

# APPENDIX A

## Glossary and Abbreviations

### **Acclimation**

Gradual physiological adjustment in response to relatively long-term environmental changes.

### **Acidification**

Ocean acidification is the process by which CO<sub>2</sub> is dissolved in seawater resulting in an increase in hydrogen ion (H<sup>+</sup>) concentration, and a corresponding decrease in the ocean's pH.

### **Acid Rain**

Precipitation which contains sulfate aerosols consisting of sulfuric acid, derived from industrial and other emissions.

### **Adaptation**

The evolutionary process, whereby populations become better suited to deal with their physical and biological environments, and therefore to survive and reproduce. It is driven by a host of factors including population diversity (genetic, phenotypic, physiological, and behavioral), inter and intra-specific competition, natural selection, and genetic processes.

### **Adaptive Trait**

Any specific physical, physiological, or behavioral trait of an organism that promotes the likelihood of an organism's survival and reproduction in a particular environment.

### **Adfluvial Population**

A population of fish which migrates between a lake and tributary streams tributary to the lake.

### **Adiabatic**

Insulated from the surroundings, unable to gain or lose heat from the environment.

### **Adipose fin**

Small fin composed of fatty tissue and located on the top-side of a fish between the dorsal and caudal fin.

### **Adjuvant**

An agent that modifies the effect of other agents, such as a pesticide. They are sometimes included in pesticides to enhance the effectiveness of the active agent.

### **Age Class**

Individuals in a population of the same age. In Pacific salmonids, an individual of less than one year is referred to a 0+ age class; a fish older than one, but less than two years, is termed a 1+ age class fish, etc.

### **Albedo**

The fraction of incoming solar radiation that is reflected back to space without being absorbed.

### **Alevin**

Newly hatched salmon or trout with a visible yolk sac, usually still maturing while still in the redd.

**Allele**

One of two or more forms of a gene. Sometimes, different alleles can result in different physical or physiological traits. Other times, different alleles will have the same result in the expression of a gene.

**Allele Frequency**

The relative proportion of all copies of a particular gene variant (allele) among the chromosomes carried by an individual of a population. In population genetics, allele frequencies are used to depict the amount of genetic diversity at the individual, population, and species level.

**Allochthonous**

Derived from outside a system such as leaves or insects that may fall into a stream.

**Alluvial**

Deposited by running water.

**Alluvium**

Material deposited by running water, including the sediments laid down in riverbeds, floodplains, lakes and estuaries.

**Anadromous**

A life history cycle that involves reproducing in freshwater, maturing in marine waters, and returning to freshwater to reproduce.

**Anadromous Fraction**

The proportion of a heterogeneous *O. mykiss* population that exhibits an anadromous life history, as opposed to the freshwater-resident life history.

**Anadromous Waters**

Water bodies typically accessible to fish migrating from the ocean, including estuaries, rivers, and lakes.

**Anaerobic**

Living, growing, or occurring in an environment with no free oxygen.

**Anal fin**

Fin located near the rear, and on the bottom side of a fish; used for stability when swimming.

**Annulus**

An annual mark formed on the hard parts of fishes (e.g., scales, bones, otoliths), corresponding to a period of growth.

**Autecology**

Ecological study of a single organism or a single species.

**Autochthonous**

Derived from within a system, such as organic matter in a stream resulting from photosynthesis by aquatic plants.

**Autotrophic**

Making food by photosynthesis or requiring only inorganic chemical for metabolic synthesis.

**Baseflow**

The portion of a stream discharge derived from natural storage sources such as groundwater, lakes, or groundwater basins that create local surface runoff; the sustained discharge that does not result from direct runoff or from stream regulation, water diversion, or other human activities.

**Baseline**

A set of reference data sets or analyses use for comparative purposes; it can be based on a reference year or location, or a reference set of standard conditions.

**Bayesian**

A formal statistical approach in which expert knowledge or beliefs are analyzed together with data. Bayesian methods make explicit use of probability for quantifying uncertainty, and are used in decision making.

**Bedform roughness**

The measure of the irregularity of streambed materials that contributes to the resistance to stream flows. Commonly represented by Mannings roughness coefficient.

**Bed-load Sediment**

The part of a stream or river's total sediment load moved along the bottom by running waters.

**Benthic**

A habitat or organism found on the stream, lake or ocean bottom.

**Biological Diversity**

The range of characteristics within an ecosystem or taxonomic group, including genetic, phenotypic and physiological variability of individuals, and life history strategies, age structure and fecundity of populations.

**Bootstrap**

A statistical methodology use to quantify the uncertainty associated with estimates obtained from a model. The bootstrap is often based on Monte Carlo resampling of residuals from the initial model fit.

**Brackish Water**

Water that contains high concentrations of salts than fresh water, but not as much as seawater. It may result from mixing of seawater with fresh water, as in estuaries, or it may occur in brackish fossil aquifers. Technically, brackish water contains between 0.5 and 30 grams of salt per liter—more often expressed as 0.5 to 30 parts per thousand (ppt or ‰). Thus, *brackish* covers a range of salinity regimes and is not a precisely defined condition. By comparison, average, seawater in the world's oceans has a salinity of about 35 ppt.

**Braided Stream**

Stream that forms an interlacing network of branching and recombining channels separated by branch island or channel bars.

**Broodstock**

Sexually mature individuals used within a hatchery or other controlled environment for breeding purposes.

**Carnivore**

An organism or species that derives its energy and nutrient requirements from a diet consisting mainly or exclusively of animal tissue, whether through predation or scavenging. Animals that depend solely on animal flesh for their nutrient requirements are considered obligate carnivores while those that also consume non-animal food are considered facultative carnivores.

**Carrying Capacity**

The maximum population of a species that an area or specific ecosystem can support indefinitely without deterioration of the character and quality of the resources. It can also refer to the maximum level of recreational use, in term of numbers of people and type of activity, which can be accommodated before the ecological value of the area declines.

**Catadromous**

A life history cycle that involves reproducing in saltwater, maturing in freshwater, and returning to saltwater to reproduce.

**Caudal fin**

Tail fin, usually with distinct rays; used principally for propulsion and turning.

**Climate**

The average prevailing conditions in the atmosphere (air temperature, wind speed and direction, humidity, precipitation, etc.) based upon an extended series of years.

**Coded-wire Tag**

Coded-wire tags are small pieces of stainless steel wire that are injected into the snouts of juvenile salmon and steelhead. Each tag is etched with a binary code that identifies its time and place of release.

**Coefficient of Variation (CV)**

The standard error of a statistic, divided by its point estimate. The CV gives an idea of the precision of an estimate, independent of its magnitude.

**Colluvium**

Lose deposits of soil and rock moved by gravity; on or below steep slopes or cliffs it is referred to as talus.

**Competition**

Interaction of individual organisms that occupy or share some part of an ecological niche such that both depend upon the same food source, shelter, or some other resource in the same community; competition may be between individuals of the same or different species.

**Cohort**

A group of fish generated during the same spawning season, and is part of the same age class.

**Confidence Interval (CI)**

The probability, based on statistics, that a number will be between an upper and lower bound.

**Conspecific**

Two or more individuals, populations, or other higher order taxonomic grouping such as a sub-species, are said to be conspecific when they belong to the same species.

**Continental Shelf**

The underwater shelf of the continent, extending seaward from the shore, with a moderate inclination, to the edge of the continental slope where the inclination increases sharply; water depth varies from 0 to 200 meters.

**Demersal**

Living in close association with the bottom of a stream or lake and generally dependent upon it.

**Demographic**

Properties of a population such as rate of growth, age structure, sex ratio, number of reproductive individuals, etc.

**Density Dependence**

In population ecology density-dependence is any population characteristic that varies with the degree of the density of the population.

**Density Independence**

External factors that influence all individuals of a population regardless of population density such as climate.

**Dimorphism**

Existence within a species of two distinct forms according to color, sex, size, organic structure, etc.

**Distinct Population Segment**

The smallest division of a taxonomic species that can be protected under the U.S. Endangered Species Act.

**Dorsal fin**

Located on the top side, generally mid-way along the body, and usually with distinct rays; provides stability when swimming.

**Ecological niche**

The position a species or population in its ecosystem. The ecological niche describes how an organism or population responds to the distribution of resources and competitors (*e.g.*, by growing when resources are abundant, and when predators, parasites and pathogens are scarce) and how it in turn alters those same factors (*e.g.*, limiting access to resources by other organisms, acting as a food source for predators and a consumer of prey).

**Ecosystem**

A biological environment consisting of all the organisms living and interacting in a particular area, as well as all the nonliving, physical components of the environment with which the organisms interact, such as air, soil, water and sunlight.

**Ecosystem Functions**

Intrinsic ecosystem characteristics related to the set of conditions and processes whereby an ecosystem maintains its integrity. Ecosystem functions include such processes as decomposition, production of biomass, nutrient cycling, and fluxes of nutrients and energy.

**Ecosystem Services**

The benefits that people obtain from functioning ecosystems; they include provisioning services such as food, timber, fiber, fuel and energy, and freshwater; regulating services such as air and water quality, equable climate, control of diseases, pests, and sediment supplies (e.g., beaches, natural building materials such as wood); supporting services such as soil formation, photosynthesis, nutrient cycle; and cultural services such as fulfilling spiritual, religious, and aesthetic needs.

**Effective Population Size ( $N_e$ )**

The number of individuals that contribute offspring to the next generation; generally smaller than the absolute population size ( $N$ ); a basic parameter in many models in population genetics.

**El Niño /La Niña Southern Oscillation**

A weather pattern that occurs across the tropical Pacific Ocean roughly every five to seven years. It is characterized by variations in the surface temperature of the tropical eastern Pacific Ocean—warming associated with El Niño and cooling with La Niña. The two variations are coupled: the warm oceanic phase, El Niño, accompanies high air surface pressure in the western Pacific, while the cold phase, La Niña, accompanies low air surface pressure in the western Pacific. ENSO causes extreme weather (such as floods and droughts) in many regions of the world, including the west coast of the United States.

**Embeddedness**

The degree to which large particles (e.g., boulders, rubble, gravel) are surrounded or covered by fine sediment, usually measured in classes according to percent of coverage.

**Emigration**

Movement of individuals out of a population. With Pacific anadromous salmonids, emigration refers to the movement of juveniles (and also adults) from freshwater to a brackish or marine environment.

**Endemic**

Species or populations occurring in restricted geographic areas due to the presence of a unique suite of environmental and biological conditions that limit the distribution of the species or population.

**Ephemeral Streams**

Streams that flow briefly after rainstorms.

**Epigenetics**

The field of study of the genetic (coding) and non-genetic (non-coding) factors acting upon cells to control selectively the expression of genes that produce development and evolution.

**Epigenome**

All the epigenetic modifications on the DNA genome and its associated histone proteins.

**Escapement**

The portion of a run of an anadromous species that is not harvested and escapes to natural or artificial spawning areas.

**Essential Fish Habitat**

Waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity as defined by 16U.S.C. 1802(10).

**Estuary**

Estuaries form a transition zone between river environments and ocean environments and are subject to both marine influences, such as tides, waves, and the influx of saline water; and riverine influences, such as flows of fresh water and sediment. The inflow of both seawater and freshwater provide high levels of nutrients in both the water column and sediment, making estuaries among the most productive natural habitats.

**Eutrophication**

The process by which a body of water becomes enriched in dissolved mineral nutrients (often phosphorus and nitrogen) that stimulates the growth of aquatic plants, and leads to depletion of dissolved oxygen, and the mortality of oxygen dependent organisms.

**Evolutionary Significant Unit**

A population (or group of populations) which exhibit two biological characteristics: (1) it is substantially reproductively isolated from other conspecific (of the same taxonomic species) population units; and (2) it represents an important component of the evolutionary legacy of the species.

**Evolvability**

The potential to generate heritable variation of individuals in a population that can be exploited by natural or artificial selection.

**Extinction**

The disappearance of a species or some other taxonomic group from a region, niche, or biota; the precise moment of extinction is generally considered to be the death of the last individual of the species (although the capacity to reproduce and recover may have been lost before that point).

**Eyed Egg**

A fish egg containing an embryo that has developed to the point where the eyes are visible through the egg membrane.

**Facultative**

The characteristic of being able to adjust to a variety of conditions or circumstances; optional or discretionary.

**Fecundity**

The reproductive potential or capacity of an organism or population, usually expressed as the number of eggs or progeny produced during a reproductive cycle. Fecundity usually increases with age and size up to some upper limit.

**Fish Ladder**

An artificial facility made of a series of steps, with flowing water and pools, to assist fish in swimming up or downstream of a fish passage barrier such as a dam or diversion.

**Fitness**

The degree that an individual is adapted to or is able to produce progeny in its local environment.

**Fluvial**

Pertaining to streams or rivers, or produced by stream action; also migrating between rivers and the ocean.

**Fork- Length**

Refers to the measurement of a fish from the tip of its snout to the fork in the caudal (tail) fin.

**Fry**

Juvenile fish that have absorbed their yolk sacs and can emerge from a redd and into deeper water to feed on their own.

**Genotype**

The genotype of an organism is the inherited genetic code of the individual. Not all individuals with the same genotype look or behave the same way because appearance and behavior are modified by environmental, developmental, or epigenetic factors. Similarly, not all individual that look alike necessarily have the same genotype.

**Genetic Distance**

A measure of the difference in allele frequencies between populations. Genetic distance can be used to compare the genetic similarity between different species, such as humans and chimpanzees. Within a species genetic distance can be used to measure the divergence between different sub-species, or populations of the same species.

**Gravid**

The condition of an individual female carrying ripe eggs, usually with a distended body.

**Greenhouse Gas**

A gas which is capable of absorbing and emitting infrared light (e.g., water vapor H<sub>2</sub>O, carbon dioxide CO<sub>2</sub>, methane CH<sub>4</sub>, nitrous oxide N<sub>2</sub>O, and ozone O<sub>3</sub>).

**Habitat**

The area that is inhabited by a particular species of animal, plant or other type of organisms. It is the natural environment in which an organism lives, or the physical environment that surrounds (influences and is utilized by) a population of a species. The term microhabitat is often used to describe the small-scale physical requirements of a particular organism or population.

**Herbivore**

An organism that derives its principal source of nutrients and energy by consuming living plants or their parts.

**Hydrologic Cycle**

The continuous movement of water on, above and below the surface of the Earth, such as from river to ocean, or from the ocean to the atmosphere, by the physical processes of evaporation, condensation, precipitation, infiltration, runoff, and subsurface flow. Water takes alternative forms of liquid, vapor, and a solid (snow and ice). The hydrologic cycle also involves the exchange of heat energy, which leads to temperature changes. For instance, in the process of evaporation, water takes up energy from the surroundings and cools the environment. Conversely, in the process of condensation, water releases energy to its surroundings, warming the environment.

The water cycle figures significantly in the maintenance of life and ecosystems on Earth. By transferring water from one location to another, the water cycle purifies water, replenishes the land with freshwater, and transports minerals to different parts of the globe. It is also involved in reshaping the geological features of the Earth, through such processes as erosion and sedimentation. The water cycle exerts an influence on climate as well.

The physiological and behavioral process by which migratory fish assimilate environmental cues to aid their return to their stream of origin as adults.

**Imprinting**

The physiological and behavioral process by which migratory fish assimilate environmental cues to aid their return to their stream of origin as adults.

**Incidental Take**

The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

**Independent population**

Any collection of one or more local breeding units whose population dynamics or extinction risk over a 100-year time frame are not substantially altered by exchanges of individuals with other populations. For example, if one independent population were to go extinct, it would not have a significant impact on the 100-year extinction risk experienced by other independent populations.

**Indigenous Species**

A species occurring naturally in a particular region, and not artificially introduced.

**Intermittent Streams**

Streams that flow for some portion, but not all, of the year. Such streams usually receive their waters primarily from surface runoff following storm events.

**Interspecific**

Interactions, such as competition or predation, between different species.

**Interrupted Stream**

Stream that exhibit surface and sub-surface flow along difference stream reaches contemporaneously. Such streams often flow through coarse gravels.

**Intraspecific**

Interactions, such as competition or predation, between individuals of a single species.

**Introgression**

The movement of genes from one gene pool to another as a result of hybridization between individuals from genetically distinct populations.

**Iteroparous**

An organism that has the potential to reproduce more than one during its life cycle. Steelhead are the only members of the Pacific anadromous salmonids (*Oncorhynchus* spp.) that do not die after initial spawning, and may return to the ocean and then return to freshwater to repeat their reproductive phase.

**Kelt**

A spawned out anadromous fish; it is generally emaciated and weak as a result of its spawning activity.

**Latent Heat**

Heat carried by water, and released when the water vapor condenses to liquid.

**Lateral line**

A series of sensory receptors (formed of a series of pores with hair-like structures) arrayed along the sides mid-way between top and bottom of the body; these sensory receptors detect water movement around the fish, allowing it to efficiently navigate currents, detect prey, and swim in coordination with other fish of the same species.

**Life Cycle**

The successive series of changes through which an organism passes, whether through asexual or sexual reproduction, including breeding, gestation, growth and maturation, and death. This cycle of phases of an individual is also referred to a life history.

**Life History Crossover**

In Pacific salmonids, the ability of anadromous *O. mykiss* to produce progeny which assume a freshwater reproductive life cycle, and the ability of resident *O. mykiss*, to produce progeny which assume an anadromous reproductive life cycle.

**Life History Polymorphism**

In Pacific salmonids, the co-occurrence of the anadromous and resident life cycle forms within a population.

**Limiting Factor**

Any factor that controls a process, such as organism growth or species population size, or distribution. The availability of food, predation pressure, or availability of shelter are examples of natural limiting factors. An example of an anthropogenic limiting factor is set of barriers to migration, which is necessary to complete an organism's life cycle.

**Littoral Zone**

The zone along the coast that forms the interface between the land and water, and often includes intertidal and near-shore waters.

**Lotic**

Pertaining to running water such as river or stream.

**Mediterranean Climate**

The climate is characterized by warm to hot, dry summers and mild to cool, wet winters. Mediterranean climate zones are associated with the five large subtropical high pressure cells of the major oceans. These high pressure cells shift toward the poles in the summer and toward equator in the winter.

**Meristics**

Measurements of an organism's physical characteristics such as length, scale, spine, fin-ray counts.

**Metapopulation**

A set of populations that is composed of multiple local populations geographically separated but connected through dispersal and periodic interbreeding. Generally individual populations within such a system have a relatively high probability of local extinction and also recolonization by other populations within the metapopulation. Metapopulations persist as a result of a balance between extinctions of subpopulations and recolonization by others.

**Migrate**

Travelling of long distances in search of a specific type of habitat to enable an organism to complete some phase of its life cycle; fish such as Pacific anadromous salmonids migrate between their spawning and rearing areas in freshwater habitat and the marine environment to feed and grow to maturity.

**Mathematical Model**

A quantitative description of anything (including processes) that cannot be directly observed, but for which relevant data can be developed, and used to simulate an approximation or estimate of the thing being modeled.

**Natal Stream**

A stream in which a returning adult fish was originally spawned and reared.

**Natural Selection**

The process by which the frequency of genetic traits in a population through differential survival and reproduction of individual bearing those traits is determined. Natural selection acts on the phenotype or the observable characteristics of an organism, but the genetic (heritable) basis of any phenotype which gives a reproductive advantage will become more common in a population (see allele frequency). Over time, this process can result in modifications in individual organisms that adapt populations for a particular ecological niche and may eventually result in the emergence of new species. It is a key mechanism of evolution.

**Non-Point Pollution**

Pollution from sources that cannot be defined as discrete points, such as areas of surface mining, construction, or developed agricultural or urbanized areas.

**Obligate**

The characteristic of being unable able to adjust to a variety of conditions or circumstances; a life history or response to particular environmental conditions without alternative means of responding.

**Omnivore**

An organism whose diet is broad, including both plant and animal foods; specifically an organism that feeds on more than one trophic level; omnivorous organisms are opportunistic, general feeders not specifically adapted to eat and digest either meat or plant material primarily.

**Operculum**

The hard bony gill cover in bony fishes

**Orographic Precipitation**

Precipitation induced when air masses pushed by winds are forced up the side of elevated land formations, such as large mountains. The lift of the air up the side of the mountain results in cooling, and ultimately condensation and precipitation.

**Otolith**

Calcareous concretions in the inner "ear" of lower vertebrates such as fish; the daily accumulation of calcareous layers can be used to determine the age of an organism, and in some cases detect the relative amount of time spent in waters with different chemical composition (*e.g.*, salt and freshwater).

**Outmigration**

The downstream migration of juvenile fish toward the ocean. See **Emigration**.

**Oviparous**

Producing eggs that develop outside the females body. Fertilization may occur either inside a female or after the eggs are released by the embryos are given no extra nutrient other than that contained in the original yolk.

**Pacific Decadal Oscillation (PDO)**

A pattern of climate variability that shifts phases on at least an inter-decadal time scale, usually about 20 to 30 years. The PDO is detected as warm or cool surface waters in the Pacific Ocean north of 20° N. During a "warm", or "positive", phase, a part of the eastern ocean warms, while the west Pacific becomes cool; during a "cool" or "negative" phase, the opposite pattern occurs.

**Panmictic Population**

A population in which all individuals are potential reproductive partners, that is, there are no restrictions of mating (*e.g.*, genetic or behavioral).

**Parameterization**

A technique used in constructing models by substituting an unknown feature such as process or limit, with a simplified, but informed estimate of the feature.

**Parr**

The rearing stage of freshwater salmonids between alevins and smolt that is distinguished by vertical bars or oval spots (parr marks) on the side of the fish.

**Pectoral fin**

Fin located toward the front of fish; used for precise movements.

**Pelvic fin**

Fin located toward the rear of the fish; used for steering and stopping.

**Pelagic**

Associated with the open sea or at or near the water's surface. Pelagic fish live near the surface or in the water column of coastal, ocean and lake waters, but not on the bottom of the sea or the lake. They are usually agile swimmers with streamlined bodies, capable of sustained cruising on long distance migrations. They can be contrasted with demersal fish which do live on or near the bottom, and reef fish which are associated with coral or volcanic reefs.

**pH**

A measure of the acidity or basicity of an aqueous solution (generally expressed as the concentration of H<sup>+</sup> ions). pH is normally measured in a range of 0-14. Pure water is said to be neutral, with a pH close to 7.0 at 25 °C (77 °F). Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline.

**Phenotype**

Any observable characteristic or trait of an organism such as its morphology (shape and size) developmental pattern, biochemical or physiological properties, and behavior. Phenotypes result from the expression of an organism's genes working in conjunction with epigenetic factors as well as the influence of environmental factors and the interactions between the two.

**Phenotypic Plasticity**

The ability of an individual to modify behavioral or other phenotypic characteristics to adjust to differing environmental conditions. In some Pacific salmonids such as steelhead, phenotypic plasticity refers to the ability to adopt either the anadromous or freshwater-resident life cycle, depending on environmental cues or influences.

**Photic Zone**

The surface layer of water where there is sufficient light for photosynthesis to occur.

**Point-Source Pollution**

Pollution originating from a confined, discrete source such as a pipe, ditch, oil-well, or factory.

**Population**

A group of interbreeding individuals that have developed a distinct gene pool and that breed in approximately the same place and time.

**Population Density**

The number of individuals per unit area, or linear distance.

**Population Model**

A quantitative description of how a population changes over time; population models can take a variety of basic forms, including age/size structured or biomass based, deterministic or stochastic, density-dependent or density-independent, spatially structured or spatially aggregated, equilibrium or nonequilibrium.

**Predation**

Predation describes a biological interaction in which a predator feeds on its prey. Predators may or may not kill their prey prior to feeding them, but the act of predation always results in the death of its prey and the eventual absorption of the prey's tissue through consumption. The key characteristic of predation however is the predator's direct impact on the prey population.

**Primary Productivity**

The production of organic compounds from atmospheric or aquatic carbon dioxide, principally through the process of photosynthesis, with chemosynthesis being much less prevalent. Almost all life on earth is directly or indirectly reliant on primary production. The organisms responsible for primary production form the base of the food chain. In terrestrial ecosystem these are mainly plants; in aquatic ecosystems, algae are primarily responsible.

**Radiative Balance**

The physical state of a system, such as the earth-atmosphere system, where the incoming and outgoing solar radiation is in equilibrium; greenhouse gases diminish outgoing solar radiation, thus disrupting the radiative balance.

**R-strategists**

R-strategists are species characterized by relatively early age of first reproduction, large brood size, numerous progeny, no parental care, and short generations. Populations exhibit exponential growth rate followed by sudden crashes in population size, and tend to live in unpredictable and rapidly changing environments. Pacific anadromous salmonids are an example of an r-strategist species.

**Recruitment**

The number of fish from a year class reaching a certain age; in fisheries management it is generally the number of fish that grow to a size subject to harvesting.

**Redd**

A shallow gravel depression excavated by a fish for the purpose of depositing its eggs within the stream channel.

**Refugia**

Habitats where individuals can avoid predation or environmental stressors such as elevated temperatures, or flood flows.

**Relative humidity**

The amount of water vapor in the air, compared with complete saturation. If relative humidity is greater than 100%, the vapor will tend to condense to liquid, until 100% is reached.

**Residualization**

The process by which an anadromous steelhead foregoes smoltification and maintains a resident, freshwater life-history.

**Riffle**

Shallow section of a stream or river with rapid current and surface broken by gravel, rubble, or boulders.

**Run**

Swiftly flowing stream reach with little surface agitation, and no major flow obstructions.

**Salmonids**

Fish of the taxonomic family Salmonidae that includes salmon, trout, whitefish, and char.

**Seasonal Lagoon**

An estuary that becomes separated from the ocean by a sandbar barrier for part of the year.

**Sea Level Rise**

The rise in average sea level elevation with respect to current terrestrial elevations. Increasing sea level is the result of increasing temperatures causing the thermal expansion of water and the addition of water to the oceans from the melting of mountain glaciers, polar ice caps, and Greenland and Antarctic ice sheets.

**Sediment**

Fragment of rock, soil, and organic matter transported and deposited in beds by wind, water, or other natural phenomena. The term can refer to any size of particles but is often used to indicate only fragments smaller than 6 mm.

**Sedimentation**

Deposition of material suspended in water or air, usually when the velocity of the transporting medium drops below the level at which the material can be supported and moved.

**Sediment Loading**

The total sediment in a stream system, whether in suspension (suspended load) or on the bottom (bed load).

**Semelparous**

Organisms which reproduce only once. The single reproductive event of semelparous organisms is usually large, as well as fatal. An example of a semelparous organism is the Pacific salmon (*Oncorhynchus* spp.), which live for several years in the ocean before migrating to the freshwater stream of its birth, laying eggs, and dying.

**Sink Population**

A local population that has a negative growth rate, or a high probability of periodic extinction; its continued persistence is dependent upon immigration from other local populations, or dispersal from more remote populations.

**Smolt**

A young salmon or steelhead that is undergoing physiological changes in preparation for entering the ocean.

**Smoltification**

The suite of physiological, morphological, biochemical, and behavioral changes, including the development of the silvery coloration and tolerance of saltwater, which takes place in salmonid parr as they prepare to migrate downstream to the ocean.

**Source Population**

A local population that has a sufficiently high growth rate when small to persist even without immigration from other local populations, or dispersal from more remote populations.

**Spawning Density**

The number of potentially spawning individual in a length of stream, tributary, or some other hydrologic unit.

**Steelhead**

A rainbow trout (*Oncorhynchus mykiss*) that exhibits an anadromous life cycle.

**Stochastic**

The state where a system's components are affected by random variability. A stochastic model is a model whose behavior is not fully specified by its form and parameters, but which contains an allowance for unexplained effects represented by random variables.

**Stratification**

The establishment of distinct layers of temperature or salinity in bodies of water such as an ocean, lake, or estuary, based upon the different density of warm and cold water or saline or freshwater.

**Stream Order**

A numerical designation (from 1 to 6 or higher) that designates the relative position of a stream or stream segment in a drainage basin from headwaters to the rivers downstream terminus.

**Substrate**

Mineral or organic material that forms the bed of a river or stream.

**Sustainable Fishery**

A fishery that does not cause or lead to undesirable changes in the biological and/or economic productivity, biological diversity, or ecosystem structure and functioning from one human generation to the next.

**Taxon**

Any named group of organisms at any taxonomic level (*e.g.*, Phylum, Order, Class, Genus, Species, Sub-species, etc.).

**Temperature Lapse Rate**

The rate of decrease in temperature with altitude in the stationary atmosphere at a given time and location.

**Thalweg**

A line connecting the deepest parts of a river or stream channel.

**Thermocline**

A region below the surface layer of the sea or lake, or pool where the temperature gradient increases abruptly (*i.e.*, where temperature decreases rapidly with increasing depth). It is often an ecological barrier, and its oscillations have significant consequences on the distribution of organisms.

**Total-Length (TL)**

The length of a fish defined as the straight-line distance from the tip of the snout to the tip of the tail (caudal fin) while the fish is lying on its side normally extended.

**Triploid**

An organism having three sets of chromosomes.

**Trophic Level**

The position an organism or species occupies in the food chain, or web. A food chain represents a succession of organisms that eat other organisms and are, in turn, eaten themselves. The number of energy transfer steps is from the start of the chain is a measure of its trophic level. Food chains start at trophic level 1 with primary producer such as plants, move to herbivores level 2, predators at level 3 and typically finish with carnivores or predators at level 4 or 5 determined by the number of energy-transfer steps to that level.

**Upwelling**

An oceanographic phenomenon that involves wind-driven motion of dense, cooler, and usually nutrient-rich water towards the ocean surface, replacing the warmer, usually nutrient-depleted surface water. The increased availability in upwelling regions results in high levels of primary productivity and thus fish growth and abundance. Wind-driven currents are diverted to the right of the winds in the Northern Hemisphere and to the left in the Southern Hemisphere. When surface water transport is occurring away from the coast, surface waters are replaced by deeper, colder, and denser water.

**Viable Salmonid Population**

An independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation (such as population size or sex ratio), local environmental variations, and genetic diversity changes over a 100-year time frame.

**Viability Population Parameters**

The four measurable characteristics of a viable salmonid population: abundance, growth rate, spatial structure, and diversity (including genetic, phenotypic diversity).

**Volitional Fish Passage**

The natural movement of fish in response to cues such as natural flow patterns or water temperature, or natural physiological changes in individuals.

**Water Table**

The irregular surface of contact between the zone of saturation and the zone of aeration; that surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.

**Weathering**

The physical/chemical processes in which a material is broken down through exposure to the atmospheric conditions (heat, water, etc.)

**Winter-Run Fish**

Anadromous fish that return to freshwater in the autumn or winter, migrating to spawning areas, and then spawn in later winter or spring.

**Young-of-the Year**

Juvenile fish that are less than a year old (and are in their first year of growth).

## Abbreviations

AMCES	AmeriCorps Environmental Stewards
AMBAG	Association of Monterey Bay Area Governments
AC	Audubon California
ACOE	Army Corps of Engineers
ACWA	Association of California Water Agencies
AFRP	Anadromous Fish Restoration Program
AG	Arroyo Grande
ASRA	Arroyo Seco River Alliance
BSLT	Big Sur Land Trust
BIA	Bureau of Indian Affairs (United States)
BLM	Bureau of Land Management (United States)
BMPs	Best Management Practices
BOR	Bureau of Reclamation (United States)
BPG	Biogeographic Population Group
BRT	Biological Review Team
CAWC	California-American Water Company
CCCOM	California Coastal Commission
CCCON	California Coastal Conservancy
CCCORP	California Conservation Corps
CDSOD	California Division Safety of Dams
CDFG	California Department of Fish and Game
CDF&FP	California Department of Forestry and Fire Protection
CDOT	California Department of Transportation
CDPR	California Department of Parks and Recreation
CDMG	California Division of Mines and Geology
CESA	California Endangered Species Act
CNPS	California Native Plant Society
COC	Chemical of Concern
CRPP	California River Parkway Program
CSFPR	California Sport Fishing Protective Association
CSWMB	California State University, Monterey Bay
CT	California Trout
CCSD	Cambria Community Service District
CAWD	Carmel Area Wastewater District
CRA	Carmel River Association
CRLC	Carmel River Lagoon Coalition
CRSA	Carmel River Steelhead Association
CRWC	Carmel River Watershed Conservancy
CRWCO	Carmel River Watershed Council
CVPOA	Carmel Valley Property Owners Association
CCRDC	Central Coast Resource Conservation and Development Council
CCSE	Central Coast Salmon Enhancement, Inc.
CHEER	Coastal Habitat, Education, and Environmental Restoration
CSLRCD	Coastal San Luis Resource Conservation District
CI	Confidence Interval

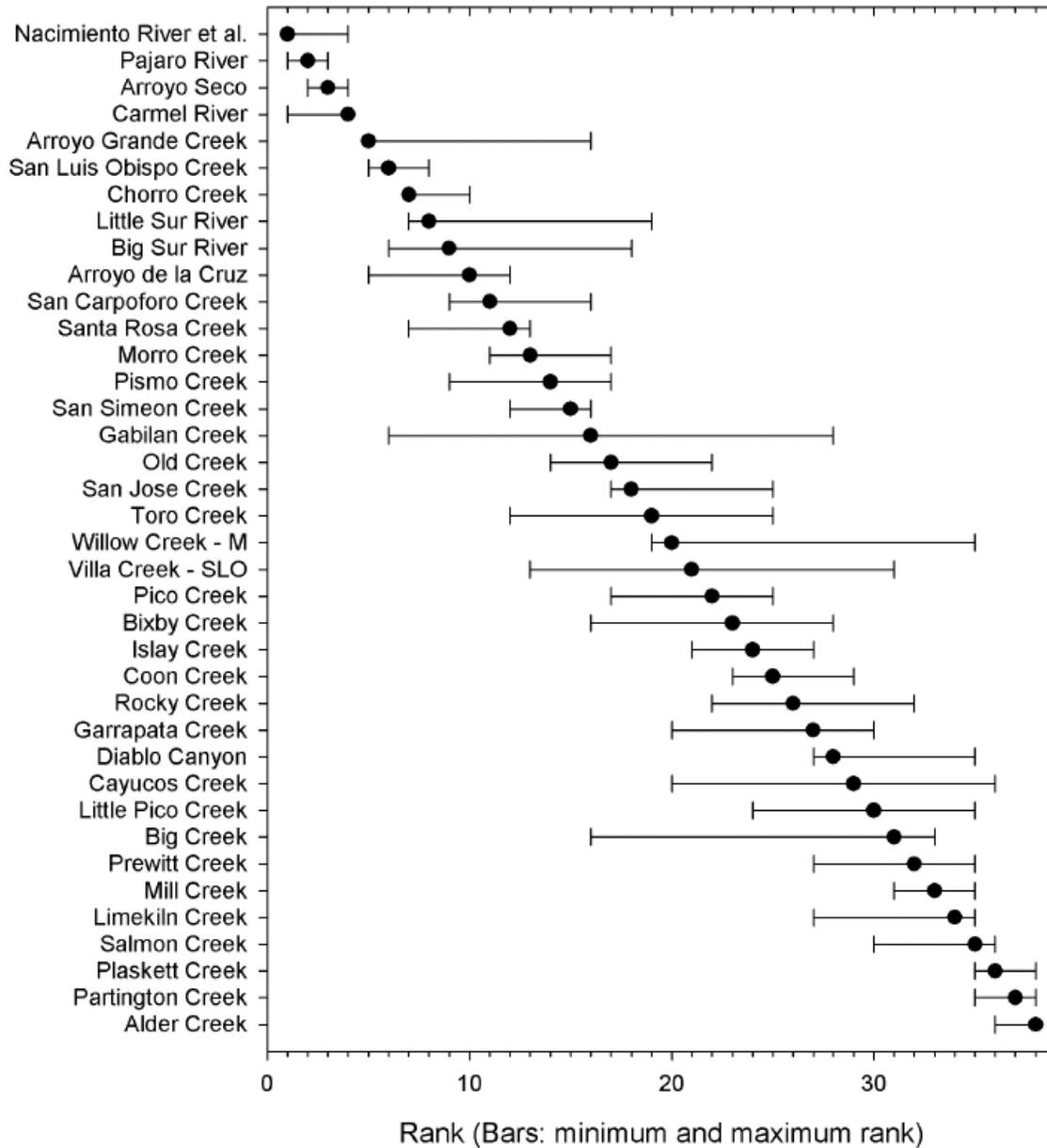
CMARP	Comprehensive Monitoring Assessment and Research Program
C <sup>0</sup>	Centigrade
cm	Centimeters
cm/sec	Centimeters per second
COA	City of Atascadero
COC	City of Carmel
COM	City of Monterey
COMB	City of Morro Bay
COG	City of Gilroy
COPS	City of Paso Robles
COPB	City of Pismo Beach
COS	City of Salinas
CSLO	City of San Luis Obispo
COSM	City of San Miguel
COW	City of Watsonville
CV	Coefficient of Variation
CWT	Coded Wire Tag
DOT	Department of Transportation (United States)
DIDSON	Dual-Frequency Identification Sonar
DPS	Distinct Population Segment
DWR	Department of Water Resources (State of California)
EPA	Environmental Protection Agency (United States)
EFH	Essential Fish Habitat
EII	Earth Island Institute
ENSO	El Nino/Southern Oscillation
ESF	Elkhorn Slough Foundation
ESA	Endangered Species Act (United States)
ESU	Evolutionarily Significant Unit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FL	Fork Length
FOR	Friends of the River
FRGP	Fisheries Restoration Grant Program
ft/sec	Feet per second
GCWC	Garrapata Creek Watershed Council
HCP	Habitat Conservation Plan
IRWMP	Integrated Regional Watershed Management Plan
km/hr	Kilometers per hour
LPFW	Los Padres Forest Watch
m	Meters
mi <sup>2</sup>	Square miles
m/sec	Meters per second
mm	Millimeters
TBD	To Be Determined
TNC	The Nature Conservancy
MC	Monterey County
MCWD	Marina Coast Water District

MOU	Memorandum of Understanding
MBMMS	Monterey Bay National Marine Sanctuary
MBSTP	Monterey Bay Salmon and Trout Project
MCPW	Monterey County Public Works Department
MCSA	Monterey County Service Area 50
MCWRA	Monterey County Water Resources Agency
MPWMD	Monterey Peninsula Water Management District
MRPD	Monterey Regional Park District
MCUSA	Monterey County Unified Sportsmen Association
NGO	Non-Governmental Organization
NFWF	National Fish and Wildlife Foundation
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPSPWRO	National Park Service, Pacific Western Regional Office
NRCS	National Resources Conservation Service
PCSRF	Pacific Coastal Salmon Recovery Fund
PITT	Passive Integrated Responder Tags
ppt	Parts per thousand
PBCSD	Pebble Beach Community Services District
PCLF	Planning and Conservation League Foundation
PVA	Population Viability Analyses
RFID	Radio Frequency Identification
RM	River Mile
RST	Rotary Screw Trap
RWQCB	Regional Water Quality Control Board
RCDMC	Resource Conservation District of Monterey County
RCDSC	Resource Conservation District of Santa Cruz County
SBC	San Benito County
SBCWD	San Benito County Water District
SCC	Santa Clara County
SCRC	Santa Cruz County
SCVWD	Santa Clara Valley Water District
SLP	Santa Lucia Preserve
SLOC	Santa Luis Obispo County
SWP	State Water Project
SWRCB	State Water Resources Control Board
TBSLT	The Big Sur Land Trust
TCLT	The Cambria Land Trust
TLCSLOC	The Land Conservancy of San Luis Obispo County
TBD	To Be Determined
TCFT	Tri-County Fish Team
TL	Total Length
TRT	Technical Recovery Team
TU	Trout Unlimited
TWC	The Wildlands Conservancy
TWI	The Watershed Institute (California State University, Monterey Bay)
USLTRCD	Upper Salinas-Las Tablas Resources Conservation District

USWC	Upper Salinas Watershed Coalition
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VWA	Ventana Wilderness Alliance
VSP	Viable Salmonid Population
USA	United States Army (Fort Hunter Liggett)
WCB	Wildlife Conservation Board (State of California)

## APPENDIX B Watershed Intrinsic Potential Rankings

Watershed rankings in the South-Central California Coast Steelhead DPS.<sup>1</sup> These rankings are based on the amount of potential habitat as an indicator of potential viability. Watersheds are ranked on the single habitat model that is preferred on *a priori* biological grounds. Horizontal bars show the range of ranks (minimum and maximum) for 48 variant biological models (See Boughton *et al.* 2006).



Bars indicate the range of ranks (minimum and maximum) for 48 variant models. (See Boughton *et al.* 2006).

## APPENDIX C

### COMPOSITION OF SOUTH-CENTRAL CALIFORNIA RECOVERY PLANNING AREA STEELHEAD BPGs

Watersheds identified within each of the four Biogeographic Populations Groups in the South-Central California Coast Steelhead DPS essential components of a recovery DPS. The identified watersheds are based on a combination of factors, including: 1) the amount of potential habitat as in indicator of potential viability, 2) potential diversity of life-history strategies exhibited by populations<sup>1</sup> within the watersheds, and 3) the diversity of habitat types within the watersheds. Additionally, the composition of watersheds addresses the need to ensure survival of a suite of populations within the DPS in the face of natural catastrophic events such as wildfires, droughts, and debris flows, through minimum spatial separation between and redundancy of watersheds/populations within each BPG. Watersheds are ranked on the single habitat model that is preferred on *a priori* biological grounds. Horizontal bars show the range of ranks (minimum and maximum) for 48 variant biological models (See Boughton *et al.* 2006, 2007).

<b>Biogeographic Group</b>	<b>Member Populations (ordered north to south)</b>
Interior Coast Range	Pajaro River, Gabilan Creek, Arroyo Seco, Upper Salinas Basin.
Carmel Basin	Carmel River
Big Sur Coast <sup>1</sup>	San Jose Creek, Malpaso Creek, Garrapata Creek, Rocky Creek, Bixby Creek, Little Sur River, Big Sur River, Partington Creek, Big Creek, Vicente Creek, Limekiln Creek, Mill Creek, Prewitt Creek, Plaskett Creek, Willow Creek (Monterey Co.), Alder Creek, Villa Creek (Monterey Co.), Salmon Creek.
San Luis Obispo Terrace	San Carpofo Creek, Arroyo de la Cruz, Little Pico Creek, Pico Creek, San Simeon Creek, Santa Rosa Creek, Villa Creek (SLO Co.), Cayucos Creek, Old Creek, Toro Creek, Morro Creek, Chorro Creek, Los Osos Creek, Islay Creek, Coon Creek, Diablo Canyon, San Luis Obispo Creek, Pismo Creek, Arroyo Grande Creek.

<sup>1</sup> Population delineations in these groups may be split too finely if there is significant dispersal of fish among neighboring coastal watersheds. For discussion see Boughton *et al.* 2006.

## APPENDIX D

### SOUTH-CENTRAL CALIFORNIA COAST STEELHEAD RECOVERY PLANNING AREA THREATS ASSESSMENT (CAP WORKBOOK) METHODOLOGY

#### Introduction

The Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) contracted with Hunt & Associates Biological Consulting Services to provide technical support in developing Recovery Plans for *Oncorhynchus mykiss* populations in the South-Central California Steelhead Recovery Planning Area. Hunt & Associates was tasked with reviewing existing information on *O. mykiss* habitat conditions, assessing the magnitude and extent of threats to *O. mykiss* and their habitats, and developing recovery actions across the South-Central California Recovery Planning Area. This document summarizes the methodology used to assess *O. mykiss* threats and sources of threats in South-Central California coastal watersheds from the Pajaro River in Monterey County south to, but not including the Santa Maria River, in San Luis Obispo County. Specifically, this document details the use of modified Conservation Action Planning Workbooks to assess watershed and life stage specific threats and threat sources for south-central California Coast *O. mykiss*. CAP workbooks have been developed previously for salmonid threat assessment and recovery planning for southern Oregon and northern California coast coho salmon as well as south-central and southern California steelhead. However, previous *O. mykiss* threat assessment workbooks, described in Kier Associates and National Marine Fisheries Service (2008), were not inclusive of all watersheds within the South-Central California Recovery Planning Area or all available environmental data and information. The CAP workbook analysis results presented in this recovery plan, therefore, builds on information in these earlier versions.

#### Methods

The Conservation Action Planning (CAP) Workbook is a database tool developed by The Nature Conservancy to identify conservation targets, assess existing habitat conditions, and identify management issues for target populations. CAP is a Microsoft Excel-based tool that facilitates the assessment of aquatic habitat quality and human-caused threats to that habitat. Once data are entered, the CAP workbook then links the observed aquatic habitat conditions to watershed conditions, provides a prioritized list of threats, and provides a summary of overall watershed health. The CAP Workbooks can be used to organize and evaluate large amounts of information on current *O. mykiss* habitat conditions and threats in selected watersheds. The CAP Workbook methodology provides a number of useful features in assessing the magnitude and extent of threats to *O. mykiss* and their habitats in that it:

- Incorporates both quantitative and qualitative (e.g., professional judgment) measures of existing habitat conditions;
- Is an objective, consistent tool for tracking changes in the status of each conservation target (i.e., *O. mykiss* life-history stage) over time and between watersheds;
- Provides an overall assessment of a watershed's "health" or viability and objective comparisons to other watersheds;
- Focuses recovery actions by identifying past, current, and potential threats to *O. mykiss* and their habitats;

- Becomes a central repository for documenting and updating knowledge and assumptions about existing conditions; and
- Creates a foundation upon which recovery actions can be tracked and up-dated, based on changing current conditions.

Twenty-two coastal watersheds, encompassing 46 drainages were identified as supporting historical and extant *O. mykiss* populations within the SCCCS Recovery Area by Boughton *et al.* (2006), and were selected for threats assessment analysis. A separate CAP Workbook was created for each of the 46 component drainages (Table D-1). Information on existing *O. mykiss* habitat conditions in each watershed was gathered from a broad range of published and un-published materials, including, peer-reviewed scientific publications, technical reports, federal, state, and local planning documents, EIS/EIRs, management plans, passage barrier assessments, habitat evaluations, and field surveys, as well as information provided by NOAA-NMFS staff, and stakeholders and other interested parties at a series of public workshops held in 2007.

The CAP Workbook process uses available information in an explicit, consistent, and transparent way, to assess current habitat conditions. The CAP Workbook allows the user to input quantitative as well as qualitative (including best professional judgment) information in order to determine what existing conditions are and what healthy targets should look like. The Workbook is iterative and should be updated as additional information becomes available.

*Conservation Targets:* Specific “conservation targets” for analysis within a CAP workbook must be identified by the user. The conservation targets in this case were *O. mykiss* life-history stages: egg, fry, smolt, and adult. A more general conservation target, “Multiple Life Stages,” was also established to allow landscape-scale land use and habitat assessment, based on information derived from GIS-based analysis of entire watersheds.

*Key Ecological Attributes (KEAs):* Assessing the “viability” or “health” of a particular conservation target (i.e., life-history stage) required identifying “Key Ecological Attributes” (KEA) for each target. Specific KEAs are aspects of the conservation target’s biology or ecology such that if missing or severely degraded, would result in loss of that target over time. KEAs, such as substrate quality, non-native species, food availability, water quality, *etc.*, were identified for each target and measurable indicators, such as turbidity, water temperature, aquatic invertebrate species richness, presence or absence of non-native predators, miles of road/square mile of watershed, *etc.*, were identified in order to characterize existing conditions in the component watersheds. All KEAs were grouped into three categories:

- *Size:* target abundance (e.g., number of adult *O. mykiss*);
- *Condition:* a measure of the biological composition, structure, and biotic interactions that characterize the target’s occurrence (i.e., generally a local measure of habitat quality or composition), and;
- *Landscape Context:* an assessment of the target’s environment (i.e., landscape-scale processes, such as connectivity, accessibility of spawning habitat; hydrology).

**Table D-1.** South-Central California Steelhead Recovery Planning Area Component Biogeographic Population Groups, Watersheds, and Corresponding CAP Workbooks.

<b>Biogeographic Population Group</b>	<b>Watershed (North to South)</b>	<b>CAP Workbook</b>
<b>Interior Coast Range</b>	Pajaro River	Main stem Pajaro River
		Uvas Creek
	Lower Salinas Basin	Main stem Salinas River
		Gabilan Creek
		Arroyo Seco
	Upper Salinas Basin	San Antonio River
Nacimiento River		
<b>Carmel River Basin</b>	Carmel River	Carmel River
<b>Big Sur Coast</b>	San Jose Creek	San Jose Creek
	Garrapata Creek	Garrapata Creek
	Bixby Creek	Bixby Creek
	Little Sur River	Little Sur River
	Big Sur River	Big Sur River
	Willow Creek	Willow Creek
	Salmon Creek	Salmon Creek
<b>San Luis Obispo Terrace</b>	San Carpofofo Creek	San Carpofofo Creek
	Arroyo de la Cruz	Arroyo de la Cruz
	Little Pico Creek	Little Pico Creek
	Pico Creek	Pico Creek
	San Simeon Creek	San Simeon Creek
	Santa Rosa Creek	Santa Rosa Creek
	Morro Creek	Morro Creek
	Morro Bay Estuary	Chorro Creek
		Los Osos Creek
	San Luis Obispo Creek	San Luis Obispo Creek
	Pismo Creek	Pismo Creek
Arroyo Grande Creek	Arroyo Grande Creek	

*Current Indicators:* The range of variation found for each indicator was then subdivided into four somewhat subjective, but discrete, categories: “Poor,” “Fair,” “Good,” or “Very Good.” The current condition of a specific indicator, taken from a field measurement, literature source, or professional judgment, is assigned to one of these four discrete rating categories. A description of indicators used in the CAP steelhead analyses and the rationale for these indicators is available in Kier Associates and National Marine Fisheries Service (2008). Functionally; however, we assumed that there are essentially two states for an indicator as it relates to the target: 1) “poor-fair,” in which the indicator exceeds or minimally meets the requirements for species survival and the population is in danger of extirpation, and 2) “good-very good,” where habitat conditions are favorable for species persistence.

The CAP Workbook can use indicators at a local, regional, and landscape-scale. For example, land use indicators, such as density of roads per square mile of watershed, has been widely employed as a landscape-scale metric of watershed “health” for salmonids throughout the western United States (see Kier Associates and NMFS, 2008). These landscape-scale metrics were used in this threat assessment to overcome logistical and analytical problems inherent in local-scale metrics of *O. mykiss* habitat quality (e.g., water temperature), that exhibit extreme spatial and temporal variation, which can lead to misinterpretations.

The goal of establishing measurable indicators in a number of instances was not possible with the current knowledge of existing habitat conditions in the component watersheds. For example, turbidity is known to be an important habitat indicator for *O. mykiss*. For the *O. mykiss* fry life stage, turbidity was defined as the “number of days turbidity exceeded 25 NTUs.” Currently, there is little or no systematic and widespread collection of turbidity data in most of the subject watersheds drainages to permit a quantitative assessment of this indicator. In these instances, subjective information, such as observations of mass wasting of slopes, descriptions of point and non-point sediment input, *etc.*, were used to qualitatively assess a current condition and rating for this indicator. Because the CAP Workbook analysis is iterative, results can be improved as better quantitative information becomes available.

*Stresses and Sources of Stress (Threats):* An important step in the CAP Workbook assessment, and the purpose of these analyses, is identification of a series of stresses to each *O. mykiss* life-history stage. These stresses are basically altered KEAs and directly affect the life-stage, *e.g.*, degraded hydrologic function, increased turbidity, presence of non-native predators, increased substrate embeddedness). Because of the lack of field derived information on specific habitat requirements (*i.e.*, tolerances) and specific habitat conditions, the GIS-based surrogate variables used for the “Multiple Life Stages” conservation target actually are sources of stress, not direct stressors on *O. mykiss* life stages (*e.g.*, increased road density (a source of stress) contributes indirectly to increased turbidity (a direct stressor). The severity (very high, high, medium, or low) and geographic scope (very high, high, medium, and low) of each stress was determined through a review of existing information. The CAP Workbook then assigns an overall stress rank (very high, high, medium, or low) to that stress.

The CAP Workbook automatically inputs the overall rank of each stress into a table that relates the stress to a series of anthropogenic sources of stress (also called Threats) that have been identified by the user as relevant to that watershed (*e.g.*, roads, grazing practices, logging, recreational facilities, agricultural conversion of watershed lands, dams, groundwater extraction, in-channel mining, *etc.*). Each threat is ranked on the basis of its relative “contribution” (very high, high, medium, or low) and “irreversibility” (very high, high, medium, or low) to each stress (*e.g.*, increased turbidity). The CAP Workbook then ranks the threat (source of stress) as “Very High,” “High,” “Medium,” or “Low” and inputs that rank into the next step of the assessment. This process is repeated for each conservation target (egg, fry, juvenile, smolt, and adult), as well as the “Multiple Life Stages” conservation target.

*Summary of Threats:* The CAP Workbook ranks the threat sources for each conservation target (*i.e.*, life-history stage) from the previous analysis into a “Summary of Threats” table that lists all the threat sources for all life-history stages and assigns a composite “Overall Threat Rank” to each threat source (*e.g.*, dams and surface water diversions), as well as an overall threat rank to that watershed for all threat sources combined. The Workbook derives a second table (“Stress Matrix”) that shows the rank of each stress on each life-history stage. The final step in the steelhead CAP assessment is the derivation of a third table entitled, “Overall Viability Summary,” that ranks the viability of each life-history stage and KEA category (size, condition, and landscape context) by calculating a composite rank of the current habitat indicators from the “Viability” table of the workbook, as well as an overall “Project Biodiversity Health Rank,” which is a measure of watershed “health” based on current habitat conditions. The first and third summary tables proved the most useful in analyzing stresses and sources of stress to *O. mykiss* in the SCCCS Recovery Planning Area.

*Data Gaps.* The tables in the CAP Workbooks for the present study have numerous blank cells. Blank cells indicate a lack of available information. Watersheds that have been intensively studied have fewer blank

cells than watersheds with few studies. However, an important feature of the CAP Workbook methodology is the ability to update the assessment as information becomes available. In the interim, professional judgment must be used to address such gaps until such time as field derived, quantitative data is available.

The CAP Workbooks analyses prepared by Kier Associates are intended to complement, not duplicate, those prepared by Hunt & Associates. During the initial stages of CAP Workbook analyses by Hunt & Associates, it was determined that, in some cases, surrogate indicators covering regional spatial scales and derived from GIS-based watershed analysis, might be useful in overcoming the spatial and temporal problems associated with habitat indicators that rely on point-data measurements (such as water temperature, turbidity, riparian corridor width and composition, *etc.*). A separate conservation target category “Multiple Life Stages” was developed for the CAP Workbook analyses that used GIS-based surrogate indicators.. Surrogate indicators, such as density of roads per square mile of watershed, density of roads within 300 feet of streams per square mile of watershed, human population density, percent of watershed converted to agriculture; percent of watershed converted to impervious surfaces, percent of watershed burned in past 25 years, and others provided a general measure of existing watershed conditions as they affect multiple steelhead life-history stages. For example, road density, especially riparian road density, and percent of watershed as impervious surface, has strong predictive power of general habitat conditions for steelhead because paved surfaces have manifold adverse effects on habitat quality, water quality, and hydrology of streams.

Hunt & Associates’ workbooks are based on review of a large number and broad range of ground-based steelhead surveys, habitat and barrier assessments, and other fieldwork, as well as the GIS-based indicators for the “Multiple Life-History” target category developed by Kier Associates. Hunt & Associates developed CAP Workbooks for 73 drainages across both Steelhead Recovery Planning Areas (27 for the South-Central California Steelhead DPS and 46 for the Southern California Steelhead DPS). Kier Associates analyzed 54 drainages across both steelhead DPSs (23 for the South-Central California Steelhead DPS and 31 for the Southern California Steelhead DPS), using the GIS-based regional indicators and on a small number of point-data measurements (such as dissolved oxygen, water temperature, *etc.*). Kier Associates’ workbooks are provided as a separate document (Kier Associates and NMFS, 2008).

Table D-2 compares the results of the two documents for watersheds in the SCCCS Recovery Planning Area. It should be noted that the difference between a “Poor” and “Fair” habitat rating or a “Good” and “Very Good” rating is often a matter of professional judgment and may always not represent important differences in habitat quality. Table D-2 explains discrepancies between “Poor-Fair” and “Good-Very Good” categories between the Hunt & Associates and Kier Associates CAP Workbook analyses.

Discrepancies typically could be explained by the type (point-data measurements) and the number of indicators used in the analysis by Kier Associates versus Hunt & Associates. As the number of indicators decreases, the relative weight given to each indicator in the analysis correspondingly increases, and if these indicators are based on point-data measurements, such as water temperature or dissolved oxygen, that exhibit extreme spatial and temporal variation, then different results can be obtained. Aside from these relatively few specific differences, the results of the two assessments closely agree.

Further refinement of individual threat severity and threat sources in specific watersheds was conducted for these threat assessments by using information from NOAA staff familiar with these watersheds to override certain final assessments.

**Table D-2.** Variation in Assessments of Overall Habitat Conditions for Steelhead in Component Watersheds in the South-Central California Steelhead Recovery Planning Area Between Two CAP Workbook Analyses\*

Watershed	Steelhead Habitat Rating		Reasons for Discrepancy
	Hunt & Associates	Kier Associates	
Pajaro River			Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life-history stage viability
Lower Salinas River			
Upper Salinas River			
Carmel River			
San Jose Creek			Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life-history stage viability
Garrapata Creek			Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life-history stage viability
Bixby Creek			
Little Sur River			
Big Sur River			<b>Difference in rating floodplain connectivity and number of available indicators used in analysis</b>
Willow Creek			
Salmon Creek			<b>Natural barrier (waterfall) in lower reach is limit of anadromy. Kier rates entire watershed as poor on this basis; Hunt &amp; Associates rates only accessible reach.</b>
San Carpoforo Creek			
Arroyo de la Cruz			
Little Pico Creek			
Pico Creek			<b>Kier includes point measurements for dissolved oxygen for fry, juvenile, and smolt life stages (rated as “poor”); difference in number of available indicators</b>
San Simeon Creek			
Santa Rosa Creek			<b>Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life- history stage viability</b>

Morro Creek	Yellow	Yellow	
Chorro Creek	Yellow	Red	Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life-history stage viability
Los Osos Creek	Yellow	Red	Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life-history stage viability
San Luis Obispo Creek	Yellow	Yellow	
Pismo Creek	Red	Red	
Arroyo Grande Creek	Yellow	Red	Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life-history stage viability

\* Overall habitat condition rating taken from "Project Biodiversity Health Rank" rating in "Overall Viability Summary" table in Summary section of individual CAP Workbooks (composite rating of habitat conditions for all steelhead life-history stages combined). Watersheds analyzed only by Hunt & Associates are not shown.

\*\* Pervasive discrepancies between Hunt & Associates vs. Kier Associates "poor" and "fair" categories here are due to fewer number of indicators used in the latter analyses.

Key: dark green = very good conditions; light green = good conditions; yellow = fair conditions; red = poor conditions.

The full CAP Workbooks, with references, are available upon request to NOAA Fisheries Southwest Regional Office, Long Beach, CA.

## APPENDIX E

### RECOVERY ACTION COST ESTIMATES FOR STEELHEAD RECOVERY PLANNING

#### Introduction

The ESA provides that “recovery plans, shall, to the maximum extent practicable . . . incorporate in each plan . . . (iii) . . . estimates of the time required and the cost to carry out those measures needed to achieve the plan’s goal and to achieve intermediate steps toward that goal.” NMFS interim recovery planning guidance (2010) further provides that, “There may be extreme cases in which estimating the date and cost to recovery is not possible due to uncertainty in what actions will need to be taken to recover the species.” The precision of any recovery cost estimate is necessarily governed by the specificity of the recovery action, and the availability of information regarding the costs of individual components of that recovery action (labor, materials, logistics, geographic scope and duration, etc.).

As noted in the Recovery Plan, there are many uncertainties regarding the recovery of South-Central California Coast steelhead, ranging from fundamental biological questions about the ecology of the species, to anticipated changes in climate. The Recovery Plan identifies categories of systemic threat sources within individual watersheds across the DPS but, because of the large number of individual threats (from site-specific activities to general land-use practices), does not provide a detailed assessment of each specific threat, and in many cases calls for further investigations to more clearly characterize and assess threats which are believed to be of particular significance for the conservation of the species (*e.g.*, fish passage barrier inventories, flows restrictions, introduction exotic species, and degradation of estuarine and other habitat types). Because of the uncertainties regarding specific aspects of the life history of steelhead (*e.g.*, relationship between anadromous vs. resident reproductive life history cycles), the Recovery Plan also provides provisional viability criteria, and identifies important research and monitoring needed to better illuminate the biological requirements of the species and thereby better refine the viability criteria, and related recovery actions.

The recovery action tables (Tables 9-4 through 13-10) developed for each BPG within the DPS identify broadly conceived recovery actions for each major threat source in all the core populations (as well as providing a priority ranking for recovery action within each core watershed). These recovery actions are based on the general recovery action descriptions contained in Chapter 8, Summary DPS-Wide Recovery Actions, Table 8.2 (Recovery Action Glossary). However, implementation of the recovery actions will require detailed background studies, and in some cases, engineering and other types of site-specific plans and/or environmental documentation, to further refine the nature, scope and other relevant details of the recovery action. Within the limits of these information constraints, an effort has been made to identify, within an order of magnitude, the estimated cost of the basic types of recovery actions.

#### Cost Estimation Method

The following describes the methods by which cost of individual types of recovery actions were estimated.

NMFS's Southwest Region has utilized a series of assumption tables for costs derived initially from the Southwest Region's *Habitat Restoration Cost References for Salmon Recovery Planning* (Thompson and Pinkerton 2008). These assumption tables have been adjusted to the extent practicable to reflect conditions in South-Central California Coast Steelhead DPS, and applied across the DPS.

The "Cost of Doing Business" is estimated on a staff-time basis. When staff is required for review only, the cost is attributed to the initial fiscal year; when implementation is intended, the staff time is annually attributed across the projected duration of the recovery action. All other costs are estimated on a per project, per area, or per distance basis.

Finally the cost estimates provided in the cost assumption tables are the direct costs of implementing each recovery action, and do not reflect indirect costs, or benefits (e.g., benefits to the local economy stemming from restored habitats that support recreational activities, reducing flood hazards, improving water quality, etc.).

### **Agricultural Development**

The costs for implementing a plan to minimize runoff from agricultural activities were derived by estimating the number of river or stream miles running through agriculturally-zoned or agriculturally-designated lands in each BPG using Geographic Information Systems (GIS). After applying a cost per linear mile, project costs were then projected over a twenty-year period. (See Assumptions and Categories Tables 15 and 19.)

### **Dams and Diversions**

The costs to execute recovery actions associated with dams and diversions were calculated using the CalFish.org mapping tool. This tool allows the determination of the number of dams/diversions across the BPG and assigns costs according to passage barrier severity. While this method may be useful for small dams and diversion, the modification or removal of large dams is highly dependent on site-specific conditions and cannot be accurately estimated without extensive technical and planning studies. (Refer to Assumptions and Categories Tables 4 and 5 for cost identities).

### **Other Passage Barriers**

Culvert replacement costs were calculated based on the assumption that a minimum of one culvert would need to be replaced in each identified watershed, or sub-watershed, annually for the first five years of Recovery Plan implementation. (See Assumptions and Categories Table)

### **Groundwater Management**

Groundwater management costs are made based on hiring one staff scientist to assess current groundwater management practices, and identify steps, if necessary, to modify practices to address potential threats. After the first year, the scientist position is dropped to 'Cost of Doing Business'. Sediment assessments are initially calculated by stream length and then on a per mile basis. (See Assumptions and Categories Tables 1, 2, and 19.)

## **Flood Control**

The costs for levee and channelization-related recovery actions are estimated by using GIS to perform a dimensional analysis of parameters such as stream length, acreage, etc. Based on these results, costs are assigned on a per mile or per acre basis. As with large dams and diversion, while this method may be useful for facilities, the modification removal of large flood control works is highly dependent on site-specific conditions and cannot be accurately estimated without extensive technical and planning studies. Federal, state and local flood control works, as well as actions such as “minimize herbicide use near levees” are considered to be “Cost of Doing Business”. (See Assumptions and Categories, Tables 1, 12 and 13.)

## **Mining and Quarrying**

The cost estimates for aggregate mining operations are made based on hiring one staff biologist to make an initial assessment of current mining practices, and identify steps, if necessary, to modify practices to address potential threats. After the first year, the position is considered to be ‘Cost of Doing Business’. (See Assumptions and Categories, Tables 1 and 2).

## **Non-Native Species**

Non-native species recovery actions consist of several distinct activities, including assessment, control, education and outreach, as well as development of monitoring programs. The costs for controlling and removing non-native species are derived on a per acre basis and a staff time scenario. The education and outreach costs are based on per program scenarios. The monitoring program costs were based on hiring a biological scientist for one year to develop a monitoring program, and then transitioning that cost into a “Cost of Doing Business” scenario. (See Assumptions and Categories, Tables 2, 17 and 18.)

## **Urban Development**

The costs for recovery actions focused on urban development threat sources were calculated based on the hiring of an Urban Regional Planner under a staff-time scenario for the first year. To assess the adequacy of current land-use planning standards and programs, and to identify step, if necessary, to address potential inadequacies. After the first year, the cost reverts to “Cost of Doing Business”. Managing effluents and storm drains were considered to be annual maintenance scenarios and “Cost of Doing Business”. (See Assumptions and Categories, Table 1.)

## **General Planning**

The costs associated with reviewing and updating General Plans or Local Coastal Plans, and more focused plans such as transportation, recreation, and water quality plans were all considered to be “Cost of Doing Business”. (See Assumptions and Categories, Table 1.)

## **Wildfires**

Public agencies are assumed to be responsible for fuel and equipment required for wildfire planning and management, as is required by the Endangered Species Act for the protection of listed species, including steelhead. Therefore, all costs associated with wildfire planning and management throughout the DPS are considered to be “Cost of Doing Business”. (See Assumptions and Categories, Tables 1 and 2.)

## Upslope/Upstream Activities

The costs for estuarine restoration recovery actions designed to deal with a variety of upslope/upstream activities were made on a per acre basis using a staff-time scenario. Costs are based on a combination of GIS dimensional analysis to determine currently existing estuarine areas as well as factoring in the percentage of historical estuarine area that still remains. The restoration of coastal estuaries is highly dependent on site-specific conditions and cannot be estimated without extensive technical and planning studies. (See Assumptions and Categories, Tables 2 and 16.)

## Regional Cost Estimate Tables: Categories and Assumptions

Table 1. Cost of Doing Business (CDB)	
Action Type	Cost Representation
CDB: Enough Staff Available	0
CDB: Inadequate Funding/Staff	0 <sup>1</sup>
Over and Above CDB	FTEs <sup>2</sup>

<sup>1</sup>Defer to IRM action where additional FTEs accounted for

<sup>2</sup>See Bureau of Labor Statistics, FTE assumption table (2008) for costs.

Table 2. Staff Time <sup>2</sup>		
Occupation	Wage <sup>1</sup> (\$/hr.)	Annual Wage (\$/FTE)
Biologist	33	68030
Biologist Technician	20	40900
Fish and Game Warden	27	56030
Police/Sheriff Patrol Officers	25	52810
Forest Fire Inspectors/ Prevention	18	36400
Forest and Conservation Workers	13	26110
Urban and Regional Planners	30	62400
Physical Scientists (all others)	44	91850

<sup>1</sup> Seasonal

<sup>2</sup>Source: Bureau of Labor Statistics, 2009

Table 3. Groundwater Management <sup>1</sup>	
Action	Cost (\$/gage) & (\$/year)
Installation of State/Private Gage	26136
Installation of USGS Gage	29545
Annual Maintenance of State/Private Gage	7955
Annual Maintenance of USGS Gage	3409

<sup>1</sup>Source: Dem-WRB Streamflow Committee, 2004

<b>Table 4. Fish Passage Improvement (\$/Project)<sup>1</sup></b>				
<b>Stream Crossing</b>	<b>Land Use</b>			
	<b>Forest</b>	<b>Agriculture</b>	<b>Suburban</b>	<b>Urban</b>
Tributary: Total Barrier	63,636	159,090	318,181	556,818
Tributary: Partial/Temporal Barrier	31,818	79,545	159,090	278,409
Stream : Total Barrier	159,090	381,818	556,818	795,454
Stream: Partial/Temporal Barrier	79,545	190,909	278,409	397,727

<sup>1</sup>Source: CDFG 2004 (p. 1-16)

<b>Table 5. Dam Removal<sup>1</sup></b>	
<b>Dam Height</b>	<b>Cost (\$/foot)</b>
< 15'	568,181
>15'	17,045
unknown height: complete barrier	1,022,727
unknown height: partial/temporal/unknown barrier	511,363

<sup>1</sup>Source: CDFG 2004 (p. 1.11)

<b>Table 6. Bridge Construction<sup>1</sup></b>	
<b>Bridge Type</b>	<b>\$/sq. ft. of decking</b>
RC Slab	191
RC Box Girder	170
CIP/PS Slab	168
CIP/PS Box Girder	298
PC/PS "I" Girder	231
PC/PS Bulb "T" Girder	239
Average	216

Source: DOT, 2008.

<b>Table 7. Replacing a Culvert</b>	
<b>New Type of Crossing</b>	<b>Average Cost (\$)</b>
Bridge <40ft	51,546
Bridge >40ft	103,093
Bottomless/Open Bottom Arch	193,961
Natural Bottom Pipe Arch	215,776
Box Culvert	248,352

Source: NMFS 2008, p. 11-15

<b>Table 8a. Road Upgrade/Road Decommissioning<sup>1</sup></b>	
<b>Location</b>	<b>Cost (\$/mile)</b>
California	18,104
California	93,279
<b>Table 8b. Road Construction (for relocation purposes)<sup>2</sup></b>	
<b>Type of Road</b>	<b>Cost (\$/mile)</b>
Non paved: two directional 12' shared path	175,000
Undivided 2-lane rural road w/ 5' paved shoulders	1,713,000

<sup>1</sup> Source: NMFS 2008, p. 43-44

<sup>2</sup> Source: DOT 2010

<b>Table 9. New Fish Ladder<sup>1</sup></b>	
<b>Waterway Size</b>	<b>Cost (\$)</b>
Large	1,022,727
Small	568,181

<sup>1</sup> Source: NMFS 2008, p. 9

<b>Table 10. Culvert Replacement (\$/Culvert)<sup>1</sup></b>				
<b>Size of Waterway</b>	<b>Road Type</b>			
	<b>Forest Road</b>	<b>Minor 2 Lane</b>	<b>Major 2 Lane</b>	<b>Hwy 4+ Lane</b>
Small (0-10')	31,976	87,209	174,419	319,767
Medium (10-20')	87,209	220,930	319,767	436,047
Large (20-30')	133,721	267,442	406,977	813,953

<sup>1</sup>Source: NMFS 2008, p. 10

<b>Table 11. Storm Drain Retrofit<sup>1</sup></b>	
<b>Action</b>	<b>Cost (\$/filter) or (\$/program)</b>
Catch Basin/Filter Installation	98
Annual Maintenance Program	6452

<sup>1</sup>Source: Kosciusko County 2002

<b>Table 12. LWD/Instream Restoration<sup>1*</sup></b>	
<b>Stream Type</b>	<b>Cost (\$/mile)</b>
Small, Rocky	68,182
Large, Rocky	159,091

<sup>1</sup>Source: CDFG 2004, p. 1.23 – 1.24

\*includes 5 yrs. of monitoring/maintenance and 10% administrative fee

<b>Table 13. Channel Restoration<sup>1</sup></b>	
<b>Type</b>	<b>Cost (\$/mile)</b>
Large scale reach restoration	4,217,623

<sup>1</sup>Source: NMFS 2008, p. 27

<b>Table 14. Riparian Planting</b>			
<b>Materials/Site Accessibility</b>	<b>Site Preparation Costs (\$/acre)<sup>1</sup></b>		
	<b>Flat/Light Clearing</b>	<b>Average Clearing</b>	<b>Steep/Heavy Clearing</b>
Low Cost	17,442	40,698	93,023
Medium Cost	26,163	63,954	110,465
High Cost	46,512	78,488	1,366,279

<sup>1</sup>Source: NMFS 2008, p. 32

<b>Table 15. Bank Stabilization<sup>1</sup></b>	
<b>Distance From Road (miles)</b>	<b>Cost (\$/foot)</b>
0.25 - 0.5	284
0.5 - 1	313
1 - 2	341
2 - 3	369
> 3	398

<sup>1</sup>Source: NMFS 2008, p. 38

<b>Table 16. Estuary Restoration<sup>1</sup></b>	
<b>Project Type</b>	<b>Cost (\$/acre)</b>
Small: tide gate removal, culvert upgrade, tidal salt marsh restoration	6000
Medium: automated tide gates, culverts, 500 feet of new dikes	67000
Large: automated tide gates, excavation of fill, re-vegetation	20000

<sup>1</sup>Source: Coastal Resources Management Council 2010

<b>Table 17. Education and Outreach Programs<sup>1</sup></b>	
<b>Type</b>	<b>Cost (\$)</b>
General Education and Outreach	76,136
Coho Specific Education	55,682

<sup>1</sup> Source: CDFG 2004, p. 1.42

<b>Table 18. Removal of Invasive Plant Species</b>	
<b>Invasive Species</b>	<b>Cost (\$/acre)</b>
Average	8028

<sup>1</sup>Source: Neil 2002

<sup>2</sup>Source: Bennet 2007 (average cost)

<sup>3</sup>Source: U.S. FWS 2001

<sup>4</sup>Source: Northern California Conservation Center 2010

<b>Table 19. Sediment Assessments<sup>1</sup></b>	
<b>Location</b>	<b>Cost (\$/mile)</b>
Average all assessments in CA	1,240

<sup>1</sup>Source: NMFS 2008, p. 61-62

**BPG: Core 1 and 2 Population Cost Estimate**

<b>BPG</b>	<b>FY 1-100 Total Costs</b>	<b>Core 1 Populations</b>	<b>Core 1 FY 1-100 Costs</b>	<b>Core 2 Populations</b>	<b>Core 1 + 2 FY 1-100 Costs</b>
Interior Coast Range	242,520,445	Pajaro River Salinas River	96,590,000	No Core 2 populations identified	N/A
Carmel River Basin	114,797,765	Carmel River	114,797,765	No Core 2 populations identified	N/A
Big Sur Coast	11,213,090	San Jose Creek Little Sur River Big Sur River	6,860,035	Garrapata Creek Bixby Creek Willow Creek Salmon Creek	4,353,055
San Luis Obispo	195,751,920	San Simeon Creek Santa Rosa Creek Pismo Creek San Luis Obispo Creek Arroyo Grande Creek	80,471,285	San Carpoforo Arroyo de la Cruz Little Pico Creek Pico Creek Morro Creek Morro Bay Estuary (Chorro Creek, Los Osos Creek)	115,280,635

**Table 20. BPG: Core 1 and 2 Population Cost Estimates****Funding Recovery Actions**

Many of the recovery actions identified in the recovery action tables are intended to restore basic ecosystem processes and function such as more natural hydrologic conditions, water quality, and riparian and estuarine habitats. These actions will, in many cases, serve to restore multiple native species and associated human uses of these natural resources. As a result, such activities may be eligible for funding from multiple funding sources at the federal, state, and local levels.

Federal funding sources include:

- NOAA/ NMFS Restoration Center Community-Based Restoration Program
- NOAA/ NMFS Restoration Center Open Rivers Initiative
- NOAA/ NMFS Proactive Species of Concern Grant Program
- NOAA National Sea Grant College Program
- NOAA Coastal and Estuarine Land Conservation Program
- NOAA/ ACOE/ USFWS/ EPA/ NRCS Estuary Habitat Restoration Program
- EPA Wetlands Protection Grants and Near Coastal Waters Programs
- US. Department of Transportation Highway Bridge Rehabilitation and Replacement Program
- U.S. Fish and Wildlife Service National Coastal Wetlands Conservation Grant Program
- U.S. Fish and Wildlife Service Coastal Program
- U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program
- U.S. Fish and Wildlife Service North American Wetland Conservation Act

- National Resource Conservation Service
- Federal Highway Administration – Road Aquatic Species Passage Funding

State funding sources include:

- California Department of Fish and Game Pacific Coast Salmon Restoration Fund
- California Coastal Conservancy Proposition 84 Funds
- California Coastal Conservancy Community Wetland Restoration Grants
- California Wildlife Conservation Board
- California State and Regional Water Quality Control Board Clean Water Grant Program
- California Integrated Watershed Management Grant Program Proposition 50 Funds
- California Department of Parks and Recreation Habitat Conservation Fund
- CalTrans Environmental Enhancement and Mitigation Program
- U.C. California/ NOAA California Sea Grant College Program

In addition to federal and state funding sources, there are also numerous private national, regional and local funding sources for South-Central California habitat restoration projects, such as:

- National Fish and Wildlife Foundation

Many of these grant programs also offer technical assistance, including project planning, design, permitting, monitoring. Additionally, regional personnel with NOAA, California Department of Fish and Game, and the U.S. Fish and Wildlife Service can provide assistance and current information on the status of individual grant programs.

## APPENDIX F

### Pesticide Application Best Management Practices

Application of pesticides requires site specific assessment, taking into account a variety of factors including the nature and density of the pest to be controlled, the timing, weather and soil conditions, the proximity to water courses, drainage patterns, and the sensitivity of species not targeted for control or elimination through the application of pesticides. Listed below are a number of best management practices and considerations intended to guide the application of pesticides in watersheds supporting anadromous fishes. For up-to-date information on pesticide use in California see California Department of Pesticide Regulation 2012a, 2012b:

- Select the lowest toxicity pesticide necessary to control the targeted species. Research the products by consulting Material Safety Data Sheets, EPA registration documents, or other sources of information that provide ecological toxicity data (e.g. No Observable Effect Concentrations (NOEC), Lethal Concentration 50% (LC50)). Avoid using materials for which such data is unavailable.
- Apply pesticides in a manner that prevents migration from the application area and exposure of listed anadromous fish and their habitat components (e.g., aquatic invertebrates or native riparian plant species).
- Applications within riparian areas (e.g., for invasive plant control) should be made with backpack sprayers, hand-held wands or other devices that give the applicator maximum control of the spraying. If this is not possible, apply the product using the largest droplet size possible to control drift. Have a dedicated observer to monitor for drift of the pesticide.
- Use a non-toxic dye to assist in identifying spray coverage and pesticide drift whenever needed.
- Use a hand-held anemometer or on-site weather station to monitor wind speeds during applications. Do not rely on visual estimation methods.
- Whenever possible, apply pesticides when listed species are not present, and maximize avoidance of reproductive or juvenile life-history stages.
- Avoid indiscriminate drifting of pesticide products into riparian areas or waterways. If applying to properties adjacent to water bodies with anadromous fish, ensure sufficient riparian vegetation is present to serve as a screen against potential drift.
- Utilize aquatic approved formulations of pesticides rather than terrestrial formulations in riparian areas or where pesticide drift into a water body may occur.
- Capture all runoff from areas using higher levels of pesticides (e.g., some agricultural crops, golf courses) and retain the runoff long enough for the pesticides to degrade to safe levels.

Treat runoff if necessary through aeration or other means. Settle out and

- Use non-chemical control methods (e.g., cleaning orchards of fallen or leftover fruit to prevent overwintering of pests) to minimize pesticide applications.
- Monitor for pests before spraying to ensure that the application of pesticides is necessary.
- Avoid adding adjuvants such as surfactants (e.g., R-11, polyoxyethyleneamine (POEA)) or synergists (e.g., piperonyl butoxide (PBO), N-octyl bicycloheptene dicarboximide (NGK 264)) to the pesticides' active ingredients unless toxicity information for these adjuvants is known and they can be safely used. Adjuvants may be more toxic to nontarget organisms such as fish and aquatic invertebrates than the pesticide active ingredient itself.
- To select the least toxic alternative, research the toxicity of adjuvants in a manner similar to the pesticide active ingredient.
- Avoid broadcast applications of pesticides to large areas or areas bordering impermeable surfaces. Utilize spot treatments.
- Promote careful use of granular formulations of pesticides when they are needed, especially by the general public. Pesticide concentrations are often highest immediately downstream of urbanized areas. Replace granular applications with other methods (e.g., spot treatments for weeds, spraying

retain sediments, if possible, for selected pesticides.

around the foundation of a building as an insect barrier rather than treating the entire property).

- Avoid the application of pesticides within 48 hours of predicted rain. (This timeframe may vary greatly depending upon the pesticide selected.)
- Avoid “water-in” granular pesticides to lawn or turf applications if another application type (e.g., spray products) can be utilized. Avoid generating pesticide runoff.
- Avoid planting or promoting known invasive plants such as Giant Reed (*Arundo donax*), Tamarisk (*Tamarix ramosissima*), Water primrose (*Ludwigia uruguayensis*), Water hyacinth (*Eichhornia* spp.), German ivy (*Senecio mikanioides*), Creeping myrtle or Common periwinkle (*Vinca minor*), Pampas grass (*Cortaderia jubata*), Spanish broom (*Spartium junceum*), etc. that frequently become the target of control programs using herbicides.

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**LITERATURE AND REFERENCES CITED**

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- Adadia-Cardoso, A., A. J. Clemento, and J. C. Garza. 2011. Discovery and characterization of single-nucleotide polymorphisms in steelhead/rainbow trout, *Oncorhynchus mykiss*. *Molecular Ecology Resources* 11(Sup1):31-49.
- Abdul-Aziz, O. L., N. J. Mantua, K. W. Myers. 2011. Potential climate change impacts on thermal habitats of Pacific salmon (*Oncorhynchus* spp.) in the North Pacific Ocean and adjacent seas. *Canadian Journal of Fisheries and Aquatic Sciences* 68(9):1660-1680.
- Adams, P., L. B. Boydstun, S. P. Gallagher, M. K. Lacy, T. McDonald, K. E. Shaffer. 2011. *California Coastal Salmonid Population Monitoring: Strategy, Design, and Methods*. Fish Bulletin No. 180. California Department of Fish and Game.
- Adkison, M. D. 1995. Population differentiation in Pacific salmon: local adaptation, genetic drift, or the environment? *Canadian Journal of Fisheries and Aquatic Sciences* 52:2762-2777.
- Agostinho, A. A., L. C. Gomes, D. R. Fernandez, and H. I. Suzuki. 2002. Efficiency of fish ladders for Neotropical ichthyofauna. *River Research and Applications* 18:299-306.
- Alagona, P. S., S. D. Cooper, M. Stoecker, and P. Beedle. 2011. *Documenting the Historic Distribution of Steelhead and Rainbow Trout (Oncorhynchus mykiss) in the Santa Ynez River, Santa Barbara County*. Prepared for the National Marine Fisheries Service, Southwest Regional Office, Protected Resources Division.
- Allen, L., D. J. Pondella II, M. H. Horn (eds.). 2006. *The Ecology of Marine Fishes: California and Adjacent Waters*. University of California Press.
- Allen, M. 1986. *Population Dynamics of Juvenile Steelhead Trout in Relation to Density and Habitat Characteristics*. Master's Thesis, Humboldt State University, Arcata.
- Allen, M. 2007. *Aquatic Habitat and Fish Population Assessment of San Luisito Creek, San Luis Obispo County, California*. Prepared by Thomas R. Payne & Associates for County of San Luis Obispo Public Works Department.
- Allen, M. 2001. *Aquatic Habitat Suitability for Oncorhynchus mykiss in the Upper Arroyo Grande Basin, San Luis Obispo County, California*. Prepared by Thomas R. Payne & Associates for County of San Luis Obispo Public Works Department.
- Allendorf, F. W., D. Bayles, D. L. Bottom, K. P. Currens, C. A. Frissell, D. Hankin, J. A. Lichatowich, W. Nehlsen, P. S. Trotter, and T. H. Williams. 1997. Prioritizing Pacific salmon stocks for conservation. *Conservation Biology* 11:140-152.
- Alley Associates. 1992. *Instream Flow Analysis of Steelhead Spawning Habitat Between the Scarlett Narrows and San Clemente Dam, Carmel River, Monterey County, California, 1991*. Prepared for the Monterey Peninsula Water Management District.
- Alley Associates. 1996. *Instream Flow Analysis of Steelhead Spawning Habitat to be Inundated or Blocked on the Carmel River and Danish Creek by the Proposed New Los Padres Dam, Upstream of the Existing Los Padres Dam, Monterey County, California, 1995*. Prepared for the Monterey Peninsula Water Management District.
- Alley Associates. 1997. *Baseline Sampling, Water Quality Monitoring and Observation of Lagoon Conditions Before Sandbar Breaching at Carmel River Lagoon, Monterey County, California 1996, Prior to Excavation of the South Arm*. Prepared for Smith and Reynolds, Erosion Control, Inc.

- Alley, Associates. 1998. *Determination of Weighted Usable Spawning Area for Steelhead in Two Stream Segments – the Scarlett Narrows to San Clemente Dam and Between San Clemente and Los Padres Dams, Carmel River, Monterey, County, California, 1998*. Prepared for the Monterey Peninsula Water Management District.
- American Rivers. 2002. *The Ecology of Dam Removal: A Summary of Benefits and Impacts*. American Rivers.
- Anderson, H., M. Hoover, and K. Reinhart. 1976. *Forests and Water: Effects of Forest Management on Floods, Sedimentation, and Water Supply*. U.S. Forest Service, Pacific Southwest Forest and Range Experiment. Station General Technical Report PSW-GTR-18.
- Anderson, T., C. Clark, Z. Croyle, J. Maas-Baldwin, K. Urquhart, F. Watson. 2008. *Carmel River Lagoon Water Quality and Steelhead Soundings: Fall 2007*. Publication No. WI-2007-04. The Watershed Institute. California State University, Monterey Bay.
- Ankenbrandt, L. G. 1988. *The Phylogenetic Relationship of the Pacific Fishes Contained in the Teleost Genera Oncorhynchus and Salmo Based on Restriction Fragment Analysis of Mitochondrial DNA*. Master's Thesis, University of Washington.
- Annear, T., D. Lobb, C. Cooner, M. Woythal, C. Hendry, C. Estes, and K. Williams. 2009. *International Instream Flow Program Initiative: A Status Report and Provincial Fish and Wildlife Agency Instream Flow Activities and Strategies for the Future*. Final Report for Multi-State Conservation Grant Project WY M-7-T. Instream Flow Council, Cheyenne, WY.
- Araki, H. B., W. R. Ardren, E. Olsen, B. Cooper, and M.S. Blouin. 2007a. Reproductive success of captive-bred steelhead in the wild: evaluation of three hatchery programs in the Hood River. *Conservation Biology* 21:181-190.
- Araki, H. B., B. Cooper, and M. S. Blouin. 2007b. Genetic effects of captive breeding cause a rapid, cumulative fitness decline in the wild. *Science* 318:100-103.
- Araki, H. B., B. A. Berejikian, M. J. Ford, and M.S. Blouin. 2008. Fitness of hatchery-reared salmonids in the wild. *Evolutionary Applications* 1:342-355.
- Araki, H. B., Cooper, and M. S. Blouin. 2009. Carry-over effect of captive breeding reduces reproductive fitness of wild-born descendants in the wild. *Biology Letters, Conservation Biology*. The Royal Society.
- Archer, D. 2007. *Global Warming: Understanding the Forecast*. Blackwell Publishing.
- Archer, D. and R. Pierrehumbert. 2011. *The Warming Papers: The Scientific Foundation for the Climate Change Forecast*. Wiley-Blackwell.
- Arthington, A. H., R. J. Naiman, M. E. McClain, and C. Nilsson. 2010. Preserving the biodiversity and ecological services of rivers: new challenges and research opportunities. *Freshwater Biology* 55:1-16.
- Aspen Institute. 2002. *Dam removal: A New Option for a New Century*. Aspen Institute Program on Energy, the Environment, and the Economy.
- Atkinson, K. J. 2010. *Habitat Conditions and Steelhead Abundance and Growth in a California Lagoon*. Master's Thesis. San Jose State University.
- Atkinson, K. J. Fuller, C. Hanson, B. Trush. 2011. *Evaluating Water Temperature and Turbidity Effects on Steelhead Life History Tactics in Alameda Creek Watershed. Technical Memorandum*. Prepared for Alameda Creek Fisheries Restoration Group.
- Aubin-Horth, N. C. R. Landry, B. H. Letcher, and H. A. Hofmann. 2005. Alternative life histories shape brain gene expression profiles in males of the same population. *Proceedings of the Royal Society* 272:1655-1662.

- Augerot, X. 2005. *Atlas of Pacific Salmon: The First Map-Based Status Assessment of Salmon in the North-Pacific*. University of California Press.
- Avise, J. C. 2000. *Phylogeography: The History and Formation of Species*. Harvard University Press.
- Aydin, K. Y., G. A. McFarlane, J. R. King, B. A. Megrey, and K. W. Myers. 2005. Linking oceanic food webs to coastal production and growth rates of Pacific salmon (*Oncorhynchus* spp.) using model on three scales. *Deep-Sea Research II* 52 (2005):757–780.
- Babbitt, Bruce. 1998. A river runs against it: Americas evolving view of dams. *Open Space Quarterly* 1(4):8-13.
- Backland, P., A. Janetos, and D. Schimel. 2008. *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States*. Synthesis and Assessment Product 4.3. Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research.
- Baglivio, E. A. 2012. *Comparing the Demographics of Two Steelhead Populations and Their Habitat Characteristics*. Master's Thesis. California Polytechnic University, San Luis Obispo.
- Baker, M. B. and G. H. Roe. 2009. The shape of things to come: Why is climate change so predictable? *Journal of Climate* 22:4574-4589.
- Baker, M. B. Jr., P. Ffolliotte, L. DeBano, and D. Neary. 2004. *Riparian Areas of the Southwestern United States: Hydrology, Ecology, and Management*. CRC Press.
- Bakke, P. 2008. *Physical Processes and Climate Change: A Guide for Biologists*. U.S. Fish and Wildlife Service - Western Washington FWO.
- Bakun, A. 1990. Global climate change and intensification of coastal upwelling. *Science* 247:198-201.
- Baldwin, D.H., Spromberg, J.A., Collier, T.K., and Scholz, N.L. 2010. A fish of many scales: extrapolating sublethal pesticide exposures to the productivity of wild salmon populations. *Ecological Applications* 19:2004-2015.
- Baltz, D. and P. Moyle. 1984. Segregation by species and size classes of rainbow trout, *Salmo gairdneri*, and Sacramento sucker, *Catostomus occidentalis*, in three California streams. *Environmental Biology of Fishes* 10:101-110.
- Barbour, M., J. Gerritsen, B. Snyder, and J. Stribling. 1999. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish*, 2<sup>nd</sup> ed. U.S. Environmental Protection Agency, Office of Water, Washington, D.C., EPA 841-B-99-002.
- Barbour, M. T. Keller-Wolf, and Alan A. Schoenherr (eds.). 2007. *Terrestrial Vegetation of California*. University of California Press.
- Barbour E. and L. Kueppers. 2008. *Conservation and Management of Ecological Systems in a Changing California*. Public Policy Institute of California.
- Barnas, K. and S. L. Katz. 2010. The challenges of tracking habitat restoration at various spatial scales. *Fisheries* 35(5):232-241.
- Barnhart, R. 1986. Species profiles: *Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Pacific Southwest) - Steelhead*. U.S. Fish and Wildlife Service Biological Report No. 82. U.S. Army Corps of Engineers Technical Report. EL-82-421.
- Barnhart, R. A. 1991. Steelhead (*Oncorhynchus mykiss*). In: J. Stolz and J. Schnell (eds.). *Trout*. Stackpole Books.

- Barnett, L. A. K. and B. C. Spence. 2011. Freshwater Survival of Stranded Steelhead Kelts in Coastal Central California Streams. *North American Journal of Fisheries Management*. 31(4): 757-764.
- Barnett, T. P., D. W. Piece, H. G. Hidalgo, C. Bonfils, B. D. Santer, T. Das, G. Bala, A. W. Wood, T. Nozawa, A. A. Mirin, D. R. Cayan, and M. D. Dettlinger. 2008. Human induced changes in the hydrology of the western United States. *Science* 319:1080-1083.
- Barratt and the Carmel Valley Historical Society. 2010. *Images of America: Carmel Valley*. Arcadia Publishing.
- Barton, H. H, D. E. G. Brings, J A. Eisen, D. B. Goldstein, N H. Patel. 2007. *Evolution*. Cold Spring Harbor Laboratory Press.
- Battin J., M. W. Wiley, M. H. Ruckelshaus, R. N. Palmer, E. Korb, K. K. Bartz, and H. Imaki. 2007. Projected impacts of climate change on salmon habitat restoration. *Proceedings of the National Academy of Sciences* 104:6720-6725.
- Batzer, D. P. and R. R. Shartz. 2006. *Ecology of Freshwater and Estuarine Wetlands*. University of California Press.
- Bazin, E. S. Glemin, and N. Galtier. 2006. Population size does not influence mitochondrial genetic diversity in animals. *Science* 312(5773):570-572.
- Beakes, M. P., W. H. Satterthwaite, E. M. Collins, D. R. Swank, J. E. Merz, R. G. Titus, S. M. Sogard, M. Mangel. 2010. Smolt transformations in two California steelhead populations: effects of temporal variability in growth. *Transactions of the American Fisheries Society* 139:1263-1275.
- Beacham, R. D. and C. B. Murray. 1990. Temperature, egg size, and development of embryos and alevins of five species of Pacific salmon: a comparative analysis. *Transactions of the American Fisheries Society* 119:927-945.
- Beacham, R. D. and C. B. Murray. 1993. Fecundity and egg size variation in North American Pacific salmon (*Oncorhynchus*). *Journal of Fish Biology* 42:485-508.
- Bean, G. S. 2007. *Geologic Controls on Channel Morphology and Low-Flow Habitat at Rattlesnake Creek, Santa Barbara, California*. Master's Thesis, Department of Geological Sciences, University of California, Santa Barbara.
- Beck, M. W., K. L. Heck Jr., K. W. Able, D. L. Childers, D. B. Eggelston, B. M. Gillanders., B. N. Halpern, C. G. Hays, K. Hoshindo, T. J. Minello, R. J. Orth, P. F. Sheridan, and M. P. Weinstein. 2001. The Identification, conservation, and management of estuarine and marine nurseries for fish and invertebrates: a better understanding of the habitats that serve as nurseries for marine species and the factors that create site-specific variability in nursery quality will improve conservation and management of these areas. *BioScience*. 51(8):633-641.
- Becker, G., I. Reining, and D. Asbury. 2008. *Steelhead/Rainbow Trout (Oncorhynchus mykiss) Resources South of the Golden Gate, California*. Center for Ecosystem Management and Restoration. Prepared for California Coastal Conservancy and the Resources Legacy Foundation.
- Bednarek, A. T. 2001. Undamming rivers: a review of the ecological impacts of dam removal. *Environmental Management* 27(6):803-814.
- Bedworth, L. and E. Hanak. 2008. *Preparing California for a Changing Climate*. Public Policy Institute.
- Beechie, T. and S. Bolton. 1999. An approach to restoring salmonid habitat forming processes in Pacific Northwest watersheds. *Fisheries* 24:6-15.
- Beechie, T. J., D. A. Sear, J. D. Olden, G. R. Pess, G. J. M. Buffington, H. Moir, P. Roni, and M. M. Pollock. 2010. Process-based principles for restoring river ecosystems. *BioScience* 60:209-222.

- Beissinger, S. R. and M. I. Westphal. 1998. On the use of demographic models of population viability in endangered species management. *Journal of Wildlife Management* 62:821-841.
- Belchik, M., D. Hellemeir, and R. M. Pierce. 2004. *The Klamath Fish Kill of 2002: Analysis of Contributing Factors*. Yurok Tribal Fisheries Program.
- Bell, C. E., J. M. DiTomaso, and M. L. Brooks. 2009. *Invasive Plants and Wildfires in Southern California*. University of California, Division of Agriculture and Natural Resources. Publication 8397.
- Bell, E., R. Dagit, and F. Ligon. 2011. Colonization and persistence of a southern California steelhead (*Oncorhynchus mykiss*) population. *Southern California Academy of Sciences Bulletin* 110(1):1-16.
- Bell, E., S. M. Albers, J. J. Kruz, and R. Dagit. 2011. Juvenile growth in a population of southern California steelhead (*Oncorhynchus*). *California Fish and Game* 97(1):25-35.
- Bell, J. L., L. C. Sloan, and M. A. Snyder. 2004. Regional changes in extreme climatic events: a future climate scenario. *Journal of Climate* 17(1):81-87.
- Bell, J. L., Lisa C. Sloan, 2006. CO<sub>2</sub> sensitivity of extreme climate events in the western United States. *Earth Interactions* 10:1-17.
- Bell, M. A., D. J. Futuyama, W. F. Eanes, and J. S. Levinton (eds.). 2010. *Evolution Since Darwin: The First 150 Years*. Sinauer Associates, Inc.
- Belt, G. H. Buffer strip design for protecting water quality and fish habitat. *Western Journal of Applied Forestry* 9:41-45.
- Bendix, J. and C. M. Cowell. 2010a. Fire, floods and woody debris: Interactions between biotic and geomorphic processes. *Geomorphology* 116:297-304.
- Bendix, J. and C. M. Cowell. 2010b. Impacts of wildfire on the composition and structure of riparian forest in Southern California. *Ecosystems* 13:99-107.
- Bendix, J. and C. R. Hupp. 2000. Hydrological and geomorphological impacts on riparian plant communities. *Hydrological Processes* 14:2977-2990.
- Benestad, R. E. 2006. Can we expect more extreme precipitation on the monthly time scale? *Journal of Climate* 19:630-637.
- Benke, R. 2002. *Trout and salmon of North America*. The Free Press.
- Benke, R. 1992. *Native Trout of Western North America*. Monograph. No. 6. American Fisheries Society.
- Berejikian, B. A., D. Vandoornik, J. Lee, A. LaRae and S. Tezak. 2005. The effects of current velocity during culture of reproductive performance of captively reared steelhead. *Transactions of the American Fisheries Society* 134:1236-1252.
- Berejikian, B. A., T. Johnson, R. Endicott and J. Lee-Waltermire. 2008. Increases in steelhead redd abundance result from two conservation hatchery strategies in the Hamma River. *Canadian Journal of Fisheries and Aquatic Sciences* 65:754-764.
- Berejikian, B. A., D. M. Van Doornik, J. A. Scheurer, R. Bush. 2009. Reproductive behavior and relative reproductive success of natural- and hatchery-origin Hood Canal summer chum salmon (*Oncorhynchus keta*). *Canadian Journal of Fisheries and Aquatic Sciences* 66:781-789.

- Berejikian, B. A., J. T. Gable, and D. T. Vidergar. 2011. Effectiveness and trade-offs associated with hydraulic egg collections from natural salmon and steelhead trout redds for conservation hatchery programs. *Transactions of the American Fisheries Society* 140:549-556.
- Berg, N., M. McCorison, and D. Toth. 2004. *Surface Water and Riparian Assessment: Southern California Forests*. Prepared for the USDA Forest Service Pacific Southwest Research Station, Angeles National Forest and Los Padres National Forest.
- Berg, W. J. and G. A. E. Gall. 1988. Gene flow and genetic differentiation among California coastal rainbow trout populations. *Canadian Journal of Fisheries and Aquatic Sciences* 45:122-131.
- Bernhardt, E. S., M. A. Palmer, J. D. Allan, G. Alexander, K. Barnas, S. Brooks, J. Carr, S. Clayton, C. Dam, J. Filleter-Shah, D. Galati, S. Gloss, P. Godwin, D. Hard, B. Haslett, R. Jenkinson, S. Katz, G. M. Kondolf, P. S. Lake, R. Lave, J. L. Meyer, T. K. O'Donnell, L. Pagano, B. Powell, E. Sudduth. 2005. Synthesizing U.S. river restoration efforts. *Science* 308(5722):636-637.
- Biedlman, R. G. *California's Frontier Naturalists*. University of California Press.
- Bilby, R. E., P. A. Bisson, C. C. Coutant, D. Goodman, S. Hanna, N. Huntly, E. J. Loudenslager, L. McDonald, D. P. Philipp, B. Riddell. 2005. *Viability of ESUs Containing Multiple Types of Populations*. Independent Scientific Advisory Board for the Northwest Power and Conservation Council, Columbia River Watershed Indian Tribes, and NOAA Fisheries.
- Biotic Resources Group, Dana Bland & Associates, Swanson Hydrology & Geomorphology, and John Dvorksy. 2006. *Arroyo Grande Creek Flood Control Project. Biotic Assessment – Final*. Prepared for the County of San Luis Obispo.
- Bjornn, T. C. and D. W. Reiser. 1991. Habitat requirements of salmonids in streams. *American Fisheries Society Special Publication* 4:91-98.
- Blakley, E. and K. Barnette. 1985. *Historical overview of Los Padres National Forest*. U.S. Forest Service, Los Padres National Forest Headquarters.
- Blahm, T. H. 1976. Effects of water diversions on fishery resources of the west coast, particularly the Pacific northwest. *Marine Fisheries Review* 38:46-51.
- Bodensteiner, W., L. Clough, S. Gilmore, P. Huntington, J. Larson, A. McMillan, S. Mack, S. Pring, E. Roth, A. Thistle, and M. Vincent. 2003. Pajaro River Watershed Flood Protection Plan. Watershed Restoration Class – Spring 2003. Watershed Institute, California State University, Monterey Bay.
- Bogan, T., O. Mohseni, and H. G. Stefan. 2003. Stream temperature-equilibrium temperature relationship. *Water Resources Research* 39.
- Bogan, T., H. G. Stefan, and O. Mohseni. 2004. Imprints of secondary heat sources on the stream temperature/equilibrium temperature relationship. *Water Resources Research* 40.
- Bonar, S. A., B. D. Bolding, M. Divens, and W. Meyer. 2005. Effects of introduced fishes on wild juvenile coho salmon in three shallow Pacific Northwest lakes. *Transactions of the American Fisheries Society* 134:641-652.
- Bond M. H. 2006. *Importance of Estuarine Rearing to Central California Steelhead (Oncorhynchus mykiss) Growth and Marine Survival*. Master's Thesis, University of California, Santa Cruz.
- Bond, M. H., C. V. Hanson, R. Baertsch, S. A. Hayes, and R. B. McFarlane. 2007. A new low-cost instream antenna system for tracking passive integrated transponder (pit)-tagged fish in small streams. *Transactions of the American Fisheries Society* 136:562-566.

- Borg, B. 2010. Photoperiodism in fishes. *In*: Nelson, R. J., D. L. Denlinger, D. E. Somers (eds.). *Photoperiodism: The Biological Calendar*. Oxford University Press.
- Bossard, C., J. Randall, and M. Hoshovky (eds.). 2000. *Invasive Plants of California's Wildlands*. University California Press.
- Boughton, D. A. 2007. Memo to Russell Strach, Assistant Regional Administrator for Protected Resources, NMFS, Long Beach, Craig Wingert, Supervisory Fishery Management Specialists, NMFS, Long Beach, and Mark H. Capelli, Recovery Coordinator, South-Central/Southern California Recovery Domain, Santa Barbara re: review of comments on the draft viability report of the Technical Recovery Team for the South-Central/Southern California Recovery Domain. NOAA, Southwest Fisheries Science Center.
- Boughton, D. A. 2009. Estimating the size of steelhead runs by tagging juveniles and monitoring migrants. *North American Journal of Fisheries Management* 30:89-101.
- Boughton, D. A. 2010a. *A Forward-Looking Frame of Reference for Steelhead Recovery on the South-Central and Southern California Coast*. NOAA Technical Memorandum NMFS-SWFSC TM-466.
- Boughton, D. A. 2010b. *Some Research Questions on Recovery of Steelhead on the South-Central and Southern California Coast*. NOAA Technical Memorandum NMFS-SWFSC-TM 467.
- Boughton, D. and H. Fish. 2003. *New Data on Steelhead Distribution in Southern and South-Central California*. NOAA, Southwest Fisheries Science Center.
- Boughton, D., H. Fish, K. Pipal, J. Goin, F. Watson, J. Casagrande, J. Casagrande, and M. Stoecker. 2005. *Contraction of the Southern Range Limit for Anadromous *Oncorhynchus mykiss**. NOAA Technical Memorandum NMFS-SWFSC TM-380.
- Boughton, D. and M. Goslin. 2006. *Potential Steelhead Over-Summering Habitat in the South-Central/Southern California Recovery Domain: Maps Based on the Envelope Method*. NOAA Technical Memorandum NMFS-SWFSC TM-391.
- Boughton, D., P. Adams, E. Anderson, C. Fusaro, E. Keller, E. Kelley, L. Lentsch, J. Neilsen, K. Perry, H. Regan, J. Smith, C. Swift, L. Thompson, and F. Watson. 2006. *Steelhead of the South-Central/Southern California Coast: Population Characterization for Recovery Planning*. NOAA Technical Memorandum NMFS-SWFSC TM-394.
- Boughton, D., M. Gibson, R. Yedor, and E. Kelly. 2007a. Stream temperature and the potential growth and survival of juvenile *Oncorhynchus mykiss* in a southern California creek. *Freshwater Biology* 52:1353-1364.
- Boughton, D., P. Adams, E. Anderson, C. Fusaro, E. Keller, E. Kelley, L. Lentsch, J. Neilsen, K. Perry, H. Regan, J. Smith, C. Swift, L. Thompson, and F. Watson. 2007b. *Viability Criteria for Steelhead of the South-Central and Southern California Coast*. NOAA Technical Memorandum NMFS-SWFSC TM-407.
- Boughton, D., H. Fish, J. Pope and G. Holt. 2009. Spatial patterning of habitat for *Oncorhynchus mykiss* in a system of intermittent and perennial stream. *Ecology of Freshwater Fish* 18:92-105.
- Bower, D., D. M. Hannah, and G. R. McGregor. 2004. Techniques for assessing the climate sensitivity of river flow regimes. *Hydrological Processes* 18:2115-2543.
- Boydston, L. B. 1973. *Steelhead Management in California with Emphasis on the Years 1969-1972*. Technical Report. Anadromous Fisheries Branch. California Department of Fish and Game.
- Bradford, M. J., R. A. Myer, and J. R. Irwin. 2000. Reference points for coho salmon (*Oncorhynchus kisutch*), harvest rates and escapement goals based on freshwater production. *Canadian Journal of Fisheries and Aquatic Sciences* 57:677-686.

- Brandt, S. A. 2000. Classification of geomorphological effects downstream of dams. *Catena* 40:375-401.
- Brett, J. R. 1971. Energetic responses of salmon to temperature – study of some salmon (*Oncorhynchus nerka*). *American Zoologist* 11:99-113.
- Brinson, M., L. J. MacDonnell, D. J. Austen, R. L. Beschta, T. A. Dillaha, D. L. Donahue, S. V. Gregory, J. W. Harvey, M. C. Molles, E. I. Rogers, and J. A. Stanford. 2002. *Riparian Areas: Functions and Strategies for Management*. Committee on Riparian Zone Functioning and Strategies for Management, Water Science and Technology Board. National Research Council. National Academy Press.
- Broecker, W. 2010. *The Great Ocean Conveyor: Discovering the Trigger for Abrupt Climate Change*. Princeton University Press.
- Brostrom, J. K., C. W. Luzier, and K. Thompson. 2010. *Best Management Practices to Minimize Effects to Pacific Lamprey (Entosphenus tridentatus)*. Prepared for U.S. Fish and Wildlife Service and U.S. Forest Service.
- Brown, L. R., R. H. Gray, R. H. Hughes, and M. R. Meador (eds.). 2005. *Effects of Urbanization on Stream Ecosystems*. American Fisheries Society Symposium 47.
- Brown, L. R., S. D. Chase, M. G. Mesa, R. J. Beamish, and P. Moyle (eds.). 2009. *Biology, Management and Conservation of Lampreys in North America*. American Fisheries Society Symposium 72.
- Brown, W. S. 1945. History of the Los Padres National Forest 1998 – 1945. Prepared for the U.S. Forest Service, Los Padres National Forest.
- Buchanan, D. V., J. E. Sanders, J. L. Zinn, and J. L. Fryer. 1983. Relative susceptibility of four strains of summer steelhead to infection by *Ceratomyxa shasta*. *Transactions of the American Fisheries Society* 112:541-543.
- Buffington, J. M., D. R. Montgomery, and H. M. Greenberg. 2004. Basin-scale availability of salmonid spawning gravel as influenced by channel type and hydraulic roughness in mountain catchments. *Canadian Journal of Fisheries and Aquatic Sciences* 61:2085-2096.
- Bunn, S. E. and A. H. Arthington. 2002. Basic principles and ecological consequences of altered flow regimes for aquatic biodiversity. *Environmental Management* 30:492-507.
- Burgner, R. L. 1980. Some features of ocean migrations and timing of Pacific salmon. In: McNeil, W. J. and D. C. Himsworth (eds.). *Salmonid Ecosystems of the North Pacific*. Oregon State University Press.
- Burgner, R. L. J. T. Light, L. Margolis, T. Okazaki, A. Tautz, and S. Ito. 1992. *Distribution and Origins of Steelhead Trout (Oncorhynchus mykiss) in Offshore Waters of the North Pacific Ocean*. International North Pacific Fisheries Commission Bulletin No. 51.
- Burgy, R. 1968. *Hydrologic Studies and Watershed Management on Brushlands*. Annual Report. No. 8, 1966-1967. Department Water Science and Engineering, University of California, Davis.
- Burroughs, W. J. 2003. *Weather Cycles: Real or Imaginary*. Cambridge University Press.
- Burroughs, W. J. 2005. *Climate Change in Prehistory: The End of the Reign of Chaos*. Cambridge University Press.
- Busby, P. B., T. C. Wainwright, G. Bryant, L. J. Lierheimer, R. S. Waples, F. W. Waknitz, and I. V. Lagomarsino. 1996. *Status Review: West Coast Steelhead from Washington, Idaho, Oregon, and California*. NOAA Technical Memorandum NMFS-NWFSC-27.
- Butler, R. L. and D. P. Borgeson. 1965. *California "Catchable" Trout Fisheries*. Fish Bulletin No. 127. California Department of Fish and Game.
- Cada, G. F. and J. J. Sale. 1993. Status of fish passage facilities at nonfederal hydropower projects. *Fisheries* 18:4-12.

- Cada, G. F. and J. E. Francfort. 1995. Examining the benefits and costs of fish passage and protection measures. *Hydro Review* 14(1):47-55.
- Cairns, J., G. R. Best, P. L. Brezonik, S. R. Carpenter, G. D. Cooke, D. L. Hey, J. A. Kusler, C. L. Schelske, L. Shaman, R. R. Sharitz, S. Sorooshian, R. E. Sparks, J. T. B. Tripp, D. E. Willard, and J. B. Zedler. 1992. *Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy*. Committee on Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy Water Science and Technology Board. National Research Council. National Academy Press.
- Caissie, D. 2006. The thermal regimes of rivers: a review. *Freshwater Biology* 51:1389-1406.
- California Coastal Conservancy. 2004. *Inventory of Barriers to Fish Passage in California's Coastal Watersheds. Conducted and Compiled by the Coastal Conservancy, Michael Bowen, Project Manager*.
- California Conservation Corps. 2005. *San Luis Obispo County Stream Crossing Inventory and Fish Passage Evaluation*. Prepared for Greenspace The Cambria Land Trust.
- California Department of Fish and Game. 1997. *Electrofishing Sampling Results for San Luis Obispo Creek, San Luis Obispo County*. Prepared for California Department of Fish and Game, Region 3.
- California Department of Fish and Game. 2003. *Atlas of the Biodiversity of California*. California Department of Fish and Game.
- California Department of Fish and Game. 2005. *Summary Report. Coast Road Watershed Erosion and Restoration Planning Project*. Monterey County, CA. Contract GS-C/P469. Prepared for the Monterey County Department of Public Works.
- California Department of Fish and Game. 2011a. 2011-12 *Freshwater Sportfishing Regulations*. California Department of Fish and Game.
- California Department of Fish and Game. 2011b. *Passage Assessment Data Base*. California Department of Fish and Game.
- California Department of Fish and Game and National Marine Fisheries Service. 2001. *Final Report on Anadromous Fish Hatcheries in California*. Joint Hatchery Review Committee. December 3, 2001.
- California Department of Fish and Game. 2004. Recommended Guidelines for Recovery Hatcheries. *In: Recovery Strategy for California Coho Salmon*. Report to the California Department of Fish and Game. Prepared by the California Department of Fish and Game. Species Recovery Strategy 2004-1.
- California Department of Fish and Game and U.S. Fish and Wildlife Service. 2010. *Final Hatchery and Stocking Program EIR/EIS*. State Clearing House #20008082025. Prepared by ICF Jones and Stokes.
- California Department of Parks and Recreation. 2008. *Initial Study Mitigated Negative Declaration. Carmel River State Beach Lagoon Water Level Management Project*. California Department of Parks and Recreation, Monterey District.
- California Department of Pesticide Regulation. 2012a. *Surface Water Protection Program Database*. Available via <http://www.cdpr.ca.gov/>
- California Department of Pesticide Regulation. 2012b. *Pesticide Information Portal, Pesticide Use Report (PUR) Data*. Available via <http://calpip.cdpr.ca.gov>
- California Department of Water Resources. 1978. *Land Use Within the California Coastal Zone*. Vol. 207.

- California Department of Water Resources. 1988. *Dams Within the Jurisdiction of the State of California*. Bulletin 17-88.
- California Hatchery Scientific Review Group. 2012. *California Hatchery Review. Statewide Report*. Prepared for the U.S. Fish and Wildlife Service and Pacific States Marine Fisheries Commission.
- California Regional Water Quality Control Board, Central Coast Region. 1999. *Salinas River Watershed Management Action Plan*.
- California State Water Resources Control Board. 2010. *Policy for Maintaining Instream Flows in Northern California Coastal Streams*. Division of Water Rights. State Water Resources Control Board.
- Capelli, M. H. 2007. San Clemente and Matilija Dam Removal: Alternative Sediment Management Scenarios. *Proceedings, U.S. Society on Dams*. USSD Annual Meeting, March 5-9, 2007, Philadelphia, Pennsylvania.
- Capelli, M. H. 2009. Memorandum to File: Maria Ygnacio Creek *O. mykiss* Mortalities, Jesusita Fire, Santa Barbara, May 15, 2009. National Marine Fisheries Service, Southwest Region, Protected Resources Division.
- Capelli, M. H. and S. J. Stanley. 1984. Preserving riparian vegetation along California's south central coast. In: Warner, R. E. and K. M. Hendrix (eds.). *California Riparian Systems: Ecology, Conservation, and Productive Management*. University of California Press.
- Carlson, J. M. and J. Doyle. 2002. Complexity and robustness. *Proceedings of the National Academy of Sciences of the United States of America* 99:2538-2545.
- Carlson, S. R. L. G. Coggins Jr., and C. O. Swanton. 1998. A simple stratified design for mark-recapture estimation of salmon smolt abundance. *Alaska Fishery Research Bulletin* 5(2):88-102.
- Carmel River Coalition. 2007. *Final Study Plan for Long Term Adaptive Management of the Carmel River State Beach and Lagoon*.
- Carmel River Watershed Conservancy. 2004. *Watershed Assessment and Action Plan of the Carmel River Watershed, California*. Prepared pursuant to the Costa-Machado Water Act of 2000.
- Casagrande, J. 2001. *How Does Land Use Affect Sediment Loads in Gabilan Creek*. Undergraduate Thesis, California State University, Monterey Bay.
- Casagrande, J. 2003. *Hydrology and Water Quality of the Carmel and Salinas Lagoons, Monterey Bay, California*. Report No. WI-2003-14. The Watershed Institute. California State University, Monterey Bay.
- Casagrande, J. 2006. *Wetland Habitat Types of the Carmel River Lagoon*. Report No. WI-2006-05. The Watershed Institute. California State University, Monterey Bay.
- Casagrande, J. M. 2010a. *Distribution, Abundance, Growth and Habitat Use of Steelhead in Uvas Creek, California*. Master's Thesis. San Jose State University.
- Casagrande, J. M. 2010b. *Historic and Current Status of Steelhead and Barriers to Migration in the Gabilan Watershed*. The Watershed Institute. California State University, Monterey.
- Casagrande, J. R. 2010. *Aquatic Ecology of San Felipe Lake, San Benito County, California*. Master's Thesis. San Jose State University.
- Casagrande, J. 2011. *Aquatic Species Habitat Assessment of the Upper Pajaro River Basin, Santa Clara and San Benito Counties, California: Summer 2011*. Prepared for The Nature Conservancy.
- Casagrande, J. 2012. *Uvas and Llagas Creek Juvenile Steelhead Distribution and Abundance, 2011*. Prepared for the National Marine Fisheries Service, Southwest Region, Santa Rosa.
- Casagrande, J., J. Hager, F. Watson, and M. Angelo. 2003. *Fish Species Distribution and Habitat Quality for Selected Streams of the Salinas Watershed: Summer/Fall 2002*. Report No. WI-2003-02. The Watershed Institute. California State University, Monterey Bay.

- Casagrande, J. and D. Smith. 2005. *Garrapata Creek Watershed Steelhead Barrier Assessment*. The Watershed Institute. Report No. WI-2005-02.
- Casagrande, J. and D. Smith. 2006. *Garrapata Creek Lagoon, Central Coast, California: A Preliminary Assessment, 2005-06*. The Watershed Institute. Report No. WI-2006-01.
- Casagrande, J. and F. Watson. 2006. *Reclamation Ditch Watershed Assessment and Management Strategy: Part A – Watershed Assessment*. Monterey County Water Resources Agency and the Watershed Institute. California State University, Monterey Bay.
- Castello, A. F. and M. L. Shelton. 2004. Winter precipitation on the U.S. Pacific Coast and El Nino-Southern Oscillation Events. *International Journal of Climatology* 24:481-497.
- Castro, J. 2005. *Geomorphic Impacts of Culvert Replacement and Removal: Avoiding Channel Incision*. United States Fish and Wildlife Service, Oregon Fish and Wildlife Office, Portland.
- Caudill, C. C., W. R. Daigle, M. L. Keefer, C. T. Boggs, M. A. Jepson, J. J. Burke, R. W. Zabel, T. C. Bjornn, and C. A. Peery. 2007. Slow dam passage in adult Columbia River salmonids associated with unsuccessful migration: delay negative effects of passage obstacles or condition-dependent mortality? *Canadian Journal of Fisheries and Aquatic Sciences* 64:979-995.
- Cayan, D. P. 2006. *Scenarios of Climate Change in California*. 2006. California Climate Change Center. University of California, Berkeley.
- Cayan, D., E. Maurer, M. Dettinger, M. Tyree, K. Hayhoe. 2008a. Climate change scenarios for the California region. *Climatic Change* 87(Suppl. 1):21-42.
- Cayan, D., P. Bromirski, K. Hayhoe, M. Tyree, M. Dettinger, R. Flick. 2008b. Climate Change Projections of Sea Level Extremes along the California Coast. *Climatic Change* 87(Suppl. 1): 57-73.
- Cayan, D., M. Tyree, M. Dettinger, H. Hidalgo, T. Das, E. Maurer, P. Bromirski, N. Graham, and R. Flick. 2009. *Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment*. California Climate Change Center, University of California, Berkeley.
- Cederholm, C., J. D. H. Johnson, R. E. Bilby, L. G. Dominguez, A. M. Garrett, W. H. Graeber, E. L. Greda, M. D. Kunze, B. G. Marcot, J. F. Palmisano, R. W. Plotnikoff, W. G. Percy, C. A. Simenstad, and P. C. Trotter. 2000. *Pacific Salmon and Wildlife - Ecological Contexts, Relationships, and Implications for Management*. Special Edition Technical Report. Prepared for Washington Department of Fish and Wildlife.
- Central Coast Salmon Enhancement. 2005. *Arroyo Grande Creek Watershed Management Plan*. Prepared for the California Department of Fish and Game.
- Central Coast Salmon Enhancement. 2008. *Nacitone Watersheds Management Plan: Water Resources Analysis Summary Report*. Prepared for the Monterey County Water Resources Conservation District.
- Central Coast Salmon Enhancement. 2009. *Arroyo Grande Watershed Management Plan Update*. Prepared for the California Department of Fish and Game.
- Chan, K. M. A., M. R. Shaw, D. R. Cameron, E. C. Underwood, and G. C. Daily. 2006. Conservation planning for ecosystem services. *PLoS* 4(11):2138-2152.
- Chiang, C. Y. 2008. *Shaping the Shoreline: Fisheries and Tourism on the Monterey Coast*. University of Washington Press.
- Chandler, G. L. and T. C. Bjornn. 1988. Abundance, growth, and interactions of juvenile steelhead relative to time of emergence. *Transactions of the American Fisheries Society* 117:432-443.
- Changnon, S. A. (ed.). 2000. *El Nino 1997-1998: The Climate Event of the Century*. Oxford University Press.

- Chilcote, M. W. 2003. Relationship between natural productivity and the frequency of wild fish in mixed spawning populations of wild hatchery steelhead (*Oncorhynchus mykiss*). *Canadian Journal of Fisheries and Aquatic Sciences* 60(9):1057-1067.
- Chilcote, M. W., K. W. Goodson, and M. R. Falcy. 2011. Reduced recruitment performance in natural populations of anadromous salmonids associated with hatchery-reared fish. *Canadian Journal of Fisheries and Aquatic Sciences* 68:511-522.
- Chin, A., S. Anderson, A. Collison, B. J. Ellis-Sugai, J. P. Haltiner, J. B. Hogervort, G. M. Kondolf, L. S. O'Hirok, A. H. Purcell, A. L. Riley, and W. Wohl. 2009. Linking theory and practice for restoration of step-pool streams. *Environmental Management* 43:645-661.
- Christie, M. R., M. Marine, and M. S. Blouin. 2011. Who are the missing parents? Grandparentage analysis identifies multiple sources of gene flow into a wild population. *Molecular Ecology* 10:1-14.
- Clay, C. H. 1995. *Design of Fishways and Other Fish Facilities*. Lewis Publishers.
- Clemento, A. J., E. C. Anderson, D. Boughton, D. Girman, and J. C. Garza. 2009. Population genetic structure and ancestry of *Oncorhynchus mykiss* populations above and below dams in south-central California. *Conservation Genetics* 10:1321-1336.
- Cleveland, P. A. 1995. *San Luis Obispo Creek Steelhead Trout Habitat Inventory Investigation*. Prepared for the California Regional Water Quality Control Board, Central Coast Region.
- Close, B. J. and S. Smith. 2004. *Stream Inventory Report Arroyo Grande Creek Summer 2004*. Prepared for Central Coast Salmon Enhancement.
- Cluer, B. 2004. *Sediment Removal from Freshwater Salmonid Habitats: Guidelines to NOAA Fisheries Staff for the Evaluation of Sediment Removal Actions from California Streams*. National Marine Fisheries Service, Southwest Region, Habitat Conservation Division.
- Collin, C. 1998. *Age and Growth of Steelhead Rainbow Trout (Oncorhynchus mykiss) in the Big Sur River*. Master's Thesis, Natural Resources Management Department, California Polytechnic University, San Luis Obispo.
- Colt, J. and R. J. White (eds.). 1991. *Fisheries Bioengineering Symposium*. American Fisheries Society Symposium.
- Combs, T. 1972. *The Steelhead Trout: Life-History, Early Angling, Contemporary Steelheading*. Northwest Salmon Trout Steelheader Company.
- Committee on Atlantic Salmon in Maine. 2004. *Atlantic Salmon in Maine*. National Research Council of the National Academies. National Academy Press.
- Committee on Sea Level Rise in California, Oregon, and Washington. 2012. *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*. National Academy Press.
- Cooke, S. J., S. G. Hinch, G. T. Crossin, D. A. Patterson, K. K. English, M. C. Healey, J. M. Shrimpton, G. Van Der Kraak, and A. P. Farrell. 2006. Mechanistic basis of individual mortality in Pacific salmon during spawning migrations. *Ecology* 87:1575-1586.
- Cooper, S. D. 2009. Memorandum to Mark H. Capelli, South-Central/Southern California Steelhead Recovery Coordinator, National Marine Fisheries Service re: *Fish Kill in Maria Ygnacio Creek Associated with Jesusita Fires, Santa Barbara, CA*. Department of Ecology, Evolution, and Marine Biology, University of California, Santa Barbara.

- Cooper, S., T. Dudley, and N. Hemphill. 1986. The biology of chaparral streams in southern California. In: J. Devries (ed.). *Proceedings of the Chaparral Ecosystems Research Conference*. California Water Resources Center Report No. 62.
- Coyne, J. A. and H. A. Orr. 2004. *Speciation*. Sinauer Associates, Inc.
- Crawford, S. S. and A. M. Muir. 2008. Global introduction of salmon and trout in the genus *Oncorhynchus*: 1870-2007. *Review of Fish Biology and Fisheries* 18:313-364.
- Cramer, S. and N. K. Ackerman. 2009. Prediction of stream carrying capacity for steelhead: the unit characteristic method. In: Knudsen, E. E and J. Hal Michael, R. (eds.). *Pacific Salmon Environmental Life History Models: Advancing Science for Sustainable Salmon in the Future*. American Fisheries Society Symposium 71.
- Crisp, D. T. 1988. Prediction, from temperature, of eyeing, hatching and 'swim-up' times for salmonid embryos. *Freshwater Biology* 19:41-48.
- Crisp, D. T. and P. A. Carling. 1989. Observations on siting, dimensions and structure of salmonid redds. *Journal of Fish Biology* 34:119-134.
- Cross, P. 1975. *Early Life History of Steelhead Trout in a Small Coastal stream*. Master's Thesis, Humboldt State University.
- Crozier, L., A. P. Hendry, P. W. Lawson, T. P. Quinn, N. J. Mantua, J. Battin, R. Shaw, and R. Huey. 2008. Potential responses to climate change in organisms with complex life histories: evolution and plasticity in Pacific salmon. *Evolutionary Applications* 1:252-270.
- Cucherousset, J. and J. D. Olden. 2011. Ecological impacts of non-native freshwater fishes. *Fisheries* 36(5):215-30.
- Culver, C. S., S. L. Drill, M. R. Myers, and V. T. Borel. 2009. *Early Detection Monitoring Manual for Quagga and Zebra Mussels*. California Sea Grant Extension Program. University of California Cooperative Extension.
- Cuthbert, R. S. Ainsley, and D. Demko. 2010. *Salinas Basin Rotary Screw Trap Monitoring. 2010 Final Report*. Prepared for the Monterey County Water Resources Agency.
- Cuthbert, R. S. Ainsley, and D. Demko. 2011a. *Salinas Basin Juvenile O. mykiss Outmigration Monitoring. 2011 Final Report*. Prepared for the Monterey County Water Resources Agency.
- Cuthbert, R. S. Ainsley, and D. Demko. 2011b. *Salinas Basin Adult Steelhead Escapement Monitoring. 2011 Annual Report*. Prepared for the Monterey County Water Resources Agency.
- Dahl, T. E. 1990. *Wetland Losses in the United States: 1780's to 1980's*. U.S. Department of Interior. U.S. Fish and Wildlife Service.
- Dailey, M. D., D. J. Reish, and J. W. Anderson. 1993. *Ecology of the Southern California Bight: A Synthesis and Interpretation*. University of California Press.
- Dambacher, J. M., P. A. Rossingnol, H. W. Li, and J. M. Emlen. 2001. Dam breaching and Chinook salmon recovery. *Science* 291:939.
- Daufresne, M. D. and P. Boet. 2007. Climate change impacts on structure and diversity of fish communities in rivers. *Global Change Biology* 13:2467-2478.
- Davidson, F. A. and S. J. Hutchinson. 1938. The geographical distribution and environmental limitations of the Pacific salmon (*genus Oncorhynchus*). *Bulletin of the United States Bureau of Fisheries*. No. 26.

- Davies B, and N. Bromage. 1991. The effects of fluctuating seasonal and constant water temperatures on the photoperiodic advancement of reproduction in female rainbow trout, *Oncorhynchus mykiss*. *Aquaculture* 205:183-200.
- Davis, F. W., E. A. Keller, A. Parikh, J. Florsheim. 1988, Recovery of the chaparral riparian zone after wildfire. *In: Proceedings of the California Riparian Conference*, September 22-24, 1988. U.S. Forest Service Technical Report PSW-110.
- Davis, F. W and M. I. Borchert. 2006. Central Coast Bioregion. *In: Sugihara, N. G., J. W. Van Wagendonk, K. E. Shaffer, J. Frites-Kaufman, and A. E. Thode (eds.). Fire in California's Ecosystems*. University of California Press.
- Davis, M. H. 2009. *Invasion Biology*. Oxford University Press.
- Davy, C and M. Lapointe. 2007. Sedimentary links and the spatial organization of Atlantic salmon (*Salmo salar*) spawning habitat in a Canadian Shield river. *Geomorphology* 83:82-96.
- Dawson, T P., S. T. Jackson, J. I. House, I. C. Prentice, G. M. Mace. 2011. Beyond predictions: biodiversity, conservation in a changing climate. *Science* 332:53-58.
- DeBano, L. 1991. The effect of fire on soil properties. *In: Proceedings, Management, and Productivity of Western-Montane Forest Soils*. General Technical Report. INT-280. USDA Forest Service Intermountain Res. Station, Fort Collins, CO.
- Décamps, H. 2011. River networks as biodiversity hot lines (in press). *Comptes Rendus Biologie* 2011.
- Denis Duffy & Associates, Inc. 1998. *Reconnaissance-Level Feasibility Study for the Operational Reconfiguration of Lower Carmel Valley Wells*. Prepared for California-American Water Company.
- Denise Duffy & Associates, Inc. 2003. *Big Sur River Steelhead Enhancement Plan*. Prepared for California Department of Parks and Recreation, Monterey District.
- Dennis, H., J. M. Ponciano, S. R. Lele, M. L. Taber and D. F. Staples. 2006. Estimating density dependence, process noise, and observation error. *Ecological Monographs* 76:323-341.
- Desbonnet, A., P. Pogue, V. Lee, and N. Wolf (eds.). 1994. *Vegetated Buffers in the Coastal Zone: A Summary Review and Bibliography*. CRC Press.
- Dettinger, M., H. Hildalgo, T. Das, D. Cayan, and N. Knowles. 2009 *Projections of Potential Flood Regime Changes in California*. California Climate Change Center, University of California, Berkeley.
- Dettman, D. H. 1984. *The Carmel River Lagoon and its Use by Steelhead*. Appendix A to Assessment of the Carmel River Steelhead Resource: Its Relationship to Streamflow and to Water Supply Alternatives. D. W. Kelley and Associates. Prepared for the Monterey Peninsula Water Management District.
- Dettman, D. H. 1989. *Evaluation of Instream Flow Recommendations for Adult Steelhead Upstream Migration in the Lower Carmel River*. Prepared for the Monterey Peninsula Water Management District. Technical Memorandum 89-04.
- Dettman, D. H. 1993. *Recommended Minimum Streamflow Requirements for the Reach Between the Proposed New Los Padres Reservoir and Existing San Clemente Reservoir*. Prepared for the Monterey Peninsula Water Management District. Technical Memorandum 93-03.
- Dettman, D. H. and D. W. Kelley. 1986. *Assessment of the Carmel River Steelhead Resource. Vol. 1. Biological Investigations*. Prepared for the Monterey Peninsula Water Management District.

- Dettman, D. H. and D. W. Kelley. 1987. *Assessment of the Carmel River Steelhead Resource. Vol. II. Evaluation of the Effects of Alternative Water Supply Projects on the Carmel River Steelhead Resource*. Prepared for the Monterey Peninsula Water Management District.
- DeVries, P. 1997. Riverine salmonid egg burial depth: review of published data and implications for scour studies. *Canadian Journal of Fisheries and Aquatic Sciences* 54:1685-1689.
- Diaz, R.J., and R. Rosenberg. 2008. Spreading dead zones and consequences for marine ecosystems. *Science* 321(5891):926-929.
- Dickens, C.W.S., P. M. Graham, G. De Winnaar, K. Hodgson, F. Tiba, R. Sekwele, S. Sikhakhane, F. De Moor, H. Barber-James, and K. Van Niekerk. 2008. The impacts of high winter flow releases from an impoundment on in-stream ecological processes. Report to the Water Research Commission. WRC Report No. 1307/1/08.
- Diffenbaugh, N. S, M. A. Snyder and L. C. Sloan. 2004. Could CO<sub>2</sub>-Induced Land Cover Feedbacks Alter Near-shore Upwelling Regimes? *Proceedings of the National Academy of Sciences*.
- Dill, W. A. and A. J. Cordone. 1997. *History and Status of Introduced Fishes in California, 1871-1996*. Fish Bulletin No. 178. California Department of Fish and Game.
- Dobzhansky, T. 1970. *Genetics of the Evolutionary Process*. Columbia University Press.
- Docker, M. F., and D. D. Heath. 2003. Genetic comparison between sympatric anadromous steelhead and freshwater resident rainbow trout in British Columbia, Canada. *Conservation Genetics* 4:227-231.
- Donohoe, C. J. 2007. *Maternal Origins of rainbow trout (Oncorhynchus mykiss) taken in slot fisheries on the Carmel and Nacimiento Rivers*. University of California, Santa Cruz.
- Donohoe, C. J., P. Adams, and C. C. Royer. 2008. Influence of water chemistry and migratory distance on ability to distinguish progeny of sympatric resident and anadromous rainbow trout (*Oncorhynchus mykiss*). *Canadian Journal of Fisheries and Aquatic Sciences* 65:1160-1175.
- Douglas, P. L. 1995. *Habitat Relationships of Oversummering Rainbow Trout in the Santa Ynez River Drainage*. Master's Thesis, Bren School of Environmental Management, University of California-Santa Barbara, Santa Barbara.
- Douglas, P. L., Forrester, G. E., and Cooper, S. D. 1994. Effects of trout on the diel periodicity of drifting in baetid mayflies. *Oecologia*. 98:48-56.
- Downs, P. W., and G. M. Kondolf. 2002. Post-project appraisals in adaptive management of river channel restoration. *Environmental Management* 29:477-496.
- Downs, P. W., Y. Cui, J. K. Wooster, S. R. Dusterhoff, and D. B. Booth. 2009. Managing reservoir sediment release in dam removal projects: an approach informed by physical and numerical modeling of non-cohesive sediment. *International Journal of River Management* 7(4):433-452.
- Doyle, M. W., E. H. Stanley, J. M. Harbor, and G. Grant. 2003 Dam removal in the United States: emerging needs for science and policy. *Transactions of the American Geophysical Union* 84(4):29-36.
- Drake, D. R. J. Naiman, B. Finney, and I. Gregory-Eaves. 2009. Long-term perspectives on salmon abundance: Evidence from Lake sediments and tree rings. In: Knudsen, E. E and J. Hal Michael, R. (eds.). *Pacific Salmon Environmental Life History Models: Advancing Science for Sustainable Salmon in the Future*. American Fisheries Society Symposium 71.
- Dumas, C. F., P. W. Schumann, and J. C. Whitehead. 2005. Measuring the economic benefits of water quality improvement with benefit transfer: an introduction or noneconomists. In: Brown, L. R., R. H. Gray, R. H.

- Hughes, and M. R. Meador (eds.). *Effects of Urbanization on Stream Ecosystems*. American Fisheries Society Symposium 47.
- Dunne, T. and L. Leopold. 1978. *Water in Environmental Planning*. W. H. Freeman and Company.
- Dvorksy, J. R. 2001. *The Influence of Valley Morphology and Coarse sediment Distribution on Rainbow Trout Populations in Sespe Creek, California at the Landscape Scale*. Master's Thesis, Department of Geography, University of California, Santa Barbara.
- Dvorksy, J. R. 2003. *Final Report: Steelhead Restoration Planning Project for the Morro Bay Watershed*. Submitted to Coastal San Luis Resource Conservation District by Swanson Hydrology & Geomorphology.
- D.W. Alley & Associates. 1996. *Assessment of Juvenile Steelhead Habitat and Fish Densities in Arroyo Grande Creek, San Luis Obispo County, California, 1996*. Prepared for Kronick, Moskovitz, Tiedemann and Girard. Project 141-01.
- D.W. Alley & Associates. 1997. *Assessment of Juvenile Steelhead Habitat and Fish Densities in Arroyo Grande Creek, San Luis Obispo, California, 1996*. Prepared for Kronick, Moskovitz, Tiedmann and Girard.
- D.W. Alley & Associates. 2001. *Monitoring Results for Lower San Simeon and Santa Rosa Creeks in 1997-99; Water Quality in Lagoons, Lagoon In-Flow and Fishery Resources in Lagoons, Immediately Upstream and In Van Gordon Creek, San Luis Obispo County, California*. Prepared for Cambria Community Services District. Project 100-11.
- D. W. Alley & Associates. 2006a. *Monitoring Results for Lower San Simeon and Santa Rosa Creeks, 2004-2005: Lagoon Water Quality, Fishery Resources and Inflow Near Cambria, San Luis Obispo County, California*. Prepared for the Cambria Community Services District.
- D.W. Alley & Associates. 2006b, Trends in Juvenile Steelhead Production in 1994-2005 for Santa Rosa Creek, San Luis Obispo County, California with Habitat Analysis and an Index of Adult Returns. Prepared for the Cambria Community Services District.
- D.W. Kelley & Associates. 2007. *Trends in the Juvenile Steelhead Population in 1994-2006 for San Simeon Creek, San Luis Obispo Creek, San Luis Obispo County, California, with Habitat Analysis and an Index of Adult Returns*. Prepared for the Cambria Community Services District.
- D.W. Alley & Associates. 2008. *Santa Rosa Creek Fishery Summary, Habitat Conditions, Watershed Management Guidelines and Enhancement Goals, 2008*. Prepared for The Land Conservancy of San Luis Obispo County.
- D.W. Alley & Associates. 2011. *2010 Juvenile Steelhead Densities in the San Lorenzo, Soquel, Aptos and Corralitos Watersheds, Santa Cruz County, CA; With San Lorenzo and Soquel Trend Analysis*. Prepared for the Santa Cruz County Environmental Health Department. Project 200-08a.
- Eaton, G. J. and R. M. Schaller. 1996. Effects of climate warming on fish thermal habitat in streams of the United States. *Limnology and Oceanography* 41:1109-1115.
- Ebersole, J. L., P. J. Wigington, J. P. Baker, M. A. Cairns, M. R. Church, B. P. Hansen, B. A. Miller, H. R. LaVigne, J. E. Compton, and S. G. Leibowitz. 2006. Juvenile coho salmon growth and survival across stream network seasonal habitats. *Transactions of the American Fisheries Society* 135:1681-1697.
- Edelman, G. M. and J. A. Galley. 2001. Degeneracy and complexity in biological systems. *Proceedings of the National Academy of Sciences of the United States of America* 98:1376-13768.

- Eder, K.J., C.M. Leutenegger, H.R. Kohler and I. Werner. 2009. Effects of neurotoxic insecticides on heat-shock proteins and cytokine transcription in Chinook salmon (*Oncorhynchus tshawytscha*). *Ecotoxicology and Environmental Safety* 72: 182-90.
- Elton, Charles S. 1958. *The Ecology of Invasions by Animals and Plants*. Methuen & Co. Ltd.
- Endler, J. A. 1977. *Geographical Variation, Speciation, and Clines*. Monographs in Population Biology. No. 10. Princeton University Press.
- Endler, J. A. 1986. *Natural Selection in the Wild*. Monographs in Population Biology. No. 21. Princeton University Press.
- Entrix Environmental Consultants and Denise Duffy and Associates. 2003. *An Assessment of Steelhead Access and Rearing Habitat Conditions in Upper San Jose Creek, Potrero Creek, Robinson Canyon Creek, and Upper San Clemente Creek on the Santa Lucia Preserve, Late Fall 2002*. Prepared for the Santa Lucia Preserve.
- Entrix Environmental Consultants and California American Water. 2006. *Environmental Impact Statement Report for the San Clemente Dam Seismic Retrofit Project*. 2 vols. Prepared for the California Department of Water Resources and the U.S. Army Corps of Engineers.
- Evans, E. C., G. R. McGregor, and C. E. Petts. 1998. River energy budgets with special reference to river bed processes. *Hydrological Processes* 12:575-595.
- Evarts, J. and M. Popper (eds.). 2001. *Coast Redwood: A Natural and Cultural History*. Cachuma Press.
- Ewing, L. C., J. M. Michael, R. J. McCarthy. 1989. *Planning for an Accelerated Sea Level Rise Along the California Coast*. California Coastal Commission.
- Faber, P. M., E. A. Keller, A. Sands, B. M. Massey. 1989. *The Ecology of Riparian Habitats of the Southern California Region: A Community Profile*. Biological Report 85(7.27). Prepared for the U.S. Department of the Interior Fish and Wildlife Series, Research and Development National Wetland Research Center.
- Fabry, V. J., B. A. Seibel, R. A. Feely, and J. C. Orr. 2008. Impacts of ocean acidification on marine fauna and ecosystem processes. *ICES Journal of Marine Science* 65:414-432.
- Fain, S. R. 2005. *An Assessment of the O. mykiss Population Genetics Literature Regarding Genetic Discreteness of Selected ESUs*. U.S. Fish and Wildlife Service.
- Fausch, K. D., Y. Taniguchi, S. Nakano, G. D. Grossman, and C. R. Townsend. 2001. Flood disturbance regimes influence rainbow trout invasions success among five holarctic regions. *Ecological Applications* 11(5):1438-1455.
- Fausch, K. D., B. Rieman, M. Young, and J. Dunham 2006. Strategies for conserving native salmonid populations at risk from nonnative invasions: tradeoffs in using barriers to upstream movement. General Technical Report RMSRS-GTR-174. U.S. Forest Service, Rocky Mountain Research Station.
- Feely, R. A., C. L., K. Lee, W. Berelson, J. Kleypas, V. J. Fabry, and F. J. Millero. 2004. Impact of anthropogenic CO<sub>2</sub> on the CaCO<sub>3</sub> system in the oceans. *Science* 305(5682):362-366.
- Feely, R. A., C. L. Sabine, J. Martin Hernandez-Ayton, D. Ianson, and B. Hales. 2008. Evidence for upwelling of corrosive "acidified" water onto the continental shelf. *Science* 320(5882):1490-1492.
- Felton, E. 1965. *California's Many Climates*. Pacific Books.
- Ferren, W. R., Jr., P. Fiedler, and R. Leidy. 1995. *Wetlands of the Central and Southern California and Coastal Watersheds*. Final Report. Prepared for U.S. Environmental Protection Agency, Region IX.

- Ficke, A. D., C. A. Myrick, L. J. Hansen. 2007. Potential impacts of global climate change on freshwater fisheries. *Reviews in Fish Biology and Fisheries* 17:581-613.
- Fife, D. L. and J. A. Minch (eds.). 1982. *Geology and Mineral Wealth of the California Transverse Range*. Annual Symposium and Guidebook No. 10. South Coast Geological Society.
- Finger, S. (ed.) 1997. *Toxicity of Fire Retardant and Foam Suppressant Chemicals to Plant and Animal Communities*. Final Report. Prepared for Interagency Fire Coordination Committee.
- FishXing. 2000. *FishXing software: Version 3.2*. U.S. Forest Service, Six Rivers National Forest. [www.stream.fs.fed.us/fishxing](http://www.stream.fs.fed.us/fishxing).
- Flagg, T. A. and C. E. Nash (eds.). 1999. *A Conceptual Framework for Conservation Hatchery Strategies for Pacific Salmonids*. National Marine Fisheries Service, Northwest Fisheries Science Center. NOAA Technical Memorandum NMFS-NWFSC TM-38.
- Fleming, D. F. and J. B. Reynolds. 1991. Effects of spawning-run delay on spawning migration of Arctic grayling. *American Fisheries Society Symposium* 10:299-305.
- Florsheim, J. L., E. A. Keller, and D. W. Best. 1991. Fluvial sediment transport in response to moderate storm flows following chaparral wildfire, Ventura County, southern California. *Geological Society of America Bulletin* 103:504-511.
- Flosi, G., S. Downie, J. Hopelian, M. Bird, R. Coey, and B. Collins. 2010. *California Salmonid Stream Restoration Manual*, 4<sup>th</sup> ed. State of California, The Resources Agency, California Department Fish and Game, Inland Fisheries Branch.
- Foley, P. 1994. Predicting extinction times from environmental stochasticity and carrying capacity. *Conservation Biology* 8(1):124-137.
- Foley, P. 1977. Extinction models for local populations. In: A. Hanski and M. E. Gilpin (eds.), *Metapopulation Biology: Ecology, Genetics, and Evolution*. Academic Press.
- Ford, A. 2004. *Upland Groundwater Pumping and Stream Flow, San Jose Creek, Monterey County*. Water Resources Center Archives. Hydrology. University of California, Multi-Campus Research Unit.
- Ford, M. J. 2002. Selection in captivity during supportive breeding may reduce fitness in the wild. *Conservation Biology* 16:815-825.
- Franklin, H. A. 1999. *Steelhead Migrations in the Salinas River*. Unpublished Oral History.
- Fraser, D. J. 2008. How well can captive breeding programs conserve biodiversity? A review of salmonids. *Evolutionary Applications* 1:535-586.
- Fretwell, S. J. 1972. *Populations in a Season Environment*. Monographs in Population Biology. No. 5. Princeton University Press.
- Frimpong, E. A., T. M. Sutton, K. Lim, J. Kyoung, P. J. Hrodey, B. A. Engel, T. P. Simon, J. G. Lee, and D. C. Le Master. 2005. Determination of optimal riparian forest buffer dimensions for stream biota- landscape association models using multimetric and multivariate responses. *Canadian Journal of Fisheries and Aquatic Sciences* 62:1-6.
- Fritts, A. L. and T. N. Pearsons. 2006. Effects of predations by non-native smallmouth bass on native salmonid prey: the role of predator and prey size. *Transactions of the American Fisheries Society* 135:853-860.

- Fry, D. H. 1938. Trout fishing in southern California streams – instructions for the beginner. *California Fish and Game* 24(2):84-117.
- Fry, D. H. 1973. *Anadromous Fishes of California*. California Department of Fish and Game.
- Fryer, J. 2012. /A Review of the Water Use & Water Management Alternatives in Cambria, California./ Prepared for the Cambria Land Trust.
- Fukushima, T. and P. Lesh. 1998. Adult and juvenile anadromous salmonid migration timing in California streams. *California Fish and Game* 84:133-145.
- Fukushima, M. 2001. Salmonid habitat-geomorphology relationships in low gradient streams. *Ecology* 82:1238-1246.
- Furniss, M. J., B. P. Stabb, S. Hazelhurst, C. F. Clifton, K. B. Roby, B. L. Ilhadrt, E. B. Larry, A. H. Todd, L. M. Reid, S. J. Hines, K. A. Bennett, C. H. Luce, and P. J. Edwards, 2010. *Water, Climate Change, and Forests: Watershed Stewardship for a Changing Climate*. General Technical Report PNW-GTR-812. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Gallagher, S. P. and Gallagher, C. M. 2005. Discrimination of Chinook salmon, coho salmon, and steelhead redds and evaluation of the use of redd data for estimating escapement in several unregulated streams in northern California. *North American Journal of Fisheries Management* 25:284-300.
- Gamble, L. H. 2008. *The Chumash World at European Contact. Power, Trade, and Feasting Among Complex Hunter-Gatherers*. University of California Press.
- Gamradt, S. and L. Kats. 1996. Effect of introduced crayfish and mosquitofish on California newts. *Conservation Biology* 10(1):1155-1162.
- Gamradt, S., L. Kats, and C. Anzalone. 1997. Aggression by non-native crayfish deters breeding in California newts. *Conservation Biology* 11(3):793-199.
- Garrapata Creek Watershed Council. 2006. *Garrapata Creek Watershed Assessment and Restoration Plan*. Prepared for the Garrapata Creek Watershed Community and the California Department of Fish and Game.
- Gerstung, E. R. 1973. *Fish Population and Yield Estimates from California Trout Streams*. California-Nevada Wildlife Society.
- Gibbins, C. N., M. J. Jeffries, C. Soulsby, and R. M. Acornley. 2001. Developing ecologically acceptable flow regimes for regulated rivers: a case study of Kielder reservoir and the Kielder water transfer system. *Fisheries Management and Ecology* 8:463-485.
- Gibbins, C., J. Shellberg, H. Moir, and C. Soulsby. 2008. Hydrological influences on adult salmonid migration, spawning, and embryo survival. In: Sear, D. and P. DeVries (eds.). *Salmonid Spawning Habitat in Rivers: Physical Controls, Biological Responses, and Approaches to Remediation*. American Fisheries Society Symposium 65.
- J. Gilchrist and Associates, Habitat Restoration Group, Philip Williams and Associates, Wetlands Research, and Monterey County Water Resources Agency. 1997. *Salinas River Lagoon Management and Enhancement Plan. Vol. 1: Plan Test. Vol. 2 Technical Appendices*. Prepared for the Salinas River Lagoon Task Force and Monterey County Water Resources Agency.
- Girman, D. and J. Garza. 2006. *Population Structure and Ancestry of O. mykiss Populations in South-Central California Based on Genetic Analysis of Microsatellite Data. Final Report*. Prepared for California Department. Fish and Game Project No. P0350021 and Pacific States Marine Fisheries Commission. Contribution No. AWIP-S-1.

- Glassow, M. A. L., H. Gamble, J. E. Perry, and G. S. Russell. 2007. Prehistory of the northern California bight and the adjacent transverse ranges. In: T. Jones and K. Klar (eds.). *California Prehistory: Colonization, Culture, and Complexity*. AltaMira Press.
- Gleason, M. G., S. Newkirk, M. S. Merrifield, J. Howard, R. Cox, M. Webb, J. Koepcke, B. Stranko, M. W. Beck, R. Fuller, P. Dye, D. Vander Schaaf, and J. Carter. 2011. *A Conservation Assessment of West Coast (USA) Estuaries*. The Nature Conservancy.
- Glick, P. B., A. Stein, and N. A. Edelson. 2011. *Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment*. National Wildlife Federation.
- Gobalet, K. W., P. D. Schulz, T. A. Wake, and J. Siefkin. 2004. Archaeological perspectives on Native American fisheries of California with emphasis on steelhead and salmon. *Transaction of the American Fisheries Society* 133:801-833.
- Godinho, H. P., A. L. Godinho, P. S. Formagio and V. C. Torquato, 1991. Fish ladder efficiency in a southeastern Brazilian River. *Ciencia e Cultura* 43(1):63-67.
- Good, T. P., R. S. Waples, and P. Adams (eds.). 2005. *Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead*. National Marine Fisheries Service, Northwest and Southwest Fisheries Science Centers. NOAA Technical Memorandum NMFS-NWFSC-66.
- Good, T. P., T. J. Beechie, P. McElhany, M. M. McClure, and M. H. Ruckelshaus. 2007. Recovery planning for endangered species act-listed Pacific salmon: using science to inform goals and strategies. *Fisheries* 32(9):426-440.
- Goodridge, J. 1997. *Historic Rainstorms in California*. California Department of Water Resources, Sacramento, CA. <http://water.usgs.gov/data.html>.
- Graf, W. L. 1999. Dam nation: A geographic census of American dams and their large-scale hydrologic impacts. *Water Resources Research* 35:1305-1311.
- Graf, W. L. (ed.). 2002. *Dam Removal: Science and Decision Making*. The Heinz Center.
- Graf, W. L. (ed.). 2003. *Dam Removal Research: Status and Prospects*. The Heinz Center.
- Grant, G. E. 2005. Out, out dam spot! The geomorphic response of rivers to dam removal. *Pacific Northwest Science Findings* 71(3):1-5. Pacific Northwest Research Station.
- Grant, P. R. and B. R. Grant. 2008. *How and Why Species Multiply: The Radiation of Darwin's Finches*. Princeton Series in Evolutionary Biology. Princeton University Press.
- Greene, H. G. 1970. *Geology of Southern Monterey Bay and its Relationship to the Groundwater Basin and Salt Water Intrusion*. Open File Report. U.S. Geological Survey and California Department of Water Resources.
- Gregory, R. and K. Wellman. 2001. Bringing stakeholder values into environmental policy choices: a community-based estuary case study. *Ecological Economics* 39:3752.
- Greig, S. M., D. A. Sear, and P. A. Carling. 2005. Fine sediment accumulation in salmon spawning gravels and the survival of incubating salmon progeny: implications for spawning habitat management. *Science of the Total Environment* 344:241-258.
- Grimes, Churchill B., R. D. Brodeur, L. J. Haldorson, S. M. McKinnell (eds.). 2007. *The Ecology of Juvenile Salmon in the Northeast Pacific Ocean: Regional Comparisons*. American Fisheries Society Symposium 57.

- Groot, C. and L. Margolis. 1991. *Pacific Salmon Life Histories*. University of British Columbia Press.
- Groot, C., L. Margolis, and W. C. Clarke (eds.). 1995. *Physiological Ecology of Pacific Salmon*. University of British Columbia Press.
- Grossinger, R. M., E. E. Beller, M. N. Salomon, A. A. Whipple, R. A. Askevold, C. J. Striplen, E. Brewster, and R. A. Leidy. 2008. *South Santa Clara Valley Historical Ecology Study, including Soap Lake, the Upper Pajaro River, and Llagas, Uvas-Carnadero, and Pacheco Creeks*. Prepared for the Santa Clara Valley Water District and the Nature Conservancy. A Report of SFEI's Historical Ecology Program. SFEI Publication #558, San Francisco Estuary Institute.
- Grossinger, R., E. D. Stein, K. Cayce, R. Askevold, S. Dark, and A. Whipple. 2011. *Historical Wetlands of Southern California: An Atlas of U.S. Survey T-Sheets 1851-1889*. San Francisco Estuary Institute Contribution #586 and Southern California Coastal Water Research Project Technical Report #859.
- Grossman, E. 2002. *Watershed: The Undamming of America*. Counterpoint.
- Gunderson, D. R. 1993. *Surveys of Fisheries Resources*. John Wiley & Sons, Inc.
- Gunderson, L. H., A. P. Clevenger, A. T. Cooper, V. H. Dale, L. Evans, G. L. Evink, L. Fahrig, K. E. Hanes, W. W. Kober, S. B. Lester, K. H. Redford, M. N. Strand, P. Wagner, and J. M. Yowell. 2005. *Assessing and Managing the Ecological Impacts of Paved Roads*. Committee on Ecological Impacts of Road Density, National Resources Council. National. Academy Press.
- Gurnell, A. M., W. Bertoldi, and D. Corenblit. 2011. Changing river channels: the hydrological processes, plants and pioneer fluvial landforms in humid temperate, mixed load, gravel bed rivers. *Earth-Science Reviews* 111(2012):129-141.
- Gustafson, R. G., R. S. Waples, J. M. Myers, L. A. Weitkamp, G. J. Bryant, O. W. Johnson, and J. J. Hard. 2007. Pacific salmon extinctions: quantifying lost and remaining diversity. *Conservation Biology* 21:1009-1020.
- Gutowski, W. J., G. C. Hegerl, G. J. Holland, T. R. Knutson, L. O. Mearns, R. J. Stouffer, P. J. Webster, M. F. Wehner, F. W. Zwiers. 2008. Causes of Observed Changes in Extremes and Projections of Future Changes. In: *Weather and Climate Extremes in a Changing Climate. Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands*. Karl, T. R., G. A. Meehl, C. D. Miller, S. J. Jassol, A. M. Waple, and W. L. Murray (eds.). A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research.
- Guthrie, D., J. M. Hoeing, C. M. Jones, M. J. Mills, S. A. Moberly, K. H. Pollock, and D. R. Talhelm. 1990. *Creel and Angler Surveys in Fisheries Management*. American Fisheries Society Symposium 12.
- Hagans, D. and T. Kraemer. 2003. *Watershed Assessment and Erosion Prevention Planning Project: Garrapata Creek Watershed, Monterey, County, California*. PWA Technical Report prepared for the California Department of Fish and Game and the Garrapata Creek Watershed Council.
- Hagar, J. M. 1995. *Report of Steelhead Spawning in Salinas River Tributaries During the 1995-95 Season and Implications for Basin Management*. Prepared for the Monterey County Water Management Resources Agency.
- Hagar, J. M. 1996. *Report on Steelhead Spawning in Salinas River Tributaries During the 1995-96 Season and Minimum Migration Flow Requirements for Steelhead in the Lower Salinas River*. Prepared for the for Monterey County Water Resources Agency.
- Hagar Environmental Science. 1996. *Salinas River Steelhead Status and Migration Flow Requirements*. Prepared for the for Monterey County Water Resources Agency.

- Hagar Environmental Science. 2001. *Salinas River Lagoon Water Quality and Fish Populations*. Appendix C-3 to EIR/EIS for the Salinas Valley Water Project. Prepared for the Monterey County Water Resources Agency and the U.S. Army Corps.
- Hagar Environmental Science. 2002. *Reconnaissance Aquatic Survey of San Jose Creek, Point Lobos State Preserve*. Prepared for the California Department of Parks and Recreation.
- Hagar Environmental Science. 2003. *Carmel River Lagoon and Salinas River Lagoon Beach Monitoring Report 2002-2003*. Prepared for the Monterey County Water Resources Agency.
- Hagar Environmental Science. 2005a. *Salinas River Lagoon. 2003-2004 Breach Monitoring Report*. Prepared for the Monterey County Water Resources Agency.
- Hagar Environmental Science. 2005b. *Salinas River Lagoon. 2004-2005 Breach Monitoring Report*. Prepared for the Monterey County Water Resources Agency.
- Hagar Environmental Science. 2005c. *Oceano Dunes Protected Fish Species Survey*. Prepared for California Department of Parks and Recreation.
- Hager, J. 2001. *An Evaluation of Steelhead Habitat and Population in the Gabilan Creek Watershed*. Undergraduate Thesis. California State University, Monterey Bay.
- Hall, C. A., Jr. 2007. *Introduction to the Geology of Southern California and Its Native Plants*. University of California Press.
- Hanak, E. and J. Lund. 2008. *Adapting California's Water Management to Climate Change*. Public Policy Institute of California.
- Hanak, E. and G. Moreno. 2008. *California Coastal Management with a Changing Climate*. Public Policy Institute of California.
- Hannah, D. M., I. A. Malcolm, C. Soulsby, and A. F. Youngson. 2008. A comparison of forest and moorland stream microclimate, heat exchanges, and thermal dynamics. *Hydrological Processes* 22:919-940.
- Hanski, I. A. and M. E. Gilpin (eds.). 1997. *Metapopulation Biology: Ecology, Genetics, and Evolution*. Academic Press.
- Hanson, C. V. 2008. *Influence of Lagoon Habitat on Steelhead Life History Variation*. M.S. Thesis. University of California Santa Cruz.
- Haro, A. J., K. L. Smith, R. A. Rulifson, C. M. Moffitt, R. J. Klauda, M. J. Dadswell, R. A. Cunjak, J. E. Cooper, K. L. Beal, and T. S. Avery. 2009. *Challenges for Diadromous Fishes in a Dynamic Global Environment*. American Fisheries Society Symposium 69.
- Harrelson, C., C. Rawlins, and J. Potyondy. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Techniques*. General Report. RM-245. U.S. Forest Service.
- Harrison, L. R. and E. A. Keller. 2006. Modeling forced pool-riffle hydraulics in a boulder-bed stream, southern California. *Geomorphology* 83:232-248.
- Harris, K., J. Larson, F. Watson. 2006. *Agricultural Management Practices and Treatment Wetlands in the Gabilan Watershed*. The Watershed Institute Report No. WI-2006-03.
- Hart, D., T. Johnson, K. Bushaw-Newton, R. Horwitz, A. Bednarek, D. Charles, D. Kreeger, and D. Velinsky. 2002. Dam removal: Challenges and opportunities for ecological research and river restoration. *BioScience* 52(8):669-681.

- Hartt, A. C. and M. D. Bell. 1985. *Early Oceanic Migrations and Growth of Juvenile Pacific Salmon and Steelhead*. Trout Bulletin 46. International North Pacific Fisheries Commission, Vancouver, Canada.
- Harvey, B. and T. Lisle. 1998. Effects of suction dredging on streams: A review and an evaluation strategy. *Fisheries* 23:8-17.
- Harvey, B. C., Whiket, J. L., and Nakamoto, R. J. 2002. Habitat relationships and larval drift of native and non-indigenous fishes in neighboring tributaries of a coastal California river. *Transactions of the American Fisheries Society* 131:159-170.
- Harvey & Stanley Associates, Inc. 1983. *Detailed Field Study Report: Pajaro River Habitat Management Plan*. Prepared for the Association of Monterey Bay Area Governments.
- Haston, L. and J. Michaelsen. 1997. Spatial and temporal variability of southern California precipitation over the last 400 yr and relationship to atmospheric circulation patterns. *Journal of Climate* 10:1836-1852.
- Hatfield, T. and J. Bruce. 2000. Predicting salmonid habitat-flow relationships for streams from western North America. *North American Journal of Fisheries Management* 20:1005-1015.
- Hayes, S. A., M. H. Bond, C. V. Hanson and R. B. MacFarlane. 2004. Interaction between endangered wild and hatchery salmonids: can pitfalls of artificial propagation be avoided in small coastal streams? *Journal of Fish Biology* 65(SupA):101-121.
- Hayes, S. A., M. H. Bond., C. V. Hanson, E. V. Freund, J. J. Smith, E. C. Anderson, A. J. Ammann, and R. B. MacFarlane. 2008. Steelhead growth in a small Central California watershed: upstream and estuarine rearing patterns. *Transactions of the American Fisheries Society* 137:114-128.
- Hayes, S. A., M. H. Bond, C. V. Hanson, A. W. Jones., A. J. Ammann, J. A. Harding, A. L. Collins, J. Peres, and R. B. MacFarlane. 2011a. Down, up, down and “smolting” twice? Seasonal movement patterns by juvenile steelhead (*Oncorhynchus mykiss*) in a coastal watershed with a bar closing estuary. *Canadian Journal of Fisheries and Aquatic Sciences* 68(80):1341-1350.
- Hayes, S. A., C. V. Hanson, D. Pearse, M. H. Bond, R. B. MacFarlane. 2011b. Should I stay or should I go? The influence of genetic origin on emigration and behavior and physiology of resident and anadromous juvenile *Oncorhynchus mykiss* (in press). *North American Journal of Fisheries Management*.
- Hayhoe, K., D. Cayan, C. B. Field, P. C. Frumhoff, E. P. Maure, N. L. Miller, S. C. Moser, S. H. Schneider, K. N. Cahill, E. E. Cleland, L. Dale, R. Drapek, R. M. Hanemann, L. S. Kalkstein, J. Lenihan, C. K. Lunch, R. P. Neilson, S. C. Sheridan, and J. H. Verville. 2004. Emissions pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences* 101:12422-12427.
- Hedderly, E. L. 1910a. Twin trout law vexing anglers: confusion worked by Jordanic verdict that steelheads and rainbows are identical. *Los Angeles Herald*, April 10, 1910, Part III, 6.
- Heizer, R. E. and A. B. Elsasser. 1980. *The Natural World of the California Indians*. University of California Press.
- Blackburn, T. C. and K. Anderson (eds.). 1993. *Before the Wilderness. Environmental Management by Native Californians*. Ballena Press.
- Helmbrecht, D. and D. A. Boughton. 2005. *Recent Efforts to Monitor Anadromous Oncorhynchus Species in the California Coastal Region: A Complication of Metadata*. National Marine Fisheries Service, Southwest Fisheries Science Center. NOAA Technical Memorandum NMFS-SWFSC TM-381.
- Hendry, A. P. and T. Day. 2003. Revisiting the positive correlation between female size and egg size. *Evolutionary Ecology Research* 5:421-429.

- Hendry, A., P. and S. C. Stearns (eds.). 2004. *Evolution Illuminated: Salmon and Their Relatives*. Oxford University Press.
- Hendry, A. P., T. Bohlin, B. Johnsson, O. K. Berg. 2004a. To Sea or Not to Sea? Anadromy versus Non-Anadromy in Salmonids. In: Andrew, H. P. and S. C. Stearns (eds.). *Evolution Illuminated: Salmon and Their Relatives*. Oxford University Press.
- Hendy, I. L., T. F. Pedersen, J. P. Kennett, and R. Tada. 2004b. Intermittent existence of a southern California upwelling cell during submillennial climate change of the last 60 kyr. *Paleoceanography* 19:1-15.
- Henke, E. 1999. *Historical Research Documentation Relative to Anadromous/Migratory Salmonid Habitat on Vandenberg Air Force Base and Point Arguello Area Air Force Properties*. Prepared for Tetra Tech, Inc.
- Hey, J., E. L. Brannon, D. E. Campton, R. W. Doyle, I. A. Fleming, M. T. Kinnison, R. Lande, J. Olsen, D. P. Philipp, J. Travis. 2005. *Considering Life History, Behavior, and Ecological Complexity in Defining Conservation Units for Pacific Salmon*. An Independent Panel Report. May 16, 2005. Prepared for National Marine Fisheries Service, Protected Resources Division.
- Hickman, J. C. (ed.) 1993. *The Jepson Manual: Higher Plants of California*. University of California Press.
- Hilderbrand, R. H., A. C. Watts, and A. M. Randall. 2005. The myths of restoration ecology. *Ecology and Society* 10(1):1-11.
- Hoelzer, G. A., R., Drewes, J. Meier, and R. Doursat. 2008. Isolation-by-distance and outbreeding depression are sufficient to drive parapatric speciation in the absence of environmental influences. *Computational Biology PLoS* 4(7).
- Hofmann, E.E. 2000. Modeling for estuarine synthesis. In: J. E. Hobbie (ed.). *Estuarine Science: A Synthetic Approach to Research and Practice*. Island Press.
- Holland, E.. 2001. *The State of California Rivers*. Western Rivers Program. The Trust for Public Land.
- Holland, V. L. 1996. *California Vegetation*. Kendall Hunt Publishing Company.
- Holmes, E. E. 2001. Estimating risks in declining populations with poor data. *Proceedings of the National Academy of Sciences* 98(9):5072-5077.
- Horne, S. P. 1981. *The Inland Chumash: Ethnography, Ethnohistory, and Archaeology*. Ph.D. Thesis, Department of Anthropology, University of California, Santa Barbara.
- Hosale, L. C. 2010. *6000 Years on the River: Evidence for Marine Use and Coastal /Inland Interactions from SBA-485, an Inland Site in the Santa Ynez River Valley, Santa Barbara, California*. M.S. Thesis. University of California, Santa Barbara.
- Hornbeck, David. 1983. *California Patterns: A Geographical and Historical Atlas*. Mayfield Publishing Company.
- Hover, E. E. 1937. Experimental modification of the sexual cycle in trout by control of light. *Science* 86:425-426.
- Howard, A. D. 1979. *Geologic History of Middle California*. University of California Press.
- Hubbs, C. L. 1946. Wandering of pink salmon and other salmonids fishes into southern California. *California Fish and Game* 32:81-86.
- Hudson, T. and T. C. Blackburn. 1982. *The Material Culture of the Chumash Interaction Sphere*. Volume 1: *Food Procurement and Transportation*. Volume II: *Food Preparation and Shelter*. Ballena Press and Santa Barbara Museum of Natural History.

- Hunt & Associates Biological Consulting Services. 2008a. *South-Central California Coast Steelhead Recovery Planning Area Conservation Action Planning (CAP) Workbooks Threats Assessment*. Prepared for National Marine Fisheries Service, Southwest Region, Protected Resources Division.
- Hunt & Associates Biological Consulting Services. 2008b. *South-Central California Coast Steelhead Recovery Planning Area Recovery Actions*. Prepared for National Marine Fisheries Service, Southwest Region, Protected Resources Division.
- Hutchings, J.A. and D.J. Fraser. 2008. The nature of fisheries and farming-induced evolution. *Molecular Ecology*. 17:294-313.
- Hutchinson, G. E. 1978. *An Introduction to Population Ecology*. Yale University Press.
- Hynes, H. B. N. 1970. *The Ecology of Running Waters*. University of Toronto Press.
- Ibbotson, A. T., W. R. C Beaumont, D. Collinson, A. Wilkinson, and P. C. Pinder. 2004. A cross-river antenna array for the detection of miniature passive integrated transponder tags in deep fast flowing rivers. *Journal of Fish Biology* 65:1441-1443.
- Intergovernmental Panel on Climate Change. 2007a. *Climate Change 2007, Working Group I: The Physical Basis*. Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.
- Intergovernmental Panel on Climate Change. 2007b. *Climate Change 2007, Working Group II: Impacts, Adaptation, and Vulnerability*. Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.
- Intergovernmental Panel on Climate Change. 2007c. *Climate Change 2007, Working Group III: Mitigation of Climate Change*. Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.
- Isaak, D. J., S. Wollrab, D. Horan, and G. Chandler. 2010. Climate change effects on stream and river temperatures across the northwest U.S. from 1980-2009. *Climate Change* DOI 10.1007/s10584-011-0326-z.
- Jackson, J. B. C., K. E. Alexander, and E. Sala (eds.). 2011. *Shifting Baselines: The Past and the Future of Ocean Fisheries*. Island Press.
- Jacobs, D., E. Chatfield, L. Kiley, G. M. Kondolf, L. Lloyd, F. Smith, D. Walker, and K. Walker 1993. *California's Rivers: A Public Trust Report*. California State Lands Commission.
- Jacobs, D., E. Stein, and T. Longcore. 2011. *Classification of California Estuaries Based on Natural Closure Patterns: Templates For Restoration and Management*. Southern California Coastal Water Research Project. Technical Report 619a.
- Jay, D. A., W. R. Geyer, and D. R. Montgomery. 2000. An ecological perspective on estuarine classification. In: Hobbie, J. E. (ed.). *Estuarine Science: A Synthetic Approach to Research and Practice*. Island Press.
- Jeffres, C., J. Opperman, and P. Moyle. 2008. Ephemeral floodplain habitats provide best growth conditions for juvenile Chinook salmon in a California river. *Environmental Biology of Fishes* 83(4): 449-458.
- Jones & Stokes Associates, Inc. 1982. *Report of 1981 Fishery Monitoring Activities in Arroyo de la Cruz*. Prepared for the California Department of Fish and Game.
- Jones & Stokes Associates, Inc. 1985. *Preliminary Results of Juvenile Steelhead Trout Survey in Arroyo de la Cruz, July 1985*. Prepared for Music, Peeler & Garrett.
- Johannsson, P. O. 1987. *The Economic Theory and Measurement of Environmental Benefits*. Cambridge University Press.

- Johnson, D. H., B. M. Shrier, J. S. O'Neal, J. A. Knutzen, X. Augerot, T. A. O'Neil, and T. N. Pearsons. 2007. *Salmonid Field Protocols Handbook: Techniques for Assessing Status and Trends in Salmon and Trout Populations*. American Fisheries Society.
- Johnson, P. T. J., J. D. Olden, and M. Jake Vander Zanden. 2008. Dam invaders: impoundments facilitate biological invasions into freshwaters. *Frontiers in Ecology and the Environment* 6(7):357-363.
- Johnstone, J. A. and T. E. Dawson. 2010. Climate context and ecological implications of summer fog decline in the coast redwood region. *Proceedings of the National Academy of Sciences*. February 16, 2010.
- Jones, T. L. and Klar (eds.) 2007. *California Prehistory: Colonization, Culture, and Complexity*. AltaMira Press.
- Jonson, B. and J. Ruud-Hansen. 1985. Water temperature as the primary influence on timing of seaward migrations of Atlantic salmon (*Salmo salar*) smolts. *Canadian Journal of Fisheries and Aquatic Sciences* 42:593-595.
- Jonsson, B. and N. Jonsson. 1993. Partial migration: Niche shift versus sexual maturation in fishes. *Reviews in Fish Biology* (3):348-365.
- Jordan, D. S. and C. H. Gilbert. 1881. *Notes On The Fishes of the Pacific-Coast of the United States*. *Proceedings of the United States National-Museum*. Vol. 4.
- Jordan, D. S. and B. W. Evermann. 1896. *The Fishes of North and Middle America*. *United States National Museum Bulletin* 47:1896.
- Jordan, D. S. and B. W. Evermann. 1923. *American Food and Game Fishes*. Doubleday, Page and Co.
- Kahler, T., H. P. Roni, and T. P. Quinn. 2001. Summer movement and growth of juvenile anadromous salmonids in small western Washington streams. *Canadian Journal of Fisheries and Aquatic Sciences* 58:1947-1956.
- Karl, T. R., G. A. Meehl, C. D. Miller, S. J. Hassol, A. M. Waple, and W. L. Murray (eds.). 2008. *Weather and Climate Extremes in a Changing Climate. Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands. Synthesis and Assessment 3.3*. Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research.
- Karl, T. R., J. M. Melillo, and T. C. Peterson (eds.). 2009. *Global Climate Change Impacts in the United States*. Cambridge University Press.
- Karl, William. 1979. *The California Water Atlas*. California Department of Water Resources.
- Keefer, M. L., C. C. Caudill, C. A. Peery, and S. R. Lee. 2008. Transporting juvenile salmonids around dams impairs adult migration. *Ecological Applications* 18:1888-1900.
- Keefer, M. L., C. A. Peery, and B. High. 2009. Behavioral thermoregulation and associated mortality trade-offs in migrating adult steelhead (*Oncorhynchus mykiss*): variability among sympatric populations. *Canadian Journal of Fisheries and Aquatic Sciences* 66:1734-1747.
- Keeley, J. E. (ed.). 1993. *Interface Between Ecology and Land Development in California*. Southern California Academy Sciences.
- Keeley, J. E. 2002. Fire management of California shrubland landscapes. *Environmental Management* 29(3):395-408.
- Keeley, J. E., C. J. Fotheringham, and M. Morias. 1999. Reexamining fire suppression impacts on brushland fire regimes. *Science* 284:1829-1832.
- Keller, E. A. and F. J. Swanson. 1979. Effects of large organic material on channel form and alluvial processes. *Earth Surface Processes* 4:361-380.

- Kennett, J. P. and L. C. Peterson. 2002. Rapid climate change: ocean responses to earth system instability in the later quaternary. *In: Achievements and Opportunities of Scientific Ocean Drilling, The Legacy of the Ocean Drilling Program, A Special Issue of the JOIDES Journal* 28(1):5-9.
- Kier Associates and National Marine Fisheries Service. 2008a. Guide to the Reference Values Used in the South-Central/Southern California Steelhead DPS Conservation Action Planning (CAP) Workbooks (DVD). Prepared for National Marine Fisheries Service, Southwest Region, Protected Resources Division.
- Kier Associates and National Marine Fisheries Service. 2008b. *Fifty-Five South-Central/Southern California Steelhead DPS Conservation Action Planning (CAP) Workbooks (DVD)*. Prepared for National Marine Fisheries Service, Southwest Region, Protected Resources Division.
- Kim, J. T. K. Kim, R. W. Arritt, N. L. Miller. 2002. Impacts of increased atmospheric CO<sub>2</sub> on the hydroclimate of the western United States. *Journal of Climate* 15:1926-1942.
- Kitting, C. L. 1990. *Major Food Resources Available to Small Steelhead, Oncorhynchus mykiss, and Other Fishes Along a Gradient of Habitats in the Carmel River Lagoon*. Prepared for the Carmel River Steelhead Association, California Coastal Conservancy, Monterey County Water Resources Agency, Monterey Peninsula Water Management District, and the California Department of Parks and Recreation.
- Kittleson Environmental Consultants. 2003. *South Fork Little Sur River Steelhead Assessment*. Prepared for Friends of the River.
- Kittleson Environmental Consultants, Denise Duffy and Associates, and Fall Creek Engineering. 2002. Big Sur River Steelhead Enhancement Plan. Prepared for the California Department of Parks and Recreation.
- Knable, A. 1978. *Characteristics of Steelhead Rainbow Trout Streams, San Luis Obispo County, California, 1978*. Master's Thesis, Natural Resources Management Department, California Polytechnic University, San Luis Obispo.
- Knudsen, E. E and J. Hal Michael, R. (eds.). 2009. *Pacific Salmon Environmental Life History Models: Advancing Science for Sustainable Salmon in the Future*. American Fisheries Society Symposium 71.
- Konrad, C. P. and D. B. Booth. 2005. Hydrologic changes in urban streams and their ecological significance. *In: Brown, L. R., R. H. Gray, R. H. Hughes, and M. R. Meador (eds.). Effects of Urbanization on Stream Ecosystems*. American Fisheries Society Symposium 47.
- Kondolf, G. M. 1986. Channel Erosion Along the Carmel River, Monterey County, California. *Earth Surface Processes and Landforms*. 11(3):307-319.
- Kondolf, G. M. 1997. Hungry water: effects of dams and gravel mining on river channels. *Environmental Management* 21:533-551.
- Kondolf, G. M. and H. Piegay (eds.). 2003. *Tools in Fluvial Geomorphology*. John Wiley & Sons, Inc.
- Kondolf, C. M., D. R. Montgomery, H. Piegay, and L. Schmitt. 2003. Geomorphic classification of rivers and streams. *In: Kondolf, G. M. and H. Piegay (eds.). Tools in Fluvial Geomorphology*. John Wiley & Sons, Inc.
- Kondolf, G. M., M. J. G. Williams, T. C. Horner, and D. Milan. 2008. Assessing physical quality of spawning habitat. *In: Sear, D. A. and P. S. Devries (eds.). Salmonid Spawning Habitat in Rivers: Physical controls, Biological Responses and Approaches to Remediation*. American Fisheries Society Symposium 65.
- Kostyack, J. and D. Rohlf. 2008. Conserving endangered species in an era of global warming. *Environmental Law Institute* 28:10203-10213.

- Kraft, M. E. 1972. Effects of controlled flow reduction on a trout stream. *Journal of the Fisheries Research Board of Canada* 29:1405-1411.
- Kreider, C. M. 1948. *Steelhead*. G. P. Putnam's Sons.
- Kreissman, Bern. 1991. *California: An Environmental Atlas and Guide*. Bear Klaw Press.
- Kuligowski, D. R., M. J. Ford and B. A. Berejikian. 2005. Fine-scale patterns of genetic relatedness in a population of steelhead. *Transaction of the American Fisheries Society* 132:1202-1212.
- Lackey, R. T., D. H. Lach, S. L. Duncan (eds.). 2006. *Salmon 2010: The Future of Wild Coast Salmon*. American Fisheries Society.
- Laetz, C.A., D.H. Baldwin, T.K. Collier, V. Herbert, J.D. Stark, and N.L. Scholz. 2009. The synergistic toxicity of pesticide mixtures: Implications for risk assessment and the conservation of Pacific salmon. *Environmental Health Perspectives*. 117:348-353.
- Lande, R. 1993. Risks of population extinction from demographic and environmental stochasticity and random catastrophes. *American Naturalist* 142:911-927.
- Landweber, L. F. and A. P. Dobson (eds.). 1999. *Genetics and the Extinction of Species: DNA and the Conservation of Biodiversity*. Princeton University Press.
- Langefors, A. H. 2005. Adaptive and neutral genetic variation and colonization history of Atlantic salmon, *Salmo salar*. *Environmental Biology of Fishes* 74:297-308.
- Larson, J., F. Watson, J. Casagrande, and B. Pierce. 2006. *Carmel River Lagoon Enhancement Project: Water Quality and Aquatic Wildlife Monitoring, 2005-6*. Publication No. WI-2006-06. The Watershed Institute. California State University, Monterey Bay.
- Lantis, D. W., R. Steiner, A. E. Karinen. 1981. *California: Land of Contrast*. Wadsworth Publishing Company, Inc.
- Leder, E. H., R. G. Danzmann, and M. M. Terguson. 2006 The candidate gene clock localizes to a strong spawning time Quantitative Trait Locus region in Rainbow trout. *Journal of Heredity*. 97(1):74-80.
- Leipper, D. F. 1994. Fog on the U.S. West Coast: a review. *Bulletin of the American Meteorological Society* 75(2): 229-240.
- Lenihan, J. M. D. Bachelet, R. Drapek, and R. P. Neilson. 2006. *The Response of Vegetation Distribution, Ecosystem Productivity, and Fire in California to Future Climate Scenarios Simulated by the MC1 Dynamic Vegetation Model*. California Climate Change Center.
- Leitritz, E. 1970. *A History of California Fish Hatcheries: 1870-1960*. *Fish Bulletin* No. 150. California Department of Fish and Game.
- Leung, L. R., Y. Qian, X. D. Bian, W. M. Washington, J. G. Han, and J. O. Roads. 2004. Mid-century ensemble regional climate change scenarios for the western United States. *Climate Change* 62:75-113.
- Levin, P. S., M. H. Schiewe. 2001. Preserving salmon biodiversity. *American Scientist* 89:220-227.
- Levin, S. A. (ed.). 2009. *The Princeton Guide to Ecology*. Princeton University Press.
- Levin, S. A. and J. Lubchenco. 2008. Resilience, robustness, and marine ecosystem-based management. *BioScience* 58:27-32.

- Levin, P. S., J. J. Fogarty, S. A. Murawski, and D. Fluharty. 2009. Integrated ecosystem assessments: developing the scientific basis for ecosystem based management of the ocean. *PLoS* 7:23-28.
- Lewis, W. M., Jr. (ed.). 2003. *Water and Climate in the West*. University of Colorado Press.
- Lichatowich, J. 1999. *Salmon Without Rivers*. Island Press.
- Lightfoot, K. G. And O. Parrish. 2009. *The California Indians and Their Environment: An Introduction*. University of California Press.
- Lindley, S. T. 2003. Estimation of population growth and extrication parameters from noisy data. *Ecological Applications* 13(3):806-813.
- Lindley, S. T., R. S. Schick, E. Mora, J. J. Anderson, S. Greene, C. Hanson, B. P. May, D. R. McEwan, R. B. MacFarlane, C. Swanson, and J. G. Williams. 2007. *Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in the Sacramento-San Joaquin Basin*. San Francisco Estuary and Watershed Science. 4 Issue 1[February 2007]. Article 4.
- Little, A. D., Inc. 1998. *Guadalupe Oil Field Remediation and Abandonment Project. Final Environmental Impact Report*. SCH #96051053. Prepared for the County of San Luis Obispo, Department of Planning and Building.
- Loarie, S. R., B. E. Carter, K. Hayhoe, S. McMahon, R. Moe, C. A. Knight, and D. D. Ackerly. 2008. Climate change and the future of California's endemic flora. *PLoS One* 3(6).
- Lockmann, R. 1981. *Guarding the Forest of Southern California: Evolving Attitudes Toward Conservation of Watershed, Woodlands, and Wilderness*. Western Land and Waters XII. The Arthur C. Clarke Company.
- Lockwood, J. L., M. F. Hoopes, and M. P. Marchetti. 2007. *Invasion Ecology*. Blackwell Publishing.
- Londquist, B. 2001. Steelhead (*Oncorhynchus mykiss*) Habitat Assessment Along the Arroyo Seco River. A Capstone Project Presented to the Faculty of Earth System Science and Policy in the Center for Science, Technology, and Information Resources, California State University, Monterey Bay.
- Logerwell, E. A., N. Mantua, P. W. Lawson, R. C. Francis, and V. N. Agostini. 2003. Tracking environmental processes in the coastal zone for understanding and predicting Oregon coho (*Oncorhynchus kisutch*) marine survival. *Fisheries Oceanography* 12:554-568.
- Lohse, K. A., D. A. Newburn, J. J. Opperman, and A. M. Merenlender. 2008. Forecasting relative impacts of land use on anadromous fish habitat to guide conservation planning. *Ecological Applications* 18(2):467-482.
- Lomolino, M. V., B. R. Riddle, and J. H. Brown. 2010. *Biogeography*. Sinauer Associates, Inc.
- Loomis, J. B. and D. S. White. 1996. Economic benefits of rare and endangered species: summary and meta-analysis. *Ecological Economics* 18:197-206.
- Love, M. and R. Taylor. 2006. *California Salmonid Stream Habitat restoration Manual, Part 9: Fish Passage Evaluation at Stream Crossings*. Prepared for the California Department Fish and Game.
- Lubchenco, J. 1998. Entering the century of the environment: A new social contract for science. *Science* 279:491-497.
- Lucas, M. C. and E. Baras. 2001. *Migration of Freshwater Fishes*. Osney Mead, Blackwell Science.
- Luers, A. and M. D. Mastrandrea. 2008. *Climate Change in California: Scenarios for Adaptation*. Public Policy Institute of California.

- Lufkin, A. (ed.). 1991. *California's Salmon and Steelhead: The Struggle to Restore an Imperiled Resource*. University California Press.
- Lytle, D. A. and N. L. Poff. 2004. Adaptation to natural flow regimes. *Trends in Ecology and Evolution* 94:94-100.
- McCullough, D. R. (ed.). 1996. *Metapopulations and Wildlife Conservation*. Island Press.
- McElhany, P., M. H. Ruckelshaus, M. J Ford, T .C. Wainwright, and E. P. Bjorkstedt. 2000. *Viable Salmonid Populations and the Recovery of Evolutionary Significant Units*. NOAA Technical Memorandum NMFS-NWFSC TM-42.
- McElhany, P., E. A. Steel, D. Jensen, and K. K. Avery. 2009. Uncertainty in a complex salmon habitat model. In: Knudsen, E. E and J. Hal Michael, R. (eds.). *Pacific Salmon Environmental Life History Models: Advancing Science for Sustainable Salmon in the Future*. American Fisheries Society Symposium 71.
- McEwan, D. 2001. Central Valley steelhead. In: Brown, R. L. (ed.). *Contributions to the Biology of Central Valley Salmonids*. Fish Bulletin No. 179. California Department of Fish and Game.
- McEwan, D. and T. A. Jackson. 1996. *Steelhead Restoration and Management Plan for California*. California Department of Fish and Game.
- McKnight, B. N. (ed.). 1993. *Biological Pollution: The Control and Impact of Invasive Species*. Indian Academy of Sciences.
- McMillan, J. R., S. L. Katz, and G. R. Pess. 2007. Observational Evidence of spatial and temporal structure in a sympatric anadromous (winter steelhead) and resident rainbow trout mating system on the Olympic Peninsula, Washington. *Transactions of the American Fisheries Society* 136:736-748.
- McMullen, C. P. and J. Jabbour (eds.). 2010. *Climate Change Science Compendium: 2009*. United Nations Environment Programme.
- McNeil, W. J. and D. C. Himsworth (eds.). *Salmonid Ecosystems of the North Pacific*. Oregon State University Press.
- McNight, C. 2002. *Oncorhynchus mykiss Habitat Assessment on Lower Garrapata Creek*. Capstone Project. California State University, Monterey Bay.
- McPhee, M. V., F. Utter, J. A. Stanford, K. V. Kuzishchin, K. A. Savvaitova, D. S. Pavlov, F. W. Allendorf. 2007. Population structure and partial anadromy in *Oncorhynchus mykiss* from Kamchatka: relevance for conservation strategies around the Pacific Rim. *Ecology of Freshwater Fish* 16:539-547.
- MacArthur, R. H. and E. O. Wilson. 1967. *The Theory of Island Biogeography*. Monographs in Population Biology. No. 1. Princeton University Press.
- MacDonnell, L., T. Rice, and S. Shupe. 1989. *Instream Flow Protection in the West*. Natural Resources Law Center, University of Colorado School of Law.
- Madriñan, L. F. S. White, B. Feist, R. Faux, S. Heppell, J. Feldhaus, G. R. Giannico, H. W. Li. 2009. Temperature as an index of juvenile red band/steelhead trout carrying capacity in a semi-arid basin (in press). *Canadian Journal of Fisheries and Aquatic Sciences*.
- Macneale, K.H., P.M. Kiffney, and N.L. Scholz. 2010. Pesticides, aquatic food webs, and the conservation of Pacific salmon. *Frontiers in Ecology Environment* 8:475-482.
- Malanson, G. P. 1963. *Riparian Landscapes*. Cambridge University Press.

- Malcolm, I. A. A. F. Youngson, and C. Soulsby. 2003. Survival of salmonid eggs in gravel bed streams: effects of groundwater-surface water interactions. *River Research Applications* 19:303-316.
- Mangel, M. and W. H. Satterthwaite. 2008. Combining proximate and ultimate approaches to understand life history variation in salmonids with application to fisheries, conservation, and aquaculture. *Bulletin of Marine Science* 83:107-130.
- Mantua, N. J., S. R. Hare, Y. Zhang, J. M. Wallace, and R. C. Francis. 1997. A Pacific interdecadal climate oscillation with impacts on salmon production. *Bulletin of the American Meteorological Society* 78:1069-1079.
- Mantua, N. J. and S. R. Hare. 2002. The Pacific decadal oscillation. *Journal of Oceanography* 58:35-44.
- Mantua, N. J. I. Tohver, and A. Hamlet. 2010. Climate change impacts on streamflow extremes and summertime stream temperature and their possible consequences for freshwater salmon habitat in Washington state. *Climate Change* 102:187-223.
- Mantua, N. J. 2011. The Pacific Decadal Oscillation. In: T. Munn (ed.) *Encyclopedia of Global Climate Change*. 5 Vols. John Wiley & Sons, Inc.
- March, R. A. 2012. *River in Ruin: The Story of the Carmel River*. University of Nebraska Press.
- Marks, J. C., G. A. Haden, M. O'Neill, and C. Pace. 2010. Effects of flow restoration and exotic species removal on recovery of native fish: lessons dam decommissioning. *Restoration Ecology* 18(6):934-943.
- Marmulla, G. and R. Welcomme (eds.). 2002. *Fish Passes: Design, Dimensions and Monitoring*. Food and Agriculture Organization, United Nations.
- Martin, J. 1995. Food Habits of Some Estuarine Fishes in a Small, Seasonal Central California Lagoon. M.S. Thesis. Department of Biology, San Jose State University.
- Martinez, A., J. C. Garza, and D. E. Pearse. 2011. A microsatellite genome screen identifies chromosomal regions under differential selection in steelhead and rainbow trout. *Transaction of the American Fisheries Society* 140:829-842.
- Mastrandrea, M., D. C. Tebaldi, C. P. Snyder, and S. H. Schneider. 2009. *Current and Future Impacts of Extreme Events in California*. California Climate Change Center, University of California, Berkeley.
- Matthews, K. R. and N. H. Berg. 1997. Rainbow trout responses to water temperature and dissolved oxygen stress in two southern California stream pools. *Journal of Fish Biology* 50:50-67.
- Maurer, E. P., S. Gibbard and P. B. Duffy. 2006. Amplification of streamflow impacts of El Niño by increased atmospheric greenhouse gases. *Geophysical Research Letters*. 33(2):L02707. 10.1029/2005GL025100.
- Maurer, E. P., H. G. Hildalgo, T. Das, M. D. Dettinger, and D. R. Cayan. 2010. Assessing climate change impacts on daily streamflow in California: the utility of daily large-scale climate data. *Hydrology and Earth System Sciences Discussions* 2010(7):1209-1243.
- May, C. L. and R. E. Gresswell. 2004. Spatial and temporal patterns of debris-flow deposition in the Oregon Coast Range, USA. *Geomorphology* 57:135-149.
- May, C. L. and D. C. Lee. 2004. The relationships among in-channel sediment storage, pool depth, and summer survival of juvenile salmonids in Oregon Coast Range streams. *North American Journal of Fisheries Management* 24:761-774.
- Mayer, K. E. and W. F. Laudenslayer, Jr. 1988. *A Guide to Wildlife Habitats of California*. California Department of Forestry and Fire Protection.

- Mayr, E. 1963. *Animal Species and Evolution*. Harvard University Press.
- Medellin-Azuara, J. C. R. Connel, K. Madani, J. R. Lund, and R. E. Howitt. 2009. *Water Management Adaptation with Climate Change*. California Climate Change Center, University of California, Berkeley.
- Meehan, W. R. (ed.). 1991. *Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats*. Special Publication 19. American Fisheries Society.
- Meyer Resources, Inc. 1988. *Benefits from Present and Future Salmon and Steelhead Production in California*. A Report to the California Advisory Committee on Salmon and Steelhead.
- Myers, K. W. K., Y. Aydin, R. V. Walker, S. Fowler, and M. L. Dahlberg. 1996. Known ocean ranges of stocks of Pacific salmon and steelhead as shown by tagging experiments, 1956-1995. North Pacific Anadromous Fish Commission. University of Washington.
- Michael, J. 2010. Business Forecasting Center. Eberhardt School of Business, University of the Pacific.
- Miller, R. R. 2005. *Freshwater Fishes of Mexico*. University Chicago Press.
- Miller, N. L. and N. J. Schlegel. 2006a. Climate change projected fire weather sensitivity: California Santa Ana wind occurrence. *Geophysical Research Letters* 33(15):L15711.
- Miller, N. L. and N. J. Schlegel. 2006b. Climate Change – Projected Santa Ana Fire Weather Occurrence. Prepared for the California Climate Change Center.
- Millstein, R. L. 2010. The concepts of population and metapopulation evolutionary biology and ecology. *In: Bell, M. A., D. J. Futuyama, W. F. Eanes, and J. S. Levinton. Evolution Since Darwin: The First 150 Years*. Sinauer Associates, Inc.
- Mitsch, W. J. and J. G. Gosselink. 2007. *Wetlands*. John Wiley & Sons, Inc.
- Mobrand, L. E., J. A. Lichatowich, L. C. Lestelle, and T. S. Vogel. 1997. An approach to describing ecosystem performance “through the eyes of salmon”. *Canadian Journal of Fisheries and Aquatic Sciences* 54:2964-2973.
- Mohseni, O. and H. G. Stefan. 1999a. Stream temperature/air temperature relationship: a physical interpretation. *Journal of Hydrology* 218:128-141.
- Mohseni, O., T. R., Erikson, and H. G. Stefan. 1999b. Sensitivity of stream temperatures in the U.S. to air temperatures projected under a global warming scenario. *Water Resources Research* 35(12):3723-3733.
- Mohseni, O., H. G. Stefan, and J. G. Eaton. 2003. Global warming and potential changes in fish habitat in the U.S. streams. *Climate Change* 59:389-409.
- Moir, H. J., C. N. Gibbons, C. Soulsby, and J. Webb. 2004. Linking channel geomorphic characteristics to spatial patterns of spawning activity and discharge use by Atlantic salmon (*Salmo salar* L.) *Geomorphology* 60:21-35.
- Montgomery, D. R. 1999. Process domains and the river continuum. *Water Resources Bulletin* 35:432-454. American Water Resources Association.
- Montgomery, D. R. 2003. *King of fish: the Thousand-Year Run of Salmon*. Westview Press.
- Montgomery, D. R. and J. M. Buffington. 1997. Channel-reach morphology in mountain drainage basins. *Geological Society of America Bulletin*. 109:596-611.
- Montgomery, D. R. and L. H. MacDonald. 2002. Diagnostic approach to stream channel assessment and monitoring. *Water Resources Bulletin* 38:1-16. American Water Resources Association.

- Monterey County Water Resources Agency. 2005. *Salinas Valley Water Project Flow Prescription for Steelhead Trout in the Salinas River, Salinas California*. Monterey County Resource Agency.
- Monterey County Water Resources Agency. 2010a. *Salinas Basin Rotary Screw Trap Monitoring. 2010 Final Report*. Prepared for the Monterey County Water Resources Agency.
- Monterey County Water Resources Agency. 2011a. *Salinas Valley Water Project Annual Fisheries Report for 2010*. Prepared for the Monterey County Water Resources Agency.
- Monterey County Water Resources Agency. 2011b. *Salinas Basin Juvenile O. mykiss Outmigration Monitoring 2011 Final Report*. Prepared for the Monterey County Water Resources Agency.
- Monterey County Water Resources Agency. 2011c. *Salinas River Basin Adult Steelhead Escapement Monitoring. 2011 Annual Report*. Prepared for the Monterey County Water Resources Agency.
- Monterey Peninsula Water Management District. 1983. *Carmel River Watershed Management Plan. Working Paper Number One. Habitat Change in the Carmel River Basin*. Prepared by John Williams, Resource Analyst.
- Monterey Peninsula Water Management District. 1987. *Carmel River Water Management Plan*. Monterey Peninsula Water Management District.
- Monterey Peninsula Water Management District 1984-2012. *Carmel River Fishery Report*. Prepared by Monterey County Water Management District.
- Monterey Peninsula Water Management District. 1992-2012. *Annual Report Monterey Peninsula Water Management District Mitigation Program Water Allocations. Environmental Impact Report*. Prepared for the Monterey Peninsula Water Management District.
- Monterey Peninsula Water Management District. 2000. *Review of Carmel River Dam Fish Passage Facilities*. Prepared by R2 Resource Consultants.
- Monterey Peninsula Water Management District. 2000-2011. *Mitigation Annual Reports*. Prepared for the Monterey Peninsula Water Management District Board of Directors.
- Monterey Peninsula Water Management District. 1991-2012. *Carmel River Monthly Fishery Reports*. Prepared for the Monterey Peninsula Water Management District Board of Directors.
- Monterey Peninsula Water Management District. 2010a. *Ten-Year Summary of the Monterey Peninsula Water Management District's Bioassessment Program on the Carmel River*. Prepared by BioAssessment Services in Association with Beverley Chaney and Thomas Lindberg, Monterey Peninsula Water Management District.
- Monterey Peninsula Water Management District. 2010b. *2008-2009 Annual Report (July 1, 2008 – June 20, 2009) for the MPWMD Mitigation Program. A Report in compliance with the MPWMD Water Allocation Program Final Environmental Impact Report*. Prepared by MPWMD Staff.
- Monterey Peninsula Water Management District and Carmel River Watershed Conservancy. 2004. *Environmental and Biological Assessment of Portions of the Carmel River Watershed*. Prepared pursuant to the Costa-Machado Water Act of 2000.
- Moore, M. R. 1980. *Factors Influencing the Survival of Juvenile Steelhead Rainbow Trout (Salmo gairdneri gairdneri) in the Ventura River, California*. Master's Thesis, Humboldt State University.
- Morbey, Y. E. C. E. Brassil, and A. P. Hendry. 2005. Rapid senescence in Pacific salmon. *American Naturalist* 166:556-778.

- Morbey, Y. E. and A. Hendry. 2008. Adaptation of salmonids to spawning habitat. In: Sear, D. and P. DeVries (eds.). *Salmonid Spawning Habitat in Rivers: Physical Controls, Biological Responses, and Approaches to Remediation*. American Fisheries Society Symposium 65.
- Moritz, M. A., M. E. Marais, L. A. Summerell, J. M. Carlson, and J. Doyle. 2005. Wildfires, complexity, and highly optimized tolerance. *Proceedings of the National Academy of Sciences of the United States of America* 102:17912-17917.
- Mount, J. F. 1995. *California Rivers and Streams*. University of California Press.
- Moyle, P. B. 2002. *Inland Fishes of California*, 2<sup>nd</sup> ed. University of California Press.
- Moyle, P. B., R. Yoshiyama, J. Williams, and E. Wikramanayake. 1995. *Fish Species of Special Concern in California*, 2<sup>nd</sup> ed. California Department of Fish and Game, Inland Fisheries Division.
- Moyle, P. B. and J. J. Cech, Jr. 2004. *Fishes: An Introduction to Ichthyology*, 5<sup>th</sup> ed. Prentice Hall.
- Moyle, P. B., J. A. Israel, and S. E. Purdy. 2008. *Salmon, Steelhead, and Trout in California: Status of an Emblematic Fauna*. University of Californian, Davis Center for Watershed Sciences.
- Moyle, P. B., J. V. E. Katz, R. M. Quinones. 2011. Rapid decline of California's native inland fishes: a status assessment. *Biological Conservation* 144(2011):2414-2423.
- Mueter, F. J., F.M. Peterman, and B.J. Pyper 2002. Opposite effects of ocean temperature on survival rates of 120 stocks of Pacific salmon (*Oncorhynchus* spp.) in northern and southern areas. *Canadian Journal of Fisheries and Aquatic Sciences* 59:456-463.
- Muhlfeld, C. C., J. J. Giersch, and B. Marotz. 2011a. Seasonal movements of non-native lake trout in a connected lack and river system. *Fisheries Management and Ecology*. 2011:1-9.
- Muhlfeld, C. C., L. Jones, D. Kotter, D. W. Miller, D. Geise, and J. Tohtz. 2011b. Assessing the impacts of river regulation on native bull trout (*Salvelinus confuentus*) and westslope cutthroat trout (*Oncorhynchus clarkia lewisi*) habitat in the upper Flathead River, Montana, USA. *River Research and Applications*. 10:1494.
- Murray, C. and J. D. McPhail. 1988. Effect of temperature on the development of five species of Pacific salmon (*Oncorhynchus*) embryos and alevins. *Canadian Journal of Zoology* 66:266-273.
- Myers, K. W. K., Y. Aydin, R. V. Walker, S. Fowler, and M. L. Dahlberg. 1996. Known ocean ranges of stocks of Pacific salmon and steelhead as shown by tagging experiments, 1956-1995. North Pacific Anadromous Fish Commission. University of Washington.
- Myers, K. W., R. V. Walker, H. R. Carlson, and J. H. Helle 2000. Synthesis and review of US research on the physical and biological factors affecting ocean production of salmon. *North Pacific Anadromous Fish Commission Bulletin* 2:1010.
- Myers, R. A., S. A. Levin, R. Lande, F. C. James, W. W. Murdoch, R. T. Paine. 2004. Hatcheries and Endangered Salmon. *Science* 303:1980.
- Naiman, R. J. and K. H. Rogers. 1997. Large animals and the maintenance of system-level characteristics in river corridors. *BioScience* 47:521-529.
- Naiman, R. J. and R. E. Bilby (eds.). 1998. *River Ecology and Management: Lessons from the Pacific Coastal Ecoregion*. Springer-Verlag.
- Naiman, R. J., H. Decamps, and M. E. McClain, 2005. *Riparia: Ecology, Conservation, and Management of Streamside Communities*. Elsevier/Academic Press.

- Narum, S. R., C. Contor, A. Talbot, and M. S. Powell. 2004. Genetic divergence of sympatric resident and anadromous forms of *Oncorhynchus mykiss* in the Walla Walla River, U.S.A. *Journal of Fish Biology* 65:471-488.
- National Marine Fisheries Service. 1996a. *Factors for Decline – A Supplement to the Notice of Determination for West Coast Steelhead Under the Endangered Species*. National Marine Fisheries Service, Northwest and Southwest Regions, Protected Resources Divisions.
- National Marine Fisheries Service. 1996b. *Steelhead Conservation Efforts: A supplement to the Notice of Determination for West Coast Steelhead Under the Endangered Species Act*. National Marine Fisheries Service, Northwest and Southwest Regions, Protected Resources Divisions.
- National Marine Fisheries Service. 1997a. *Characterization of on Ongoing Watershed-Scale Conservation Efforts within Four Proposed Steelhead Evolutionary Significant Units (ESU) in California*.
- National Marine Fisheries Service. 1997b. *Aquatic Properly Functioning Condition Matrix (Species Habitat Needs Matrix)*. National Marine Fisheries Service, Southwest Region, Habitat Conservation Division.
- National Marine Fisheries Service. 2000. *Guidelines for Salmonid Passage at Stream Crossings*. National Marine Fisheries, Southwest Region, Habitat Conservation Division.
- National Marine Fisheries Service. 2002. *Instream Flow Needs for Steelhead in the Carmel River. Bypass flow Recommendations for Water Supply Projects Using Carmel River Waters*. Prepared for the National Marine Fisheries Service, Southwest Region – Santa Rosa Field Office.
- National Marine Fisheries Service. 2004. *Biennial Report to Congress on the Recovery Program for Threatened and Endangered Species: October 1, 2002 – September 30, 2004*. National Marine Fisheries Service, Office of Protected Resources.
- National Marine Fisheries Service. 2005a. *Status Review of West Coast Steelhead From Washington, Idaho, Oregon, and California*. NOAA Technical Memorandum NMFS-NWFSC TM-66.
- National Marine Fisheries Service. 2005b. *2005 Report to Congress: Pacific Coastal Salmon Recovery Fund FY 2000-2005*. National Marine Fisheries Service, Office of Protected Resources.
- National Marine Fisheries Service. 2006a. *Protected Resources Division Strategic Plan*. National Marine Fisheries Service, Protected Resources Division.
- National Marine Fisheries Service. 2006b. *Biennial Report to Congress on the Recovery Program for Threatened and Endangered Species: October 1, 2004 – September 30, 2006*. National Marine Fisheries Service, Office of Protected Resources.
- National Marine Fisheries Service. 2006c. *2006 Report to Congress: Pacific Coastal Salmon Recovery Fund FY 2000-2005*. National Marine Fisheries Service, Office of Protected Resources.
- National Marine Fisheries Service. 2007a. *2007 Federal Recovery Outline for the Distinct Population Segment of Southern California Steelhead*. National Marine Fisheries Service, Southwest Region, Protected Resources Division.
- National Marine Fisheries Service. 2007b. *2007 Report to Congress: Pacific Coastal Salmon Recovery Fund FY 2000-2005*. National Marine Fisheries Service, Office of Protected Resources.
- National Marine Fisheries Service. 2008a. *2008a Report to Congress: Pacific Coastal Salmon Recovery Fund FY 2000-2005*. National Marine Fisheries Service., Office of Protected Resources.

- National Marine Fisheries Service. 2008b. *Final Biological Opinion: U.S. Department of Agriculture, U.S. Forest Service's proposal to apply eight long-term fire retardants to all USFS Lands*. July 25, 2008. National Marine Fisheries Service, Office of Protected Resources.
- National Marine Fisheries Service). 2008c. *Final Biological Opinion: U.S. Environmental Protection Agency's registration of pesticides containing chlorpyrifos, diazinon, and malathion*. National Marine Fisheries Service, Office of Protected Resources. [www.nmfs.noaa.gov/pr/pdfs/pesticide\\_biop.pdf](http://www.nmfs.noaa.gov/pr/pdfs/pesticide_biop.pdf).
- National Marine Fisheries Service. 2008d. *Final Biological Opinion: Environmental Protection Agency Registration of Pesticides Containing azinphos methyl, bensulide, dimethoate, disulfoton, ethoprop, fenamiphos, naled, methamidophos, methidathion, methyl parathion, phorate and phosmet*. National Marine Fisheries Service, Office of Protected Resources. [http://www.nmfs.noaa.gov/pr/pdfs/final\\_batch\\_3\\_opinion.pdf](http://www.nmfs.noaa.gov/pr/pdfs/final_batch_3_opinion.pdf)
- National Marine Fisheries Service. 2008e. *Final Biological Opinion: Environmental Protection Agency Registration of Pesticides Containing 2,4-D, triclopyr BEE, diuron, linuron, captan, and chlorothalonil*. [http://www.nmfs.noaa.gov/pr/pdfs/consultations/pesticide\\_opinion4.pdf](http://www.nmfs.noaa.gov/pr/pdfs/consultations/pesticide_opinion4.pdf)
- National Marine Fisheries Service. 2009. *2009 Report to Congress: Pacific Coastal Salmon recovery Fund FY 2000-2008*. National Marine Fisheries Service, Office of Protected Resources.
- National Marine Fisheries Service. 2010a. *Interim Recovery Planning Guidance for Federally Threatened and Endangered Species*. Version 3.1 June 2010. National Marine Fisheries Service, Office of Protected Resources.
- National Marine Fisheries Service 2010b. *Fisheries Economics of the United States, 2008*. United States Department of Commerce. NOAA Technical Memorandum NMFS-F/SPO-109.
- National Marine Fisheries Service. 2010c. *2010 Report to Congress: Pacific Coastal Salmon recovery Fund FY 2000-2009*. National Marine Fisheries Service, Office of Protected Resources.
- National Marine Fisheries Service. 2012. *Final Biological Opinion: Environmental Protection Agency registration of pesticides containing oryzalin, pendimethalin, trifluralin*. [http://www.nmfs.noaa.gov/pr/pdfs/consultations/pesticides\\_batch5opinion.pdf](http://www.nmfs.noaa.gov/pr/pdfs/consultations/pesticides_batch5opinion.pdf).
- National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2005. *Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (Salmo salar)*. National Marine Fisheries Service, Office of Protected Resources.
- National Oceanic and Atmospheric Administration and Environmental Protection Agency. 1991a. *Susceptibility and status of West Coast estuaries to nutrient discharges: San Diego Bay to Puget Sound*. Prepared by NOAA/ EPA Team on Near Coastal Waters.
- National Oceanic and Atmospheric Administration. 1991b. *Distribution and Abundance of Fishes and Invertebrates in the West Coast Estuaries*. Vol. II: *Species Life History Summaries*. National Oceanic and Atmospheric Administration, National Ocean Survey.
- National Research Council. 2002. *Riparian Areas*. Committee on Riparian Zone Functioning and Strategies for Management, Water Science and Technology Board, Board on Environmental Studies and Toxicology, Division on Earth and Life Studies. National Academy Press.
- National Research Council. 2004. *Adaptive Management for Water Resources Planning*. Panel on Adaptive Management for Resource Stewardship, Committee to Assess the U.S. Army Corps of Engineers Methods of Analysis and Peer Review for Water Resources Project Planning, Water Science and Technology Board, Ocean Studies Board, Division on Earth and Life Studies. National Academy Press.

- National Research Council. 2010. *Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean*. Committee on the Development of an Integrated Science Strategy for Ocean Acidification Monitoring, Research, and Impacts Assessment. Ocean Studies Board. Division on Earth and Life Studies. National Academy Press.
- Natural Resources Consulting Engineers. 2001. *Review of CVSIM Modeling of the Carmel River Unimpaired Flows*. Prepared for the National Marine Fisheries Service, Southwest Region, Santa Rosa.
- Nedeff, N. 2004. *Garrapata Watershed Assessment and Restoration Plan. Riparian Element*. Prepared for the Garrapata Creek Watershed Council.
- Nedeff, N. 2005. *Garrapata Creek Watershed Assessment. Phase Two: Upper Watershed*. Prepared for the Garrapata Creek Watershed Council.
- Neelin, D. J. 2011. *Climate Change and Climate Modeling*. Cambridge University Press.
- Nehlsen, W., J. E. Williams, and J. A. Lichatowich. 1991. Pacific salmon at the crossroads: stocks at risk from California, Oregon, Idaho and Washington. *Fisheries* 16(2):4-21.
- Nelson, J. 1994. *Steelhead Population and Habitat Assessment on Arroyo de la Cruz, San Luis Obispo County, 1993*. Prepared for the California Department of Fish and Game.
- Nelson, J. 2005. *Garrapata Creek Steelhead Population Assessment*. Prepared for the California Department of Fish and Game, Central Coast Region.
- Nelson, J., E. Baglivio, and T. Kahles. 2005a. *Santa Rosa Creek Steelhead Habitat and Population Survey*. Prepared for California Department of Fish and Game.
- Nelson, J., E. Baglivio, and T. Kahles. 2005b. *San Simeon Creek Steelhead Habitat and Population Survey*. Prepared for California Department of Fish and Game.
- Nelson, J., E. Baglivio, and T. Kahles. 2006a. *Stream Inventory Report San Jose Creek*. Prepared for the California Department of Fish and Game.
- Nelson, J., E. Baglivio, and T. Kahles. 2006b. *Stream Survey Report Seneca Creek*. Prepared for the California Department of Fish and Game.
- Nelson, K. C. and M. A. Palmer. 2007. Stream temperature surges under urbanization and climate change: data, models, and responses. *Journal of the American Water Resources Association* 43(2):440-452.
- Nemeth, J. D. and R. B. Kiefer. 1999. Snake river spring and summer Chinook salmon – the choice for recovery. *Fisheries* 24:16-23.
- Newcombe, C. P. 2003. Impact assessment model for clear water fishes exposed to excessively cloudy water. *Water Resources Bulletin* 35:529-544. American Water Resources Association.
- Newcombe, C. P. and D. D. McDonald. 1991. Effects of suspended sediments on aquatic ecosystems. *North American Journal of Fisheries Management* 11:72-82.
- Newcombe, C. P. and J. Jensen. 1996. Channel suspended sediment and fisheries: synthesis for quantitative assessment of risk and impact. *North American Journal of Fisheries Management* 16(4):1-34.
- Newman, W., F. Watson, M. Angelo, J. Casagrande, and B. Feikert. 2003. *Land Use History and Mapping in California's Central Coast Region*. Publication No. WI-2003-03. The Watershed Institute. California State University, Monterey Bay.

- Newson, M. D. and A. R. Large. 2006. 'Natural' rivers, 'hydromorphological quality' and river restoration: a challenging new agenda for applied fluvial geomorphology. *Earth Surface Processes and Landforms* 31:1606-1624.
- Nichols, K. M., W. P. Young, R. G. Danzmann, B. D. Robinson, C. Rexroad, M. Noakes, R. B. Phillips, P. Bentzen, I. Spies, K. Knudsen, F. W. Allendorf, B. M. Cunningham, J. Brunelli, H. Zhang, S. Ristow, R. Drew, K. H. Brown, P. A. Wheeler, and G. H. Thorgaard. 2002. A consolidated linkage map for rainbow trout (*Oncorhynchus mykiss*). *Animal Genetics* 34:102-115.
- Nielsen, J. L. 1994. *Molecular Genetics and Stock Identification in Pacific Salmon (Oncorhynchus mykiss)*. Ph.D. Dissertation, Department of Biology, University of California, Berkeley.
- Nielsen, J. L. 1999. The evolutionary history of steelhead *Oncorhynchus mykiss* along the US Pacific coast: developing a conservation strategy using genetic diversity. *ICES Journal of Marine Science* 56:449-458.
- Nielsen, J. L., C. Gan, and W. Thomas. 1994a. Differences in genetic diversity of mtDNA between hatchery and wild population of *Oncorhynchus*. *Canadian Journal Fisheries and Aquatic Sciences* 51(Suppl. 1):290-297.
- Nielsen, J. L., T. E. Lisle, and V. Ozaki. 1994b. Thermally stratified pools and their use by steelhead in northern California streams. *Transactions of the American Fisheries Society* 123:613-626.
- Nielsen, J. L., C. Gan, J. Wright, D. Morris, and W. Thomas. 1994c. Biogeographic distribution of mitochondrial and nuclear markers for southern steelhead. *Molecular Marine Biology and Biotechnology* 3(5):281-293.
- Nielsen, J. L., T. Lisle, and V. Ozaki. 1994d. Thermally stratified pools and their use by steelhead in northern California streams. *Transactions of the American Fisheries Society* 123:613-626.
- Nielsen, J. L., C. Carpanzano, M. Fountain, and C. Gan. 1997. Mitochondrial DNA and nuclear microsatellite diversity in hatchery and wild *Oncorhynchus mykiss* from freshwater habitats in southern California. *Transactions of the American Fisheries Society* 126:397-417.
- Nielsen, J. L. and M. C. Fountain. 1999. Microsatellite diversity in sympatric reproductive ecotypes of Pacific steelhead (*Oncorhynchus mykiss*) from the Middle Fork Eel River, California. *Ecology of Freshwater Fish* 8:159-168.
- Nielsen, J. L., E. L. Heine, C. A. Gan, and M. C. Fountain. 2000. Molecular analysis of population genetic structure and recolonization of rainbow trout following the Cantara spill. *California Fish and Game* 86:21-40.
- Nielsen, J. L., J. M. Scott, J. L. Aycrigg. 2001. Endangered species and peripheral populations: cause for conservation. *Endangered Species Update* 18(5):194-197.
- Nielsen, J. L. and G. T. Ruggerone. 2009. Climate change and dynamic ocean carrying capacity: growth and survival of Pacific salmon at sea. In: Knudsen, E. E. and J. Hal Michael, Jr. (eds.). *Pacific Salmon Environmental Life History Models: Advancing Science for Sustainable Salmon in the Future*. American Fisheries Society Symposium 71.
- Nielsen-Pincus, M. and C. Moseley. 2010. *Economic Employment Impacts of Forest Watershed Restoration in Oregon*. Ecosystem Workshop Program. Working Paper 24. Institute for a Sustainable Environment. University of Oregon.
- Noga, E. 2000. *Fish Disease: Diagnosis and Treatment*. Iowa State University. Press.
- Norris, R. M. and R. W. Webb. 1990. *Geology of California*. John Wiley & Sons, Inc.

- Northcote, T. G. 1958. Effect of Photoperiodism on response of juvenile trout to water currents. *Nature* 191:4618):1283-84.
- Northcote, T. G. 1997. Why sea run? An exploration into the migratory/residency spectrum of coastal cutthroat trout. In: Hall, J. D. P. A. Bisson, and R. E. Gresswell (eds.). *Sea-Run Cutthroat Trout: Biology Management and Future Conservation*. American Fisheries
- Null, S. E., J. H. Viers, and J. F. Mount. 2010. Hydrologic response and watershed sensitivity to climate warming in California's Sierra Nevada. *PLoS One* 5(4).
- Ode, P., A. C. Rehn, and J. T. May. 2005. A quantitative tool for assessing the integrity of southern coastal California streams. *Environmental Management* 35(4):493-504.
- Oldani, N. O. and C. R. M. Baigum. 2002. Performance of a fishway system in a major South American dam on the Paraná River (Argentina-Paraguay). *River Research and Applications* 18:171-183.
- Oldani, N. O., C. R. M. Baigum, J. M. Nestler, and R. A. Goodwin. 2007. Is fish passage technology saving fish resources in the lower La Plata River Basin? *Neotropical Ichthyology* 5(2):89-102.
- Olden, J. D. and R. J. Naiman. 2010. Incorporating thermal regimes into environmental assessments: modifying dam operations to restore freshwater ecosystem integrity. *Freshwater Biology* 56:86-107.
- Orr, H. G., A. Ar. Large, M. D. Newson, and C. L. Walsh. 2008. A predictive typology for characterizing hydromorphology. *Geomorphology* 100:32-40.
- Osgood, K. E. (ed.). 2008. *Climate Impacts on U.S. Living Marine Resources: National Marine Fisheries Service Concerns, Activities and Needs*. NOAA Technical Memorandum NMFS-F/SPO TM-89.
- Ostrom, E. 2009a. Design principles of robust property-right institutions: what have we learned? Workshop on Political Theory and Policy Analysis. In: Ingram, K. G. and U. Hong (eds.) *Property Rights and Long Policies*. Lincoln Institute of Land Policy.
- Ostrom, E. 2009b. A general framework for analyzing sustainability of social-ecological systems. *Science* 325:419-422.
- Otte, F. and M. McEwen. 2001. *Existing Data Summary Morro Bay Watershed. Morro Bay Watershed Steelhead Restoration Planning Process*. Prepared for Coastal San Luis Resource Conservation District.
- Owens, P. N., R. J. Batalla, A. J. Collins, B. Gomez, D. M. Hicks, A. J. Horwitz, G. M. Kondolf, M. Marden, M. J. Page, D. H. Peacock, E. L. Petticrew, W. Salomons, and N. A. Trustrum. 2005. Fine-grained sediment in river systems: environmental significance and management issue. *River Research and Applications* 21:693-717.
- Pacific States Marine Fisheries Commission. 1999. *Conservation and Enhancement of Essential Fish Habitat*. Pacific Marine Fisheries Commission.
- Pacific Watershed Associates. 2003. *Watershed Assessment and Erosion Prevention Planning Project for Garrapata Creek Watershed, Monterey, California*. 2001 California Coastal Salmon Recovery Program. Prepared for the California Department of Fish and Game.
- Palacios, D. P., S. J. Bograd, R. Mendelssohn, and F. B. Schwing. 2004. Long-term and seasonal trends in stratification in the California Current, 1950-1993. *Journal of Geophysical Research* 109(C10):C10016.
- Palmer, T. 2012. *Field Guide to California Rivers*. University of California Press.
- Palumbi, S. R. and C. Sotka. 2011. *The Death & Life of Monterey Bay: A Story of Revival*. Island Press.

- Panel on Adaptive Management for Resource Stewardship. 2011. *Adaptive Management For Water Resource Projects*. National Research Council. National Academy Press.
- Paquet, P. J., T. Flagg, A. Appleby, J. Barr, L. Blankenship, D. Campton, M. Delarm, T. Evelyn, D. Fast, J. Gislason, P. Kline, D. Maynard, L. Mobrand, G. Nandor, P. Seidel, and S. Smith. 2011. Hatcheries, conservation and sustainable fisheries – achieving multiple goals: results of the hatchery scientific review group’s Columbia River Basin Review. *Fisheries* 36(11):547-561.
- Parenti, L. R. and M. C. Ebach. 2009. *Comparative Biogeography: Discovering and Classifying Biogeographical Patterns of a Dynamic Earth*. University of California Press.
- Pauly, D. 1995. Anecdotes and the shifting baseline syndrome of fisheries. *Trends in Ecology and Evolution* 10(10):430.
- Pearse, D. E. and J. C. Garza. 2008. *Historical Baseline for Genetic Monitoring of Coastal California Steelhead, *Oncorhynchus mykiss*. Final Report*. Prepared for California Department of Fish and Game Fisheries Restoration Grant Program. Grant PO5100530.
- Pejchar, L. and K. Warner. 2001. A river might run through it again: criteria for consideration of dam removal and interim lessons from California. *Environmental Management* 28:561-575.
- Perry, W., F. Watson, J. Casagrande, and C. Hanley. 2007. *Carmel River Lagoon Enhancement Project: Water Quality and Aquatic Wildlife Monitoring, 2006-7*. Publication No. WI-2007-02. The Watershed Institute. California State University, Monterey Bay.
- Peterson, N., A. Hendry, and T. Quinn. 1992. *Assessment of Cumulative Effects on Salmonid Habitat: Some Suggested Parameters and Target Conditions*. Prepared for the Washington Department Natural Resources and the Cooperative Monitoring, Evaluation, and Research Committee, Timber/Fish/Wildlife Agreement. University of Washington.
- Peterson, W. T. and F. F. Schwing. 2003. A new climate regime in Northeast Pacific ecosystems. *Geophysical Research Letters* 30(17):1896.
- Philander, S. G. 1990. *El Nino, La Nina, and the Southern Oscillation*. International Geophysics Series. Vol. 46. Academic Press.
- Philander, S. G. 2004. *Our Affair with El Nino. How We Transformed an Enchanting Peruvian Current into a Global Climate Hazard*. Princeton University Press.
- Pierrehumbert, R. T. 2010. *Principles of Planetary Climate*. Cambridge University Press.
- Pilkey, O. H. and R. Young. 2009. *The Rising Sea*. Island Press.
- Pimm, S. L., H. L. Jones, and J. Diamond. 1988. On the risk of extinction. *American Naturalist* 132:757-785.
- Pincetl, S. S. 1999. *Transforming California: A Political History of Land Use and Development*. The Johns Hopkins University Press.
- Pipal, K., M. Jessop, G. Holt, and P. Adams. 2010. *Operation of Dual-Frequency Identification Sonar (DIDSON) to Monitor Adult Steelhead (*Oncorhynchus mykiss*) in the Central California Coast*. NOAA Technical Memorandum NMFS-SWFSC-454.
- Pizzuto, J. 2002. Effects of dam removal on river form and process. *BioScience* 52:683-91.
- Platts, W. and M. McHenry. 1988. *Density and Biomass of Trout and Char in Western Streams*. U.S. Forest Service, Intermountain Research Station. General Technical Report. INTR-241.

- Podlech, M. 2011. *College Lake Smolt Outmigrant Study, Spring 2011*. Prepared for the Resources Conservation District of Santa Cruz County.
- Poff, N. L., J. D. Allan, M. B. Bain, J. R. Karr, K. L. Prestegard, B. D. Richter, R. E. Sparks, and J. C. Stromberg. 1997. The natural flow regime: a paradigm for river conservation and restoration. *BioScience* 47:769-784.
- Poff, N. L., B. D. Richter, A. H. Arthington, S. E. Bunn, R. J. Naiman, E. Kendy, M. Acreman, C. Apse, B. Bledsoe, R. E. Tharme, and A. Warner. 2010. The ecological limits of hydrological alteration (ELOHA): a new framework for developing regional environmental flow standards. *Freshwater Biology* 55:147-170.
- Poff, N. L. and J. K. H. Zimmerman. 2010. Ecological responses to altered flow regimes: a literature review to inform the science and management of environmental flows. *Freshwater Biology* 55:194-205.
- Pollock, K. H., C. M. Jones, and T. L. Brown. 1994. *Angler Survey Methods and Their Application to Fisheries Management*. American Fisheries Society Special Publication No. 25.
- Polyakov, V., A. Fares, and M. H. Ryder. 2005. Precision riparian buffers for the control of nonpoint source pollutant loading into surface water: A review. *Environmental Reviews* 13:129-144.
- Pompeu, P. and C. B. Martinez. 2007. Efficiency and selectivity of a trap and truck fish passage system in Brazil. *Neotropical Ichthyology* 5(2):169-176.
- Pon, L. B., S. G. Hinch, S. J. Cooke, D. A. Patterson, and A. P. Farrell. 2009. Physiological, energetic and behavioral correlates of successful fishway passage of adult sockeye salmon *Oncorhynchus nerka* in the Seton River, British Columbia. *Journal of Fish Biology* 74:1323-1336.
- Poole, G. 2002. Fluvial landscape ecology: addressing uniqueness within the river discontinuum. *Freshwater Biology* 47:641-660.
- Primack, R. 2008. *A Primer of Conservation Biology*, 4<sup>TH</sup> ed. Sinauer Associates, Inc.
- Punt, A. E. and R. Hilborn. 1997. Fisheries stock assessment and decision analysis: the Bayesian approach. *Reviews in Fish Biology and Fisheries* 5-63(1997).
- Quinn, R. D. and Sterling C. Kelley. 2006. *Introduction to California Chaparral*. University of California Press.
- Quinn, T. P. 2005. *The Behavior and Ecology of Pacific Salmon and Trout*. American Fisheries Society and University of Washington Press.
- Quinn, T. P. and Meyers, K. W. 2005. Anadromy and the marine migration of Pacific salmon and trout: Rounsefell revisited. *Reviews in Fish Biology and Fisheries* 14:421-42.
- Rahmstorf, S. 2007. A semi-empirical approach to projecting future sea-level rise. *Science* 315(5810):368-370.
- Raines, Melton & Carella and EDAW. 2002. *Carmel River Dam Alternative Plan B. Plan B Project Report A.97-03-052*. Prepared for the Water Division of the California Public Utilities Commission.
- Raleigh, R., T. Hickman, R. Solomon, and P. Nelson. 1984. *Habitat Suitability Information: Rainbow Trout*. U.S. Fish and Wildlife Service. FWS/OBS-82/10.60.
- Raper, S. C. B. and R. J. Braithwaite. 2006. Low sea level rise projections from mountain glaciers and icecaps under global warming. *Nature* 439:311-313.
- Rathbun, G., K. Worcester, D. Holland, and J. Martin. 1991. *Status of Declining Aquatic Reptiles, Amphibians, and Fishes in the Lower, Cambria, San Luis Obispo County, California*. Prepared for Greenspace Land Trust.
- Reeves, G. H., D. B. Hohler, D. P. Larsen, D. E. Busch, K. Kratz, K. Reynolds, K. F. Stein, T. Atzet, P. Hays, and M. Tehan. 2004. *Aquatic and Riparian Effectiveness Monitoring Plan for the Northwest Forest Plan*. General

- Technical Report. PNW-GTR-577. U.S. Department of Agriculture, Forest Service. Pacific Northwest Research Station, Portland.
- Regan, H. M. M. Colyvan, M. A. Burgman. 2000. Fuzzy Set Theory and Threatened Species Classification *Biological Conservation* 14(4):1192-1199.
- Reid, G. K. and R. D. Wood. 1976. *Ecology of Inland Waters and Estuaries*. D. Van Nostrand Company.
- Reid, I. and J. B. Laronne. 1995. Bedload sediment transport in an ephemeral stream and a comparison with seasonal and perennial counterparts. *Water Resources Research* 31:773-781.
- Reiser, D. W. 2008. Enhancing salmonid populations via spawning habitat restoration actions. *In: Sear, D. and P. DeVries (eds.). Salmonid Spawning Habitat in Rivers: Physical Controls, Biological Responses, and Approaches to Remediation*. American Fisheries Society Symposium 65.
- Revelle, R. R. (ed.) 1990. *Sea-Level Change. Studies in Geophysics*. National Research Council. National Academy Press.
- Rich, A. and E. A. Keller. 2011. Watershed Controls on the Geomorphology of Small Coastal Lagoons in an Active Tectonic Environment. *Estuaries and Coasts* (14 September 2011):1-19.
- Richardson, J. S., E. Taylor, D. Schluter, Mike Pearson, and T. Hatfield. 2010. Do riparian zones qualify as critical habitat for endangered freshwater fishes? *Canadian Journal of Fisheries Aquatic Science* 67:1197-1204.
- Ricklefs, R. E. and G. L. Miller. 1999. *Ecology*. W. H. Freeman and Company.
- Riggs, J. A. (ed.). 2002. *U.S. Policy on Climate Change: What's Next? A Report of the Aspen Institute Environmental Policy Forum*. The Aspen Institute.
- Riggs, J. A. (ed.). 2004. *A Climate Policy Framework: Balancing Policy and Politics*. A Report of an Aspen Institute Policy Dialogue. The Aspen Institute.
- Riley, A. 1998. *Restoring Streams in Cities: A Guide for Planners, Policy Makers, and Citizens*. Island Press, Washington, D.C.
- Rischbieter, D. 1990a. *Resource Inventory: Aquatic Life – Andrew Molera State Park*. Prepared for the California Department of Parks and Recreation, Natural Heritage Section.
- Rischbieter, D. 1990b. *Resource Inventory: Aquatic Life –Pfeiffer Big Sur State Park*. Prepared for the California Department of Parks and Recreation, Natural Heritage Section.
- Rischbieter, D. 2004. *Lower Arroyo Grande Creek and Lagoon Fishery and Aquatic Resources Summary Monitoring Report*. Oceano Dunes State Vehicular Recreation Area Pismo Dunes State Reserve. Prepared for California Department of Parks and Recreation, Central Valley District.
- Rischbieter, D. 2006. *Lower Arroyo Grande Creek and Lagoon Fishery and Aquatic Resources Summary 2005. Monitoring Report*. Oceano Dunes State Vehicular Recreation Area Pismo Dunes State Reserve. Prepared for California Department of Parks and Recreation, Central Valley District.
- Rischbieter, D. 2007. *Lower Arroyo Grande Creek and Lagoon Fishery and Aquatic Resources Summary 2006. Monitoring Report*. Oceano Dunes State Vehicular Recreation Area Pismo Dunes State Reserve. Prepared for California Department of Parks and Recreation, Central Valley District.
- Rischbieter, D. 2008. *Lower Arroyo Grande Creek and Lagoon Fishery and Aquatic Resources Summary 2007. Monitoring Report*. Oceano Dunes State Vehicular Recreation Area Pismo Dunes State Reserve. Prepared for California Department of Parks and Recreation, Central Valley District.

- Roberts, B. and R. White. 1992. Effects of angler wading on survival of trout eggs and pre-emergent fry. *North American Journal of Fisheries Management* 12:450-459.
- Robinson, M. 1993. *The Distribution and Abundance of Benthic and Epibenthic Macroinvertebrates in a Small Seasonal Central California Lagoon*. Master's Thesis. San Jose State University.
- Roemmich, D. And J. McGowan. 1995. Climatic warming and the decline of zooplankton in the California Current. *Science* 267:1324-1326.
- Rogers, K. 2005. The real river management challenge: Integrating scientists, stakeholders and service agencies. *River Research and Applications* 22:1-12.
- Rosenberger, A. E. and Dunham, J. B. 2005. Validation of abundance estimates from mark-recapture and removal techniques for rainbow trout captured by electrofishing in small streams. *North American Journal of Fisheries Management* 25:1395-1410.
- Rosgen, D. 1994. A classification of natural rivers. *Catena* 22(1994):169-199.
- Rosgen, D. 1998. *A Field Guide for Stream Classification*. Wildlands Hydrology Books.
- Ross Taylor and Associates. 2003. *Final Report: Morro Bay Watershed Stream Crossing Inventory and Fish Passage Evaluation*. Prepared for the Coastal San Luis Obispo Resource Conservation District.
- Ruckelshaus, M., T. Klinger, N. Knowlton, and D. R. Demaster. 2008. Marine ecosystem-based management in practice: scientific and governance challenges. *BioScience* 58:53-63.
- Rucker, E. and E. J. Ordall. 1953. Infectious diseases of Pacific salmon. *Transactions of the American Fisheries Society* 83:297-312.
- Ruddiman, W. F. 2005. *Plows, Plagues and Petroleum: How Humans Took Control of Climate*. Princeton University Press.
- Rundio, D.E. and S. T. Lindley. 2008. Seasonal patterns of terrestrial and aquatic prey abundance and their use by *Oncorhynchus mykiss* in a coastal basin with a Mediterranean climate. *Transactions of the American Fisheries Society* 137:467-480.
- Rundio, D. E. 2009. Community-habitat relationships in coastal streams in Big Sur, California, USA: travertine influences macroinvertebrate abundance and community structure. *Hydrobiologia* 620:91-108.
- Ruse, M. and J. Travis. 2009. *Evolution: The First Four Billion Years*. Harvard University Press.
- Ryan, G., and L. E. Burch. 1992. An analysis of sundowner winds: A California downslope wind event. Sixth Conference on Mountain Meteorology, American Meteorological Society, Portland.
- R2 Resource Consultants. 2000. *Review of Carmel River Dam Fish Passage Facilities*. Prepared for the Monterey Peninsula Water Management District.
- San Benito County Water District. 2006. *Groundwater Management Plan Update for the San Benito County Portion of the Gilroy-Hollister Groundwater Basin – Draft Program Environmental Impact Report*. Prepared for the San Benito County Water District.
- Satterthwaite, W. H., M. P. Beakes, E. M. Collins, D. R. Swank, J. E. Merz, R. G. Titus, S. M. Sogard, and M. Mangel. 2009. Steelhead life history on California's central coast: insights from a state-dependent model. *Transactions of the American Fisheries Society* 138:532-548.

- Satterthwaite, W. H., M. P. Beakes, E. M. Collins, D. R. Swank, J. E. Merz, R. G. Titus, S. M. Sogard, and M. Mangel. 2010. State-dependent life history models in a changing (and regulated) environment: steelhead in the California Central Valley. *Evolutionary Applications* 3(210):221-243.
- Satterthwaite, W. H. S. A. Hayes, J. E. Mertz, S. M. Sogard, D. M. Frechette, and M. Mangel. 2012. State-Dependent Migration Timing and Use of Multiple Habitat Types in Anadromous Salmonids. *Transactions of the American Fisheries Society*. 141(3):781-794.
- Santa Clara Valley Water District. 2006. *Santa Clara Valley Water District's Clean, Safe Creeks and Natural Flood Protection Program: Independent Oversight Report, Fiscal Year 2004-2005*. Prepared for the Santa Clara Valley Water District.
- Sawyer, John O. and T. Keeler-Wolf. 1995. *A Manual of California Vegetation*. California Native Plant Society.
- Sax, D. F., J. J. Stachowicz, and S. D. Gaines. 2005. *Species Invasion: Insights into Ecology, Evolution, and Biogeography*. Sinauer Associates, Inc.
- Schindler, D. E., X. Auger, E. Fleishman, N. Mantua, B. Riddell, M. Ruckelshaus, J. See, and M. Webster. 2008. Climate change, ecosystem impacts, and management for Pacific salmon. *Fisheries* 33(10):502-506.
- Schluter, D. 2000. *Ecology of Adaptive Radiation*. Oxford University Press.
- Schwing, F., S. Lindley, E. Danner, and D. Boughton. 2010. *Climate Change in California: Implications for the Recovery and Protection of Pacific Salmon and Steelhead*. NOAA Technical Memorandum NMFS-SWFSC TM-451.
- Science Applications International Corp. 2003. *Proposed Final Santa Maria River Estuary Enhancement and Management Plan*. Prepared for The Dunes Center.
- Scott, R. W. and W. T. Gill. 2008. *Oncorhynchus mykiss: Assessment of Washington State's Steelhead Population Programs*. Washington Department of Fish and Wildlife, Olympia Washington.
- Sear, D. and P. DeVries (eds.). 2008. *Salmonid Spawning Habitat in Rivers: Physical Controls, Biological Responses, and Approaches to Remediation*. American Fisheries Society Symposium 65.
- Sear, D., L. B. Frostick, G. Rollinson, and T. E. Lisle. 2008. The significance and mechanics of fine-sediment infiltration and accumulation in gravel spawning beds. In: Sear, D. and P. DeVries (eds.). *Salmonid Spawning Habitat in Rivers: Physical Controls, Biological Responses, and Approaches to Remediation*. American Fisheries Society Symposium 65.
- Service, R. F. 2011. Will busting dams boost salmon? *Science* 334:888-892.
- Shalowitz, A. L. 1964. *Shore and Sea Boundaries: With Special Reference to Interpretation and Use of the Coast and Geodetic Survey Data*. 2 Vols. U.S. Department of Commerce. Coast and Geodetic Survey. Publication 10-1.
- Shapovalov, L., and A. C. Taft. 1954. *The Life Histories of the Steelhead Rainbow trout (Salmo gairdneri gairdneri) and Silver Salmon (Oncorhynchus kisutch) with Special Reference to Waddell Creek, California, and Recommendations Regarding their Management*. Fish Bulletin No. 98. California Department of Fish and Game.
- Shapovalov, L., A. Cordone, and W. Dill. 1981. A list of the freshwater and anadromous fishes of California. *California Fish and Game* 67:4-38.
- Shaw, R. M., L. Pendleton, D. Cameron, B. Morris, G. Bratman, D. Bachelet, K. Lausmeyer, J. Mackenzie, D. Conklin, J. Lenihan, E. Haunreiter, and C. Daly. 2009. *The Impact of Climate Change on California's Ecosystem Services*. California Climate Change Center, University of California, Berkeley.

- Simpson, G. G. 1944. *Tempo and Mode in Evolution*. Columbia University Press.
- Smith, D., W. Newman, F. Watson, and J. Hameister. 2004. *Physical and Hydrologic Assessment of the Carmel River Watershed California*. Report No. WI-2004-05/2. The Watershed Institute. California State University, Monterey Bay.
- Smith, D., J. Casagrande, M. Vincent, J. McDermont, A. Price, A. Martin, Z. Carlson. 2005. *Garrapata Watershed Assessment: Hydrology and Sedimentology (2001 to 2004)*. The Watershed Institute. Report No. WI-2005-03.
- Smith, D., J. Casagrande, M. Vincent, J. McDermont, A. Price, A. Martin, and Z. Carlson. 2006. *Garrapata Watershed Assessment: Water and Sediment Monitoring in 2004-2005*. The Watershed Institute. Report No. WI-2006-02.
- Smith, J. J. 1982. *Fish of the Pajaro River*. In: Moyle, P. B., J. J. Smith, R. A. Daniels, and D. M. Baltz (eds.) *Distribution and Ecology of Stream Fishes of the Sacramento-San Joaquin Drainage System*. *University of California Publications in Zoology* 115:83-169.
- Smith, J. J. 1990. *The Effects of Sandbar Formation and Inflows on Aquatic Habitat and Fish Utilization in Pescadero, San Gregorio, Waddell and Pomponio Creek Estuary/Lagoon Systems, 1985-1989*. Report prepared under Interagency Agreement 84-04-324, between the Trustees for California State University and the California Department of Parks and Recreation.
- Smith, J. J. 1998. *Steelhead and other Fish Resources of Western Mt. Hamilton Streams*. Unpublished Report. San Jose State University.
- Smith, J. J. 2007a. *Steelhead Distribution and Ecology in the Upper Pajaro River System and Mainstem (with reach descriptions and limiting factor identification for Llagas Creek Watershed and stream descriptions, habitat quality ratings and limiting factors by reach for the Pajaro River and for the upper Pajaro River tributaries)*. Revised 7 November 2007. Department of Biological Sciences, San Jose State University.
- Smith, J. J. 2007b. *Effects of Operation of Pacheco Reservoir on Steelhead*. Unpublished Report, Department of Biology, San Jose State University.
- Smith, J. J. and H. W. Li. 1983. *Energetic factored influencing foraging tactics of juvenile steelhead trout, Salmo gairdneri*. In: Noakes, D. L. G., D. G. Lindquist, G. S. Helfman, and J. A. Word (eds.). *Predators and Prey in Fishes*. Dr. W. Junk Publishers, The Hague, The Netherlands.
- Smith, L. W., E. Dittmer, M. Prevost, and D. R. Burt. 2000. Breaching of a small irrigation dam in Oregon: a case history. *North American Journal of Fisheries Management* 20:205-219.
- Snider, W. 1983. *Reconnaissance of the Steelhead Resource of the Carmel River Drainage, Monterey County*. Prepared for the California Department of Fish and Game, Environmental Services Branch. Administrative Report No. 83-3.
- Snyder, J. O. 1913. *The Fishes of the Streams Tributary to Monterey Bay, California*. Bulletin of the United States Bureau of Fisheries 32:49-72.
- Snyder, M. A., J. L. Bell and L. C. Sloan. 2002. Climate responses to a doubling of atmospheric carbon dioxide for a climatically vulnerable region. *Geophysical Research Letters*. 29(11): 10.1029/2001GL014431.
- Snyder, M. A., L. C. Dittenbaugh, N. S., and J. L. Bell. 2003. Future Climate change and upwelling in the California Current. *Geophysical Research Letters* 30(15):1823.
- Snyder, M. A. and L. C. Sloan. 2005. Transient future climate over the western United States using a regional climate model. *Earth Interactions* 9(11).

- Sogard, S. M., T. H. Williams, and H. Fish. 2009. Seasonal patterns of abundance, growth, and site fidelity of juvenile steelhead in a small coastal California stream. *Transactions of the American Fisheries Society* 138:549-563.
- Sogard, S. M., J. E. Merz, W. H. Satterthwaite, M. P. Beakes, D. R. Swank, E. M. Collins, R. G. Titus, and M. Mangel. 2012. Contrasts in habitat characteristics and life history patterns of *Oncorhynchus mykiss* in California's central coast and Central Valley. *Transactions of the American Fisheries Society* 141:747-760.
- Sokal, R. and F. J. Rohlf. 1995. *Biometry: The Principles and Practices of Statistics in Biological Research*. W. H. Freeman.
- Solomon, S., G. Plattner, R. Knutti, and P. Friedlingstein. 2009. Irreversible climate change due to carbon dioxide emissions. *Proceedings of the National Academy of Science of the United States of America* 106:1704-1709.
- Southwick Associates. 2009. *Calculation of the Projected Economies and Jobs Impact of Salmon Recovery in California*. June 24, 2009. Fish and Wildlife Economics and Statistics. [http://www.asafishing.org/newsroom/documents/salmon\\_recovery\\_economics.pdf](http://www.asafishing.org/newsroom/documents/salmon_recovery_economics.pdf).
- Southwood, T. R. E. 1977. Habitat, the template for ecological strategies? *Journal of Animal Ecology* 46:337-365.
- Spanne, L. 1975. Seasonal variability in the population of Barbareno Chumash villages: an explanatory model. *In: Papers on the Chumash*. San Luis Obispo County Archaeological Society Occasional Paper No. 9.
- Spencer, W. D., S. J. Barry, S. R. Beissinger, J. L. Florsheim, S. Harrison, K. A. Rose, J. J. Smith, and R. R. White. 2006. *Report of Independent Science Advisors for Santa Clara Valley Habitat Conservation Plan/Natural Community Conservation Plan*. Prepared for the County of Santa Clara, Santa Clara Valley Water District, City of Gilroy, City of Morgan Hill, City of San Jose, Santa Clara Valley Transportation Authority, California Department of Fish and Game, and the United States Fish and Wildlife Service.
- Spina, A. P. 2003. Habitat associations of steelhead trout near the southern extent of their range. *California Fish and Game* 89(2):81-95.
- Spina, A. P. 2007. Thermal ecology of juvenile steelhead in a warm-water environment. *Environmental Biology of Fishes* 80:23-34.
- Spina, A. P. and K. Johnson. 1999. *Habitat Characteristics of Solstice Creek: Implications for Steelhead*. National Marine Fisheries Service, Habitat Conservation Division.
- Spina, A. P. and D. R. Tormey. 2000. Post-fire sediment deposition in geographically restricted steelhead habitat. *North American Journal of Fishery Management* 20:562-569.
- Spina, A. P., M. A. Allen, and M. Clarke. 2005. Downstream migration, rearing abundance and pool habitat associations of juvenile steelhead in the lower mainstem of a south-central California stream. *North American Journal of Fish Management* 25:919-930.
- Spina, A. P., M. McGoogan, and T. Gaffney. 2006. Influence of surface-water withdrawal on juvenile steelhead and their habitat in a south-central California stream. *California Fish and Game* 92(2):81-90.
- Stanford, J. A., J. V. Ward, C. A. Frissell, R. N. Williams, J. A. Lichatowich, and C. C. Countant. 1996. A general protocol for restoration of regulated rivers. *Regulated Rivers Research and Management* 12:391-413.
- Stanley, E. H. and M. W. Doyle. 2003. Trading off: the ecological effects of dam removal. *Frontiers in Ecology and the Environment* 1:15-22.

- Stanley, S., J. Brown, and S. Grigsby. 2005. *Protecting Aquatic Ecosystems: A guide for Puget Sound Planners to Understand Watershed Processes*. Ecology Publication #05-06-027. Washington State Department of Ecology.
- Stark, B. and B. Wilkison. 2002. *San Luis Obispo Creek Watershed Enhancement Plan*. Prepared for the California Coastal Conservancy.
- Stasiunaite, P. and N. Kazlauskiene. 2002. Impact of municipal wastewater chemicals on the rainbow trout (*Oncorhynchus mykiss*) in its early development. *Ekologija* 2:58-64.
- Stephenson, J. and G. Calcarone. 1999. *Southern California Mountains and Foothills Assessment: Habitat and Species Conservation Issues*. General Technical Report GTR-PSW-172. U.S. Forest Service, Pacific Southwest Research Station.
- Stern, N. *The Economics of Climate Change: The Stern Review*. Cambridge University Press.
- Stillwater Sciences, Central Coast Salmon Enhancement, and Greenspace-The Cambria Land Trust. 2012. *Santa Rosa Creek Watershed Management Plan*. Prepared for California Department of Fish and Game. Fisheries Restoration Grant Program P0740401.
- Stocking, R.W. and J. L. Bartholomew. 2004. *Assessing Links Between Water Quality, River Health and Ceratomyxosis of salmonids in the Klamath River System*. Department of Microbiology, Oregon State University.
- Stoecker, M. W. and S. Allen. 1998. *How the Regional GIS Database Can be Useful to Southern California Steelhead Recovery*. Department of Evolution, Ecology, and Marine Sciences, University of California, Santa Barbara.
- Stouder, D. J., P. A. Bisson, and R. J. Naiman (eds.). 1997. *Pacific Salmon and Their Ecosystems: Status and Future Options*. Chapman and Hill.
- Sugihara, N. G., J. W. Van Wagtendonk, K. E. Shaffer, J. Fites-Kaufman, and A. E. Thode (eds.). 2006. *Fire in California's Ecosystems*. University of California Press.
- Sumpter, J. P. and A. C. Johnson. 2005. Lessons from endocrine disruption and their application to other issues concerning trace organics in the aquatic environment. *Environmental Science Technology* 39:431-4332.
- Sundermeyer, D. R. 1999. *Hatchery Influence on Pajaro River Steelhead Analyzed with Microsatellite DNA*. Master's Thesis, San Jose State University.
- Sunderstrom, S., C. Mosely, M. Nielsen-Pincus, and E. J. Davis. 2011. *Quick Guide to Monitoring Economic Impacts of Ecosystem Restoration and Stewardship*. Ecosystem Work Program. Summer 2011. Institute for a Sustainable Environment. University of Oregon.
- Swanson Hydrology & Geomorphology. 2004. *Arroyo Grande Creek Watershed Management Plan: Geomorphic and Hydrologic Assessment*. Prepared for Central Coast Salmon Enhancement.
- Swanson Hydrology & Geomorphology. 2006a. *Arroyo Grande Creek Steelhead Distribution and Abundance Survey – 2006*. Prepared for Central Coast Salmon Enhancement in association with Hagar Environmental Science.
- Swanson Hydrology & Geomorphology. 2006b. *Arroyo Grande Creek Erosion, Sedimentation and Flooding Alternatives Study*. Prepared for Coastal San Luis Resource Conservation District.
- Sweet, S. S. 1992. *Initial Report on the Ecology and Status of the Arroyo Toad (Bufo microscaphus californicus) on the Los Padres National Forest of Southern California, with Management Recommendations*. Prepared for U.S. Forest Service, Los Padres National Forest.
- Swezy, S. L. and R. F. Heizer. 1977. Ritual management of salmonid fish resources in California. *The Journal of California Archaeology* 4:7-29.

- Swift, C. C. 1975. *Survey of the Freshwater fishes and their Habitats in the Coastal Drainages of Southern California*. Natural History Museum of Los Angeles County.
- Swift, C. C., T. Haglund, and M. Ruiz. 1990. *Status of Freshwater Fishes of Southern California with Recommendations for Preserves to Maintain their Existence*. Prepared for California Department of Fish and Game, Inland Fisheries Branch. Section of Fishes. Natural History Museum of Los Angeles County.
- Swift, C. C., T. Haglund, M. Ruiz, and R. Fisher. 1993. *The Status and Distribution of the Freshwater Fishes of Southern California*. *Southern California Academy Sciences Bulletin* 92(3):101-172.
- Swift, C. C. and S. R. Howard. 2009. Current Status and Distribution of the Pacific Lamprey South of Point Conception, Southern California. In: Brown, L. R., S. D. Chase, M. G. Mesa, R. J. Beamish, P. D. Moyle (eds.). *Biology, Management, and Conservation of Lampreys in North America*. American Fisheries Society Symposium 72.
- Swezey, S. L. and R. L. Heizer. 1977. Ritual management of salmonid fish resources in California. *The Journal of California Anthropology* 4:7-29.
- Tague, C., M. Farrell, G. Grant, S. Lewis, and S. Rey. 2007. Hydrogeologic controls on summer stream temperatures in the McKenzie River Watershed, Oregon. *Hydrological Processes* 21:3288-3300.
- Tague, C., G. Grant, M. Farrell, J. Choate, and A. Jefferson. 2008. Deep groundwater mediates streamflow response to climate warming in the Oregon Cascades. *Climate Change* 86:189-210.
- Tague, C., L. Seaby, and A. Hope. 2009. Modeling the eco-hydrologic response of a Mediterranean type ecosystem the combined impacts of projected climate change and altered fire frequencies. *Climatic Change* 93:137-155.
- Tainter, J. A. 1975. Hunter-gatherer territorial organization in the Santa Ynez Valley. *Pacific Coast Archaeological Society Quarterly* 11(2):2740.
- Tait, C., J. Li, G. Lamberti, T. Pearsons, and H. Li. 1994. Relationships between riparian cover and the community structure of high desert streams. *Journal North American Benthological Society* 13:45-56.
- Tallis, H., P. S. Levin, M. Ruckelshaus, S. E. Lester, K. L. McLeod, D. L. Fluharty, and B. S. Halpern. 2010. The many faces of ecosystem-based management: making the process work today in real places. *Marine Policy* 34:340-348.
- Tatara, C. P., S. C. Riley, B. A. Berejikian. 2011a. Effects of hatchery fish density on emigration, growth, survival, and predation risk of natural steelhead parr in an experimental stream channel. *North American Journal of Fisheries Management* 31:224-235.
- Tatara, C. P., B. A. Berejikian. 2011b. Mechanisms influencing competition between hatchery and wild juvenile anadromous Pacific salmonids in freshwater and their relative competitive abilities. *Environmental Biology of Fishes* DOI:10.1007/s10641-01109906-z
- Temple, G. M. and Pearsons, T. N. 2006. Evaluation of the recovery period in mark-recapture population estimates of rainbow trout in small streams. *North American Journal of Fisheries Management* 26:941-948.
- The Land Conservancy of San Luis Obispo County. 2008. *Santa Rosa Creek Watershed Conservation Plan*. Prepared for the California Coastal Conservancy.
- The Nature Conservancy. 2000. *The Five-S Framework for Site Conservation: A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success*, 2<sup>nd</sup> ed. Vol. 1.

- The Nature Conservancy. 2007. *Conservation Action Planning (CAP) Basic Practice Workbook: Developing Strategies, Taking Action, and Measuring Success at Any Scale*. January 12, 2007. <http://www.conserveonline.org/workspaces/cbdgateway/cbdmain/cap/practices>.
- Thomas, L. P., M. D. DeBacker, J. R. Boetsch, and D. G. Peitz. 2001. *Conceptual Framework, Monitoring Components and Implementation of a NPS Long-Term Ecological Monitoring Program – Prairie Cluster Prototype Program Status Report*. U.S. National Park Service.
- Thomas R. Payne and Associates. 2000. *HIS Assessment of Coon Creek and San Luis Obispo Creek*. Prepared for City of San Luis Obispo Utilities Department.
- Thomas R. Payne and Associates. 2001. *The Distribution and Abundance of Steelhead in Tributaries to Morro Bay, California*. Prepared for the Coastal San Luis Resource Conservation District.
- Thomas R. Payne and Associates. 2004. *Distribution and Abundance of Steelhead in the San Luis Obispo Creek Watershed, California*. Prepared for the City of San Luis Obispo Utilities Department.
- Thomas R. Payne and Associates and S. P. Cramer & Associates, Inc. 2005. *The Importance of Resident and Anadromous Life Histories to the Viability of Oncorhynchus Populations*. Thomas R. Payne and Associates and S. P. Cramer and Associates.
- Thompson, C. J. and C. Pinkerton. 2008. *Habitat Restoration Cost References for Salmon Recovery Planning*. NOAA Technical Memorandum NMF-SWFSC TM-425.
- Thompson, L. C., J. L. Voss, R. E. Larsen, W. D. Tietje, R. A. Cooper, and P. B. Moyle. 2008. Role of hardwood in forming habitat for southern California steelhead. In: Merenlender, A., D. McCreary, K. L. Purcell (eds.) *Proceedings of the Sixth California Oak Symposium: Today's Challenges, Tomorrow's Opportunities*. General Technical Report PSW-GTR-217. U. S. Forest Service, Pacific Southwest Research Station.
- Thompson, L. C. J. L. Voss, R. E. Larsen, W. D. Tietje, R. A. Cooper, and P. D. Moyle. 2012. Southern steelhead (*Oncorhynchus mykiss*), hard woody debris, and temperature in a California central coast watershed. *Transaction of the American Fisheries Society* 141(2):275-284.
- Thorgaard, G. H. 1983. Chromosomal differences among rainbow trout populations. *Copeia* 1983(3):650-662.
- Thorp, J. H., M. C. Thomas, and M. D. DeLong. 2006. The riverine ecosystem synthesis: biochemistry in river networks across space and time. *River Research and Applications* 22:123-147.
- Thrower, F. P. and J. E. Joyce. 2004a. Effects of 70 years of freshwater residency on survival, growth, early maturation, and smolting in a stock of anadromous rainbow trout (*Oncorhynchus mykiss*) from southeast Alaska. In: *Uses of Propagated Fish in Resource Management*. American Fisheries Society Symposium 44.
- Thrower, F. P., C. Guthrie, III, J. Nielsen, and J. Joyce. 2004b. A comparison of genetic variation between and anadromous steelhead, *Oncorhynchus mykiss*, population and seven derived populations sequestered in freshwater for 70 years. *Environmental Biology of Fishes* 69:111-125.
- Thrower, F. P., J. J. Hard, and J. E. Joyce. 2004c. Genetic architecture of growth and early life-history transitions in anadromous and derived freshwater populations of steelhead. *Journal of Fish Biology* 65(SupA):286-307.
- Thrower, F. P., J. E. Joyce, A. G. Celewycz, and P. W. Malecha. 2008. The potential importance of reservoirs in the western United States for recovery of endangered populations of anadromous steelhead. American Fisheries Society Symposium 62.
- Thrower, F. P. and J. J. Hard. 2009. Effects of a single event of close inbreeding on growth and survival of steelhead. *Conservation Genetics* 10:1299-1307.

- Titus, R., D. Erman, and W. Snider. 2010. History and status of steelhead in California coastal drainages south of San Francisco Bay. In draft for publication in *Fish Bulletin*. California Department of Fish and Game.
- Tononi, G., O. Sporns, and G. M. Edelman. 1999. Measures of degeneracy and redundancy in biological networks. *Proceeding of the National Academy of Sciences of the United States of America* 96:3257-3262.
- Trenberth, K. E. 1999. Conceptual framework for changes of extremes of the hydrological cycle with climate change. *Climatic Change* 42:327-339.
- Trenberth, K. E., J. Meehl, J. Masters, R. Somerville. 2011. Current Extreme Weather and Climate Change. *Climate Communication: Science & Outreach*. (September 7, 2011).
- Tri-County Fish Team. 2006. *Recommended Barrier and Watershed Priority Ranking Methodology for San Luis Obispo, Santa Barbara, and Ventura Counties, CA*. Prepared for Conception Coast Project.
- United States Army. 2007. *Integrated Natural Resources Management Plan. Fort Hunter Liggett, California*. Prepared for U.S. Army Combat Support Training Center, Fort Hunter Liggett, California.
- United State Fish and Wildlife Service. 1980. *Carmel River Instream Flow Study*. Prepared for the Division of Ecological Services, Sacramento.
- United States Fish and Wildlife Service. 1998. *Draft Recovery Plan for the least Bell's vireo (Vireo bellii pusillus)*. U.S. Fish and Wildlife Service.
- United States Fish and Wildlife Service. 1999. *Arroyo Southwestern Toad (Bufo microscaphus californicus) Recovery Plan*. U.S. Fish and Wildlife Service, California/Nevada Operation Office.
- United States Fish and Wildlife Service. 2002. *Recovery Plan for the Southwestern Willow Flycatcher (Empidonax traillii extimus)*. U.S. Fish and Wildlife Service, California/Nevada Operation Office.
- United States Fish and Wildlife Service. 2003. *Recovery Plan for the California Red-Legged Frog (Rana aurora draytonii)*. U.S. Fish and Wildlife Service, California/Nevada Operation Office.
- United States Fish and Wildlife Service. 2005. *Recovery Plan for the Tidewater Goby (Eucyclogobius newberryi)*. U.S. Fish and Wildlife Service, California/Nevada Operation Office.
- United States Fish and Wildlife Service. 2006. Revised critical habitat for the tidewater goby (*Eucyclogobius newberryi*). Federal Register 71(228): 68913-68995.
- United States Fish and Wildlife Service. 2007. *Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (Charadrius alexandrinus nivosus)*. U.S. Fish and Wildlife Service, California/Nevada Operation Office.
- United States Fish and Wildlife Service. 2010. *Best Management Practices to Minimize Adverse Effects to Pacific Lamprey (Entosphenus tridentatus)*. United States Fish and Wildlife Service, United States Forest Service, United States Bureau of Reclamation.
- United States Forest Service. 2000. *Arroyo Seco Watershed Analysis*. Prepared by the United States Forest Service. Monterey District.
- United States Forest Service. 2004. *Atlas of Southern California Planning Maps, National Forests of Southern California Land Management Plan Revision: Angeles National Forest, Cleveland National Forest, Los Padres National Forest, and San Bernardino National Forest*. U.S. Forest Service, Pacific Southwest Region, Report No. R5-MB-053.
- United States Forest Service. 2005a. *Executive Summary of the Final Environmental Impact Statement for Revised Land Management Plans: Angeles National Forest, Cleveland National Forest, Los Padres National Forest, and San Bernardino National Forest*. U.S. Forest Service, Pacific Southwest Region Report No. R5-MB-085.

- United States Forest Service. 2005b. *Land Management Plan, Part 1: Southern California National Vision; Part 2: Forest Strategy; Part 3: Design Criteria for the Southern California National Forests: Angeles National Forest, Cleveland National Forest, Los Padres National Forest, San Bernardino National Forest*. U.S. Forest Service, Pacific Southwest Region R5-MB-075, R5-MB-078, and R5-MB-080.
- United States Geological Survey. 2001. *Floods in the Cuyama Valley, California, February 1998*. USGS Fact Sheet 162-00. <http://water.usgs.gov/pubs/FS/fs-162-00>.
- United States Geological Survey. 2011. Website: <http://water.usgs.gov/data.html>.
- Upper Salinas-Las Tablas Resource Conservation District. 2004. *Upper Salinas River Watershed Action Plan*. Final Report to the State Water Resources Conservation District.
- Vadas, R. L., Jr. 2000. Instream flow needs for anadromous salmonids and lamprey on the Pacific coast, with special reference to the Pacific southwest. *Environmental Monitoring and Assessment* 64:331-358.
- Vallis, G. K. 2012. *Climate and the Oceans*. Princeton University Press
- Vermeij, G. J. 2004. *Nature: An Economic History*. Princeton University Press.
- Voss, J. L., L. C. Thompson, R. E. Larsen, W. D. Tietje, R. A. Cooper, and P. B. Moyle. 2007. *Cooperator Report: Habitat Requirements of Steelhead in the Upper Salinas River Watershed*. U.C. Extension, Davis.
- Waisanen, P. J. and N. B. Bliss. 2002. Changes in population and agricultural land in coterminous United States counties, 1790-1997. *Global Biogeochemical Cycles* 16(4):1-18.
- Walters, C. 1997. Challenges in adaptive management of riparian ecosystems. *Conservation Ecology* 1(2):1.
- Walters, C. 1996. *Adaptive Management of Renewable Resources*. Blackburn Press.
- Walton, J. 2003. *Storied Land: Community and Memory in Monterey County*. University of California Press.
- Waples, R. S. 1991a. Pacific salmon, *Oncorhynchus spp.*, and the definition of "species" under the Endangered Species Act. *Marine Fisheries Review* 53(3):11-22.
- Waples, R. S. 1991b. *Definition of "Species" Under the Endangered Species Act: Application to Pacific Salmon*. NOAA Technical Memorandum NMFS F/NWC-194.
- Waples, R. S. 1995. Evolutionarily significant units and the conservation of biological diversity under the Endangered Species Act. Evolution and the aquatic ecosystem: Defining unique units in population conservation. American Fisheries Society Symposium 17.
- Waples, R. S. 1998. Evolutionarily Significant Units, Distinct Population Segments, and the Endangered Species Act: Reply to Pennock and Dimmick. *Conservation Biology* 12(3):718-721.
- Waples, R. S. 2010. Captive breeding and the Evolutionary Significant Unit. In: Levin, S. A. (ed.). *The Encyclopedia of Biodiversity*. Princeton University Press.
- Waples, R. S. and J. Drake. 2004. Risk/benefit considerations for marine stock enhancement: a Pacific salmon perspective. In: Leber, K. M., S. Kitadi, H. L. Blankenship, and T. Svasand (eds.). *Stock Enhancement and Sea Ranching: Developments, Pitfalls, and Opportunities*. Oxford University Press.
- Waples, R. and G. R. Pess, and T. Beechie. 2008. Evolutionary history of Pacific salmon in dynamic environments. *Evolutionary Applications* 1(2):1869-206.
- Waples, R. S., T. Beechie, G. R. Pess. 2008a. Evolutionary history, habitat disturbance regimes, and anthropogenic changes: what do these mean for resilience of Pacific salmon populations? *Ecology and Society* 14(1):3.

- Waples, R. S., G. R. Pess, and T. Beechie. 2008b. Evolutionary history of Pacific salmon in dynamic environments. *Evolutionary Applications* 1:189-206.
- Waples, R. S., A. E. Punt, J. M. Cope. 2008c. Integrating genetic data into management of marine resources: how can we do it better? *Fish and Fisheries* 9:423-449.
- Waples, R. S., M. M. McClure, T. C. Wainwright, P. McElhany, and P. Lawson. 2010. Integrating evolutionary considerations in recovery planning for Pacific salmon. In: DeWoody, J. A., C. Michler, K. Nichols, G. Rhodes, and K. Waste (eds.). *Molecular Approaches in Natural Resource Conservation and Management*. Cambridge University Press.
- Ward, B. R. 2000. Declivity in steelhead trout recruitment at the Keogh River over the past decade. *Canadian Journal Fisheries Aquatic Science* 57:298–306.
- Ward, B. R., P. A. Slaney, A. R. Facchom. and R. W. Land. 1989. Size-based survival in steelhead trout (*Oncorhynchus mykiss*): back-calculated lengths from adults' scales compared to migrating smolts at the Keogh River, British Columbia. *Canadian Journal Fisheries Biology* 44:1853-1858.
- Warner, R. and K. Hendrix (eds.). 1984. *California Riparian Systems: Ecology, Conservation, and Productive Management*. University California Press, Berkeley, CA.
- Warrick, J. A. and L. A. K. Mertes. 2010. Sediment yield from the tectonically active semiarid Western Transverse Ranges in California. *Geological Society of America Bulletin* 121(7/8):1054-1070.
- Waters, T. 1995. *Sediment in Streams: Sources, Biological Effects, and Control*. American Fisheries Society Monograph No. 7.
- Watson, F. L. Pierce, M. Mulitsch, W. Newman, A. Rocha, M. Fain, and J. Nelson. 2000. Water Resources and Land Use Change in the Salinas Valley. A Progress Report of the Hydro-Ecological Modeling Group. The Watershed Institute. California State University, Monterey Bay. Report No. WI-1999-01.
- Watson, F. and J. Casagrande. 2004. *Potential Effects Groundwater Extractions on Carmel Lagoon*. Report No. WI-2004-09. The Watershed Institute. California State University, Monterey Bay.
- Watson, J., J. Casagrande, and F. Watson. 2008. *Central Coast Region South District Basin Planning & Habitat Mapping San Jose, Salmon, San Simeon, Santa Rosa, Chorro, San Luis Obispo, Pismo, Arroyo Grande*. Report No. WI-2007-03. . The Watershed Institute. California State University, Monterey.
- Watson, J. D., T. A. Baker, S. P. Bell, A. Gann, M. Levine, and R. Losik. 2008. *Molecular Biology of the Gene*, 6<sup>th</sup> ed. Cold Spring Harbor Laboratory Press.
- Webb, B. W. F. Nobilis. 2007. Long-term changes in river temperature and the influence of climatic and hydrological factors *Hydrological Sciences Journal* 52:74-85.
- Wegner, S. J., D. J. Isaak, C. H. Luce, H. M. Neville, D. D. Fausch, J. D. Dunham, D. C. Dauwalter, M. K. Young, M. M. Elsner, B. E. Rieman, A. F. Hamlet, and J. E. Williams. 2011. Flow regime temperature, and biotic interactions drive differential declines of trout species under climate change. *Proceedings of the National Academy of Sciences*
- Welch, D. W., M. C. Melnychuk, E. R. Rechisky, A. D. Porter, M. C. Jacobs, A. Ladouceur, R. S. McKinley, and G. D. Jackson. 2009. Freshwater and marine migration and survival of endangered Cultus Lake sockeye salmon (*Oncorhynchus nerka*) smolts using POST, a large-scale acoustic telemetry array. *Canadian Journal of Fisheries and Aquatic Sciences* 66(5):736-750.

- Wells, A. W., J. S. Diana, and C. C. Swift. 1975. *Survey of the Freshwater Fishes and Their Habitats in the Coastal Drainages of Southern California. Final Report*. California Department of Fish and Game, Inland Fisheries Branch. Contract AB-26.
- Wenger, S. 1999. *A Review of the Scientific Literature on Riparian Buffer Width, Extent and Vegetation*. University of Georgia, Institute of Ecology. Office of Public Service and Outreach.
- Wenger, S. J., C. H. Luce, A. F. Hamlet, D. J. Isaak, and H. M. Neville. 2010. Macroscale hydrologic modeling of ecologically relevant flow metrics. *Water Resources Research* 46:1-10.
- West-Eberhard, M. J. 2003. *Developmental Plasticity and Evolution*. Oxford University Press.
- Westerling, A. L. and B. P. Brant. 2008. Climate change and wildfire in California. *Climate Change* 87(Suppl.1):231-249.
- Westerling, A. L., B. P. Bryant, H. K. Preisler, T. P., Holmes, H. G. Hildalgo, T. Das, and S. R. Shrestha. 2009. *Climate Change, Growth, and California Wildfire*. California Climate Change Center, University of California, Berkeley.
- Whitcare, J. and A. Bender. 2010. Degeneracy: a design principle for achieving robustness and evolvability. *Journal of Theoretical Biology* 263:143-153.
- Whitton, B. A. (ed.). 1975. *River Ecology. Studies in Ecology*. Vol. 2. University of California Press.
- Wicks, B. J., R. Joensen, Q. Tang, and D. J. Randall. Swimming and ammonia toxicity in salmonids: the effect of sub lethal ammonia exposure on the swimming performance of coho salmon and the acute toxicity of ammonia in swimming and resting rainbow trout. *Aquatic Toxicology* 59(2002):55-69.
- Wilcox, C. and H. Possingham. 2002. Do life history traits affect the accuracy of diffusion approximations for mean time to extinction? *Ecological Applications* 12(4):1163-1179.
- Wilkins, J. S. 2009. *Species: A History of An Idea*. University of California Press.
- Williams, B. K., J. D. Nichols, and M. J. Conroy. 2001. *Analysis and Management of Animal Populations: Modeling, Estimation, and Decision-Making*. Academic Press.
- Williams, G. P. and P. A. Bisson. 2003. Downstream effects of dams on alluvial rivers. U.S. Geological Survey Professional Paper No. 1286.
- Williams, T. H., S. T. Lindley, B. C. Spence, and D. Boughton. 2011. *Status Review Update for Pacific Salmon and Steelhead Listed Under the Endangered Species Act: Southwest Region*. National Marine Fisheries, Southwest Fisheries Science Center, Fisheries Ecology Division.
- Williamson, M. 1966. *Biological Invasions*. Chapman & Hall.
- Wilson, E. O. and W. H. Bossert. 1971. *A Primer of Population Biology*. Sinauer Associates, Inc.
- Winter, B. 1987. *Racial Identification of Juvenile Summer and Winter Steelhead and Resident Rainbow Trout (Salmo gairdneri Richardson)*. Administrative Report No. 87-1. California Department of Fish and Game, Inland Fisheries Branch.
- Wohl, E. E. (ed.). 2000. *Inland Flood Hazards: Human, Riparian, and Aquatic Communities*. Cambridge University Press.
- Wohl, E. E. 2001. *Virtual Rivers: Lessons from the Mountain Rivers of the Colorado Front Range*. Yale University Press.

- Wohl, E. E. 2004. *Disconnected Rivers: Linking Rivers to Landscapes*. Yale University Press.
- Wood, J. W. 1979. *Diseases of Pacific Salmon – Their Prevention and Treatment*. State of Washington Department of Fisheries, Hatchery Division.
- Wooster, J. K. 2003. *Geomorphic Responses Following Dam Removal: A Flume Study*. Master's Thesis, Department of Geological Sciences, University of California, Davis.
- World Commission on Dams. 2000. *Dams and Dam Development: A New Framework for Decision Making*. The Report of the World Commission on Dams. Earthscan Publications.
- Wright, S. 1978. *Evolution and the Genetics of Populations: Variability Within and Among Natural Populations*. Vol. 4. University of Chicago Press.
- Wunderlich, R. C., B. D. Winter, and J. H. Meyer. 1994. *Restoration of the Elwha River ecosystem*. *Fisheries* 19(8):11-20.
- Wurster, F. C. J. V. Hall, and E. F. Blok. 2002. Recent changes in the extent of estuarine wetlands in southern California: Pt. Piedras Blancas to Santa Monica. *California and the World Ocean 02: Revising California's Ocean Agenda*.
- Yaffee, S. L. Ecosystem management in practice: the importance of human institutions. *Ecological Applications* 6(3):724-727.
- Yasutake, W. T. and J. H. Wales. 1983. *Microscopic Anatomy of Salmonids: An Atlas*. United State Fish and Wildlife Service. Resource Publication 150.
- Zhang, M., and R. Goodhue. 2010. *Agricultural Pesticide Best Management Practices Report. A Final Report for the Central Valley Regional Water Quality Control Board*. Prepared for the Central Valley Regional Water Quality Control Board.
- Zimmerman, C. E. 2005. Relationships of otolith strontium-to-calcium ratios and salinity: experimental validation of juvenile salmonids. *Canadian Journal of Fisheries and Aquatic Sciences* 62:88-97.
- Zimmerman, C. E. and G. Reeves. 2000. Population structure of sympatric anadromous and nonanadromous *Oncorhynchus mykiss*: evidence from spawning surveys and otolith microchemistry. *Canadian Journal Fisheries and Aquatic Sciences* 57:2152-2162.
- Zimmerman, C. E., G. W. Edwards, and K. Perry. 2009. Maternal origin and migratory history of steelhead and rainbow trout captured in rivers of the Central Valley, California. *Transactions of the American Fisheries Society* 138:280-291.
- Zydlewski, G. B., A. Haro, K. G. Whalen, and S. D. McCormick. 2001 Performance of stationary and portable passive transponder detection systems for monitoring of fish movements. *Journal of Fish Biology* 58:1471-1475.
- Zydlewski, G. B., G. Horton, T. Dubeuril, D. Letcher, S. Casey, and J. Zydlewski. 2006. Remote monitoring of fish in small streams: a unified approach using pit tags. *Fisheries* 31:492-502.

#### **FEDERAL REGISTER NOTICES CITED**

55 FR 24296. 1990. Endangered and Threatened Species: Listing and Recovery Priority Guidelines.

- 56 FR 224. 1991. Policy Applying the Definition of Species Under the Endangered Species Act to Pacific Salmon.
- 61 FR 4722. 1996. Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act.
- 61 FR 56139. 1997. Proposed Rule: Endangered and Threatened Species: Listing of Several Evolutionary Significant Units (ESUs) of West Coast Steelhead.
- 62 FR 43937. 1997. Final Rule: Endangered and Threatened Species: Listing of Several Evolutionary Significant Units (ESUs) of West Coast Steelhead.
- 68 FR 15100. 2003. Policy for Evaluation of Conservation Efforts when Making Listing Decisions.
- 70 FR 37204. 2005. Final Policy: Policy on the Consideration of Hatchery-Origin Fish in Endangered Species Act Listing Determinations for Pacific Salmon and Steelhead.
- 70 FR 52488. 2005. Final Rule: Endangered and Threatened Species; Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California.
- 71 FR 834. 2006. Final Rule: Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead.