

## Session Summary

### The Role of Watersheds in Reconciling Fisheries with Conservation

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Several keynote speakers at the Fourth World Fisheries Congress emphasized the importance of understanding ecosystem processes if we are to effectively reconcile fisheries with conservation. Nowhere is this more important than in watershed management. Watershed processes determine the properties of freshwater ecosystems and thereby regulate the productivity of local fisheries, as well as other fisheries whose target species spend part of their life cycles in freshwater ecosystems. Fish are but one of many natural resources that comprise the spectrum of ecological “goods and services” watersheds provide (drinking water, irrigation, hydroelectric power, water for industrial processes, and others) and, as such, are subject to inevitable tradeoffs and compromises that accompany different interests with competing water needs. In watersheds, reconciling fisheries with conservation means not only balancing exploitation with the need for conserving the long-term viability of fish populations, it also means balancing the aquatic ecosystem requirements of fish with other societal needs for water. Oral and poster presenters in the Watershed Session offered a wide range of ideas on how these balances might be achieved. Their ideas fell into several general categories.

#### Watershed Management Requires a Hierarchical Approach

Several presenters noted the inadequacy of managing strictly at the local level, which meant deciding harvest, conservation or restoration issues based on the perceived conditions at a particular location in a watershed without giving due consideration to the context of the surrounding landscape. A hierarchical approach involves setting objectives and strategies at the watershed scale and making local decisions based on actions that are compatible with these overarching goals. A thorough, watershed-wide assessment of environmental conditions affecting fishery resources is often the necessary first step, followed by an agreed upon plan that sets general goals for the watershed and permits increased specificity in decision making at the local level.

#### Reconciling Fisheries with Conservation in Watersheds must be Viewed as One of Many Competing Demands for Water

A number of the papers in the session addressed conflicts between fisheries and other land and water uses. Several, for example, dealt

with the impact of forestry operations on aquatic habitats and fish populations, and one paper described the conflict between protecting the habitat of an endangered shad population and the development of a water supply reservoir for more than a half million people. Such conflicts are never easy to resolve and scientific experts employed by competing interests usually advocate opposing positions. Within the last two decades or so, committees of independent scientists have been assembled to study watershed issues and provide objective descriptions of the likely outcomes of management alternatives based on the best current science; such committees do not make policy, but they do inform politicians about the risks and benefits of different actions. One innovative paper in the session noted that the effect of national water security programs on freshwater fisheries was poorly understood at both a local and global scale.

### Watershed Processes Determine Appropriate Management Strategies

The dynamic nature of ecological processes operating at the watershed scale was addressed by several presenters. Some of the biophysical processes affecting fisheries and conservation included climate change, disturbance-based patterns of erosion and runoff, and the introduction of non-native species. There was a clear consensus that management strategies will be more effective if they include provisions for accommodating watershed change, whether mediated by shifts in climate, periodic natural disturbances such as fires and floods, and the intentional or unintentional establishment of exotic species. Two papers emphasized the identification of biological hotspots, locations in the watershed likely to support high aquatic production (e.g., tributary junctions), as special places that require conservation. Long-term habitat benefits of

natural disturbance processes were recognized in several presentations. One paper even noted that management of disturbances caused by a wildlife species (beaver) could be used to enhance fish stocks in the Yukon River, Canada.

### Watershed Governance Systems Influence the Balance Between Exploitation and Conservation

In the past, watershed management has been the responsibility of governmental organizations with regulatory authority, but more recently management decisions have been shared with a variety of nongovernmental organizations. Some of the most successful have been "watershed councils," which are composed of groups of stakeholders charged with recommending habitat improvement projects, educating the public regarding watershed processes, and promoting collaboration between traditional adversaries. As one paper points out, watershed councils can also help support monitoring programs by engaging activists in the monitoring process and by providing timely feedback to stakeholders regarding the efficacy of restoration projects. However, other papers note that losses of aquatic habitats are continuing in most areas and many restoration projects are not living up to expectations. Local organizations often seem ill equipped to deal with restoration failure, while larger organizations (federal and state/provincial agencies) seem better equipped to document broad-scale habitat declines but often lack local support to effect remedies.

### New Decision Support Tools Assist Landscape-Scale Analyses

Advances in geospatial mapping technology, remote environmental sensing, spatial and temporal modeling, and the ability to share

data via the internet have all contributed to the development of tools to aid watershed decision makers in reconciling fisheries with conservation. The session included papers on spatially explicit modeling of land development on Pacific salmon, landscape models of stream channel dynamics in Ontario, Canada, and coastal Oregon, USA, water temperature models for evaluating the adequacy of riparian buffers along forested streams, and a Geographic Information System (GIS)-based model of stream shading and steelhead *Oncorhynchus mykiss* growth. All of these papers presented information that transcended the reach scale typical of freshwater habitat studies, thus giving policy makers a better opportunity to view the big picture.

How well did the papers address the central theme of reconciling fisheries with conservation in watersheds? Overall, most papers focused more on successes than failures. This is typical of many watershed presentations, where there is a reluctance to highlight projects that did not work. Only a few papers dealt with the fact that, in most areas, freshwater habitats are being lost more rap-

idly than they are being restored and the global capacity of freshwater ecosystems to increase capture fisheries has apparently reached its limit. Several papers recognized that collaboration among stakeholders and improved systems of watershed governance were the keys to the reconciliation process, but examples of real successes (i.e., fisheries that recovered as a result of better watershed management) were largely absent.

On the other hand, a number of authors presented exciting examples of new technologies that can be used to inform management decisions. These tools, if applied properly, will lead to an improved understanding of the tradeoffs between fishing, habitat conservation, and other natural resource management actions. The session contained a useful cross section of papers dealing with the complex issues involved in reconciling fisheries with conservation in watersheds. Readers will find examples of both technically and socially oriented attempts to achieve effective conservation that, hopefully, will stimulate new ideas and creative approaches to a very difficult problem.

