

# Program Introduction and Overview

## North Coast Watershed Assessment Program (NCWAP)

### Assessment Needs for Salmon Recovery & Watershed Protection

The North Coast Watershed Assessment Program (NCWAP), an interagency effort between the California Resources Agency and the California Environmental Protection Agency, was established in 2000 to provide a consistent scientific foundation for collaborative watershed restoration efforts and to better meet the State needs for protecting and restoring salmon species and their habitats under State and Federal laws. The program was developed by a team of managers and technical staff from the following departments with watershed responsibilities for the North Coast:

- California Resources Agency
- California Department of Fish and Game (CDFG)
- California Department of Forestry and Fire Protection (CDF)
- California Department of Conservation/California Geological Survey (DOC/CGS)
- California Department of Water Resources (DWR)
- North Coast Regional Water Quality Control Board (NCRWQCB) of the State Water Resources Control Board.
- The Institute for Fisheries Resources (IFR) is also a partner and participant in this program.

The California Resources Agency in coordination with CalEPA, initiated NCWAP in part in response to specific requests from landowners and watershed groups that the State take a leadership role in conducting scientifically credible, interdisciplinary assessments that could be used for multiple purposes. The need for comprehensive watershed information grew in importance with listings of salmonids as threatened species, the Total Maximum Daily Load (TMDL) consent decree, and the increased availability of assistance grants for protecting and restoring watersheds.

Listings under the federal Endangered Species Act for areas within the NCWAP region (the North Coast Hydrologic Unit) began with coho salmon in 1997, followed by Chinook salmon in 1999, and steelhead in 2000. In 2001, coho was proposed for listing under the California Endangered Species Act. Concerns about the potential impacts of salmonid listings and TMDLs on the economy are particularly strong on the North Coast where natural resource-dependent industries predominate. Cumulative impacts related to human activities including landslides, flooding, timber harvest, mining, ranching, agricultural uses, and development; along with natural processes can adversely affect watershed conditions and fish habitat. In order to recover California's salmonid fisheries, it is necessary to first assess and understand the linkages among management activities, dominant ecological processes and functions, and factors limiting populations and their habitat.

The NCWAP integrates and augments existing watershed assessment programs to conform to proven methodologies and manuals available from each participating department. The program also responds to recommendations from a Scientific Review Panel (SRP) which was created under the auspices of the State's Watershed Protection and Restoration Council as required by the March, 1998 Memorandum of Understanding (MOU) between the National Marine Fisheries Service (NMFS) and the California Resources Agency. The MOU required a comprehensive review of the California Forest Practice Rules (FPRs) with regard to their adequacy for the protection of salmonid species. In addition, the promise of significant new state and federal salmon restoration funds highlighted the need for watershed assessments to ensure that those dollars are well spent.

### NCWAP Program Goals

The NCWAP was developed to improve decision-making by landowners, watershed groups, agencies, and other stakeholders with respect to restoration projects and management practices to protect and improve

salmonid habitat. It was therefore essential that the program took steps to ensure its assessment methods and products would be understandable, relevant, and scientifically credible. As a result, the interagency team developed the following goals:

- Organize and provide existing information and develop limited baseline data to help evaluate the effectiveness of various resource protection programs over time;
- Provide assessment information to help focus watershed improvement programs, and assist landowners, local watershed groups, and individuals to develop successful projects. This will help guide programs, like the CDFG Fishery Restoration Grants Program, toward those watersheds and project types that can efficiently and effectively improve freshwater habitat and support recovery of salmonid populations;
- Provide assessment information to help focus cooperative interagency, nonprofit and private sector approaches to protect the best watersheds and streams through watershed stewardship, conservation easements, and other incentive programs; and
- Provide assessment information to help landowners and agencies better implement laws that require specific assessments such as the State Forest Practice Act, Clean Water Act, and State Lake and Streambed Alteration Agreements.

## **Program Objectives and Guiding Questions**

During the assessment process, the NCWAP agencies will work together very closely at all stages to consider how man-caused and naturally occurring watershed processes interact and affect stream conditions for fisheries, and other uses, and also consider the implications for watershed management.

During the formulation of the NCWAP's Methods Manual, the participating agencies agreed upon a short list of guiding questions with the key questions being:

- What watershed factors are limiting salmonid populations?
  - What are the general relationships between natural events and land use histories, for example, fire, flood, drought, earthquake, etc.; and urban and rural land development, timber harvest, agriculture, roads, dams, and stream diversions. How is this history reflected in the current vegetation and level of disturbance in North Coast watersheds? How can these kinds of disturbances be meaningfully quantified?
  - What is the spatial and temporal distribution of sediment delivery to streams from landsliding, bank, sheet and rill erosion, and other erosion mechanisms, and what are the relative quantities for each source?
  - What are the current salmonid habitat conditions in the watershed, the aquatic/riparian zone, and the estuary (flow, water temperature/shade, sediment, nutrients, instream habitat, large woody debris, and its recruitment); how do these compare to desired conditions (life history requirements of salmon, Basin Plan water quality objectives)?
  - What are the effects of stream, spring, and groundwater uses on water quality and quantity?
  - What role does large woody debris (LWD) have within the watershed in forming fish habitat and determining channel condition and sediment routing and storage?
  - What are the history and trends of the sizes, distribution, and relative health and diversity of salmonid populations and/or other aquatic community organisms within the watersheds?
  - Does the status of these populations reflect current watershed and stream habitat conditions or does it indicate constraints beyond which the watershed might exist. For example, a lack of stream connectivity that prevents free movement for adults or juveniles, or a poor marine life history, could affect a salmonid population.

These questions have guided the individual team members in data gathering and procedure assessment. The questions have provided direction for those analyses that required more interagency, interdisciplinary synthesis, including the analysis of factors affecting anadromous salmonid production.

## Program Assessment Region and Agency Roles

The NCWAP assessment area includes all coastal drainages from Sonoma County north to Oregon. This area corresponds with the North Coast Water Quality Control Board's region. The region has been subdivided into thirty-one basins for NCWAP assessment purposes (Figure 3). Thus, the program will organize existing information and provide limited baseline environmental and biological information for approximately 6.5 million acres of private and public lands over an estimated seven-year period. The administrative lead for the NCWAP is the California Resources Agency.

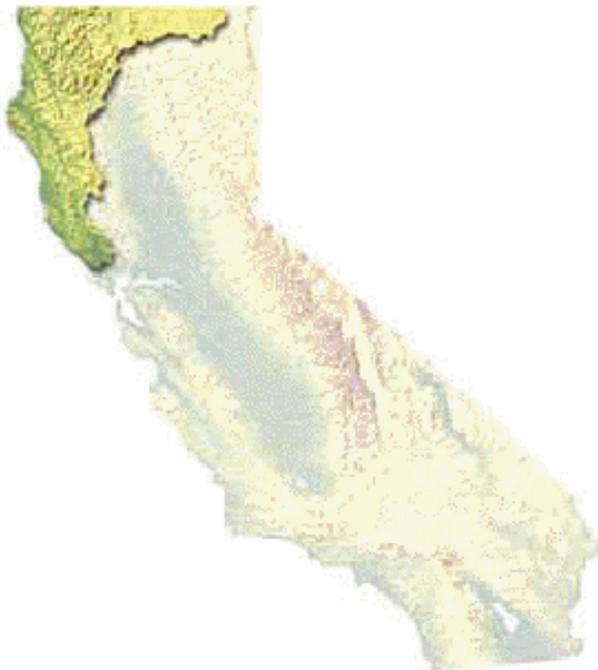


Figure 3. NCWAP Basin Assessment Area.

The roles of the five participating agencies in these efforts are as follows:

- CDFG will compile, develop, and analyze data related to anadromous fisheries habitat and populations. It will also lead an interagency evaluation of factors affecting anadromous fisheries production at the watershed level and provide recommendations for restoration and monitoring in the final synthesis report.
- CDF will compile, develop, and analyze data related to historical land use changes in the watersheds. It will also lead on preparing reports that synthesize information, findings, and recommendations, and develop a framework for assessing cumulative impacts.
- DOC/CGS will compile, develop, and analyze data related to the production and transport of sediment. Tasks will include baseline mapping of landslides, landslide potential, and instream sediment, as well as an analysis of stream geomorphology and sediment transport.
- NCRWQCB will compile, collect, and analyze water quality data for the assessments.
- DWR will install and maintain stream monitoring gages where needed to develop and analyze stream flow information.

## Salmon, Stream, and Watershed Issues

Pacific coast anadromous salmonids are dependent upon a high quality freshwater environment at the beginning and end of their life cycles. As such, they thrive or perish during their freshwater phases depending upon the availability of cool, clean water, free access to migrate up and down their natal streams, clean gravel suitable for successful spawning, adequate food supply, and protective cover to escape predators and ambush prey. These life requirements must be provided by diverse and complex instream habitats as the fish move through their life cycles. If any life requirements are missing or in poor

condition at the time a fish or stock requires it, fish survival can be impacted. These life requirement conditions can be identified and evaluated on a spatial and temporal basis at the stream reach and watershed levels. They comprise the factors that support or limit salmonid stock production.

“Protection and maintenance of high-quality fish habitats should be among the goals of all resource managers. Preservation of good existing habitats should have high priority, but many streams have been damaged and must be repaired. Catastrophic natural processes that occlude spawning gravels can reduce stream productivity or block access by fish (for example), but many stream problems, especially in western North America, have been caused by poor resource management practices of the past. Enough now is known about the habitat requirements of salmonids and about good management practices that further habitat degradation can be prevented, and habitat rehabilitation and enhancement programs can go forward successfully” (Meehan, 1991).

“In streams where fish live and reproduce, all the important factors are in a suitable (but usually not optimum) range throughout the life of the fish. The mix of environmental factors in any stream sets the carrying capacity of that stream for fish, and the capacity can be changed if one or more of the factors are altered. The importance of specific factors in setting carrying capacity may change with life the stage of the fish and season of the year” (Bjorn and Reiser 1991).

Through the course of the year’s natural climatic events, hydrologic responses, and erosion processes interact to shape freshwater salmonid habitats. These processes influence the kind and extent of the watershed’s vegetative cover as well, and act to supply nutrients to the stream system.

“In the absence of major disturbance, these processes produce small, but virtually continuous changes in variability and diversity against which the manager must judge the modifications produced by nature and human activity. Major disruption of these interactions can drastically alter habitat conditions” (Swanston 1991).

Major watershed disruptions can be caused by catastrophic events, such as the 1964 flood. They can also be created over time by multiple small natural or human disturbances. These disruptions can drastically alter instream habitat conditions and the aquatic communities that depend upon them. Thus, it is important to understand the critical, interdependent relationships of salmon and steelhead with their natal streams during their freshwater life phases, and their streams’ dependency upon the watersheds within which they are nested, and the energy of the watershed processes that binds them together.

In general, natural disturbance regimes like landslides and wildfires do not impact larger watersheds like the 300 square mile Mattole in their entirety at any given time. Rather, they normally rotate episodically across the entire basin as a mosaic composed of the smaller subbasin, watershed, or sub-watershed units over long periods of time. This creates a dynamic variety of habitat conditions and quality over the larger watershed (Reice 1994).

The rotating nature of these relatively large, isolated events at the regional or basin scale assures that at least some streams in the area will be in suitable condition for salmonid stocks. A dramatic, large-scale example occurred in May, 1980 in the Toutle River, Washington, which was inundated in slurry when Mt. St. Helens erupted. The river rapidly became unsuitable for fish. In response, returning salmon runs avoided the river that year and used other nearby suitable streams on an opportunistic basis, but returned to the Toutle two years later as conditions improved. This return occurred much sooner than had been initially expected (Quinn et al. 1991, Leider 1989).

Human disturbance sites, although individually small in comparison to natural disturbance events, are usually spatially distributed widely across basin level watersheds (Reeves et al. 1995). For example, a rural road or building site is an extremely small land disturbance compared to a forty-acre landslide or wildfire covering several square miles. However, when all the roads in a basin the size of the Mattole are looked at collectively, their disturbance effects are much more widely distributed than a single large, isolated landslide that has a high, but relatively localized impact to a single sub-watershed.

Human disturbance regimes collectively extend across basin and even regional scales and have lingering effects. Examples include water diversions, conversion of near stream areas to urban usage, removal of large mature vegetation, widespread soil disturbance leading to increased erosion rates, construction of levees or armored banks that can disconnect the stream from its floodplain, and the installation of dams and

reservoirs that disrupt normal flow regimes and prevent free movement of salmonids and other fish. These disruptions often develop in concert and in an extremely short period of time on the natural, geologic scale.

Human disturbances are often concentrated in time because of newly developed technology or market forces such as the California Gold Rush or the post-WWII logging boom in Northern California. The intense human land use of the last century, combined with the transport energy of two mid-century record floods on the North Coast, created stream habitat impacts at the basin and regional scales. The result of these recent combined disruptions has overlain the pre-European disturbance regime process and conditions.

Consequently, stream habitat quality and quantity are generally depressed across most of the North Coast region. It is within this generally impacted environment that both human and natural disturbances continue to occur, but with vastly fewer habitat refugia lifeboats than were historically available to salmon and steelhead. Thus, a general reduction in salmonid stocks can at least partially be attributed to this impacted freshwater environment.

Although no long-term fish counts exist for the Mattole River, Department of Fish and Game fish ladder counts at Benbow Dam and Cape Horn Dam, in the neighboring Eel River system, reflect an over 80% decline in coho salmon, Chinook salmon, and steelhead trout populations over the span of the last century (Figure 4, Figure 5). The Eel River, especially the nearby South Fork Eel River, which is the location of Benbow Dam, has similar watershed conditions and land use history to the Mattole River. Anecdotal evidence from anglers and longtime local residents supports the likelihood of a similar decline in Mattole fisheries (see Mattole Basin Profile). Since 1980, collaborative work between the Department of Fish and Game and the Mattole Salmon Group to collect field data and observations shows there is a record of very low coho and Chinook salmon populations, and depressed steelhead trout populations.

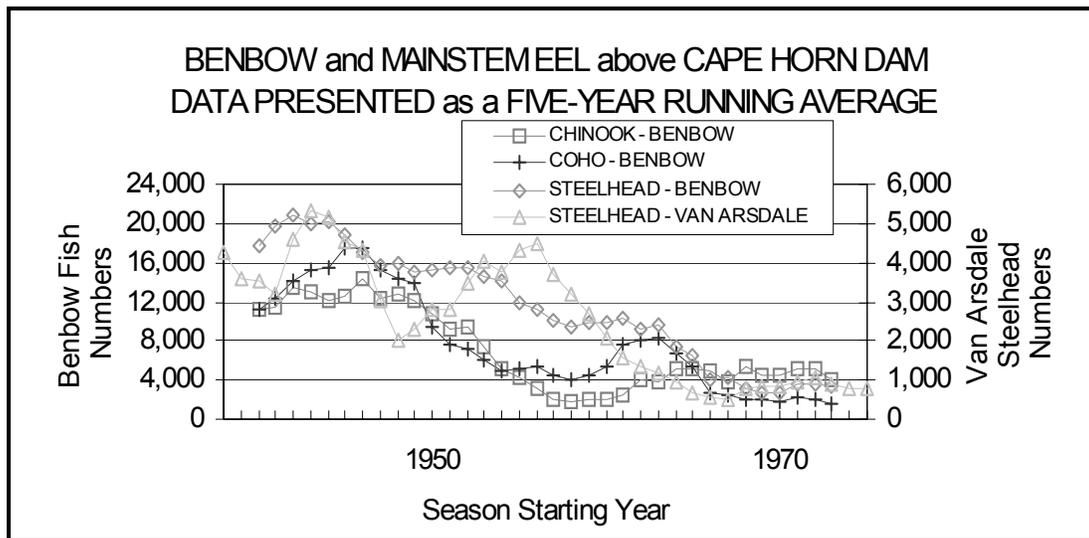


Figure 4. Five-year running average of salmonids at Benbow Dam, South Fork Eel River, and Mainstem Eel River above Cape Horn Dam

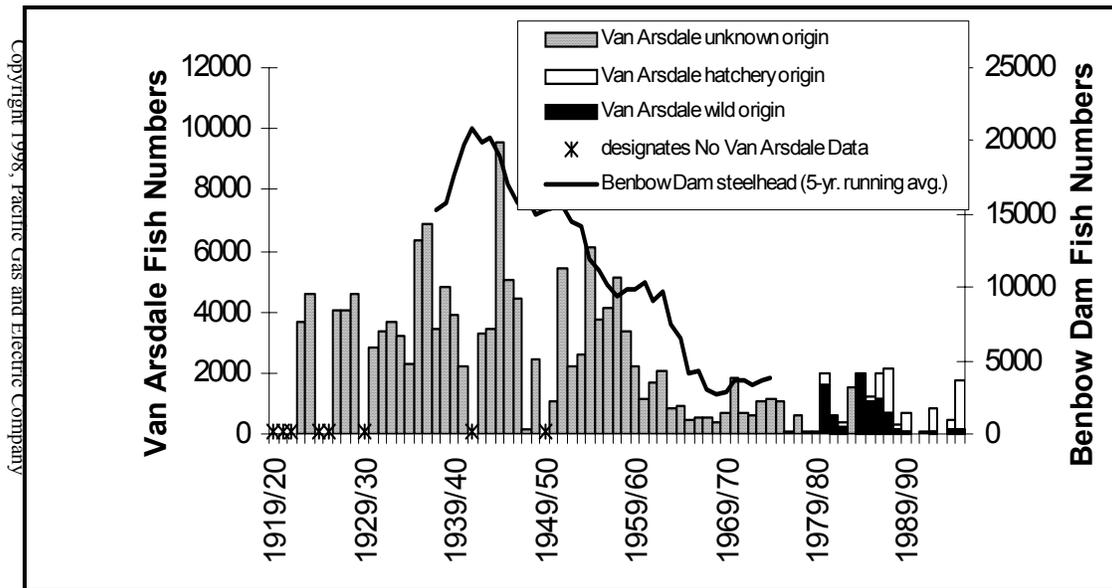


Figure 5. Historical steelhead trout ladder counts at Van Arsdale Fisheries Station, mainstem Eel River, and Benbow Dam, South Fork Eel River.

## Factors Affecting Anadromous Salmonid Production

Chinook salmon, coho salmon, and steelhead trout all utilize headwater streams, larger rivers, estuaries, and the ocean for parts of their life history cycles. There are several factors necessary for the successful completion of an anadromous salmonid life history.

A main component of the NCWAP is the analyses of the freshwater factors in order to identify whether any of these factors are at a level that limits production of anadromous salmonids in North Coast watersheds. This limiting factors analysis (LFA) provides a means to evaluate the status of a suite of key environmental factors that affect anadromous salmonid life history.<sup>1</sup> These analyses are based on comparing measures of habitat components such as water temperature and pool complexity to a range of reference conditions determined from empirical studies and/or peer reviewed literature. If a component's condition does not fit within the range of reference values, it may be viewed as a limiting factor. This information will be useful to identify underlying causes of stream habitat deficiencies and help reveal if there is a linkage to watershed processes and land use activities.

In the freshwater phase in salmonid life history, stream connectivity, stream condition, and riparian function are essential for survival. Stream connectivity describes the absence of barriers to the free instream movement of adult and juvenile salmonids. Free movement in well-connected streams allows salmonids to find food, escape from high water temperatures, escape from predation, and migrate to and from their stream of origin as juveniles and adults. Dry or intermittent channels can impede free passage for salmonids; temporary or permanent dams, poorly constructed road crossings, landslides, debris jams, or other natural and/or man-caused channel disturbances can also disrupt stream connectivity.

Stream condition includes several factors; adequate stream flow, suitable water quality, suitable steam temperature, and complex habitat. For successful salmonid production, stream flows should follow the natural hydrologic regime of the watershed. A natural regime minimizes the frequency and magnitude of storm flows and promotes better flows during dry periods of the water year. Salmonids evolved with the natural hydrograph of coastal watersheds, and changes to the timing, magnitude, and duration of low flows and storm flows can disrupt the ability of fish to follow life history cues. Adequate instream flow during low flow periods is essential for good summer time stream connectivity, and is necessary to provide juvenile salmonids free forage range, cover from predation, and utilization of localized temperature refugia from seeps, springs, and cool tributaries.

<sup>1</sup> The concept that fish production is limited by a single factor or by interactions between discrete factors is fundamental to stream habitat management (Meehan 1991). A limiting factor can be anything that constrains, impedes, or limits the growth and survival of a population.

Three important aspects of water quality for anadromous salmonids are water temperature, turbidity, and sediment load. In general, suitable water temperatures for salmonids are between 48-56° F for successful spawning and incubation, and between 50-52°F and 60-64° F, depending on species, for growth and rearing. Additionally, cool water holds more oxygen, and salmonids require high levels of dissolved oxygen in all stages of their life cycle.

A second important aspect of water quality is turbidity, which is the relative clarity of water. Suspended sediments (turbidity) affect nutrient levels in streams that in turn affect primary productivity of aquatic vegetation and insect life. This eventually reverberates through the food chain and affects salmonid food availability. Additionally, high levels of turbidity interfere with a juvenile salmonids' ability to feed and can lead to reduced growth rates and survival (Trush, personal communication).

A third important aspect of water quality is stream sediment load. Salmonids cannot successfully reproduce when forced to spawn in streambeds with excessive silt, clays, and other fine sediment. Eggs and embryos suffocate under excessive fine sediment conditions because oxygenated water is prevented from passing through the egg nest, or redd. Additionally, high sediment loads can cap the redd and prevent emergent fry from escaping the gravel into the stream at the end of incubation. High sediment loads can also cause abrasions on fish gills, which may increase susceptibility to infection. At extreme levels, sediment can clog the gills causing death. Additionally, materials toxic to salmonids can cling to sediment and be transported through downstream areas.

Habitat diversity for salmonids is created by a combination of deep pools, riffles, and flatwater habitat types. Pools, and to some degree flatwater habitats, provide escape cover from high velocity flows, hiding areas from predators, and ambush sites for taking prey. Pools are also important juvenile rearing areas, particularly for young coho salmon. They are also necessary for adult resting areas. A high level of fine sediment fills pools and flatwater habitats. This reduces depths and can bury complex niches created by large substrate and woody debris. Riffles provide clean spawning gravels and oxygenate water as it tumbles across them. Steelhead fry use riffles during rearing. Flatwater areas often provide spatially divided pocket water units that separate individual juveniles which helps promote reduced competition and successful foraging (Flosi et al. 1998).

A functional riparian zone helps to control the amount of sunlight reaching the stream, provides vegetative litter, and contributes invertebrates to the local salmonid diet. These contribute to the production of food for the aquatic community, including salmonids. Tree roots and other vegetative cover provide stream bank cohesion and buffer impacts from adjacent uplands. Near-stream vegetation eventually provides large woody debris and complexity to the stream (Flosi et al. 1998).

Riparian zone functions are important to anadromous salmonids for numerous reasons. Riparian vegetation helps keep stream temperatures in the range that is suitable for salmonids by maintaining cool stream temperatures in the summer and insulating streams from heat loss in the winter. Larval and adult macroinvertebrates are important to the salmonid diet and they are in turn dependent upon nutrient contributions from the riparian zone. Additionally, stream bank cohesion and maintenance of undercut banks provided by riparian zones in good condition maintains diverse salmonid habitat, and helps reduce bank failure and fine sediment yield to the stream. Lastly, the large woody debris provided by riparian zones shapes channel morphology, helps retain organic matter and provides essential cover for salmonids (Murphy and Meehan 1991).

Therefore, excessive natural or man-caused disturbances to the riparian zone, as well as directly to the stream and/or the watershed itself can have serious impacts to the aquatic community, including anadromous salmonids. Generally, this seems to be the case in streams and watersheds in the North Coast of California. This is borne out by the recent decision to include many North Coast Chinook and coho salmon, and steelhead trout stocks on the Endangered Species Act list.

## **Disturbance and Recovery of Stream and Watershed Conditions**

### ***Natural and Human Disturbances***

The forces shaping streams and watersheds are numerous and complex. Streams and watersheds change through dynamic processes of disturbance and recovery (Madej 1999). In general, disturbance events alter streams away from their equilibrium or average conditions, while recovery occurs as stream conditions

return towards equilibrium after disturbance events. Given NCWAP's focus on anadromous salmonids, an important goal is to determine the degree to which current stream and watershed conditions in the region are providing salmonid habitat capable of supporting sustainable populations of anadromous salmonids. To do this, we must consider the habitat requirements for all life stages of salmonids. We must look at the disturbance history and recovery of stream systems, including riparian and upslope areas, which affect the streams through multiple biophysical processes.

Disturbance and recovery processes can be influenced by both natural and human events. A disturbance event such as sediment from a natural landslide can fill instream pools providing salmon habitat just as readily as sediment from a road failure. On the recovery side, natural processes (such as small stream-side landslides) that replace instream large woody debris washed out by a flood flow help to restore salmonid habitat, as does large woody debris placed in a stream by a landowner as a part of a restoration project.

Natural disturbance and recovery processes, at scales from small to very large, have been at work on north coast watersheds since their formation millions of years ago. Recent major natural disturbance events have included large flood events such as occurred in 1955 and 1964 (Lisle 1981a) and ground shaking and related tectonic uplift associated with the 1992 Cape Mendocino earthquake (Carver et al., 1994). Major human disturbances (e.g., post-European development, dam construction, agricultural and residential conversions, and the methods of timber harvesting practices used particularly before the implementation of the 1973 Z'Berg-Nejedly Forest Practice Act) have occurred over the past 150 years (Ice 2000). Salmonid habitat also was degraded during parts of the last century by well-intentioned but misguided restoration actions such as removing large woody debris from streams (Ice 1990). More recently, some efforts at watershed restoration have been made, generally at the local level. For example, in California and the Pacific Northwest, minor dams from some streams have been removed to clear barriers to spawning and juvenile anadromous fish. For a thorough treatment of stream and watershed recovery processes, see the publication by the Federal Interagency Stream Restoration Working Group (FISRWG 1998).

### ***Defining Recovered***

While it is generally agreed that improvements in a condition or set of conditions constitute recovery. In that context, recovery is a process. One can determine a simple rate of recovery by degree of improvement over some time period, and from only two points in time. And one can discuss recovery and rates of recovery in a general sense. However, a simple rate of recovery is not very useful until put into the context of its position on a scale to the endpoint of recovered.

Recovered not only implies, but necessitates, knowledge of an endpoint. In the case of a recovered watershed, the endpoint is a set of conditions deemed appropriate for a watershed with its processes in balance and able to withstand perturbations without large fluctuations in those processes and conditions. Recovered fish habitat could be habitat in an optimum state or in state that allows for a suitable and stable population or something in between. The endpoint of recovered for one condition or function may be on a different time and geographic scale than for another condition or function.

### ***Factors and Rates of Recovery***

Over the past quarter-century, several changes have allowed the streams and aquatic ecosystems to move generally towards recovery. The rate of timber harvest on California's north coast has slowed during this period, with declining submissions of timber harvesting plans (THPs) and smaller average THPs (T. Spittler, pers. comm.). In addition, timber harvesting practices have greatly improved over those of the post-war era, due to increased knowledge of forest ecosystem functions, changing public values, advances in road building and yarding techniques, and regulation changes such as mandated streamside buffers that limit equipment operations and removal of timber. For example, Cafferata and Spittler (1998) found that almost all of the more recent landslides occurring in an area logged in the early 1970s were related to the legacy logging roads. In contrast, in a neighboring watershed logged in the late 1980s to early 1990s, landslides to date have occurred with about equal frequency in the logged areas as in unlogged areas.

Further, most north coast streams have not recently experienced another large event on the scale of the 1964 flood. Therefore, we would expect most north coast streams to show signs of recovery (i.e., passive restoration [FISRWG 1998]). However, the rates and degrees of stream and watershed recovery will likely vary across a given watershed and among different north coast drainages.

In addition to the contributions made to recovery through better land management practices and natural recovery processes, increasing levels of stream and watershed restoration efforts also are contributing to recovery. Examples of these efforts include road upgrades and decommissioning, removal of road-related fish passage barriers, installation of instream fish habitat structures, etc. While little formal evaluation or quantification of the contributions of these efforts to recovery has been made, there is a general consensus that many of these efforts have made important contributions.

Some types and locations of stream recovery for salmonids can occur more readily than others. For example, in headwater areas where steeper source reaches predominate, suspended sediment such as that generated by a streamside landslide or a road fill failure may start clearing immediately, while coarser sediments carried as bedload tend to flush after a few years (Lisle 1981a, Madej and Ozaki 1996). Broadleaf riparian vegetation can return to create shading, stabilize banks, and improve fish habitat within a decade or so. In contrast, in areas lower in the watershed where lower-gradient response reaches predominate, it can take several decades for deposited sediment to be transported out (Madej 1982, Koehler et al. 2001), for widened stream channels to narrow, for aggraded streambeds to return to pre-disturbance level, and for streambanks to fully revegetate and stabilize (e.g., Lisle 1981b). Lower reach streams will require a similar period for the near-stream trees to attain the girth needed for recruitment into the stream as large woody debris to help create adequate habitat complexity and shelter for fish, or for deep pools to be re-scoured in the larger mainstems (e.g., Lisle and Napolitano 1998).

### ***Continuing Challenges to Recovery***

Given improvements in timber harvesting practices in the last 30 years, the time elapsed since the last major flood event, and the implementation of stream and watershed restoration projects, it is not surprising that many north coast streams show indications of trends towards recovery (Madej and Ozaki 1996). Ongoing challenges associated with past activities that are slowing this trend include chronic sediment delivery from legacy (pre-1975) roads due to inadequate crossing design, construction and maintenance (California State Board of Forestry, Monitoring Study Group 1999), skid trails and landings (Cafferata and Spittler 1998), the lack of improvements in stream habitat complexity (from a dearth of large woody debris) for successful fish rearing, and the continuing aggradation of sediments in low-gradient reaches that were deposited as the result of activities and flooding in past decades (Koehler et al. 2001).

Increasing development on several north coast watersheds raises concerns about new stream and watershed disturbances. Private road systems associated with rural development have historically been built and maintained in a fashion that does little to mitigate risks of chronic and catastrophic sediment inputs to streams. While more north coast counties are beginning to put in place grading ordinances that will help with this problem, there is a significant legacy of older residential roads that pose an ongoing risk for sediment inputs to streams. Other issues appropriate to north coast streams include potential failures of roads during catastrophic events, erosion from house pads and impermeable surfaces, removal of water from streams for domestic uses, effluent leakages, and the potential for deliberate dumping of toxic chemicals used in illicit drug labs.

Some areas of the North Coast have seen rapidly increasing agricultural activity, particularly conversion of grasslands or woodlands to grapes. Such agricultural activities have typically been subject to little agency review or regulation and can pose significant risk of chronic sediment inputs to streams.

Associated with development and increased agriculture, some north coast river systems, such as the Navarro, are seeing increasing withdrawal of water, both directly from stream and from groundwater sources connected to streams, for human uses. Water withdrawals pose a chronic disturbance to streams and aquatic habitat. Such withdrawals can result in lowered summer stream flows that impede the movement of salmonids and reduce important habitat elements such as pools. Further, the withdrawals can contribute to elevated stream water temperatures that are harmful to salmonids.

Key questions for landowners, agencies, and other stakeholders revolve around whether the trends toward stream recovery will continue at their current rates, and whether those rates will be adequate to allow salmonids to recover their populations in an acceptable timeframe. Clearly, the potential exists for new impacts from both human activities and natural disturbance processes to compromise recovery rates to a degree that threatens future salmonid recovery. To predict those cumulative effects will likely require additional site-specific information on sediment generation and delivery rates and additional risk analyses of other major disturbances. Also, our discussion here does not address marine influences on anadromous

salmonid populations. While these important influences are outside of the scope of NCWAP, we recognize their importance for sustainable salmonid populations and acknowledge that good quality freshwater habitat alone is not adequate to ensure sustainability.

## Policies, Acts, and Listings

Several federal and state statutes have significant implications for watersheds, streams, fisheries, and their management. Here, we present only a brief listing and description of some of the laws.

### Federal Statutes

One of the most fundamental of federal environmental statutes is the **National Environmental Policy Act (NEPA)**. NEPA is essentially an environmental impact assessment and disclosure law. Projects contemplated or plans prepared by federal agencies or funded by them must have an environmental assessment completed and released for public review and comment, including the consideration of more than one alternative. The law does not require that the least impacting alternative be chosen, only that the impacts be disclosed.

The federal **Clean Water Act** has a number of sections relevant for watersheds and water quality. Section 208 deals with non-point source pollutants arising from silvicultural activities, including cumulative impacts. Section 303 deals with water bodies that are impaired to the extent that their water quality is not suitable for the beneficial uses identified for those waters. For water bodies identified as impaired, the US Environmental Protection Agency or its state counterpart (locally, the North Coast Regional Water Quality Control Board and the State Water Resources Control Board) must set targets for Total Maximum Daily Loads (TMDLs) of the pollutants that are causing the impairment. Section 404 deals with the alterations of wetlands and streams through filling or other modifications, and requires the issuance of federal permits for most such activities.

The federal **Endangered Species Act (ESA)** addresses the protection of animal species whose populations are dwindling to critical levels. Two levels of species risk are defined. A threatened species is any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. An endangered species is any species that is in danger of extinction throughout all or a significant portion of its range. In general, the law forbids the take of listed species. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting a species or attempting to engage in any such conduct. A take of a species listed as threatened may be allowed where specially permitted through the completion and approval of a Habitat Conservation Plan (HCP). An HCP is a document that describes how an agency or landowner will manage their activities to reduce effects on vulnerable species. An HCP discusses the applicant's proposed activities and describes the steps that will be taken to avoid, minimize, or mitigate the take of species that are covered by the plan. Many of California's salmon runs are listed under the ESA, including the Chinook and coho salmon found in the Mattole Basin. Steelhead trout, which are also found in the Mattole Basin, have been proposed for listing.

### State Statutes

The state analogue of NEPA is the **California Environmental Quality Act (CEQA)**. CEQA goes beyond NEPA in that it requires the project or plan proponent to select for implementation the least environmentally impacting alternative considered. When the least impacting alternative would still cause significant adverse environmental impacts, a statement of overriding considerations must be prepared.

The **Porter-Cologne Water Quality Control Act** establishes state water quality law and defines how the state will implement the federal authorities that have been delegated to it by the US EPA under the federal Clean Water Act. For example, the US EPA has delegated to the state certain authorities and responsibilities to implement TMDLs for impaired water bodies and NPDES (national pollution discharge elimination system) permits to point-source dischargers to water bodies.

**Sections 1600 et seq. of the Fish and Game Code** are implemented by the Department of Fish and Game. These agreements are required for any activities that alter the beds or banks of streams or lakes. A 1600 agreement typically would be involved in a road project where a stream crossing was constructed. While

treated as ministerial in the past, the courts have more recently indicated that these agreements constitute discretionary permits and thus must be accompanied by an environmental impact review per CEQA.

The **California Endangered Species Act (CESA)**. The California Endangered Species Act (Fish & Game Code §§ 2050, et seq.) generally parallels the main provisions of the Federal Endangered Species Act and is administered by the California Department of Fish and Game (CDFG). Coho salmon in the Mattole Basin are listed as threatened under CESA. The State Fish and Game Commission is expected to make the final listing decision of this species in 2003.

The **Z'Berg-Nejedly Forest Practice Act (FPA)** and associated **Forest Practice Rules** establish extensive permitting, review, and management practice requirements for commercial timber harvesting. Evolving in part in response to water quality protection requirements established by the 1972 amendments to the federal Clean Water Act, the FPA and Rules provide for significant measures to protect watersheds, watershed function, water quality, and fishery habitat.