The pattern of technological attempts to offset human impacts is not limited to the Columbia River; it is widespread throughout the Northwest, from California to British Columbia and Alaska. A consistent theme of this technological optimism has been neglect of scientific rigor. Hatcheries and other means intended to benefit fish and wildlife were rarely monitored or evaluated. Management objectives or other ways of stating hypotheses about effectiveness were not formulated. Undocumented judgments of agency personnel, often made without supporting evidence, were accepted as expert opinion. Historical experience that would have prevented the re-enactment of errors was not taken into account. All that seemed unimportant at first: adult fish appeared to be abundant in the oceans and the river reaches below the dams. As salmon abundances have declined and American Indian treaty rights have gained legal standing, however, the inadequacy of the scientific record has become glaring and finally crippling. (NRC 1996, pp. 129-130)

Before we ask what should be included in a biological monitoring program for assessing the effectiveness of habitat restoration projects, it is important to understand why previous monitoring efforts have failed. There are several reasons that many programs are unable to provide timely information needed for adaptive learning. First, we have not fully considered the dynamic aspects of watershed processes and the natural resources with which we are concerned. We tend to view natural disturbances such as large wildfires or floods as "disasters" needing remediation, when in fact these events are often the key processes of habitat formation. Following a large flood in western Oregon and Washington in February 1996, for example, many streams and rivers contained abundant log jams from debris flows and dam-break floods. A number of proposals have been put forward to remove the log jams before they block upstream salmon migrations or breach and cause damage to property (or existing habitat enhancement projects) downstream. Assessment of the effects of the flood often focused primarily on potential damage to capital structures and putative migration barriers rather than on whether the flood had changed stream channels to more natural conditions. Despite repeated warnings from scientists in the region about the detrimental long-term consequences of large woody debris removal, it is likely that in some locations we will repeat the same errors made after the large floods of 1962 and 1964.

Another cause of monitoring failure has been our inability to deal with the innately high interannual variability of fish populations, especially anadromous salmonids. The abundance of different life history stages of anadromous salmonids typically varies by about 50 to 70 percent annually (Figure 1), although resident fishes may be somewhat less variable. This variability has enormous implications for monitoring programs. It suggests that decades of monitoring will be required to detect increases in fish populations in response to habitat improvement projects using conventional statistical techniques (Figure 2). Aside from statistical
Spatial and temporal scales of monitoring programs tend to be too small and too short. There are plenty of reasons, including inadequate monitoring funds, institutional and ownership barriers, and lack of database sharing and integration. What we call watershed monitoring is actually stream-reach monitoring in many cases. While stream-reach monitoring does yield useful information at micro- and mesohabitat scales, it is generally inadequate to evaluate habitat improvement programs at a watershed scale. For really effective adaptive learning, monitoring efforts should be large in area and long in duration to provide the spatial and temporal context needed for policy adjustments.

Better measures of response to habitat improvement projects are also needed, and they should be more ecologically based. It is becoming increasingly clear that single-species surveys conducted during the summer low-flow period are inadequate to produce data that are meaningful and timely to resource managers. In terms of biological monitoring, measures that integrate organism and community response over time and space (e.g., species diversity, aquatic guild organization, riparian communities, fish movements) are likely to yield more insight into the functioning condition of a rehabilitated stream than single-species population estimates. At present, it is not known whether these measures will be more stable over time or more responsive to habitat improvement projects, but they are better indices of ecological health than surveys that focus only on individual populations. Biologists should wean themselves from a preoccupation with commercially or recreationally valuable fishes as sole indicators of restoration effectiveness, as these species are usually influenced by other anthropogenic factors over which we have little control.

In terms of geomorphic and hydrologic monitoring, measures that emphasize process as well as current condition (e.g., sediment budgets, woody debris inputs and routing, floodplain connections, channel and hydraulic complexity) are likely to yield more comprehensive information about ecological recovery than are threshold-based parameters (e.g., percent fines, dissolved oxygen, temperature). Because process-based monitoring programs are intensive, time consuming, and costly, a regional network of cooper-
tive experimental watersheds should be established for long-
term evaluations of different habitat improvement tech-
niques, allowing different organizations to combine sci-
cient and financial resources. These experimental watersheds
should be located in different biogeoclimatic zones, be large
enough (fourth to sixth order) to encompass entire breeding
populations, and contain both treated and untreated con-
tral drainages.

The "staircase" study design of C.J. Walters and others
(Figure 3), in which enhancement projects can be sequen-
tially applied to watersheds in an experimental fashion, is
a promising approach that could allow investigators to
partition environmental trends (e.g., temporal trends caused
by climate change) and variability among streams—two
formidable barriers to monitoring success—from treatment
responses. Such a study design would be well suited to large
experimental watersheds in which separate tributaries can
be treated differently.

Peter A. Bisson
USDA Forest Service
Pacific Northwest Research Station

Recommended Readings

Naiman, R.J., T.J. Beechie, L.E. Benda, P.A. Bisson, L.H.
Macleod, M.D. O'Connor, C. Oliver, P. Olson, and
E.A. Steel. 1992. Fundamental elements of ecologically
healthy watersheds in the Pacific Northwest Coastal
Management: Balancing Sustainability and Envi-
ronmental Change. Springer-Verlag, New York, NY.

Naiman, R.J., J.J. Magnuson, D.M. McKnight, J.A. Stanford,
management: a national initiative. Science 270:584-
585.

ecosystems. National Academy Press, Washington, DC.
552 p.

National Research Council (NRC). 1996. Upstream: salmon
and society in the Pacific Northwest. National Academy

Reeves, G.H., L.E. Benda, K.M. Burnett, P.A. Bisson, and J.R.
Sedell. 1995. A disturbance-based ecosystem approach to
maintaining and restoring freshwater habitats of evo-
olutionarily significant units of anadromous salmonid in
the Pacific Northwest. American Fisheries Society Sym-
posium 17:334-349.


designs for estimating transient responses to habitat
alteration: is it practical to control for environmental
interactions? Pages 13-20 in C. D. Levings, L.B. Holtby,
and M.A. Anderson, eds. Proceedings of the National

Workshop on Effects of Habitat Alteration on Salmonid
Stocks. Canadian Special Publication of Fisheries and
Aquatic Sciences 105. Canada Dept. of Fisheries and
Oceans, Ottawa, Ontario, Canada.

LANDOWNER LIABILITY FOR STREAM
HABITAT IMPROVEMENT STRUCTURES

Introduction

Now that owners and operators of private timberland
are erecting wildlife habitat improvement projects, legal
issues of liability when structures fail are of concern. Al-
though the 1993 Oregon Legislature provided some immu-

nity for projects done in cooperation with the Oregon Depart-
ment of Fish and Wildlife, that immunity is limited. The
legislature did not provide immunity for personal injury or
death as a result of the failure of a structure, and they
provided only limited immunity for property damage result-
ing from a failure.

Without an absolute immunity to all types of liability,
every operator or landowner needs to be aware of the legal
claims and defenses that would be involved if a structure
should fail and cause damage, injury, or death downstream.
This article addresses the potential legal theories by an
injured party, as well as the defenses available to private
and public landowners where these projects are constructed.

Potential Claims

Trespass

A trespass to land occurs when one person interferes
with another's possession of the land. A trespass claim has
three elements: entry by the Defendant, a right by the
Plaintiff to possession of the land, and negligence or intent
by the Defendant.

Entry: This element does not require a person to actually
interfere with the possession of another's land. Entry may be
satisfied where a person causes an object to enter another's
land (Martin v. Reynolds Metals Co., 221 Or 86, 342 P2d 790
(1959), cert. denied, 362 US 918 (1960)). Oregon courts have
found the entry element satisfied where fire spreads from the
land of one party to another (Marten v. Union Pacific Rail-
road, 256 Or 563, 474 P 739 (1970)).

Plaintiff's right to possession: In order to sue for trespass
to land, the plaintiff need not be the owner of the land. One
who simply has the right to possess may maintain such a
claim. For example, a tenant may bring such a claim. Also,
on timberland, the person who holds the rights to the stand-
ing timber may bring a claim if the timber is damaged (see
for example, Boyer v. Anuitch, 90 Or 163, 175 P 853 (1918)).

Intent: An intentional, unauthorized invasion of another's
property is always subject to a claim. However, even an
unintentional intrusion that arises out of negligence or an
From the Director

Last year the COPE Program cosponsored the 10th International Stream Habitat Improvement Workshop, Salmonid Habitat: Operational Solutions to Problems in Forested Streams. Other sponsors included the Department of Forest Engineering at Oregon State University, the Portland Chapter and Fisheries Management and Bioengineering sections of the American Fisheries Society, and the Oregon Forest Resources Institute. Held in Corvallis and attended by 250 resource managers, the workshop spanned four days and included a two-day field trip to the Oregon Coast Range and the Cascade Range. The topics covered an incredibly wide range of subjects related to the improvement of instream habitat, including riparian silviculture. From the many papers and case studies that were presented, 10 have been selected for publication in this combined issue of the COPE Report.

Reading this issue of the COPE Report reminded me of several impressions the workshop made on me last summer. The first is the tremendous commitment many people have made to developing new information and testing innovative ideas to improve salmonid habitat quality in forested streams. Second, I was struck by the diversity of disciplines the workshop participants represented. It illustrated the point that problems we face with declining salmonid populations are complex and demand an interdisciplinary approach. Finally, I was encouraged by the progress that has been made in understanding salmonid habitat requirements and how managers can modify instream and streamside environments to meet those needs. Sure, some things have not worked out as well as hoped, but there are always some failures on the road to eventual success.

I am sure you will find this issue of the COPE Report insightful and encouraging.

Steve Hobbs

2 ADAPTIVE COPE

10TH International Stream Habitat Improvement Workshop:
Salmonid Habitat: Operational Solutions to Problems in Forested Streams
2 Workshop Perspective

3 Stream Habitat Improvement for Salmon: The Rest of the Story

9 Aquatic-Terrestrial Interactions in Pacific Northwest Watersheds

13 Stream Habitat Improvement: A Decision-Making Process

14 Monitoring Success of Stream Habitat Improvement: Physical Habitat

17 Monitoring Biological Success of Stream Habitat Improvement Projects

19 Landowner Liability for Stream Habitat Improvement Structures

21 Stability of Stream Habitat Improvement Structures

24 Riparian Area Silviculture in Western Oregon: Research Results and Perspectives, 1996

27 Integrating Stream Habitat Improvement with Harvesting

Steve Hobbs

IN THIS ISSUE