

AFS Policy Statement #4:
Sedimentation
(Full Text)

A. Issue Definition

It is the policy of the American Fisheries Society to identify the detrimental effects of sedimentation on aquatic habitats, identify the sources of man-caused erosion, recommend corrective measures, and become directly involved in control programs.

Ever since man started tilling the soil, cutting trees for building material, building roads, and performing the many other activities of our modern civilization, he has increased the rate of soil erosion and grossly affected the physical and biological character of fresh and estuarine aquatic habitats. The increase in sediment transport from the land to the rivers and streams is not always obvious to the casual observer peaks of soil movement occur during storm events of wind and water. The fluvial process of sediment transport moves soil and rock particles at different rates for different sizes, gradient of streams, and volume of flow. When the sediment-carrying capacity of a stream is exceeded, deposition takes place in the lower-velocity reaches and aquatic habitat is frequently altered or destroyed for the indigenous species.

Dredging of navigation channels in estuaries has resulted in excessive sedimentation of estuarine bottoms, especially when dredged material is discharged into open water.

B. Impacts on Aquatic Environments

The rate of sedimentation may be so gradual that a generation of man passes before obvious physical changes take place in a stream, or it can be dramatic. The perception problem is aggravated by man's general inability to perceive phenomena whose periodicity is greater than one human lifetime. Too often by the time we see the effects on an economically important species, the damage has been done. If one researches historical records, examples of total change in the character of rivers can be found. An example is the Coquille River of Oregon where ocean-going vessels ascended twenty-five miles inland in the early 1900's, but today one can wade across at that point in midsummer. In contrast, the flushing of a reservoir, a cloudburst in an overgrazed watershed or logging areas with unstable soils may completely change the character of a stream in an hour or a month.

The Nibrobrara River in Nebraska is one of the many streams in the country that have experienced frequent and sizable fish kills (20,000/mile), and continuing destruction of fish habitat for catfish, sauger, and bass, due to the frequent flushing of sediment (4-6 times/year) from a publicly owned reservoir behind the Spencer Dame. The effect of excessive deposition of alluvial sediments in a stream is to cause the depth to decrease and the width to increase. Velocity decreases and the characteristic riffle-pool relationship is altered, decreasing the number and depth of pools. Temperature gradients of the pools, so beneficial to some species, are eliminated. A river or stream so altered by

sedimentation is more subject to flooding and the accompanying out-of-channel erosion. Further habitat modification results from public demands for channelization and spoil disposal, and the cycle is continued.

Deposition of silt and sand in gravel-bottom rivers and streams fills the interstices of the gravel, reduces the velocity of water flow through the gravel, and decreases the dissolved oxygen content if much organic matter is present. If sedimentation is severe, the gravel may be completely blanketed. In some cases, the stream bottom becomes compacted and assumes the character of concrete.

Another example occurred on the Connecticut River where erosion of weed beds on the river bank caused a dramatic decrease in the walleye population that almost eliminated this important sport fishery. The erosion was the direct result of a pumped storage project that caused rapid changes in river flow. The responsible power company recognized the problem and took corrective action.

Sedimentation in estuaries can cause changes in current flows and disrupt salinity regimes. Productive bottoms can be altered or destroyed, and water depths decreased.

C. Effects on Fish, Shellfish, and Related Organisms

The effects of excess sedimentation may be most damaging to the salmonid species because they deposit their eggs in gravel. The survival of the eggs of salmonids for periods of up to three months is highly dependent on high permeability of the gravel and adequate velocity of flow through the gravel to carry away metabolic waste products and furnish oxygen near saturation. Silting of the gravel after spawning results in reduced permeability, velocity, and dissolved oxygen. Mortality of incubating salmonid eggs and fry prior to emergence from the gravel is directly related to the amount of silt and sand filling the interstices. Research studies have shown that when the percentage of silt and sand less than three millimeters exceeds 20 percent of the total, the mortality of salmonid eggs and fry sharply increases.

Many warmwater and coolwater fishes-including minnows, darters, suckers, sculpins, rock bass, spotted bass, smallmouth bass, and walleyes-are known to spawn on gravel substrates and are also severely affected.

Sedimentation is no less damaging to aquatic insect larvae that can inhabit gravel-bottomed streams to at least one meter in depth in the substrate. This basic fish food source can be reduced or eliminated from stream sections by sediment. The natural production of some fish species is largely dependent on an adequate aquatic insect food supply. Reduced growth rate and size of smolts of anadromous salmonids greatly affects their survival in their migration to the ocean and as returning adults. The same effect is known to occur in the Great Lakes and the Finger Lakes of New York.

All fish species that inhabit gravel streams utilize the voids among the gravel as cover and protection from predators and adverse physical conditions. This is especially important to newly emerged fry.

When a stream becomes heavily sedimented, the fish species dependent on a gravel environment, being mobile, leave the area, and they are replaced by species more tolerant of silt. They are generally bottom feeders-including suckers, carp, and minnow species-that graze on detritus and prey on silt-tolerant families of midges and worms. These species replace the mayflies, stoneflies, and caddisflies, which are less tolerant of silt. An important fact is that while one life stage of an organism may be able to tolerate sedimentation, that organism may not necessarily be able to exist under such conditions for its entire life span.

High-suspended solids in an estuary or marine habitat can seriously hamper the setting of larval clams and oysters. The settleable material can also smother benthic invertebrates. Historical records report wholesale destruction of shellfish in estuaries of Oregon because of heavy siltation after forest fires. Those waters have never recovered their former productivity.

Settleable material also can smother submerged vegetation and destroy this essential habitat for the juveniles of fresh and marine species. Chronic suspended solids can reduce or eliminate photosynthetic plant growth. Bull kelp is reported to be damaged by high-suspended solids in the ocean from land sources.

D. Needed Actions

A number of actions are needed to halt and reverse the continuing destruction of natural fish and shellfish habitat from sedimentation. The nonpoint source nature of the problem from our land management practices must be recognized and contained at the local level. States doing water quality management planning under the US Clean Water Act Amendments of 1977 have the responsibility and authority for identifying nonpoint source problems and implementing the necessary control measures. State agencies in the United States are delegated the responsibility by the Governors to develop the planning and be a party to the implementation of all nonpoint sources controls for their states. State planning under the Clean Water Act is financially supported by and requires the approval of the US Environmental Protection Agency.

In general, however, the state, provincial, and Federal pollution control agencies are not sufficiently aware of the serious limiting nature of the sediment problem on aquatic habitat. There is, therefore, a general conclusion that if water quality standards are met, the 1983 goal of the US Clean Water Act for protection and propagation of fish, shellfish, and wildlife will also be met. Quite often this assumption is not true because typical water quality standards presently do not have appropriate criteria relating to the environmental substrate requirements for fish habitat. This is particularly true for sedimentation where turbidity (a measure of light transmission) is usually the only sediment-related criterion included in water quality standards. Fish habitat is continuing

to be lost through ignorance. Research and implementation of criteria or approaches for evaluating the condition of fishery habitat must be factored into water quality standards and nonpoint source pollution control programs. These criteria, appropriate to specific geographic areas, must at a minimum include measure of stream morphology, riparian vegetation, bottom composition, and minimum flow. Monitoring methodologies must also be researched and implemented into state and provincial programs.

To accomplish this radical departure from current pollution control strategy will require the support of state, provincial, and Federal fish and game agencies, and effort at all levels of the Society. The local Chapters of American Fisheries Society should become more directly involved with their state or province in identifying nonpoint source fishery problems particularly from sedimentation. They can be on policy advisory committees to help develop solutions to problems, lobby for passage of forest practice and sediment control laws, and alert the public to the need for their support for education of responsible groups and agencies and control of the land water management problems.

Some AFS Chapters are already involved at the local level in erosion control measures. Their effectiveness could be greatly enhanced by participation at the state and national policy-making levels. This policy must be aggressively pursued with state and provincial water pollution control agencies and the Environmental Protection Agency in the United States and the Departments of Fisheries and the Environment in Canada.

The American Fisheries Society through its lobbying ability and expertise of its membership can provide the technical guidelines and leadership in this effort.