Chapter 1

Program Introduction and Overview

North Coast Watershed Assessment Program (NCWAP) for Salmon Recovery and Watershed Protection

The North Coast Watershed Assessment Program (NCWAP) is an interagency effort between the California Resources Agency and the California Environmental Protection Agency (CalEPA), established to provide scientifically credible, interdisciplinary assessments that will facilitate watershed management and restoration, recovery of threatened and endangered salmonid species, and protection of water quality. It is designed to provide a consistent body of information for use by landowners, stakeholders, and collaborative watershed groups.

The program was developed by a team of managers and technical staff from the 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), and the North Coast Regional Water Quality Control Board (NCRWQCB) of the State Water Resources Control Board (SWRCB). The Institute for Fisheries Resources (IFR) also is a partner and participant in this program.

Its goals are to:

1. Organize and provide existing information and develop limited baseline data to help evaluate the effectiveness of various resource protection programs over time.
2. 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 support programs, like CDFG's Fishery Restoration Grants Program, toward those watersheds and project types that can efficiently and effectively improve freshwater habitat and lead to improved salmonid populations.
3. 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.
4. 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.

The program's work is intended to provide answers to the following assessment questions at the basin and subbasin scales in California's North Coast watersheds:

- What are the history and trends of the size, distribution, and relative health and diversity of salmonid populations?

- What are the current salmonid habitat conditions? How do these conditions compare to desired conditions?
- What are the past and present relationships of geologic, vegetative, and fluvial processes to stream habitat conditions?
- How has land use affected these natural processes?
- Based upon these conditions, trends, and relationships, are there elements that could be considered to be limiting factors for salmon and steelhead production?
- What watershed and habitat improvement activities would most likely lead toward more desirable conditions in a timely, cost effective manner?

Each participating department is responsible for products related to their primary discipline and for conducting an interdisciplinary analysis and synthesis. For the Gualala River Watershed Assessment:

- CDFG compiled, collected, and analyzed data related to anadromous fisheries habitat and populations, developed a stream reach module for the program's Ecosystem Management Decision System (EMDS) model, and identified limiting factors and restoration priorities for coho salmon and steelhead trout.
- CDF compiled, developed, and analyzed data related to historic land use change, including vegetation, timber harvest, and road maps, and developed a preliminary upslope sediment module for the EMDS watershed model.
- CGS compiled, developed, and analyzed data related to the geology and geologic processes, and produced maps of geology, geomorphic features related to landsliding, instream sediment and transport zones, and relative landslide potential.
- NCRWQCB compiled, collected, and analyzed water chemistry and temperature data for the assessment, served as Team Lead, and assisted with public outreach.
- DWR installed and maintained three stream flow monitoring gages for future hydrologic information and analysis, compiled water rights information, and provided a hydrologic analysis for the watershed.

1.1 Salmon / Stream / Watershed / Land Use Relationships

Anadromous Pacific 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 for successful spawning, adequate food supply, and protective cover for escaping predators and ambushing prey. These life requirements must be provided by diverse and complex instream habitats as the fish move through their life cycles. If any of these elements is missing or in poor condition at the time a fish or stock requires it, its survival can be adversely 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 stage of the fish and season of the year" (Bjorrn and Reiser 1991).

Through the course of the years, climate, watershed hydrologic responses, and erosion events interact to shape freshwater salmonid habitats. These include 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. All these disruptions can drastically alter instream habitat conditions and the aquatic communities that depend upon them. Thus, it is important to understand the critical, dependent relationships of salmon and steelhead trout with their natal streams during their freshwater life phases, their streams' dependencies 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 298-square-mile Gualala, in their entirety at any given time. Rather, such disturbances normally rotate episodically across the entire Gualala River Watershed 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 and 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 expected initially.

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 40-acre landslide or wildfire covering several square miles. However, when all the roads in a basin the size of the Gualala River Watershed 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 with and in an extremely short period of time, on the natural geologic scale.

These human disturbances are often concentrated in time because of newly developed technology or market forces such as the California Gold Rush or the post-World War II logging boom in northern California. This 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 trout. A general reduction in salmonid stocks can at least partially be attributed to this impacted freshwater environment.

1.1.1 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 analysis of these factors in order to identify whether any of them 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. 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. 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 the component's condition does not fit within the range of the reference values, it may be viewed as a limiting factor. This information will be useful to identify the 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 stream temperature, and complex habitat. For successful salmonid production, stream flows should mimic 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 provided by seeps, springs, and cool tributaries.

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° and 56° Fahrenheit (F) for successful spawning and incubation, and between 50-52 and 60-64 F for growth and rearing, depending on species. 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. Water clarity and turbid suspended sediment levels 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 juvenile salmonids' ability to feed and can lead to reduced growth rates and survival (B. 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 from the gravel into the stream at the end of incubation. High sediment loads can also cause abrasions on fish gills, which may be susceptible 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 the downstream areas.

Habitat complexity 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, areas to hide 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, reducing water depths and potentially burying complex niches created by large substrate and woody debris. Riffles provide clean spawning gravels and oxygenate water as it tumbles across them. Steelhead trout 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, and provides vegetative litter and invertebrate fall. 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 dependant 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 a stream 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 the 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 recent decisions to "list" many north coast chinook and coho salmon, and steelhead trout stocks under the Federal Endangered Species Act and to list coho salmon under the State Endangered Species Act.

1.1.2 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"

It is generally agreed that improvements in a condition or set of conditions are a process of recovery. 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 purturbations 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. As discussed below, the endpoint of "recovered" for one condition or function may be on a different time and geographic scale than for another condition or function.

In this report we use the term recovery in two ways. We use it in discussing the concept of recovery as in this section. We also use it when qualified with an endpoint or benchmark for a condition, such as, "recovered to 1942 conditions" in reference to canopy. The Gualala Total Maximum Daily Load (TMDL) contains several targets that were developed as benchmarks for recovery of the system with regard to physical characteristics of the stream channels, both in terms of suitability for salmonids and as indicators of fluvial stability. The targets were developed with information and knowledge available at the time and are expected to change, to be improved upon in the future. In the meantime, they exist as one set of benchmarks to provide a context for recovery and "recovered." The Flosi et al (1998) targets and EMDS relationships also constitute benchmarks for salmonid habitat based on current knowledge.

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 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 intense storms of 1964. 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 has been made of the contributions of these efforts towards recovery, there is a general consensus that many of these efforts have resulted in important improvements.

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 (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 (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 roads (pre-1975) 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 for successful fish rearing (from a dearth of large woody debris), 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 into place grading ordinances that will help with this problem, there is a substantial 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 vineyards. 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 the 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.

1.2 Policies, Acts, and Listings

Several federal and state statues have significant implications for watersheds, streams, fisheries, and their management. A very brief listing and description of several laws are included below.

1.2.1 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 (EIS) 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. Sections 208 and 319 deal with non-point source pollution, including development, agricultural, and silvicultural activities, and cumulative impacts. Section 303 deals with waterbodies that are impaired such that their water quality is not suitable for the beneficial uses identified for those waters. For water bodies identified as impaired, the U.S. Environmental Protection Agency (USEPA) or its state counterpart (here, the NCRWQCB and the SWRCB) must set targets for 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). A HCP is a document that describes how an agency or landowner will manage their activities to reduce effects on vulnerable species. A 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. Listings under the federal ESA for areas within the NCWAP region (the North Coast Hydrologic Unit) began with coho salmon in 1996, followed by Chinook salmon in 1999, and steelhead trout in 2000. They all are listed as threatened below impassable barriers

1.2.2 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 USEPA under the federal Clean Water Act. For example, the USEPA has delegated to the state certain authorities and responsibilities to implement TMDLs for impaired water bodies, and the national pollution discharge elimination system (NPDES) permits for point-source discharges to water bodies.

Sections 1600 et seq. of the Fish and Game Code, implemented by CDFG are required for any activities that alter the beds or banks of streams or lakes. This 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 constitute discretionary permits and, thus, must be accompanied by an environmental impact review per CEQA.

The California Endangered Species Act (CESA) (Fish and Game Code Section 2050, et seq.) generally parallels the main provisions of the federal ESA and is administered by CDFG. In August 2002, the California Fish and Game Commission voted to list the coho salmon, on north coast California rivers from the Gualala to the Oregon border, as "threatened" under CESA.

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.