The New Fishery Management

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A new concept in biology — the "ecosystem" approach helps to better manage Colorado's fishery resource

By **ROBERT T. LACKEY**

THE goal of fishery management is to maximize the catch of desired fish by fishermen on a sustained basis. At first glance this goal may seem simple enough, but closer examination illustrates its complexity. Before fishery biologists consider methods to realize this goal, they must first decide what is meant by "desired" fish. What do fishermen want in terms of fish and the fishing experience? What compromises can be made to satisfy the largest number of fishermen? These questions are important and must be answered before biologists can formulate an effective management program.

The Ecosystem

Let's assume that the above questions have been answered. The goal of management efforts in a particular fishery may be to produce large numbers of eight-inch fish, but in another fishery it may be to produce trophy-size catches. We can now proceed with a concept that is developing in many biological sciences: the ecosystem approach. An ecosystem includes all animals, plants and environmental factors in an area. This approach emphasizes *interrelationships* among animals, plants and the non-biological environment. In terms of lake ecosystems, this means fish are affected by other animals, plants (including plankton) and the lake environment. The angler is included as one predator in this highly *interdependent* system.

How does this concept relate to producing the best fishing? The number and size of fish in a lake are influenced by the whole ecosystem and not just by the actions of anglers. This is apparent when we look at fish as one level in a food chain. In the first link of this chain, planktonic algae utilize sunlight and nutrients as a food source. Animal plankton and small fish eat these planktonic algae and are, in turn, eaten by larger fish. The adult game fish population is usually the last step in this food cycle.

With these ideas in mind, we can visualize some reasons why maximum fish harvest is not attained. Limiting factors, ranging from an obscure trace nutrient necessary for algae growth to low dissolved oxygen for fish life, can arise at any stage in the food chain.

The author is currently conducting a fishery research project at Parvin Lake for the Division, to evaluate the effects of forced lake recirculation on an aquatic ecosystem.

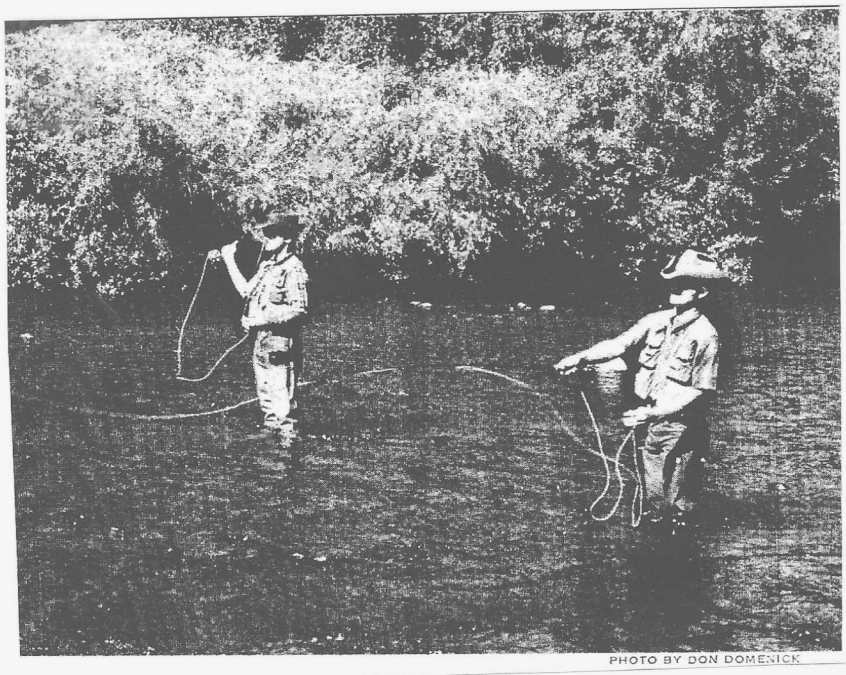


PHOTO BY DON DOMENICK

Management Tools

Tools used in fishery management fall into several general categories. By using these tools in a variety of ways, biologists can improve fish yield.

1. *Harvest Rates.* Creel limits, season length and time, and gear limitations are fairly easy ways to manage fisheries. Such regulations are usually designed to limit or control removal of fish at a rate equal to production by the ecosystem.

2. *Recruitment Rates.* Recruitment means addition of new fish to a fishery. Management in this area includes hatchery stocking, improvement of spawning areas, and other habitat improvement designed to increase survival of young fish.

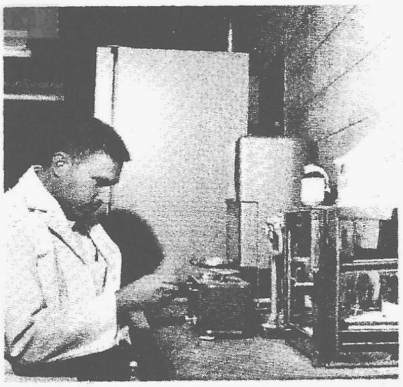
3. *Introductions.* Addition of new species to an aquatic ecosystem such as game fish, forage fish, bottom animals or other organisms constitutes an important area of management. Coho salmon introduction into the Great Lakes is a widely known success story. Introduction of invertebrate animals as fish food is potentially an important tool, but much less used.

4. *Reclamation.* This category includes eradication and re-establishment of fish populations when other efforts to improve fish yield have been unsuccessful.

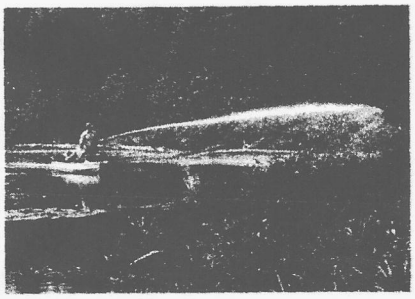
Ecosystem Management

Optimum fishery management using the above tools must be based on an understanding of the aquatic ecosystem. To obtain such an understanding,

Stocking of hatchery raised fish is an important management tool available to fishery biologists.



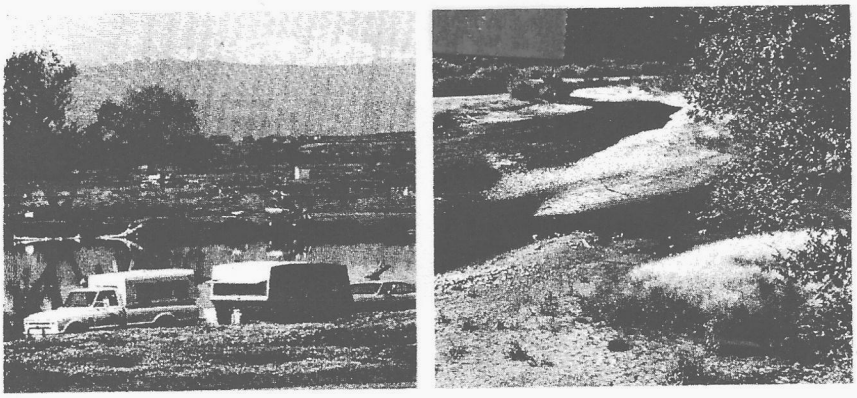
Not all research work is done outdoors. Laboratory research on aquatic ecosystems is necessary to learn the roles and interactions of various components.



Lake reclamation includes eradication and re-establishment of fish populations when other management efforts have failed.

it is necessary to conduct research with specific objectives in mind. The objectives are to learn what role individual components (nutrients, plankton, fish, etc.) play in the lake ecosystem. For example, how are water temperature and plankton growth related? To what extent do young game fish and forage fish compete for food?

When biological research yields sufficient information on interactions in an aquatic ecosystem, biologists can proceed with a relatively new concept for a management program: simulation and ecosystem modeling. The ecosystem being studied is simulated or modeled by describing interactions in mathematical terms. For example, growth of algae is determined by available nutrients and the amount of sunlight striking the lake. Such a relationship is written as an equation based on experimental results. It is not necessary to understand the mechanics of this technique, but only to realize its importance in studying ecosystems. To ease bookkeeping and calculation tasks, these equations can be solved by computer.



Fisheries vary from those in wild areas to those near population centers. Management programs must be developed for each. And some anglers desire trophy fish, while others want a hatchery maintained fishery — a diversity of views which is also an important consideration in fishery management.

Application to fishery management involves *exercising* the simulation repeatedly under a variety of fishing regulations and management tools. What would happen to the fishery if we increased plankton growth? If we introduced another fish species, would yield increase or decrease? What are the longterm effects of regulations such as size limits, creel limits, planting catchable fish, or planting fingerlings? The model can be projected over many years to check the long-term effects of management that are not recognizable in a short term study. By such methods biologists can develop a *feel* for the fishery and how it behaves.

A final consideration important to fishery management is insight into a fishery gained by applying the ecosystem approach. In constructing simulation models, biologists can see where data are lacking. For example, what role do nongame fish have in the ecosystem if they are little used as forage by game fish? Future research can be directed at questions like this. By hypothetically managing the fishery by simulation, we can make at least some of our mistakes in the laboratory.

About the Author:

Dr. Bob Lackey is professor of fisheries science at Oregon State University. In 2008, he retired after 27 years with the Environmental Protection Agency's national research laboratory in Corvallis where he served as Deputy Director among other senior science and management jobs. Since his very first fisheries job mucking out raceways in a California trout hatchery, he has worked on an assortment of natural resource issues from various positions in government and academia. His professional assignments involved diverse aspects of natural resource management, but mostly he has operated at the interface between science and policy. He has published over 100 articles in scientific journals. Dr. Lackey has long been an educator, having taught at five North American universities and continues to teach a graduate course in ecological policy. Canadian by birth, he is now a U.S.-Canadian dual-citizen living in Corvallis, Oregon.