attempting to control their harvest. Fishing regulations encompasses both size and bag limits. Size limits usually state the minimum legal size for a specific species, the rationale being to prevent small fish from being kept and to allow fish to spawn at least once. Some biologists now feel that this simple designation places too much emphasis and fishing pressure, on larger fish. A regulation exists where anglers can keep fish only above the minimum size limit and below the maximum size limit. Some species of fish such as the barramundi are males until they reach about 800 to1000mm in length. After that they change sex to females and on reaching 1200mm must be returned to the water, ready to spawn. Catch and release designated areas have become popular in some waters.

Bag limits regulate the number of fish that can be taken by an angler on a daily basis. Possession limits are similar to bag limits, but specify the number of fish that can be in one's possession. Possession limits mean that, if the bag limit were 10 fish in your possession, and you caught 4 fish yesterday and 6 fish today then that is all that is allowed in your possession. This prevents an angler from repeatedly catching bag limits and storing them in a cooler or freezer for future use. Bag limits attempt to distribute the catch among more people over a greater time period.

Maximum and minimum size limits allow harvesting of fish within certain size limits, and prohibit the taking of fish smaller or larger than that size. Many biologists believe that this is a better way to limit catches, since it protects not only the smallest of the species, but also requires release of large breeding fish. These breeding fish can then help to repopulate the species during spawning season and maintain predator/prey balance. While there are no regulations current on the keeping of large breeding female flathead, a public education program through the media, Sunfish branches, and through fishing identities, encourages the public to release them back safely to the water so they can spawn, thereby ensuring fish for the future.

State regulations restrict catches on some waters to only one large fish of certain species, thus ensuring that many will be left to replenish the species. Some fishing clubs impose regulations that are more restrictive than state regulations. They realise that the club's continued success depends upon constant catches of fish and angler satisfaction.

Catch and release fishing is now becoming acceptable amongst the angling community. In fact, fishing classic competitions in fresh and salt water environments promote the live catch at the weigh in, and then returned to the water. More points are allocated for this method against killed fish. It is also a method to limit harvest. Catch and release fishing is also a part of the fishing regulations in certain waters where fish may be caught, but must be immediately released.

Other regulations prescribe the fishing closures for selected species. Usually the closed seasons are those in which the fish are spawning. For similar reasons other regulations establish off limit areas on certain waters. Regulations that prohibit the use of certain types of bait are enacted to prevent the entry of undesirable species and diseases into streams, dams and impoundments. A common regulation prohibits the use of goldfish, carp or species not bought from a bait shop.

Habitat Management

Habitat management involves the protection, restoration, control, or enhancement of dams, impoundments, rivers, estuaries, and coastal waters. In some cases, habitat management or improvement is accomplished with the help of fishing clubs, recreational lobby groups such as Sunfish and community groups under the direction of the Queensland Fishery Service and the Department of Primary Industries.

Freshwater stream improvements can be accomplished by building small dams to raise pool levels, reinforcing banks with rock or logs, and creating cover from overhanging trees. Similarly on dams and impoundments the planting of structure such as overhanging trees, water weeds and establishing sunken logs to hold fish, can improve fish habitat. In the salt water environment mangrove habitats are recognised as the major source for maintaining protection and food sources for small fish and crustaceans. Strict rules for the protection of fish habitats are enforced by fines and imprisonment.

Artificial reefs for both fresh and salt water areas are an important way to improve some fisheries and increase available fish. Reefs can be as simple as a concrete block, or as complex as the sinking of large scrap ships and other steel structures. While artificial reefs imply a bottom structure such as a coral reef, there are commercially available reefs that are anchored to the bottom but sit as surface structures in order to attract

fish. These are known as FADs (Fish Attracting Devices) or (Fish Aggregation Devices).

Structures for both fresh and salt water are important in two different ways. Structure will also hold, foster and develop algae, weeds, invertebrates, crustaceans, and other flora and fauna. These are the bottom of the food chain and the basis of life for larger bait fish and game fish species. Structures help to gather and hold fish, because they act as a home providing comfort, safety and food. Structure in these areas gathers the fish and makes for excellent fishing. Fish will not stay in areas with plain flat bottoms.

Water pH within certain narrow ranges close to a neutral pH of 7.0 is important for the maintenance of fish life. pH of 7.2 - 8.3 is typical, 6.0 - 9.0 pH is acceptable, and a pH of 5.5 - 9.5 is tolerable. However, fish prefer neutral (pH 7.0) or slightly alkaline (up to pH 7.9) water. Acid rain, acid mine run-off and acid industrial pollution makes pHs abnormally low (very acidic - pH 4.0 – 5.0) and kills fish life and fishing areas. Some pH control is possible, either by using crushed limestone (alkaline) in affected streams and lakes by releasing limestone slurry in careful doses to counteract any acid influx into the water. However, pH control is temporary, expensive, and needed most in those waters that naturally are least productive.

Weeds are important in most waters. They provide a basis for the food chain, provide protection for fish, and convert carbon dioxide to oxygen. However, uncontrolled weeds can be disastrous, since they choke waterways, make boat traffic impossible, and begin the eutrophication (over enrichment) process of dams and impoundments. In some areas, artificially introduced plants such as water hyacinth have become serious problems. Cabomba (cabomba capoliniana) and salvinia (salvinia molesta) are two noxious weeds, which were released by uncaring people who disposed of their fish aquariums into local waterways. Cabomba is a very serious underwater weed and was found to grow to 10m long in Lake McDonald, the rowing venue for the 2000 Olympics which had serious problems because of the dramatic growth of underwater weeds causing difficult passage for the rowers' oars. Other noxious weeds, which have been introduced and grow along the banks of the waterways, are the parthenium weed (parthenium hysterophorus), alligator weed (alternanthera philoxerordes) and hymenechme (hymenechme amplexicaulis). There is no simple answer for weed control, although scientists are continually researching, cutting, poisoning, uprooting and introducing other species to eat or to destroy the plants as aids to control.

Temperature is the most important factor affecting the species in a given body of water. All species have a range of preferred temperatures. Warm waters are best for the so called warm water species such as barramundi, king threadfin salmon and sooty grunter, while cold waters are best for cold water species such as bream, tailor and murray cod. Watershed protection will help maintain a cool temperature for freshwater streams. Temperature can be controlled in streams running from dam outlets, by controlling the level of the outlet from a dam. High outlets result in higher water temperatures; low outlets mean colder water temperatures. However, low outlets often result in water with little or no oxygen, and baffles leading from the outlet to the stream are often used to aerate and oxygenate the water. A flow of cold water released from a dam will change the activity of fish downstream as they sense the sudden fall in river water temperature.

Watershed maintenance involves everything from watershed protection to clearing of hazardous snags or obstructions. All waterways need a suitable buffer zone of forest land around them to protect them from rapid run off of water, muddying of the water, run-off of pesticides, herbicides, insecticides, and fertilisers from nearby agricultural areas, and adequate natural shoreline to protect against erosion. Good agricultural practices, control of urban development, and pollution control are vital components of watershed management.

Surveys

Management surveys provide information on the needs of fishermen, the fish harvest, and the condition of fish populations. Surveys can include tagging of fish, angler surveys, and biological surveys.

Angler surveys are conducted in two ways; access point and roving. Access point surveys are usually done at the boat ramp or waterfront, to compile information. Fishing success, rate of catch, catch per unit of effort, number and size of catch, equipment used, locations fished, and similar information is recorded. Roving surveys are done on the water. This information can then be utilised to determine the need for bag or size limits, seasons, closures and stocking programs.

Biological surveys usually involve electro-shocking, poisoning or netting. In shocking, waters are electrified with special equipment temporarily to incapacitate the fish, which can then be gathered for quantitative and qualitative data. Netting is another method to gather fish data. Netting is usually done by several agencies netting at the same time and place, to eliminate variables. The agencies can build a baseline of biological data trends including information on the habitat and the food chain. Poisons, if used properly, are effective for certain tasks and pose little danger to people.

Tagging involves placing a tag or mark on fish. This allows biologists to obtain important information on growth rates, migrations and movements, species health, weight increases, and similar data. Comparison of data from the time fish are released to similar data gained upon capture, gives fisheries biologists important information.

Tagging is done in a specific way. When fish are tagged, the place of capture, length, and species are recorded in a tagging log book. A free-call phone number on the tag ensures that the angler who caught the tagged fish can pass on the information to Suntag. The information passed on to Suntag, which is the official central agency, is compiled into a national register. People who catch a tagged fish are asked to record the date and place of capture, fork length and total length, whether the fish was kept or released and your name and address. This information is compared against the original data of the fish to see the changes that may have taken place. The angler receives a certificate from Suntag showing all the details of the fish from when it was first tagged.

Allocation of Water/Aquatic Resources

Water is basic to human life in a variety of ways. Not only can we not live without water for more than seven days, but water is also necessary for manufacturing, trade (shipping lines), housing developments (thus increased prices for shoreline property such as canals), farming and for a variety of recreational interests.

There is a constant demand for water from a variety of areas, all vital in their own way, but all in a way destructive to the natural waterway. The great amount of water needed for the production of aluminium for instance, might affect water usage in that area. Water used and released in sewage, chemical, and steel production will pollute waterways if it is not monitored and treated. The damming of a stream for flood control or irrigation may deplete water flow down stream, affecting habitat, fish spawning and fisheries. A reservoir formed for recreation, might be applauded by swimmers, water skiers, sailing, power craft, and anglers, but can ruin the favourite recreation of river canoeists, river and stream anglers, and white water rafters.

Constant water monitoring is required, along with adequate controls to assure that the quality remains high. For the conflicting areas of water usage, a balance must be met to assure that industry, farming, commercial and recreational needs, including many forms of fishing, are all treated fairly.

Commercial fishing and recreational fishing are often in conflict over concerns about the numbers of fish caught, and the economic importance of these fish. The

economic importance of commercially caught fish is usually rated at the market price of the catch. The economic importance of recreational fishing is far broader and more important to many communities. It involves boat and tackle sales, ships chanderly, fuel (for boats and for cars to reach the area), boat and trailer registration fees, insurance costs, maintenance costs, convenience store sales, motels, grocery stores and restaurants, charter boat rentals, party boat trips, and boat rentals. As an indicator, a recent survey of fishers and boat owners, undertaken on the Pummicestone Passage showed that fishers in the region owned a total of $97,377,059 of capital equipment, and spend a total of $8,212,616 per year to go fishing. This is just one example of the economic importance of recreational fishing.

Problems

Fisheries' management seeks to avoid problems through preventative measures. Some problems face everyone - but are generally solved through management programs which include:

Depletion of Genetic Strains of Fish
Biologists carefully control species so that hearty, viable strains are produced in hatcheries. A problem can develop when a hybrid is introduced in an area in which one of the parent species is still present. A dilution of genes or a loss of the original species can occur if the hybrid proves to be more adept in adapting to the environment, or if it proves to be a more dominant strain than the original stock.

Over Harvesting
Controlled legal size and bag limits, constant monitoring and surveys by fisheries biologists can keep this from happening. When it becomes a danger, emergency regulations usually allow for closure of an area pending a more detailed survey and analysis.

Loss of Habitat
This is by far the greatest danger, since it is generally out of the hands of fishermen and fisheries' biologists. Housing developments, shopping malls, industrial plants, human consumption, irrigation, loss of buffer zones, and accidental spillage from shipping can reduce or completely eliminate habitat areas or cause loss of natural waters.

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LESSON 27

FISHERIES CONSERVATION

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LESSON 27

Fisheries Conservation

Lesson Objectives

Following this lesson students will:

1. Understand how available habitat, food, water conditions and watershed conservation affect fish populations.

2. Understand the difference between quantity and quality in fishing.

3. Be aware that acid rain, watershed loss, and changes in waterways require the use of conservation practices to maintain the resource.

4. Understand the difference between conservation and preservation.

5. Realise that poaching, over harvesting, loss of habitat, and lack of education and understanding are major problem areas for fisheries' conservation.

Materials for the Lesson

1. Overhead transparencies and photocopies from graphics in the appendix.

2. Materials from the state department of natural resources or from local and national conservation groups.

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TEACHING STRATEGY

Lesson Content Outline	Classroom Procedure
	Due to the nature of the content of this lesson you may wish to involve a conservation officer, fisheries' biologist, high school teacher or other consultant.
I. Population Dynamics	1. Introduce class to the lesson objectives.
A. Fish Populations B. Quality versus Quantity C. Boom Fisheries D. Natural Population Fluctuations	2. Conservation is the wise use of our natural resources (aquatic resources), without enhancing or embellishing them, but always with the thought of preserving and protecting them for the use of future generations. Discuss this concept with the students so that it is understood, and that it requires a knowledge of the production that can be sustained from an ecosystem. It also involves an awareness of environmental factors which can enhance or harm the fishery.
II. Environmental Problems A. Acid Rain B. Watershed Loss 1. Developments and Housing Projects 2. Destructive Practices 3. Canal Drains	3. Discuss population dynamics and the fact that, regardless of fishing pressure, natural causes create fluctuations in the numbers of fish available, their size, and the carrying capacity of a given body of water. 4.Discuss a boom fishery. Lake Tinaroo and the stocking with barramundi, and other native species, which have grown to be record breaking sports fish and placed Lake Tinaroo on the world map for catching large barramundi. Other examples in the local area may have more direct impact on the class and should be discussed.
III. Conservation Practices A. Fish Management B. Water Quality C. Watershed Protection D. Aquatic Food Chain Biology	5.Conservation becomes much more complex with factors which have a direct effect and over which we have only limited control. Discuss the effect of acid rain and water-shed loss, through development, "point source" pollution from industry, canal drainage, farming, and temperature pollutants, and the difficulty in conservation as a result.
IV. Conservation Versus Preservation A. Wise Resource Use B. Resolving the Conflict **V. Problem Areas** A. Illegal Fishing B. Over harvesting C. Lack of Education and Understanding	6. Conservation practices and management of fisheries are interrelated. Fish management, water quality, watersheds, and protection of the entire food chain are necessary for conservation to be totally effective. Everything is inter-related, and a change in one area can affect the end result. A parallel can be drawn between an automobile accident involving several cars caught in a chain reaction, to the problem with a break in the food chain and the result at the end. 7. Aquatic resources are renewable. Fish not caught and utilised will ultimately die, replaced by others of the same species. Most people believe that utilisation of renewable resources can be enjoyed without destroying the resource. Some people feel that these resources should not be utilised in any way. They are often called "conservationists" or "environmental advocates". Most professional wildlife managers consider this an unrealistic view. This controversy can result in a lively class discussion.

8. Poaching and the taking of more fish that can possibly be used, even though there is no bag limit, are two major problems in conservation efforts. Discuss these factors and ask students to suggest ways that they can become involved and make a contribution in these areas. Educational efforts help.

INTRODUCTION

Conservation and management of fish and fish habitat are closely related. (see Lesson 26 - Fisheries Management). Conservation involves the wise use of areas and species, not by enhancing or embellishing those areas or species, but with the thought of preserving and protecting resources for the use of future generations.

Conservation is based on an awareness and understanding of basic biological principles. It requires knowledge of the levels of production that can be sustained from each ecosystem and of the effects of the utilisation and harvest on the population of a given species. It involves an awareness of environmental factors which can enhance or harm fisheries, such as the introduction of a species, creation of boom fisheries, the destruction by acid rain, and watershed loss adversely affecting water quality and recreational fisheries.

One conflict often gaining much press coverage occurs between those interested in conservation with utilisation of a species such as fishing, versus those interested in complete preservation and protection with no outside human influence. Environmentalists and animal rights advocates generally are more interested in the welfare of individual animals, while conservationists are primarily concerned with populations, communities, and the sustained welfare of the entire system.

Poaching, over harvesting and destructive land and water practices are all areas of concern, which are damaging to conservation efforts. These are best addressed through education to create increased understanding and broad support of basic conservation principles along with vigorous law enforcement.

NARRATIVE

Population Dynamics

In a natural state, the population of a given fish species contains fish of varying sizes. Most fish lay eggs numbering into the tens, or hundreds of thousands. Only a few reach adulthood. Many eggs, fry and fingerlings are eaten by large fish or are subject to the harsh whims of nature. Natural disasters such as freezes, drought, and heavy rain can cause large fish kills, destroy habitat, and rearrange waterways.

Murray cod become solitary for much of their life, staking out the best spot in a lake or stream through a "pecking order" similar to that found in common terrestrial species. Thus, the largest and most belligerent fish will take the best stump or log as "home", leaving the smaller fish to fight among themselves for less desirable areas.

True schooling species such as mullet, pilchards, whiting and bream, remain in schools of their year class (hatching year) with all members of the school remaining similar in length and size. As the fish age, schools become smaller, a result of natural predation of the species, accidents, disease and other natural disasters. The population dynamics then of any given species is shaped like the pyramid of the basic biological food chain. The smaller of the species are more numerous.

Anglers fishing such an environment (which will exist basically with or without fishing or other pressures) have a choice between a situation of many small fish, or that of a few large fish. Each aquatic system has a limit as to what it can produce in a given time period. Watershed geology, climate, and the shape of the lake can be fundamental factors determining carrying capacity.

The "balance" of species also affects the productivity of each system, although carrying capacity seems to be the major factor. When fishing for schooling fish, one finds that each fish is very close in size and weight to all the others. When fishing for randomly scattered fish, one finds that the catch will vary in size with most of the fish being smaller.

The one exception to this can occur in the so-called "boom fisheries". Boom fisheries may develop when a new dam or impoundment is constructed or a new species is introduced into waters where no competition is present and food is plentiful. Here, large numbers of large fish can quickly grow to maximum size, fueled by the lack of disease, predation, and danger, and with plenty of forage fish. An example is Lake Tinaroo where barramundi were introduced. The barramundi together with other introduced native species have flourished. It has resulted in an unlimited supply of baitfish for the barramundi to hunt. As a result world record barramundi up to 50kg have been caught, and the publicity of such large fish being caught in an easily accessible lake have now made Lake Tinaroo "a place to catch the big ones".

Environmental Problems

Conservation and protection of fisheries become increasingly difficult with factors affecting them, both directly and adversely. Some species have become extinct as a result of extensive pollution or over harvest. Some waterways have become devoid of fish and aquatic life as a result of damaging ecological conditions.

Environmental problems can be caused by anything that changes the character of water from its normal state. Factors which can affect waterways, thus fish, include:

Acid Rain

According to the experts, acid rain results from high sulfur content coal used in many industries. The lack of smoke stack "scrubbers" that clean the smoke causes the release of high sulfur smoke into the air where it becomes sulfuric acid.

Acid streams, lakes, and ponds are then created by acid rain. The acid destroys the biological food chain and directly harms fish and water grasses as well. Even without direct harm, the effect on the food chain can cause a reduction in populations.

The greatest damage from acid rain is probably to the watershed. Acid rain's major impact has been on poorly buffered, low productive, but clean and beautiful lakes, dams and impoundments. The actual loss to fishing has been relatively small, but acid rain is an extremely complex and important problem. As with many problems, the "weakest" go first, but this should provide as a warning for us to protect the "stronger."

Industrial Pollution:

Industrial or "point source" pollution can come from many sources including heavy metals, chemicals, and solvents. Some pollutants are thought to cause deformed fish, loss of eggs, sterile fish, and diseased fish. Such pollutants are usually introduced into the water directly through industrial stormwater drains, although some leakage from land or land-bound sludge ponds also occurs. Industrial sites are generally built on land that is unsuitable for housing and are usually sited on land that is low lying or near a creek or waterway. Recent state and national legislation has done much to clean up these problems, but more must be done to complete the task and to prevent future occurrences. The Environmental Protection Agency and local government authorities monitor water quality around these industrial parks for any sign of pollution as a part of maintaining healthy waterways.

Farm Pollutants

Herbicides, pesticides, fertilisers, and soil particles, including phosphorus and nitrogen, are major farm pollutants, sometimes called "non-point source". These are more stringently controlled than in the past but still can easily enter most waterways through severe rainfall and upset the biological chain of life. Phosphorus and nitrogens, found in many fertilisers, fertilise plant life and algae growth, causing plant blooms, which ultimately die. This process consumes oxygen, making it difficult for most fish species to live.

Temperature Pollutants

Even clean industries, which do not produce pollutants into a waterway can cause harm. Many power plants are located on rivers to use the water as a coolant for nuclear reactors and steam turbines. However this heated water is reintroduced to the waterway, causing two problems. First, the heated water creates an unnatural element for the fish. They concentrate in this warmer water in the winter, but if the heated water is stopped, it may cause them to die as a result of sudden temperature change. Cold water releases from dams can be likewise harmful to fish.

The second problem occurs when the intake water draws in with it tiny invertebrates and crustaceans that, in turn, are killed, thus taking them out of the food chain for the small fish in the river. In addition, the intake water causes small fish and fingerlings to become caught on the protective screens since they do not have the size or strength to fight the current.

Water Quality

The lack of water clarity caused by stirring the water is also a pollutant of sorts, as is the siltation caused by poor tillage practices and construction sites. It makes feeding difficult with reduced visibility and causes silt deposits on beds, that destroy most eggs during spawning. The silt can also cover and destroy many small plants and animal life, affecting fish eggs and the food chain.

Watershed Loss

A watershed is the area drained by a river system or by smaller streams, lakes, and ponds in smaller basins. The loss of trees, brush, and grasses on the shores of lakes, dams, impoundments, or streams, also called "riparian habitat", has serious consequences for water quality. This can be caused by poor forestry practices or by cattle overgrazing, thus affecting water in several ways. First, it eliminates the natural growth, which has roots extending into the shoreline. This, in turn, allows for soil erosion, causing a loss of shoreline, increased turbidity in the water with the resultant loss of eggs, and invertebrates, and siltation of the bottom.

The lack of foliage and poor soil conservation practices in a watershed allows quick run off, increases the hazards of acid rain (if it exists in the area) increases soil erosion, changes water temperatures, and causes fluctuating water levels, all of which can be harmful.

Canal Drains

Straightening or canals drains for navigation, agricultural purposes and flood control is a relatively recent practice. The purpose is to allow for a quicker flow of water, thus presumably less flooding. This result is not always achieved, and in the process, a stream is completely ruined for most aquatic life forms. Canals destroy the natural habitat of fish, their food and the biological chain of life. It makes currents that are impossible for any but the larger species to cope with, often increases stream temperature by destroying shade covered eddies, eliminates hiding places for fish, and may increase down-stream flooding.

Conservation Practices

Conservation practices and management of fish and fisheries are interrelated. While conservation is the wise use of natural areas and waterways for the maintenance and protection of fish and other plants and animals, it is based on sound fisheries' management.

Water quality is important to fish survival as well as for man's use. In some states, reservoirs are used for fishing, but the stringent water quality standards and regulations prohibit the use of fuel powered outboards. The spillage of fuel from outboards probably does not harm the fish, but gives the water an "off" taste. Fuel can be removed through an expensive activated carbon process or by utilising hydrocarbon bacteria, which do a faster job. For instance, examples of dams or impoundments that hold water for human consumption around the Brisbane and Gold Coast areas and which ban the use of fuel powered outboards are the Heinz Dam, Wivenhoe Dam and the

Leslie Harrison Dam. With a cooperative effort between the general public and the fishing public, fishing is allowed, but only electric motors are permitted. As a result, the water quality is determined by the needs of both people and fisheries.

In some cases water quality is almost impossible to guard, as in areas affected by acid rain. Most other problems can be dealt with through legislation, by establishing buffer zones to help control industrial or farming pollutants, by watershed protection, and by requiring a buffer zone of vegetation around all waterways.

Waterway protection is vital and can involve everything from, legislation to require a buffer zone of natural watersheds around waterways and outright purchase of the watershed by the state or private conservation groups, to wire encased stone bulkheads to protect the shoreline.

A vital aspect of all protection is a realisation that not only adult game fish need continuous protection, but also that the whole waterway of lake, pond, stream, marsh, bay or ocean must be protected continuously to allow for the biological food chain to thrive. Without the biological food chain, there can be no game species on a continuing basis. Game species are completely dependent upon adequate reproduction, good water quality, and the chain of life that provides a basis for eggs, fry, fingerlings and forage fish.

Conservation versus Preservation

Resources such as minerals and oil are non-renewable. When man removes them from the ground, there is no replacement process to produce more. Other resources such as fish, forests, animal and plant life are renewable. Forests can be cut, replanted, and harvested like any other crop.

Likewise, fish are renewable. Fish not caught and utilised will ultimately die, replaced by others of the same species. Death can be from disease, predation, lack of food, overpopulation or other factors. Most conservationists believe that utilisation of renewable resources including, harvesting forests, hunting of game animals for sport, fishing, or in some cases, subsistence, can be enjoyed without destroying the resource.

Conservationists feel that taking of natural resources is wrong, and that fish, game and forests should not be utilised in any way. Most professional wildlife managers consider this an unrealistic view.

Sustainability does require careful monitoring of these renewable resources. Bag and size limits on fish protect the species and allow the taking of reasonable numbers for sport, while not affecting the population as a whole. One possible resolution is to allow some selected areas to remain untouched by man and to permit only natural factors to affect the fish, game and flora.

Problem Areas

Understanding the basics of aquatic biology makes it easier to understand and realise why biologists and fisheries' managers must formulate management plans that may include size and bag limits. Naturally, these plans should vary among species and specific waters. Some species have much higher reproduction rates, which allow extensive fishing without size or bag limits.

It is a fishing offence, with on the spot fines or court action, to take fish from closed areas, exceed the bag limit of a regulated species, or take fish in an illegal manner such as nets. Illegal fishing methods involve nets placed as a barrier across streams, cross lines or fish traps.

Illegal fishing robs all of us since it can destroy many fish along with their habitat, can take large numbers of fish (netting and trawling), and when practised extensively can quickly reduce any waterway toward being almost devoid of fish.

Over harvesting technically can be considered poaching, but is not thought of as damaging or as "bad" as true poaching by many anglers. Over

harvesting can be either legal or illegal. Illegal over harvesting includes taking more fish than the law allows, or taking the limit and "adding" fish allowed to a less fortunate angler. Thus, with three anglers fishing together with a limit of ten fish per angler, each angler is allowed only ten. Some anglers (and the same flawed thinking also applies to some hunters) take fish on another bag limit (with permission, but still illegally) until all limits are filled; 30 fish in this hypothetical situation.

Legal over harvesting can include the catching of more fish than can possibly be used for food, even though there is no bag limit. Some species do not have bag limits and could be legally caught by the hundreds. Winter whiting are a good example. Each season these whiting school for spawning along the southern bays of the Queensland coast such as Harvey Bay and Moreton Bay. These fish are popular for a family day fishing and used to be caught in significant numbers. The decline in numbers was assisted by trawling which sought out these fish as a by-catch in recent times. A regulation has now been introduced placing a total ban on the trawling for winter whiting but at the same time the Queensland Fisheries Service is considering the introduction of a minimum size and bag limit. Recognition has been given to the sustainability of winter whiting fish stocks and both the commercial and recreational fishers have to contribute to this factor.

This does not mean that fish should not be caught, only that most species of fish should be released once a sufficient amount for food is caught. Such a decision would place control over those "shamateurs" who sell fish on the black market. Hence, over harvesting becomes an ethical or moral issue, not a legal one.

An understanding of biological processes is critical to compliance with fisheries' law. Knowledge of the purpose of bag and size limits, the effects of dumping liquids or solids, clear cutting crops or forests all the way to a shoreline, polluting a lake, or destroying stream beds or habitat containing fish food insects on the resource, is important to the preservation of resources. Natural things are all connected in some way. Water quality is affected by the air pollutants (acid rain), soil (erosion and soil run off and siltation), pollutants (from upstream areas and unrelated industries and farms), and housing (developments especially along the shoreline that destroy wetlands which are the nursery areas for many fish species).

Education, such as encompassed in this series of lessons on fishing and aquatic biology, is necessary if conservation is to be a meaningful, workable, understandable concept, rather than an abstract theory with no practical application. A lack of conservation practices by only a few can affect the beauty of the natural outdoor world; the pleasure received from all water-related sports and the quality of the fishing experience.

LESSON 28

FISHING ETHICS AND YOUR PERSONAL COMMITMENT

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LESSON 28

Fishing Ethics and Your Personal Commitment

Lesson Objectives

Following this lesson students will:

1. Know that each angler has a personal responsibility to fishing and the aquatic environment.

2. Have an understanding and a respect for the resource.

3. Understand the importance of catch and release.

4. Know what is expected of them in relation to other anglers, land owners, and non-fishing resource users.

5. Have a basis to develop their own sense of ethics.

6. Be familiar with fishing regulations and why they are vital to the survival of the fishery.

7. Know how to get involved individually and as part of a group to protect the environment and the fishery.

8. Understand why fishing is an enjoyable recreational pursuit.

Materials for the Lesson

1. Copies of local and state fishing regulations.

2. A list of local fishing clubs and conservation organisations, and their counterparts on a regional and national level.

3. Photocopies and overhead transparencies made from graphics in appendix for distribution to class and for use as teaching aids.

SUNFISH QUEENSLAND INC.

TEACHING STRATEGY

Lesson Content Outline	Classroom Procedure
1. Introduction **11. Personal Fishing Responsibility** A. Ethical Behaviour B. Legal Behaviour C. Personal Action and Responsibility D. Minimize, Not Intensify Individual Impact	This lesson on ethics and your personal commitment is another that can be extended to several class sessions. However, the students, no matter how young, should understand that ethical behaviour is judged as being right or wrong on a set of written laws. Therefore, some behaviours may be legal, but may not be ethical. Ask the students if they can think of any examples where this might be true. Prompt them by asking if making a lot of noise near an angler is ethical behaviour. It is legal, but is it ethical? List several of their responses on a blackboard or easel. Our actions and behaviours affect the environment directly, either in positive or negative ways, and therefore affect others who use the outdoors and our aquatic resources. All have a responsibility to become personally committed to preserving and enhancing our aquatic resources through positive involvement, on an individual or group basis.
E. Respect for the Resource 1. Catch and Release 2. Litter 3. Education of Anglers	1. Introduce students to the lesson objectives. 2. Discuss the role of the individual angler and his/her attitude to our aquatic resources. Each angler must recognise that whatever is done has an effect on the resource. Efforts must be taken to minimise, not intensify this individual impact. Ask students what they can do. Responses could include not discarding drink cans, plastic bags or any other rubbish on banks or in the water, keeping enough fish only to eat and returning the rest for another day; or becoming involved in a "clean up" project. Note these suggestions on the chalkboard as they are mentioned and discussed. 3. Ask students what the cumulative impact on the resource would be if each angler made a personal commitment similar to those mentioned. For example, if every angler released just one trophy sized sport fish to spawn again, how many millions of fish would that add to the resource? Many sport fish, both fresh and salt water, are under threat today. This effort could have a tremendous impact on the fishery each year. Also, everything in the aquatic environment is related to everything else. When a balance is lost, there is a tremendous effect on the aquatic resource. Ask students how educating anglers can impact on the resource. Would knowledgeable anglers behave in an ethical manner that would have a positive effect on the resource? Perhaps this would lead back to the importance of attitude, which is paramount.

F. Respect for Others 1. Fisherman 2. Landowners 3. Non-fishing Users	4. Not only must anglers respect the resource, but also they must respect others who use the resource. Ask students to suggest other users/people who are affected. Use overhead transparency produced from graphics in the appendix to stimulate their thinking. Asking permission to fish on private property and then taking care of that property are two major ethical actions. Ask them for others. Suggestions could include references to water skiers, other anglers, landowners, hikers, campers, etc. Have students list behaviours that would show respect to these groups. Be as specific as possible,
Ill. Familiarity with Letter and Intent of Fishing Regulations	5. Fishing regulations have been established to protect the resource. All anglers have a responsibility to follow written laws and regulations established by state and/or Federal authorities. Discuss several of the reasons why these regulations are necessary. Distribute copies of your state's pamphlets on Fishing Regulations. Review some of the basic fishing regulations that are important, such as seasons, limits on locally popular fish, and possession limits. Ask students what their ethical responsibility is if they know of someone who is flagrantly violating these regulations.
IV. Sportsman Involvement and Responsibility A. Legislative Actions 1. Ecologically Based 2. In co-operation with state conservation agencies B. Organisations C. Personal Actions	6.Discuss with students why we each have a responsibility to become involved in protecting aquatic resources. Student responses should be listed on the chalkboard. Include in the discussion individual and joint state conservation efforts, legislative actions that can be taken, and organisations that can be joined. Many local groups have an active national organisation such as Clean up Australia Day. Others include Coast Care, and Healthy Waterways, Land Care and River Care groups.
V. Why Fishing Is a Good Environmental Sport and Recreation	7. Angling is a sport enjoyed by all. Participation is not limited by age, sex, religion or anything else. Ask the students to list why fishing is a good environmental sport and recreation. Your list on the chalkboard will be lengthy. Then refer them back to their responsibilities and discuss how much they have to gain by becoming actively involved in preserving and enhancing our aquatic resources.

INTRODUCTION

Fishing is an extremely personal pursuit. An angler may opt to fish passively, sitting on the bank of a creek, waterfront seawall, or jetty. Another angler may take a more aggressive approach and actively stalk the quarry. The level of participation chosen is not something to be judged by others. It is an individual decision in the search for enjoyment, relaxation, and delicious, healthful food.

Each enthusiast, however, must shoulder a responsibility for the resource. There is a growing necessity to determine one's own fishing ethics aimed toward ensuring that the same opportunities will exist for future generations. This is a personal commitment that must be followed diligently without policing.

For some, it goes beyond the attitude afield or the respect shown to others. This commitment is much more than simply obeying established rules and regulations. It may foster individual effort to leave the aquatic environment in better condition than found, or it may encourage an angler to become part of a group battling for the future of the resource.

No matter how ethics and commitment manifest themselves, everyone who plans to participate in fishing, and to use the aquatic resources of this great land, must address them.

NARRATIVE

Personal Fishing Responsibility

Many economics respond to supply and demand. In theory and often in practice, as the demand for something increases, suppliers strive to meet that demand. It may take a little time for supply to catch up to demand, but the curves will eventually cross.

The demand for a specific species may skyrocket as more anglers discover the fun of fishing. Those who probe a certain lake, stream, or estuary may want healthier and larger specimens than they are presently catching. Others may demand more fishable water. Increasing the supply of fish to respond to these requests becomes extremely complex and, in some cases, borders on the impossible.

Housing developments, shopping centres, and schools convert pristine natural habitat into what might be termed by some as more civilised surroundings. In the process, aquatic resources are lost. Pollution in various forms lowers the fish carrying capacity of other waterways and diminishes the resource. Each body of water has a finite limit on the number of each species it can accommodate and, unlike a factory that expands to meet product demand, aquatic resources tend to diminish rather than to increase.

It is possible, of course, to reverse the trend, but it is doubtful that will happen. However, of immediate concern are measures to protect and preserve that which is available today for future generations. At the rate aquatic resources are being lost, preservation, in itself, is an awesome commitment.

All of this responsibility funnels down to the individual angler and his personal fishing responsibility. It is easy enough to let the other person worry about tomorrow. However, if everyone subscribed to that philosophy, there would be no one to assume stewardship over the resource. Rather than leave this responsibility in the hands of someone else, fishermen must become personally involved.

Minimise, Not Intensify Individual Impact

The impact of an individual angler measured against the total resource might seem insignificant. Does it really make a difference how many fish he packs into his cooler or how he treats the habitat? Only one angler would not alter the overall picture dramatically but his impact has a cumulative effect. What one person does, adds to the behaviour and attitude of the next and the next.

Estimates indicate 880,000 anglers and visitors fish the waters of Queensland each year. At present a bag limit of 30 applies to snapper. Anglers now consider that, owing to the decline in fish numbers, a bag limit of 30 snapper can never be reached nowdays. On an individual basis, an angler would certainly be practising conservation and treating the resource with a great deal of respect if 6 fish were kept at an average weight of 3kg per fish. However, if each of the 880,000 anglers fished once a year and caught 18kg of snapper at the 6 fish bag limit, the fisheries' resource would be depleted by 15,840,000kg of snapper.

The bottom line becomes one of attitude. Each angler must recognise that whatever he does has an important effect on the overall picture. Through research and effective fisheries' management, man can deter the current trend of decline and even restore certain habitat.

The continuation of the freshwater fishery in lakes, dams and impoundments around Queensland depends upon science. Freshwater fish do not spawn unless they are wild stock in rivers and creeks. They do not spawn in the lakes, dams and impoundments. Instead, females are stripped of their roe which is fertilised with the milt from males. The eggs are then placed in a fish hatchery. Juveniles are released in the dams, lakes and impoundments. Other juvenile stocks are released into local streams and rivers so that they will be imprinted with the scent of those waters and have the ability to spawn when they are mature.

With all species of fish, care must be taken to ensure that an adequate spawning stock remains to produce ongoing year classes. At times, it is necessary to institute fisheries' regulations to make certain the spawn occurs.

One method is to establish a minimum size limit, usually a length at which the fish will have spawned at least once. In certain cases, maximum size limits are established because only the larger fish spawn. It is important to understand that these restrictions are not arbitrary and should be followed, for future fishing depends on it. Providing food for the family is one of the leading reasons given by recreational anglers for sport fishing. If a fisherman understands the fragile resource, he can be encouraged to concentrate on a variety of species for food.

Respect for the Resource

Some fish are far too valuable to be caught only once. Concerned anglers who have supported and nurtured catch and release programs have advanced this theory. The fishery resource must be respected and protected. A growing number of anglers now take only what they need for food and release the rest of the catch unharmed.

Trout and salmon anglers in Australia traditionally release most of the fish they catch and an increasing percentage of bass fishermen are doing the same. The more people who selectively practise the catch and release philosophy, the healthier the resource should become. Some folks argue that the fish die when turned loose, but that argument has little validity in the scientific community, especially if the fish have been handled properly.

Fish species which take longer to reach maturity and those which spawn a limited number of times are more susceptible to over harvest. The longer it takes a fish to reach a reproductive age, the more easily it can be depleted.

In catch and release fishing a fish should be landed quickly while it still has plenty of strength. Handling should be kept to a minimum. A wet towel should be used to hold the fish and prevent the removal of the slime covering the scales. Covering the eyes of the fish slows down shock. Use a soft webbing landing net as the knots on the traditional type net tend to tear away the slime and scales. Unhook the fish as gently as possible, keeping it in the water. If the hook has been swallowed, or is difficult to remove, simply cut the line as close to the hook as possible. The hook will rust out or become dislodged naturally. It is also

good practice to squash the barbs on the hooks to make easier removal.

No one can adequately describe the marvellous feeling experienced when a fish is released and swims away. It fosters an inner satisfaction that outweighs the momentary glory of showing the fish to other people. Many fish are photographed and then quickly released. The picture will trigger fond memories and the fish can bring another angler much enjoyment.

Until recently, few anglers ever dreamed that the supply of certain fish in the estuaries or ocean would become threatened or that hatchery operations would be started to stock these areas. Barramundi, mangrove jack, whiting, bream and flathead, and other species are presently being raised in controlled conditions and stocked in the natural environment.

No animal lives totally isolated from others in an aquatic environment. When certain baitfish disappear, it affects game fish dependent on that bait. If the environment is altered so that juveniles have difficulty surviving, the stocks of adult fish dwindle very quickly. The balance of nature is always fragile.

Every person who teaches fishing to others should make students aware of the need for catch and release. Those who already understand the critical concept of protecting the habitat and resource should share this knowledge with others. Many fishermen simply do not think that what they do individually will have any effect on the system. They are obviously wrong and should be shown how their impact is cumulative. Education holds the key to the future. Without a knowledgeable fishing public battling to maintain quality, there will be even less for future generations.

Respect for Others

Anglers are often referred to as "sportsmen." The connotation is that in regard to their fishing and the fishery they conduct themselves in a manner that affords respect for others while also following an exemplary code of ethics. It is not unusual for a sportsman to give every advantage on the water to his partner. He may even suggest that the other person fish what he perceives to be better water or to take the prime position in the boat
.
This attitude of concern should go beyond fishing partners and close friends. There are unwritten rules of respect for other anglers. If someone is fishing a dry fly and working upstream, another angler does not enter and begin fishing. Each person should be given adequate room to fish undisturbed. If someone moves out of a spot to fight a fish, he has a right to come back when he has landed or lost his quarry. When a boat is working an area, another boat does not move in ahead or crowd the first one for there are certain proprietary rights.

Etiquette on the water is no different from anywhere else. It is the age-old rule of treating others as one would want to be treated. When one shows respect for others, it makes the day much more pleasant for everybody. Fishing is not relaxing when anglers aggravate each other over inconsequential matters.

Anglers who ignore good manners in the field make it difficult or impossible for those who follow to gain access to the land. Most farmers and landowners are reasonable people, willing to host those who behave as guests. They expect visitors to leave everything the way they found it. If a fisherman has to open a closed gate to gain access, the gate must be shut behind him so farm animals cannot escape.

No one enters another's house without asking. Seeking permission to fish private waters to gain access to public waters shows respect and courtesy. It takes only a few minutes to knock on the door to ask if fishing is allowed. Perhaps the owner would like a fish or two for dinner. Basic courtesy and respect ensure that the land will be open next week and next year. Posted lands are the result of illegal trespass and littering or damage of private property. Owners may overlook aggravations a few times, but

when problems persist, the gates are locked.

Nothing is more frustrating to fisherman than personal water craft and water skiers zigzagging through prime fishing habitat. Trout anglers shudder at the sight of hikers or campers marring the banks of productive water. Sightseers zipping across habitats in high powered boats anger anglers with the waves the boat generates and come crashing and shaking their otherwise calm boat. These and countless other encounters with non-fishing users of aquatic resources create friction and conflict.

The fisherman considers the water to be his domain and frowns on what he considers unauthorised intrusion. Non-angling people believe they are merely enjoying the great outdoors and that there is certainly enough room for everybody. Few of these enthusiastic souls would purposely or knowingly ignore the needs of an angler and ruin his day. The problem centres on the fact that non-anglers are frequently unaware of what is involved in fishing.

The resource should be available to everyone and must be shared. Angry confrontations seldom solve the problem. Education can help people comprehend the requirements of fishermen and can aid fishermen to understand what other outdoor users need.

Every boat should have a container for litter. Anglers who walk into a fishing spot should carry out everything carried in, including food wrappers, empty cans, plastic bags, and even cigarette filters. A great many sportsman now pick up litter left by others, which is a good idea.

Too often people who find beautiful flowers or plants growing in the wild pick the flowers or dig the plants to take home. However, it is unfair to others to mar the beauty of an area for those who will come later.

Familiarity with Letter and Intent of Fishing Regulations

The adage that "rules were meant to be broken" has no place in the outdoors. Fishing regulations have been established to protect and spread the resource for more people. It is vital for those who fish to be intimately familiar with all restrictions relating to habitat and different species. Ignorance of the law is no excuse. If there are fishing seasons, these must be learned. They have been established either to protect the fish during spawning seasons or as a method for limiting the catch on heavily fished waters.

Bag limits are set to keep people from taking too many fish at one time. This spreads the resource so everyone can enjoy a share of it. At the same time, restricting the catch protects the stock of a given species both in specific bodies of water and in total.

Size limits are aimed at allowing fish to grow to spawning size before they are caught. The rationale is that if each fish spawns at least once, it will help the stock remain adequate. Of course, this does not take diminishing habitat into account, but size limits are a vital part of fisheries management.

Some states have basic regulations that apply from border to border. Other states vary seasons, size and bag limits from waterway to waterway or area to area. Check regulations carefully.

A few anglers bend the rules at every opportunity. If a fish is too small, some people clean it on the spot, hoping that a law enforcement officer will not be able to tell the length of the whole fish. Some state laws prevent fish from being cleaned on the water so that size can be ascertained. In the Queensland fishery regulations, the skin must not be removed from any fish or filleted while on board a boat. Once brought ashore, the skin may be removed and once removed cannot be returned to the boat.

Some so-called sportsmen go out in the morning, catch a bag limit, and immediately take it home or hide it in an esky cooler in their car. Then, they return to catch another limit. Such an irresponsible attitude is not only illegal,

but affects everyone who shares the resource.

An increasing number of states require a basic fishing licence to fish in freshwater streams. They pay for a permit with a high percentage of the permit fee going towards the purchase of fingerlings for restocking programs.

More and more coastal states are also requiring a salt water licence. Licensing serves many purposes. Managers get an accurate count of participants and the revenues can be used to support the resource. Without these much needed funds, the support of the fishery would be meagre, at best.

Sportsmen Involvement and Responsibility

The concept of letting someone else worry about the resource has little meaning if the resource is to be protected and conserved. Every user must share part of the load and the burden. More and more aquatic habitat is being lost every year, carrying capacities are dwindling, and more people are turning to fishing.

Increasing pressure and demand matched against decreasing supply does not hold well for the future. Business interests with political clout often receive a green light to turn an aquatic resource into an area for shoreside homes or other business ventures and in the process, destroy the resource.

Police enforce laws and protect people from criminal actions. It is easy to become complacent and not even want to know what is happening. Unfortunately, there are very few watchdogs when it comes to the environment and the resources. Frequently, specific laws must be thrust under the noses of the judiciary before an attempt is made to enforce them. Few people wander around looking for polluters so they can blow the whistle. If prime waterway is about to have canal developments or subjected to the developer's earth moving machinery, only a handful of concerned citizens stand tall and shout. Many warnings go unheeded until it is too late.

About 880,000 anglers fish in Queensland. However, politicians know that anglers are part of the unknown silent majority and that they never seem to pull on the oars at the same time. However times have changed and a peak lobby body known as Sunfish now meets with the Queensland Fisheries Service and Ministers of the Government with important issues relating to the environment and habitats. Many issues from areas within the state have been rectified due to the influence of Sunfish . The Government recognises Sunfish as the political representative of anglers.

Legislative Actions

Governmental bodies on every level are becoming increasingly involved in ecological based legislation. Many elected officials are not well versed on these subjects, and even those who are, want to take the pulse of their constituency before committing to one side or the other. That is where involvement by sportsmen can pay dividends.

No one is closer to the scene than the actual users of a resource. Anglers know what is happening to their favourite waters. Making one's views known to those who will vote on legislation is vital. It is far too easy to shirk this responsibility, expecting others to pick up the standard and carry it into battle. This is where lobby organisations such as Sunfish represent the anglers in political approach.

Contacts with legislators should be meaningful. Irate behaviour is far less convincing than simply presenting facts in a logical manner. Letters should be short, to the point, and deal with the issues. Every angler needs to get involved and to accept a share of the responsibility for protecting the resource.

Organisations

Joining an organisation is an excellent means for becoming involved in resource projects. Many groups have taken a leadership position and are exceptionally aggressive in approach. Many fresh and salt water fishing clubs take an active position on current issues.

Many organisations exist locally as well as on country, state, regional, and national levels. One merely has to select those of interest and join. Some are strictly for fishing, while others concern themselves with the environment and conservation in general.

The State Government has regulating authorities that support Sunfish issues and follow any issues put to them.. Some of these are the Environmental Protection Agency, Department of Natural Resources, Department of Primary Industries, Marine Parks, National Parks and Wildlife and local government authority such as the Brisbane City Council.

Individual members lend financial support to these groups such as Sunfish Queensland and add to the total membership. That impresses legislators and the groups have more clout. For hands-on involvement, however, local or state groups offer more opportunity. One must consider an area of concern and then join the group or groups that best serve those needs. Few people have the time to work diligently for several organisations, so it is wise to give a few total support.

Personal Actions

One way streets do not go very far. Simply taking from a resource without putting something back into it is a short-sighted view that produces damaging consequences. To paraphrase an old saying, one does not kill the goose that lays the golden egg. Standing idly by and watching an aquatic ecosystem disintegrate has the same connotation. Fishermen cannot let others take away the waters and the stocks of fish if the sport is to continue.

Involvement and responsibility trigger personal action. Money for a "war chest" is one way of helping, but there is no substitute for people giving of their time and expertise. Each angler must decide what he is willing to do and then volunteer his service.

Above all, every fisherman has the responsibility to be well informed on current issues affecting the sport and the aquatic ecosystems that make it possible. This should be done on a continuing basis by reading newspapers, magazines, books, and listening to radio and television. Dissemination of information is better today than ever, and almost all pertinent issues are covered by the press.

Why Fishing is a Good Environmental Sport and Recreation

There is no sport like fishing. It has universal appeal and is not limited by age, sex, race, education or financial means. Anyone can fish and have fun doing it even though the degree of participation may be tailored to individual preference. It might be a casual pastime or a serious pursuit. One can fish from the bank, from mid-stream, or from the comfort of a boat, and disadvantaged anglers can participate as well.

Learning to catch fish is relatively easy and there are greater advances in tackle today than ever before. Whether it is a pond in a city park, a remote stream flowing through the wilderness, or the shore of a mighty ocean, water has a soothing effect on people. Being near the water is relaxing and promotes a feeling of well being. Fishing also encompasses an unknown factor. One is never certain when he will catch a fish or what size the fish will be. Hope springs eternal in the hearts of fishermen.

There is no better way to learn about nature and to be part of it than through fishing. Anglers have an excellent opportunity to observe all types of wild creatures and to marvel at the mysteries of nature.

Watching the first fingers of dawn claw across a dark sky is a marvellous

experience. Seeing the sun come up across the water or dip below the horizon as it sets is equally wonderful. There are trees and birds, gurgling streams, crashing surf, and the violent eruption of a game fish as it engulfs its prey at the surface. These sights and sounds cannot be duplicated in every-day life. Fishing is more than a method to gather food. It is an adventure and a unique recreational pursuit.