Summary

AFS Policy Statement #5:
Cumulative Effects of Small Modifications to Habitat
(Abbreviated)

Accumulation of localized or small impacts from various, often unrelated, projects can result in serious regional and global impacts on fisheries resources. Cumulative effects have been defined as "environmental change resulting from the accumulation and interaction of the effects of one action with the effects of one or more other actions occurring on a common resource." These effects can be additive and interactive in a variety of ways. Complex spatial and temporal relationships also exist.

Cumulative change can occur in ecosystems such as watersheds. Effects within smaller watershed areas fall within many categories from sedimentation to dredging and organic debris distribution. Hydrologic effects and sedimentation from land disturbance are interrelated. Biological ramifications are dependant on watershed size, because there can be linear increases in fish species as stream order increases and there are numerous strong relationships among biological measures and stream size. Within watersheds, hydropower development can have cumulative effects. Ecological effects vary with flow fluctuations and channel morphology. Highly variable flows affect fish differently depending on the way a given species uses the habitat, and flow fluctuations reduce community complexity. These changes, however, are not always predictable, and mortality cannot be apportioned to sources of impact. Effects within watersheds can accumulate in large drainage basins.

Within watersheds a fish species may or may not respond to habitat factors as described by laboratory experiments. Such response of fish populations makes quantitative predictions for small habitat modification impacts difficult. Gains resulting from planned mitigation or improvement projects cannot always be quantified for similar reasons. Cumulative losses of even one element of fish habitat can extend over long time periods. Losses of habitat elements such as large woody debris can have effects for 80 to 160 years.

Fish react to their habitat in a variety of ways, and changes in habitat can induce changes in ecology, behavior, growth, reproduction, homeostasis, organ function, histology, cell integrity, and gene function. Extremely small amounts of toxicants in the habitat can have significant effects, which may be sublethal, but result in lost production. Cumulative effects occur in altered growth, reproduction, tissue, and behavior. Trophic levels can determine the nature of cumulative effects. The type of habitat can affect chemical accumulation and fish can internally alter elements provided by the habitat.

Cumulative effects of small habitat modifications cannot be simply and easily written into a precise linear equation, due to mathematical limitations. All individual effects on fish habitat result in cumulative effects on global fisheries.

The AFS policy regarding cumulative effects of small modifications to habitat is to:

1. Encourage full disclosure and assessment of potential cumulative impacts during project planning, including ecosystem modeling when necessary.

2. Encourage development of a common framework for assessment methodologies.

3. Encourage regulatory agencies to utilize full and complete disclosure using new methodologies.

4. Discourage actions such as wetland alteration, watershed modification, point and

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nonpoint source pollution, which cause predicted small losses to fish habitat, unless effective mitigating measures which fully compensate for projected losses are employed.

5. Encourage expanded research on habitat improvement and mitigation, focusing on offsetting potential habitat loss and ecosystem restoration.

6. Encourage development of more integrated approaches to research and professional communication.

7. Develop and incorporate measures to more fully educate professionals and the public about cumulative effects.

8. Encourage inclusion of the study of cumulative effects in university fisheries programs.

9. Encourage experimental research at the watershed level, the largest practical scope for controlled and replicated study.