Characteristics of Fisheries

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In 1975 nearly 54 million Americans over the age of nine fished. The amount of money spent on fishing (boats, motors, fishing tackle, camping gear, motels, food, entrance fees, and field clothing) was estimated to be in excess of $15 billion. Fishing opportunities are clearly a major attraction for tourists in many communities.

In commercial fisheries, demand for fish used as food for man and domestic animals is growing rapidly. This increase in demand for fisheries products has made the oceans, estuaries, and fresh waters important sources of animal protein.

Fisheries science is the profession concerned with effective management of aquatic *renewable* natural resources, the oceans, seas, estuaries, streams, rivers, ponds, lakes, and reservoirs.

A fishery is an aquatic, renewable natural resource system composed of three interacting components: aquatic habitat; aquatic biota; and human use of the aquatic biota. Aquatic habitat is the physical component of a fishery and includes such factors as lake, ocean, or stream water quality, soil characteristics, and bottom shape and contour. Aquatic biota, the second component, is represented by the animals and plants in a fishery. The biotic component ranges from microscopic plankton to bottom dwelling animals, higher plants, and, of course, all kinds of fish. The third component of a fishery, human use, deals with man's use of the biota, usually fish (although fishing for food or sport includes harvest of salmon, trout, crabs, catfish, frogs, shrimp, clams, oysters, bass, kelp, sponges, whales, and other forms of aquatic biota). Man's effects on aquatic biota may also be caused by industrial, agricultural, and domestic water use for waste chemical disposal, irrigation, or drinking.

The two fisheries components, aquatic habitat and aquatic biota, taken together are simply an *aquatic ecosystem*. Aquatic ecology—the study of the relationships between animals, plants, and their environment—is a very complex field. By adding a third component, human use, the discipline becomes even more complex—the status of all areas of renewable natural resources management.

Fisheries resources can be arbitrarily classified as to habitat: (1) estuaries at the mouths of streams and rivers; (2) coastal waters over continental shelves; (3) offshore waters above continental slopes and deep ocean basins; (4) flowing fresh water; and (5) standing fresh water.

An estuary is the aquatic environment where fresh water meets salt water (i.e., a stream or river emptying into the ocean). Estuaries have both marine

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and freshwater characteristics. Coastal waters are those relatively shallow, inshore areas over continental shelves. A continental shelf is the ocean floor formed by underwater extensions of the continents, starting from land and extending outward to depths less than 200 meters. Offshore waters are the deep areas above the continental slopes and deep ocean basins. Continental slopes (200 to 3,000 meters deep) are sea floors that extend beyond the continental shelves at an average descent of approximately four degrees to the deep ocean basins (3,000 to 6,000 meters deep). Continental slopes make up the largest part (over 70 percent) of the earth's water cover.

Flowing fresh waters are the streams and rivers that vary in size from the smallest mountain trickle to the mouth of the Mississippi River. Standing freshwater fisheries resources are the ponds, lakes, and reservoirs. The separation between ponds and lakes is arbitrary. Reservoirs are by definition man-made.

Most of the worldwide marine harvest (70 million metric tons) is from coastal and offshore waters. The catch consists mostly of finfish and is taken mainly for commercial purposes. Recreational fishing (particularly in the United States and Canada) plays a more important role in fresh water, coastal, and estuarine areas. Crustaceans and molluscs are important resources along coastal areas and estuaries. In addition, estuaries are important spawning and nursery areas for maintenance of many coastal and some offshore fish populations.

Fresh water recreational fishing is extremely popular in North America. In 1975, nearly 40 million anglers fished warm-water streams, ponds, lakes and reservoirs in the United States. Over 18 million anglers fished in cold-water resources. Over 6 million Americans fished for sea-run fish. Marine recreational fishing, in contrast, was pursued by over 15 million anglers.

Many problems confront a fisheries scientist attempting to effectively manage a fishery. Suppose, for example, that a manager, employed by a state fish and wildlife agency, is responsible for managing a large reservoir, a mountain lake, or a coastal area. He routinely faces a number of problems and constraints in carrying out his assignment:

1. *Inadequate information upon which to base management recommendations and decisions*

As is true in all areas of renewable natural resource management, there is rarely enough information available to comfortably make management recommendations and decisions. Often a fisheries scientist must recommend positions and policies with relatively little available ecological or sociological data. The scientist may face situations such as: What will be the impact of channeling a stream on the aquatic ecosystem? How will this channelization affect public recreational opportunities? How does society collectively feel about the trade-offs in such decisions?

2. *Conflicting desires within the general public*

Lakes, reservoirs, rivers, streams, ponds, estuaries, and oceans may be used by anglers, boaters, bird-watchers, water skiers, farmers (irrigation), industrial interests (electrical generation, manufacturing), cities and towns (drinking water), and many other segments of society. Many of these uses cause severe conflicts. For example, use of reservoir water for agricultural irrigation often precludes quality fishing opportunities because of excessive lake drawdown. No one likes to drag a boat over extensive mud flats, but fewer people yet want to pay more for food.

3. *Conflicting desires within the fishing public*

Fishermen themselves rarely agree as to what fishing should produce. Should a particular resource, for example, be managed for trophy trout or "fryers"; for hatchery or native trout; for "catch and release" or consumptive use? These are some of the real and routine conflicts that face any fisheries manager in assessing what the public wants from a fishing experience.

4. *Largely uncontrollable nature of aquatic environments*

Managers are often faced with the frustrating reality that they can only partially control or influence aquatic environments. The number and kinds of habitat changes possible in a reservoir, lake, river, or ocean environment are few. Certainly the gross degradation of aquatic ecosystems by pollution can often be eliminated, but excessive runoff resulting from widespread land-use practices (i.e., urban, agricultural, etc.) is much more difficult to control. Alteration of aquatic habitat for increased fish production is possible in most fisheries, but it is most applicable in streams and ponds.

5. *Natural variation in animal and plant populations*

All populations undergo a certain amount of natural fluctuation. Crappie, for example, may be very common in a lake during one year and rare the next. Many of these population variations are poorly understood and take place at unpredictable intervals.

6. *Dynamic aspects of biotic populations*

All animal and plant populations under natural conditions are in a state of change even though the populations may appear to be stable. The total weight of fish, or other animals or plants, may be roughly the same year after year; however, the rate of death, birth, predation, growth, or harvest may be drastically different.

SUMMARY

Fisheries are complex, interacting systems. Fisheries management is carried out in a world of uncertainty, conflicting desires of various segments of the public, and dynamic aquatic ecosystems. The importance of fisheries resources is immense, and management is an essential component in wisely using these resources.

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