# Fishery Management in a Nutshell

*Fishery regulations have recently increased dramatically. New methods to measure the health of fisheries have evolved, and the framework in which fishery managers must operate has been more narrowly defined. More than ever, anglers need to understand the biological basis of regulation as well as the regulatory process. Well-informed anglers can become an integral part of the process rather than the objects of regulation.*

## Fish are a common property resource

Many anglers, frustrated by unwanted regulation, wonder why government officials have the right to tell them how much they can catch, where and when they can catch it, and how they can catch it. Most common property resources are held in trust and managed for the people by state or federal government agencies. This principal originated in common (public) grazing areas in England as grass disappeared when citizens put more and more sheep on the land held in common. Everyone lost as "the commons" became overgrazed and this became known as "the tragedy of the commons." Fish living in public waters are such a common property resource. The government has the responsibility of managing the fish for the benefit of all citizens, even those who do not fish.

## Fishery managers are directed by elected officials

Managing fishery resources is ultimately the responsibility of elected officials. Elected officials in most states and in the federal government, however, have delegated much of that responsibility to resource agencies that employ people trained in the sciences of fishery biology, economics, and natural resource management. The National Marine Fisheries Service (NMFS) is the federal government agency with primary responsibility for managing marine fish from three miles to 200 miles offshore. Coastal states are responsible for inshore waters and offshore waters out to three miles and for adopting regulations which support higher level management.

## The Magnuson Act requires management plans

The legislation that directs how the NMFS manages the nation's fisheries is the Magnuson-Stevens Fishery Conservation and Management Act, also known as the Magnuson Act. The Act requires fishery management plans (FMPs) with public input that describe the nature and problems of a fishery along with regulatory recommendations to conserve the fishery. After approval by the Secretary of Commerce, regulations that implement management measures in the FMPs become federal law and are enforced by NMFS and the states.

## Legislation directs and organizes managers and officials

The Magnuson Act created eight regional fishery management councils. Each council develops fishery management plans (FMPs) for the stocks in their geographical region. Each council is made up of representatives from the agencies that are in a council's region. Council

members who vote include: each state's director of marine fisheries or equivalent; a person knowledgeable or experienced in recreational fishing, commercial fishing or marine conservation from each state; and at-large members from any of the states in the region who are nominated by the governor and selected by the Secretary of Commerce. Councils also have a Scientific and Statistical Committee and Advisory Panels to help formulate FMPs. The Scientific and Statistical Committee is usually made up of university and government (state and federal) professionals knowledgeable in technical areas such as statistics and fishery biology. Advisory Panels consist of people knowledgeable in commercial and recreational fisheries or who represent other interests.

## Management conservation prevents overfishing

Fishery management plans contain a great deal of information on the biology of the stock (or stocks) as well as the fishery (landings, gear, fishing grounds, processing, markets, etc). A plan identifies problems in a fishery and proposes management measures in the form of fishing regulations that will correct the problems. Conservation and management measures work to prevent overfishing while achieving, on a continuing basis, the optimum yield for each fishery. Conservation and management measures are based on the best scientific information available and take into account variations among fishery resources and catches. Plans define overfishing, outline actions to prevent overfishing and, when overfishing already exists, recommend actions to rebuild the stocks in a specified period of time.

## Conservation is usually required for optimum yield

Optimum yield means the amount of fish that will provide the greatest overall benefit to the nation with particular reference to food production and recreational opportunities. If fishing effort is too high, it usually means that there are too many boats or anglers in the fishery. Fishery managers sometimes call this over-capitalization. This means more has been invested in boats and/or gear (fishing power) than the fishery can support. If no new boats are added to a fishery, but each boat doubles its fishing power by carrying twice as much gear or anglers or using new technology (sonar, GPS, etc.) the new effort can have the same impact on fish stocks as doubling the number of boats. One goal of fishery assessment biologists is to estimate the amount of fish that can be safely removed (total allowable catch - TAC) while keeping the fish population healthy. These estimates may be modified by political, economic, and social considerations. Optimum yield is based on the maximum amount of fish that can be harvested safely, but is modified by economic, social, and ecological factors. This may include the goals of providing seafood to consumers and recreational fishing experience and its contribution to the economy.

## Conservation is controlled by regulations

Regulation strategies have developed over time to control access and catch sizes that minimize the impact and cost on anglers and managers. Sometimes these regulations can seem unreasonable to anglers when the details of the plan, mechanism or action are unknown. Most regulations are aimed at reducing the overall annual catch rate. In order to calculate catch rates, fishery biologists divide the yearly landings by the fishery "effort" to calculate the catch-per-unit effort (CPUE equals catch rate). For example, 30,000 pounds of rockfish caught by 6,000 days of fishing effort gives a catch-per-unit of effort of five pounds per day. In a longline fishery, the effort might be called hook-hours while in a recreational fishery it is called angler-days. The catch-per-unit effort is directly related to the amount of fish in the stock. A decline in CPUE usually indicates a decline in the stock. Management efforts are

usually aimed at the total catch by making it more difficult to take fish, however they may limit effort directly to give the remaining anglers more fish. Limiting effort results in fewer fishing days but increases catch per day.

## Optimum yield is determined by stock assessment

One of the simplest stock assessment methods requires almost no knowledge about the biology of the stock. However, good information about the fishery is required. In this assessment, the manager only needs to look at the history of landings for the stock and the effort expended to catch the stock. The key word here is effort. Landings data (the amount of fish caught and landed per year) alone are not very useful. Landings data are often used to suggest that there are problems in a fishery. Declines in landings or increases in landings are signals that something has changed in the fishery. In either case, the effort by anglers to catch the stock must be considered. The catch-per-unit effort is the appropriate way to evaluate changes in catch because CPUE is an indicator of stock abundance. Problems arise in measuring effort over time in a fishery that may have changed from sailboats pulling one net to diesel-powered vessels with sophisticated electronics pulling multiple nets. When both the catch and the catch-per-unit effort decline, it is an indication that the stock is probably overfished. This means too much effort is being applied for the stock to maintain itself. The obvious solution is to reduce the amount of fishing until the catch-per-unit effort returns to the earlier stages of the fishery. The problem is that by the time there is a clear decline in catch-per-unit effort, stocks may be well overfished, even to the point of collapse.

## Stock assessment is based on catch, effort and biology

Stock assessment is all of the activities that fishery biologists do to describe the conditions or status of a stock. The result of a stock assessment is a report on the health of a stock and recommendations that would maintain or restore the stock. Stock assessments often consist of two nearly separate activities. One is to learn as much as possible about the biology of the species in the stock. The other is to learn about the fishing activities for the stock. Even in the best stock assessments it is rare that everything that should be known about a stock is known. Both assessments proceed with the assumption that the best available information (data) will be used. Fishery managers are obligated to protect the stocks, and in the case of federal fishery management, are mandated by law to use the best available data. The best available data principle sometimes creates a conflict for anglers. In the past, when managers have asked for more and better data from anglers, the result has usually been more regulations. The data appear to have been “used against the anglers.” From the managers’ point of view the data were used to ensure that the fishery could continue. When anglers don’t provide good data, the fishery will be managed on the data available, which may be incomplete. This can result in overly restrictive management, which is wasteful or can result in continued overfishing and declining catches. In either case, anglers are the losers. It is in the long-term interest of anglers to provide the best data possible.

## Catch and effort are estimated from the fishery

When the data are collected by examining the landings of anglers, they are called fishery-dependent data. When a sample of the landings is examined, the total landings are “estimated” from the samples. Samples are used in many ways to estimate what is going on in a fishery. For example, fishing mortality can be estimated from a tagging study. After a lot of fish from a stock are tagged, the percentage of tagged fish that are caught and reported is

an estimate of the fishing mortality. Another procedure is to obtain fish from anglers, age them, and then compare the length, weight and age of the fish. You cannot tell the age of fish by looking at their size because they grow at different rates. Fish are normally aged by examining samples of bony parts such as otoliths (ear bones) that contain a record of growth like rings on a tree. Once it is established that each ring truly represents a year, then the age of a fish can be determined. We expect that the younger fish will be more numerous and there will be fewer fish at each subsequent age due to fishing and natural causes. Often, anglers are not catching young fish in proportion to their abundance. The young fish may not be in the same areas as the older fish, or they may not be caught by the fishing gear, or they may be thrown back. When fishery biologists see this, they say that the one-year-fish are "not fully recruited" to the fishery. The first year a fish is readily harvested in a fishery it is referred to as a recruit. Harvesting some fish before they spawn does not automatically doom the stock, but it is something that needs to be evaluated. Declining landings or declines in average size of fish are signs of possible problems. Determining the age of spawning and the age of the fish being caught are two steps toward management.

## Fishery biology is studied within the fishery

Any reliable information about the fishing process or the biology of the stock contributes to the stock assessment. Among the basic biological information that fishery biologists find most useful are the age structure of the stock and the relation between fish length and age. Once this is known, then important characteristics of the stock such as growth rate and death rate (mortality) can be determined. This information is used to create a picture of the stock which describes its current status. The age structure of a stock is a sort of historic picture. It reveals something about the current status of the stock as well as its past history. The picture by itself does not reveal how many fish can be caught, but provides information which leads to the answer. When anglers appear to be catching fish before they have a chance to spawn and there are other signs of trouble in the fishery, the usual management response is to protect small fish. Protection most often comes in the form of length limits or gear restrictions that favor the harvest of larger fish. Unfortunately, protecting small fish does not necessarily get at the larger problem of overfishing. Overfishing can still occur on the remaining fish in a stock even when the small fish are protected because small fish produce fewer eggs than large fish. Enough fish have to "survive to spawn" and replenish the stock at a sustainable level. One way of looking at the effect of fishing mortality is to compare the fished stock to what it would be without fishing. Fishery management plans attempt to define a rate of fishing mortality which, when added to the natural mortality, will lead to the rebuilding of a stock or the maintenance of a stock at some agreed upon level. If the remaining spawning population is below the level considered necessary to sustain the stock, then fishing mortality needs to be reduced.

## Growth, age and death of fish populations are studied

Knowing the age of first spawning and the age of fish being caught are important aspects of fishery assessment. Size limits, gear restrictions and catch restrictions can be put in place to protect fish so that they have a chance to spawn more than once. Fish die from either natural mortality or fishing mortality. Once fishing mortality and natural mortality are known, they can be used to examine the effects of fishing on the stock. Sometimes the number of fish caught from a "year class" (a group of fish born in the same year) is known for each year of fishing in the life span of a year class. Using the number caught each year from a year class and the mortality rate, the size of the year class (number born) can be reconstructed. If the

natural and fishing mortality rates are known, then the number of fish born to produce the catch of fish can be calculated. The reconstructed year class can then be tested with different rates of fishing mortality to see what the effects might be. The information can also be used in other calculations such as determining the “spawning stock biomass” which is the weight of all fish in a stock that are old enough to spawn. Results of these studies are considered when determining the number of spawning fish necessary to sustain the stock and the total allowable catch.

## Allowable harvest may be allocated among fishing groups

In a simple world we would just decide how many fish can be caught (total allowable catch) and divide it by the amount of fish that would provide an average angler with a reasonable catch. The results are the number of anglers that the fishery can sustain, the number of licenses that should be allowed and the size of a “reasonable catch”. However, most U.S. fisheries have been open-entry or open-access fisheries. Anyone who could afford a boat and the equipment could pursue a living or enjoyment by fishing. When the harvest of a stock is restricted by management, the different groups of anglers that use that stock often find themselves in conflict. The conflict occurs because each user group realizes it could harvest more fish if the other group did not exist or if the other group was restricted even further. These disagreements in allocation occur among different kinds of commercial anglers or between commercial and recreational anglers. The determination of total allowable catch and the allocation decisions have not always been separated. However, there is a movement to keep them as separate as possible. With this in mind, fishery biologists determine the total allowable catch based on the scientific information available. Then the fishery management councils make the allocation decisions in federal fishery management. Similar boards or commissions are often responsible at the state level.

## Fishing groups give advice to managers and officials

The technicalities of stock assessment and the regulatory process may seem overwhelming. Anglers are constantly involved in the process and provide valuable advice to managers and elected officials. The advisory anglers, council staff, state directors of marine fisheries , state representatives, and panel members are human beings just like you, not faceless bureaucrats. They will respect your questions and your interest in management if you treat them with common courtesy.  Mutual respect can lead to mutual understanding and cooperative management.

## Steps anglers can take to begin getting involved:

* Call the council that is responsible for your region.
* Read the fishery management plan that regulates your fishery.
* Ask to be put on the mailing list for notices of hearings and fishery plans.
* Find out who is on the advisory panel that might represent your interests.
* Contact your state’s representatives on the council. Express your concerns.
* Contact advisory panel members and find out what their views are.
* Attend public hearings, make comments and talk with your representative.

This “nutshell” was derived from a larger work; “FISHERIES MANAGEMENT FOR ANGLERS: A manual for anglers to understand the federal management process” by Richard K. Wallace, William Hosking and T Szedlmayer. Auburn University pursuant to NOAA Award No. NA37FDO079, Document - MASGP-94-012. *The full document is available by:*

**Writing** - Director of AUMERC, 4170 Commanders Drive, Mobile, AL 36615
**Email** - twhites@acesag.auburn.edu
**Telephone** - (334) 438-5690 **Fax** - (334) 438-5670
**Internet order** - http://www.uaf.edu/seagrant/Pubs_Videos/pubs/M-01.html
**Internet download** - http://www.psmfc.org/recfin/lib

***This brochure was produced by:***
Recreational Fisheries Information Network
Pacific States Marine Fisheries Commission
recfin@psmfc.org - http://www.recfin.org