Chapter 5
Recreation and Economics

This chapter discusses the potential for the Program to affect recreation activity and economics in California. It describes recreational and commercial activities centered on fishing for trout, salmon, and steelhead in inland waters and the ocean. It also provides information on the jobs and costs associated with operating the DFG hatchery facilities. The direct and indirect economic values of the California fishing segment of the economy are presented.

Sources of Information

Key information sources for this assessment included:

- DFG fisheries managers and biologists and hatchery supervisors,
- DFG salmon surveys,
- DFG agency databases,
- DFG's report to the Legislature on the Steelhead Fishing Report and Restoration Card program (Jackson 2007),
- the USFWS's biennial *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* and the related economic impact assessment *Sportfishing in America—An Economic Engine and Conservation Powerhouse* (U.S. Fish and Wildlife Service 2002, 2007; Southwick Associates 2008),
- Pacific Fishery Management Council's annual reviews of ocean salmon fisheries (Pacific Fisheries Management Council 2007, 2009), and
- California Department of Parks and Recreation's (DPR's) periodic surveys on public opinions and attitudes (California Department of Parks and Recreation 2003, 2009).

Existing Conditions

The following sections describe the current status of regulations that affect recreational and commercial fishing for salmon, steelhead, and trout; the recreational activity that is generated by salmon, steelhead, and trout fishing in California; the economic activity that is generated by operating the DFG hatcheries; and the economic activity that is generated by recreational and commercial fishing in the state.

Regulatory Setting

Title 14 of the CCR establishes the California Fish and Game Commission, gives it authority to adopt regulations covering take of fish and game, and contains the regulations adopted by the commission. Fishing regulations prescribe open waters, fishing seasons, harvest limits, and legal methods of catch. The California Fish and Game Commission considers a wide range of information, including public input and fish surveys conducted by DFG and other agencies, in establishing fishing

regulations. In addition, the Pacific Fishery Management Council annually assesses salmon populations and establishes sustainable salmon take quotas for the Pacific Coast states. The California Fish and Game Commission then promulgates salmon fishing regulations to ensure that the portion of California's quota not reserved for Native American tribes is not exceeded by commercial fishers and anglers. All of these regulations affect the availability of recreational and commercial fishing opportunities and, therefore, the economic value of these fisheries within California.

State CEQA Guidelines Section 15064(e) states that "[e]conomic and social changes resulting from a project shall not be treated as significant effects on the environment. Economic or social changes may be used, however, to determine that a physical change shall be regarded as a significant effect on the environment." Recreation impacts are generally considered by CEQA as environmental effects, particularly regarding physical impacts on or changes in the need for recreation facilities. Changes in fish stocking could affect waters used for fishing such that biodiversity or the need for recreation facilities could be substantially affected. The significance of changes in recreation use resulting from stocking program changes can be evaluated in terms of recreation-related expenditures. Similarly, when an EIS is prepared, economic and social impacts related to natural or physical impacts must be discussed (40 CFR 1508.14). The following sections discuss the direct and total impacts associated with the three sectors directly affected by the DFG Program.

Environmental Setting

Recreation

The main goal of California's fish hatchery and stocking program is to satisfy demand for recreational fishing and to fulfill mitigation requirements for specified state-sponsored projects.DFG has stocked fish from the hatcheries it operates in public waters throughout the state for more than 100 years to enhance sport fishing opportunities by increasing catchable fish abundance. Sport fishing is a moderately popular form of outdoor recreation in California. A recent survey of more than 3,000 adult residents found that participation rates (i.e., the shares of the population that participate in specified activities) for freshwater and saltwater fishing ranked 19th and 35th, respectively, out of 50 listed outdoor recreation activities (California Department of Parks and Recreation 2003). Many outdoor recreation trips are devoted solely to fishing. Many other trips include fishing among other activities, such as driving for pleasure, hiking on trails, beach use, picnicking, camping, and motor-boating. Depending on the recreation site and the participant's preferences, fishing may be the primary objective of a trip or may be incidental to other activities.

The DFG Program focuses on cold-water fisheries, namely trout, steelhead (i.e., anadromous rainbow trout), and salmon. Inland fisheries are supplemented by trout (rainbow, brown, brook, lake, golden, and Lahontan cutthroat) plantings in lakes, reservoirs, and rivers; kokanee and Chinook salmon in large lakes and reservoirs; and Coho salmon in Lake Oroville. Anadromous rivers are supplemented with steelhead and Chinook and Coho salmon. Ocean fishing is supplemented by Chinook salmon planted in rivers and estuaries. All species planted by DFG are native to California except brown, brook, and lake trout.

Sites where freshwater fish are planted by DFG in California may generally be classified into three types: rivers and creeks, reservoirs and relatively low-elevation lakes, and high-mountain lakes. These types of sites offer distinct fishing experiences. Reservoirs, low-elevation lakes, and high-mountain lakes with road access offer fishing that typically involves little physical exertion. Fishing

rivers, streams, and high-mountain lakes reached by trail typically require considerable walking or wading on the part of anglers. High-mountain lakes are almost always situated in nearly pristine, quiet recreation settings, usually in wilderness areas. Other types of waters may be in pristine areas or in relatively developed settings associated with various levels of congestion and noise. Ocean fishing for Chinook salmon is also a distinct experience from other types of fishing associated with stocked fish.

Many of the public waters stocked by DFG, as well as some lakes and streams not stocked by DFG, are planted with fish from private hatcheries by local agencies and private organizations and individuals. In addition, fish from private hatcheries are used to stock private ponds hydrologically disconnected from public waters. Such ponds provide fishing opportunities for landowners and their guests and customers. Species produced in private hatcheries and stocked for fishing include rainbow trout, black bass (e.g., largemouth bass and smallmouth bass), sunfish (e.g., bluegill and redear sunfish), crappie (e.g., black crappie and white crappie), catfish (e.g., channel catfish and blue catfish), Sacramento perch, and white sturgeon (Starr pers. comm.). Relatively good information is maintained on private fish stocking under permits issued by DFG. However, private ponds throughout most of the Central Valley and southern California are exempt from the fish-stocking permit requirement, and almost no information is available on the extent of stocking or fishing in these waters.

DFG records show that less than 10,000 pounds of warm-water fish (i.e., species other than trout and other salmonids) were stocked in California under DFG permits in 2008 (Starr pers. comm.). Because of the relatively small amount of permitted private stocking and because of the lack of information on unpermitted stocking, recreation associated with fishing for warm-water fish species is not analyzed in this EIR/EIS. Although fishing for warm-water species accounts for roughly one-third of all freshwater fishing in California (U.S. Fish and Wildlife Service 2007), warm-water fishing known to be dependent on hatcheries is minor.

Annual trout stocking from private hatcheries under DFG permits averages less than 100,000 pounds, in comparison with the approximately 4.3 million pounds of trout stocked from DFG hatcheries in 2008 (Starr pers. comm.). Most of the permitted private trout stocking occurs in Mono and Inyo Counties (Starr pers. comm.). An unknown additional amount of private trout stocking occurs in the Central Valley and southern California under the stocking-permit exemption. The statewide estimates of trout fishing activity used in this EIR/EIS and discussed below are independent of the sources of the fish sought and of the type of water fished, other than whether it was freshwater or saltwater. Survey respondents reported the number of days they spent fishing for specified species, regardless of whether the fish were wild or reared in public or private hatcheries and regardless of whether they fished in public waters or private ponds (U.S. Fish and Wildlife Service 2007).

Many anglers consider fishing for wild fish to be a distinct experience from fishing for planted fish. Others are indifferent as to whether they fish water populated by planted fish, wild fish, or both. Anglers pursuing wild fish frequently practice catch-and-release fishing, whereas anglers fishing for hatchery fish frequently keep their catch.

Fishing Participation

Estimates of fishing participation rates for Californians vary widely. A 2006 survey by the USFWS (2007) found that 4.3% of residents age 16 or older had participated in fishing that year, while 15% of residents ages 6–15 had participated in fishing. This adult participation rate placed California

joint last (with New York and Pennsylvania) among the 50 states (U.S. Fish and Wildlife Service 2007). In contrast, a 2007 survey by the DPR (California Department of Parks and Recreation 2009) found that 21.4% and 10.8%, respectively, of adult residents had participated in freshwater and saltwater fishing in the past year, and California youths under age 18 had a general fishing participation rate of 29.2%. Approximately 1.28 million annual resident fishing licenses were purchased in 2007, along with approximately 750,000 1- or 2-day resident licenses, implying 7% of Californians age 16 or older purchased fishing licenses in 2007 (California Department of Finance 2009; California Department of Fish and Game 2009a).

The popularity of fishing is decreasing. The DPR survey found that the freshwater fishing participation rate in California declined by 37% between 2002 and 2007. USFWS surveys show that California freshwater fishing participation declined by 34% from 2001 to 2006, while saltwater fishing participation decreased by 22% (U.S. Fish and Wildlife Service 2002, 2007). This trend is consistent with fishing participation trends throughout the Pacific region and the nation. Fishing license sales were highly stable from 2004 to 2008, while the state's population increased by roughly 5% (California Department of Fish and Game 2009a).

Avidity measures the average number of participation days per year per participant. The USFWS (2007) found that both freshwater and saltwater anglers averaged 10.0 days of fishing in 2006, but anglers fished an average of 10.4 days in fresh water and 9.0 days in saltwater in 2001. The DPR (2009) survey found an average of 12.8 days for freshwater anglers and 10.7 days for saltwater anglers in 2007; both levels had declined since 2002.

Trout Fishing Participation

Trout are easily the most popular type of freshwater fish sought by California anglers. Anglers spent 8.3 million days fishing for trout in 2006 (Table 5-1), compared with 2.1 million days fishing for black bass, the next most popular type (U.S. Fish and Wildlife Service 2007). An estimated 871,000 residents and nonresidents fished for trout in California in 2006, for an average avidity of 9.5 days per angler. In 1996, California trout fishing days and anglers were estimated at 16.3 million and 1.5 million, respectively, indicating that participation rates declined roughly by half over 1996–2006 (Pullis and Laughland 1999).

Table 5-1. Estimated California Fishing Days for Trout, Steelhead, and Salmon (Thousands)

Trout[a]	Steelhead[b]	Freshwater Salmon[a, c]	Saltwater Salmon[a]
8,273	25	505	1,009

Notes:

[a] In 2006.
[b] Annual average for 2003–2005.
[c] Includes fishing in inland lakes and rivers.
Sources: U.S. Fish and Wildlife Service 2007; Jackson 2007.

Most rivers in California are open for trout fishing roughly from late April until mid-November, although most waters downstream from Central Valley and foothill dams are open and accessible year-round. Most lakes and reservoirs are open for trout fishing year-round, but most high-elevation lakes and reservoirs are inaccessible in winter and early spring. Thus, trout fishing is generally a year-round activity at lower elevations and a summer–fall pastime in the mountains.

Table 5-2 shows the most popular trout and inland salmon fisheries in California, as judged by DFG fisheries managers, along with these fisheries' dependence on hatchery fish. Knowledgeable DFG fisheries biologists from throughout the state were asked to identify popular sport-fishing waters in their region and to rank their dependence on hatchery stocking. The only criterion the biologists were asked to apply in identifying popular waters was the relative level of fishing use observed at each water. No limit was placed on the number of waters to include or the minimum use level required to qualify as "popular." The resulting regional lists incorporate substantial subjectivity and vary considerably with regard to the amount of fishing that occurs at listed waters. The biologists were asked to rank the hatchery-dependence of listed waters based on their professional judgment by assigning a 1 to unstocked waters; a 5 to waters completely dependent on stocked trout; and 2, 3, or 4 to waters with intermediate levels of hatchery dependence. Most of these waters are stocked with trout and salmon from DFG hatcheries; some are also stocked with trout from private hatcheries.

Table 5-2. Popular Resident Trout and Inland Salmon Fisheries and Dependence on Hatchery Fish

Fishery	County	Type of Water[a]	Hatchery Fish Dependence[b]
Region 1			
Ewing Gulch Reservoir	Trinity	R	3
Lewiston Lake	Trinity	R	5
Trinity Lake	Trinity	R	3
Trinity River (above Trinity Lake)	Trinity	S	4
Boulder Lake (Big, Trinity Alps)	Trinity	H	4
Boulder Lake (Canyon Creek)	Trinity	H	4
Boulder Lake (Little, Trinity Alps)	Trinity	H	4
Canyon Creek Lake (upper)	Trinity	H	4
Deer Lake (Trinity Alps)	Trinity	H	4
Horseshoe Lake (Trinity Divide)	Trinity	H	4
Mumbo Lake	Trinity	H	4
Stoddard Lake (upper)	Trinity	H	4
Tamarack Lake (Trinity Divide_	Trinity	H	4
Tangle Blue Lake	Trinity	H	4
Baum Lake	Shasta	R	4
Burney Creek	Shasta	S	4
Fall River	Shasta	S	1
Grace Lake	Shasta	R	5
Hat Creek (lower)	Shasta	S	1
Hat Creek (upper)	Shasta	S	5
Manzanita Lake	Shasta	N	1
McCloud River (lower)	Shasta	S	1
McCumber Reservoir	Shasta	R	5
Sacramento River (Keswick Dam–Battle Creek)	Shasta	S	1
Shasta Lake	Shasta	R	4

Fishery	County	Type of Water[a]	Hatchery Fish Dependence[b]
Whiskeytown Lake	Shasta	R	4
Sacramento River (upper)	Shasta/Siskiyou	S	2
McCloud River (upper)	Siskiyou	S	4
Lake Siskiyou	Siskiyou	R	5
Battle Creek, south fork	Tehama	S	5
Deer Creek	Tehama	S	5
Blue Lake	Lassen	N	5
Crater Lake	Lassen	N	5
Eagle Lake	Lassen	N	5
McCoy Flat Reservoir	Lassen	R	5
Silver Lake	Lassen	N	5
Dorris Reservoir	Modoc	R	5
Pine Creek Reservoir	Modoc	R	5
Reservoir "F"	Modoc	R	5
West Valley Reservoir	Modoc	R	5
Dry Lake	Del Norte	N	5
Muslatt Lake	Del Norte	N	5
Sanger Lake	Del Norte	N	5
Fish Lake	Humboldt	N	5
Freshwater Lagoon	Humboldt	R	5
Ruth Reservoir	Trinity	R	5
Cleone Lake	Mendocino	R	5
Hammerhorn Lake	Mendocino	R	5
Howard Lake	Mendocino	R	5
Eel River, middle fork	Mendocino	S	1
Russian River, east branch	Mendocino	S	5
Bass Lake	Siskiyou	R	5
Greenhorn Reservoir	Siskiyou	R	5
Juanita Lake	Siskiyou	R	5
Kangaroo Lake	Siskiyou	N	5
Klamath River (upper)	Siskiyou	S	1
Medicine Lake	Siskiyou	N	5
Lake Shastina	Siskiyou	R	3
Trout Lake	Siskiyou	R	5
Boulder Lake East	Siskiyou	H	4
Campbell Lake	Siskiyou	H	4
Castle Lake	Siskiyou	H	4
Duck Lake (Big)	Siskiyou	H	4
Elk Lake (Little)	Siskiyou	H	4
Fox Creek Lake	Siskiyou	H	4

Fishery	County	Type of Water[a]	Hatchery Fish Dependence[b]
Granite Lake (Green)	Siskiyou	H	4
Gumboot Lake (Lower)	Siskiyou	H	4
Hancock Lake (Big)	Siskiyou	H	4
Kangaroo Lake	Siskiyou	H	4
Lily Pad Lake	Siskiyou	H	4
Paradise Lake	Siskiyou	H	4
Sacramento River, South Fork	Siskiyou	H	4
Region 2			
Truckee River (lower)	Placer, Nevada	S	1
Truckee River (upper)	El Dorado	S	1
Carson River, east fork	Alpine	S	4
Lake Almanor	Plumas	R	4
Antelope Valley Reservoir	Plumas	R	5
Lake Oroville	Butte	R	5
Collins Lake	Yuba	N	5
Bucks Lake	Plumas	N	4
Lake Davis	Plumas	R	4
Frenchman Lake	Plumas	R	4
Jackson Meadows Reservoir	Sierra, Nevada	R	4
Stampede Reservoir	Sierra	R	4
Boca Reservoir	Nevada	R	4
Prosser Creek Reservoir	Nevada	R	4
Donner Lake	Nevada	N	5
Lake Tahoe	Nevada	N	1[c]
Loon Lake	El Dorado	H	5
Union Valley Reservoir	Placer	R	5
Ice House Reservoir	Placer	R	5
Jenkinson Lake	El Dorado	N	5
Caples Lake	Alpine	N	4
Silver Lake	Amador	H	5
Bear River Reservoir, lower	Amador	R	5
Blue Lake, upper	Alpine	N	5
Heenan Lake	Alpine	N	5
Camanche Reservoir	Amador, Calaveras, San Joaquin	R	5
Lake Amador	Amador	R	5
Pardee Reservoir	Amador, Calaveras	R	5
Spicer Meadow Reservoir	Tuolumne	R	5
New Bullards Bar Reservoir	Yuba	R	5
Folsom Reservoir	El Dorado, Placer, Sacramento	R	5

Fishery	County	Type of Water[a]	Hatchery Fish Dependence[b]
Indian Valley Reservoir	Lake	R	5
French Lake	Nevada	R	3
Blue Lake, upper	Lake	N	5
Tiger Creek Afterbay	Amador	R	4
Paradise Pond	Butte	R	5
Paradis Reservoir	Butte	R	5
Thermalito Afterbay	Butte	R	5
Angels Creek	Calaveras	S	4
White Pines Lake	Calaveras	H	5
Letts Lake	Colusa	R	5
American River, Silver Fork	El Dorado	S	3
American River, South Fork (Riverton)	El Dorado	S	3
Jenkinson Lake	El Dorado	R	5
Taylor Creek	El Dorado	S	2
Wrights Lake	El Dorado	H	3
Martis Creek Reservoir	Nevada	R	5
Rollins Reservoir	Nevada	R	4
Scotts Flat Reservoir, upper	Nevada	R	5
Sugar Pine Reservoir	Placer	R	5
Truckee River	Placer	S	3
Englebright Reservoir	Yuba	R	3
Region 3			
Putah Creek	Yolo, Solano	S	3
Lake Berryessa	Napa	R	4
Arroyo del Valle	Alameda	R	4
Los Vaqueros Reservoir	Contra Costa	R	5
Lake Sonoma	Sonoma	R	1
Lake Chabot	Alameda	R	5
Lafayette Reservoir	Contra Costa	R	5
San Pablo Reservoir	Contra Costa	R	5
Alpine Lake	Marin	R	5
Bon Temps Reservoir	Marin	R	5
Lagunitas Lake	Marin	R	4
Hennesey Reservoir	Napa	R	5
Lake Merced	San Francisco	R	5
Coyote Reservoir	Santa Clara	R	5
Loch Lomand Reservoir	Santa Cruz	R	5
Pinto Lake	Santa Cruz	R	5
Ralphine Lake	Sonoma	R	5
Stevens Creek Reservoir	Santa Clara	R	4

Fishery	County	Type of Water[a]	Hatchery Fish Dependence[b]
Region 4			
Avocado Lake	Fresno	R	5
Big Creek (Huntington Res. trib.)	Fresno	S	5
Big Creek (Kings River trib.)	Fresno	S	5
Courtright Reservoir	Fresno	R	5
Dinkey Creek	Fresno	S	5
Edison Lake	Fresno	R	3
Hume Lake	Fresno	R	5
Huntington Lake	Fresno	R	4
Kings River (above Pine Flat Res.)	Fresno	S	2
Kings River (below Pine Flat Res.)	Fresno	S	5
Mono Creek	Fresno	S	5
Pine Flat Reservoir	Fresno	R	5
Portal Forebay	Fresno	R	5
Rancheria Creek	Fresno	S	5
San Joaquin River, south fork	Fresno	S	5
San Joaquin River, below Friant Dam	Fresno	S	5
Shaver Lake	Fresno	R	4
Tamarack Creek	Fresno	S	5
Tenmile Creek	Fresno	S	5
Ward Lake	Fresno	R	5
Wishon Reservoir	Fresno	R	5
Woodward Park Lake	Fresno	R	5
Alder Creek	Kern	S	5
Brite Valley Reservoir	Kern	R	5
Cedar Creek	Kern	S	5
Hart Park Lake	Kern	R	5
Kern River (sections 1, 2, and 4)	Kern	S	5
Lake Isabella	Kern	R	5
Ming Lake	Kern	R	5
River Walk Lake	Kern	R	5
Truxtun Lake	Kern	R	5
Woollomes Lake	Kern	R	5
Bass Lake	Madera	R	5
Big Creek	Madera	S	5
Chaquito Creek, west fork	Madera	S	5
Chaquito Creek (lower)	Madera	S	5
Corrine Lake	Madera	R	5
Eastman Lake	Madera	R	5
Granite Creek	Madera	S	5

Fishery	County	Type of Water[a]	Hatchery Fish Dependence[b]
Hensley Lake	Madera	R	5
Lewis Creek	Madera	S	5
Mammoth Pool Lake	Madera	R	4
Manzanita Lake	Madera	R	5
Rock Creek	Madera	S	5
San Joaquin River, middle fork	Madera	S	4
Starkweather Lake	Madera	R	5
McClure Reservoir	Mariposa	R	5
McSwain Reservoir	Mariposa	R	5
Merced River, section II	Mariposa	S	5
Los Banos Detention Reservoir	Merced	R	5
Merced River, section I	Merced	S	5
Yosemite Lake	Merced	R	5
El Estero Lake	Monterey	R	5
Nacimiento River, upper	Monterey	S	5
Atascadero Lake	San Luis Obispo	R	5
Lopez Lake	San Luis Obispo	R	5
Santa Margarita Lake	San Luis Obispo	R	5
Modesto Reservoir	Stanislaus	R	5
Turlock Reservoir	Stanislaus	R	5
Woodward Reservoir	Stanislaus	R	5
Balch Park Lakes	Tulare	R	5
Big Meadows Creek	Tulare	S	5
Bravo Lake	Tulare	R	5
Deer Creek	Tulare	S	5
Hedrick Pond	Tulare	R	5
Kaweah Reservoir	Tulare	R	5
Kern River (above section 6)	Tulare	S	2
Kern River (sections 5 and 6)	Tulare	S	5
Kern River, south fork	Tulare	S	1
Little Kern River	Tulare	S	1
Peppermint Creek	Tulare	S	5
Poso Creek	Tulare	S	5
Stoney Creek	Tulare	S	5
Success Reservoir	Tulare	R	5
Tule River, middle fork	Tulare	S	5
Tule River, north fork	Tulare	S	1
Tule River, north fork of middle fork	Tulare	S	5
White River	Tulare	S	5
Basin Creek	Tuolumne	S	5

Fishery	County	Type of Water[a]	Hatchery Fish Dependence[b]
Beardsley Reservoir	Tuolumne	R	5
Beaver Creek	Tuolumne	S	5
Cherry Valley Reservoir	Tuolumne	R	5
Deadman Creek	Tuolumne	S	5
Don Pedro Reservoir	Tuolumne	R	5
Herring Creek	Tuolumne	S	5
Lyons Canal	Tuolumne	S	5
Lyons Reservoir	Tuolumne	R	5
Melones Reservoir	Tuolumne	R	5
Moccasin Creek	Tuolumne	S	5
Pinecrest Lake	Tuolumne	R	5
Powerhouse Stream	Tuolumne	S	5
Stanislaus River, Clarks fork	Tuolumne	S	5
Stanislaus River, middle fork	Tuolumne	S	5
Stanislaus River, north fork	Tuolumne	S	5
Stanislaus River, south fork	Tuolumne	S	5
Tulloch Lake	Tuolumne	R	5
Tuolumne River, middle fork	Tuolumne	S	5
Tuolumne River, north fork	Tuolumne	S	5
Tuolumne River, south fork	Tuolumne	S	5
Beryl Lake	Fresno	H	5
Bullfrog Lake	Fresno	H	5
Chagrin Lake	Fresno	H	5
Chain Lake (upper)	Fresno	H	5
Corbett Lake	Fresno	H	5
Coyote Lake	Fresno	H	5
Crater Lake	Fresno	H	5
Crown Lake	Fresno	H	5
Dinkey Lake (second)	Fresno	H	5
Dutch Lake	Fresno	H	5
East Lake	Fresno	H	5
Fleming Lake	Fresno	H	5
Hidden (Florence) Lake	Fresno	H	5
Hobler Lake	Fresno	H	5
Mirror Lake	Fresno	H	5
Mystery Lake	Fresno	H	5
Rae Lake	Fresno	H	5
Red Lake	Fresno	H	4
Scepter Lake	Fresno	H	5
South Lake	Fresno	H	4

Fishery	County	Type of Water[a]	Hatchery Fish Dependence[b]
Spanish Lake, Big	Fresno	H	4
Spanish Lake, Little	Fresno	H	5
Strawberry Lake	Fresno	H	5
Swede Lake	Fresno	H	5
Tocher Lake	Fresno	H	5
Twin Buck Lakes	Fresno	H	5
West Lake	Fresno	H	5
Apollo Lake	Fresno	H	5
Arctic Lake	Fresno	H	5
Gordon Lake	Fresno	H	5
Harvey Lake	Fresno	H	5
Hooper Lake	Fresno	H	5
Island Lake	Fresno	H	4
Italy Lake	Fresno	H	3
Nelson Lake (lower)	Fresno	H	5
Orchid Lake	Fresno	H	5
Summit Lake	Fresno	H	5
Tooth Lake	Fresno	H	3
Vee Lake	Fresno	H	3
Anne Lake	Fresno	H	3
Avalanche Lake	Fresno	H	5
Brave Lake	Fresno	H	5
Coyote Lake (Margaret Lakes)	Fresno	H	5
Frog Lake	Fresno	H	5
George Lake	Fresno	H	5
Minnie Lake	Fresno	H	5
Pryor Lake	Fresno	H	5
Sedge Lake (Margaret Lakes)	Fresno	H	5
Shelf Lake	Fresno	H	4
Twin Lake (lower)	Fresno	H	5
Vengeance Lake	Fresno	H	5
Walling Lake	Fresno	H	5
Anne Lake	Madera	H	5
Cora Lake (middle)	Madera	H	5
Fernandez Lake (middle)	Madera	H	5
Grizzly Lake	Madera	H	5
Jackass Lake (lower)	Madera	H	5
Jackass Lake (middle)	Madera	H	5
Joe Crane Lake	Madera	H	5
Junction Lake	Madera	H	5

Fishery	County	Type of Water[a]	Hatchery Fish Dependence[b]
Lillian Lake	Madera	H	3
Monument Lake	Madera	H	5
Norris Lake	Madera	H	5
Rainbow Lake	Madera	H	5
Star Lake (lower)	Madera	H	4
Vandeburg Lake	Madera	H	3
Jennie Lake	Tulare	H	5
Weaver Lake	Tulare	H	5
Big Lake	Tuolumne	H	5
Black Bear Lake	Tuolumne	H	5
Buck Lake (lower)	Tuolumne	H	5
Buck Lake (upper)	Tuolumne	H	3
Camp Lake	Tuolumne	H	5
Clear Lake	Tuolumne	H	5
Gem Lake	Tuolumne	H	5
Grizzly Peak Lake (east)	Tuolumne	H	5
Grouse Lake	Tuolumne	H	3
Hyatt Lake	Tuolumne	H	5
Jewelry Lake	Tuolumne	H	5
Piute Lake	Tuolumne	H	5
Relief Lakes	Tuolumne	H	5
Rosasco Lake	Tuolumne	H	5
Waterhouse Lake	Tuolumne	H	5
Yellowhammer Lake	Tuolumne	H	5
Bighorn Lake	Fresno	H	5
Blue Lake	Madera	H	5
Isberg Lake (lower)	Madera	H	4
Rockbound Lake	Madera	H	5
Region 5			
San Gabriel River, west fork	Los Angeles	S	3
San Gabriel River, east fork	Los Angeles	S	3
Trabuco Creek	Orange	S	4
Piru Creek	Ventura	S	4
Arroyo Seco	Los Angeles	S	5
Boquet Canyon Creek	Los Angeles	S	5
Rose Valley Lakes	Ventura	N	5
Little Rock Reservoir	Los Angeles	R	5
Cuyamaca Lake	San Diego	N	5
Doane Pond	San Diego	R	5
Laguna Lake	Orange	N	5

Fishery	County	Type of Water[a]	Hatchery Fish Dependence[b]
El Dorado Park Lakes	Los Angeles	N	5
Elizabeth Lake	Los Angeles	N	5
Jackson Lake	Los Angeles	N	5
Region 6			
Diamond Valley Reservoir	Riverside	R	5
Hemet Lake	Riverside	N	5
Perris Lake	Riverside	N	5
Skinner Lake	Riverside	N	5
Arrowbear Lake	San Bernardino	N	5
Big Bear Lake	San Bernardino	N	5
Silverwood Lake	San Bernardino	N	5
Deep Creek	San Bernardino	S	2
Santa Ana River, south fork	San Bernardino	S	5
Bridgeport Reservoir	Mono	R	4
Convict Lake	Mono	N	4
Crowley Lake	Mono	R	4
East Walker River	Mono	S	2
George Lake	Mono	N	5
Hot Creek	Mono	S	2
Gull Lake	Mono	N	5
June Lake	Mono	N	5
Lundy Lake	Mono	N	5
Mammoth Creek	Mono	S	4
Mary Lake	Mono	N	5
Owens River (section 3)	Mono	S	4
Owens River, upper	Mono	S	2
Rock Creek (sections 1 and 2)	Mono	S	4
Silver Lake	Mono	N	5
Twin Lakes (Bridgeport)	Mono	N	4
Twin Lakes (Mammoth)	Mono	N	5
Virginia Lakes	Mono	N	5
Walker River (sections 2 and 3)	Mono	S	4
Bishop Creek, Intake II	Inyo	S	5
Diaz Lake	Inyo	N	5
Independence Creek	Inyo	S	5
Lone Pine Creek	Inyo	S	5
North Lake	Inyo	N	5
Owens River, section 2	Inyo	S	4
Pleasant Valley Reservoir	Inyo	R	4
Rock Creek Lake	Inyo	N	5

Fishery	County	Type of Water[a]	Hatchery Fish Dependence[b]
Sabrina Lake	Inyo	N	5
South Lake	Inyo	N	5

Sources:
Region 1: Benthin pers. comm.; Weseloh pers. comm.
Region 2: Lehr pers. comm., Rowan pers. comm.
Region 3: Neillands pers. comm.
Region 4: Kollenborn pers. comm.
Region 5: Maxwell pers. comm.

Region 6: Kinney pers. comm.

Notes:

[a] H = high-mountain lake, N =natural lake (low–moderate elevation), R = reservoir, and S = stream.
[b] 1 = none, 2 = low (1%–33%), 3 = moderate (34%–66%), 4 = high (67%–99%), 5 = total (100%).
[c] Excludes fish stocking by the State of Nevada.

Steelhead Fishing Participation

Although steelhead spend most of their lives in the ocean, sport fishing for steelhead occurs only in rivers while the fish are migrating to and from spawning sites. The sample size for the USFWS (2007) survey for anglers reporting having fished for steelhead was too small to allow estimation of fishing activity. However, relatively good information on steelhead fishing in California is provided by the Steelhead Fishing Report and Restoration Card program. This DFG program requires anglers to report detailed information on steelhead fishing activity each year, including daily summaries of wild and hatchery steelhead caught and released for each river fished. Reported catch levels for steelhead may be overstated in that some anglers probably classified resident rainbow trout as steelhead, particularly for fish caught in the Klamath, Sacramento, and Yuba Rivers, where resident rainbow trout commonly attain adult steelhead size.

The number of anglers purchasing steelhead report cards has fluctuated substantially since they were instituted in 2003. Steelhead report card sales totaled approximately 51,000 in 2005 and 45,000 in 2006 (Jackson 2007). An average of 25,245 steelhead fishing trips per year were reported for 2003–2005, the most recent period for which data are available. Based on the requirement for steelhead anglers to make individual steelhead report card entries for each day and each river fished, a "trip" is defined as fishing one river on 1 day. Because a significant, but unknown, number of steelhead anglers fail to submit report cards, and some anglers occasionally report fishing multiple rivers on 1 day, this number represents a conservative estimate of steelhead fishing days in California.

According to report cards for 2003–2005, 44% of all steelhead caught were planted, and 56% were wild. Hatchery steelhead accounted for at least one-third of the reported 2003–2005 catch for several of the state's important steelhead fisheries, including the Mad River and nearby creeks (88% hatchery fish), Russian River (79% hatchery fish), Feather River (73% hatchery fish), Trinity River (60% hatchery fish), American River (49% hatchery fish), San Lorenzo River (48% hatchery fish), Sacramento River lower reaches (40% hatchery fish), and the Smith River and nearby creeks (34% hatchery fish). With the exception of the San Lorenzo River, all of these streams are located along

the north coast or in the Sacramento Valley, Trinity County, or Siskiyou County. They accounted for 73% of all reported steelhead fishing trips in California. (Jackson 2007.)

Most steelhead fishing is associated with the fall run and occurs between September and December. Some rivers' steelhead runs occur relatively early or late, and some rivers, such as the Klamath and Sacramento Rivers, provide steelhead fishing opportunities during most of the year.

Salmon Fishing Participation

Sport fishing for anadromous salmon occurs in the Pacific Ocean and in estuaries and streams tributary to the ocean, which Chinook and Coho salmon use during spawning runs. In addition, Chinook and kokanee salmon are planted in large landlocked lakes and reservoirs to enhance fishing opportunities; the only inland water stocked with Coho salmon is Lake Oroville. Adult Californians spent 505,000 days fishing for salmon in fresh water and 1.0 million days salmon fishing in saltwater in 2006 (U.S. Fish and Wildlife Service 2007). No definitive information is available on the proportions of freshwater salmon fishing that occur in inland lakes as opposed to rivers (Aiken pers. comm.).

California saltwater salmon fishing occurs offshore and in river estuaries from Morro Bay north to the Oregon border. The most popular rivers for Chinook salmon fishing and their dependence on hatchery fish are shown in Table 5-3. Rivers with salmon hatcheries are generally relatively dependent on hatchery fish, while other rivers and smaller coastal streams support salmon fisheries composed almost entirely of wild fish.

Table 5-3. Popular Anadromous Chinook Salmon Fisheries in Rivers and Their Dependence on Hatchery Fish

Fishery	County	Hatchery Fish Dependence[a]
Region 1		
Klamath River	Del Norte, Humboldt, Siskiyou	2
Trinity River	Humboldt, Trinity	3
Smith River[b]	Del Norte	
Eel River	Humboldt, Trinity, Mendocino	1
Mad River	Humboldt	5
Sacramento River	Tehama, Shasta	3
Region 2		
Feather River	Sutter, Yuba, Butte	3
American River	Sacramento	4
Mokelumne River	San Joaquin	4
Sacramento River	Sacramento, Yolo, Colusa, Glenn, Butte	4
Region 3		
Sacramento River	Solano, Sacramento	4
San Joaquin River	Sacramento, San Joaquin, Contra Costa	4

Fishery	County	Hatchery Fish Dependence[a]
Region 4		
Merced River	Merced	2
Tuolumne River	Stanislaus	1
Stanislaus River	Stanislaus, Tuolumne	1
San Joaquin River	Stanislaus	4

Sources:
Region 1: Chesney 2008; Chesney and Knechtle 2009; Knechtle 2007; Sinnen et al. 2009; Jong pers. comm.; Radford pers. comm.
Region 2: Quinones pers. comm.
Region 3: Wilson pers. comm.
Region 4. Kollenborn pers. comm.

Notes:

[a] 1 = none, 2 = low (1%–33%), 3 = moderate (34%–66%), 4 = high (67%–99%), 5 (100%) = total.
[b] DFG lacks data to reliably characterize hatchery dependence of Smith River Chinook salmon.

Most ocean salmon fishing occurs in spring and summer. River salmon fishing is concentrated in late summer and fall, associated with fall runs. Most fishing for inland salmon takes place in the warm months of summer and fall.

Between 1976 and 2006, the annual recreational ocean salmon catch in California averaged 139,223 fish (Pacific Fishery Management Council 2009). Declining numbers of salmon have resulted in severe restrictions on salmon fishing in California since 2007. The statewide recreational ocean salmon catch totaled 47,704 in 2007 and was negligible in 2008. In 2008, the season was restricted to February 16–April 4 within a roughly 75-mile-long area north of Point Arena. In 2009, the ocean recreational salmon fishing season was restricted to August 29–September 7 (California Department of Fish and Game 2009b).

New methods for assessing the rearing history (i.e., hatchery versus wild) of ocean salmon were recently tested in waters off the central California coast and determined to yield 91% accurate results (Barnett-Johnson et al. 2007). This study estimated that 90% of the central California ocean catch was reared in hatcheries. Of the remaining 10% reared in the wild, an unknown proportion were progeny of hatchery fish. Hatcheries supplying the Sacramento–San Joaquin River system thus apparently account for a larger share of the ocean sport and commercial catches of Chinook salmon than previously had been estimated (Barnett-Johnson et al. 2007). Similar levels of hatchery dependence likely occur off the northern California coast, where salmon reared in the Klamath–Trinity River system are more abundant (Borok pers. comm.).

Economics

The main effects of DFG fish hatchery operations and DFG private fish stocking programs on the California economy and the economies of regions within California involve the market transactions associated with hatchery and stocking operations. Spending generated by DFG hatchery operations and by hatchery-dependent sport and commercial fishing is analyzed below. Other economic effects indirectly associated with fish hatcheries and stocking include the social (i.e., non-market) costs resulting from declines in sensitive species from competition with stocked fish. Such biodiversity

impacts are analyzed in detail in Chapter 4 of this EIR/EIS. The social costs of biodiversity impacts could be assessed using economic analysis methodologies such as the contingent valuation method, which assesses people's willingness to pay to avoid such impacts. These costs, however, are not analyzed in this document because the issue of the economic benefits of modifying the hatchery and stocking programs did not arise during scoping for this EIR/EIS.

DFG Fish Hatchery Operations

Like all government services, DFG fish hatchery operations and the related fish planting operations affect economic activity levels and peoples' livelihoods and economic well-being. These operations directly affect DFG hatchery and fisheries staff and hatchery suppliers, retailers, and proprietors who sell fishing-related goods and services to anglers, and commercial salmon fishers. Such effects circulate through local and regional economies as directly affected people and businesses in turn purchase goods and services. Output, income, and employment are the primary measures of economic activity used to assess the economic impacts of policy decisions, such as those being considered for DFG fish hatcheries and stocking programs. Fish hatcheries and aquaculture facilities operated by private entities are not analyzed in this document.

Economic activity can be measured at three levels: direct, indirect, and induced effects. Direct effects are associated with sales of goods and services directly changed by a project. For the Program, directly affected industries include DFG fish hatcheries, retail trade and related businesses that sell goods and services to anglers, and commercial fishing. Indirect effects result from changes in sales between directly affected businesses and their suppliers and, in the case of commercial fishing, from value added by businesses that process and market the catch and their suppliers. Induced effects consist of spending resulting from changes in the incomes of directly and indirectly affected households. Total effects (i.e., the sum of direct, indirect, and induced effects) are related to direct impacts by *multipliers* for measures such as output, income, and employment. Multipliers usually are estimated using input-output models, which represent the aggregation of all inter-industry transactions that constitute a regional economy.

DFG hatcheries are staffed by state employees and operate based on purchases of a wide range of supplies and equipment from private vendors. DFG operates 14 hatchery facilities that produce trout for recreational fishing. In addition, it operates nine hatchery facilities that produce salmon to mitigate the fishery impacts of specified dams and one hatchery facility to enhance steelhead populations. In 2008, the total cost to operate these hatchery facilities was $16.7 million (Table 5-4). Regions 1 and 6 accounted for more than half of the hatchery expenditures. The largest cost category for hatchery operations was for personnel, with fish food costs being the next largest category. A total of 184 staff positions are authorized within the hatchery program, approximately one-third of which are manager-supervisor positions and two-thirds of which are technician-clerical positions (Table 5-5). Roughly 20% of the technician positions are seasonal, with the rest being year-round.

Table 5-4. DFG Hatchery Expenses, Fiscal Year 2008 (Thousands of Dollars)[a]

Category	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Subtotal
Personnel[b]	$2,746	$2,202	$715	$1,337	$427	$2,262	$9,690
Electricity	$266	$129	$40	$46	$260	$475	$1,214
Chemicals and medical	$37	$55	$23	$2	$23	$55	$194
Vehicle fuel	$109	$100	$32	$70	$30	$140	$482
Vehicle maintenance and repair	$16	$34	$11	$13	$3	$44	$120
Vehicle parts and supplies	$29	$30	$6	$31	$96	$58	$249
Fish food	$570	$640	$135	$347	$237	$650	$2,578
Miscellaneous	$287	$375	$377	$160	$213	$765	$2,177
Total	$4,059	$3,564	$1,337	$2,007	$1,288	$4,449	$16,705

Source: Starr pers. comm.

Notes:

[a] Sources of funding are discussed in Chapter 2.

[b] Excludes personnel costs for one senior hatchery supervisor per region.

Table 5-5. Authorized DFG Hatchery Administrative and Support Staff

	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Fish Production and Distribution	Total
Supervisor-manager	11	9	3	7	2	9	13	54
Technician-clerical	34	36	9	17	6	25	3	130
Total	45	45	12	24	8	34	16	184

Source: Starr pers. comm.

Sport Fishing

Sport fishing is a small but locally important component of California's $244 billion leisure travel sector (Dean Runyan Associates 2008). An estimated $1.1 billion was spent on freshwater fishing trips and equipment in California in 2006, and a nearly equal amount was spent on saltwater fishing trips and equipment (U.S. Fish and Wildlife Service 2007).

Fresh Water

Freshwater fisheries supplemented by DFG planting include fisheries for trout, steelhead, and anadromous and inland salmon. Recent estimated fishing days for these types of fishing in California are shown in Table 5-1. Assuming per-day trout, steelhead, and freshwater salmon fishing trip expenditures equal the average for all freshwater fishing ($49.28), fishing for these types of fish accounted for $432 million in trip-related purchases. These expenditures were allocated among

three categories: food and lodging (36%), transportation (31%), and other trip costs (33%). Total equipment expenditures for trout, steelhead, and freshwater salmon fishing were an estimated $358 million. Such sales revenues are re-spent repeatedly both within and outside California. Within-state re-spending expanded the total economic output of freshwater fishing expenditures by an estimated 80% (i.e., a total output multiplier of 1.8), resulting in a total output impact of $1.42 billion (Southwick Associates 2008). The total employment impact of these sales is approximately 15,300 jobs (Southwick Associates 2008).

Trout fishing–related spending occurs throughout the state. Although trout fishing opportunities are generally relatively limited in the state's metropolitan areas and drier regions, DFG trout plantings often target urban areas and other areas lacking sport fishing opportunities. Many of the communities most economically dependent on trout fishing are located in the Sierra Nevada and Cascade Ranges and foothills.

Freshwater fishing for steelhead and anadromous salmon primarily affects the economies of communities located near anadromous waters. Such communities are primarily located along the north coast, in the Sacramento Valley, and in Trinity and Siskiyou Counties. Communities receiving substantial spending associated with fishing for inland salmon include Oroville and the Tahoe-Donner communities of Truckee, Tahoe City, and South Lake Tahoe.

Fishing for warm-water species dependent on stocking from private hatcheries is not analyzed in this EIR/EIS because the amount of such stocking for which data are available (i.e., fish stocked under DFG permits) is insignificant in comparison to trout fishing. However, fishing for warm-water species dependent on stocking from private hatcheries, especially stocking exempt from permitting requirements, results in the same types of economic impacts as trout fishing and is an important source of revenue for some owners of private ponds.

Saltwater

In 2006, saltwater fishing in California was estimated at 1.023 million days. Trip-related expenditures for saltwater fishing average $78.45 per day (U.S. Fish and Wildlife Service 2007). Thus, total trip-related expenditures for saltwater salmon fishing are estimated at $80.0 million. Trip-related saltwater fishing spending is allocated among food and lodging (32%), transportation (16%), and other trip-related expenditures (52%). Equipment expenditures for saltwater salmon angling are estimated at $71.0 million (U.S. Fish and Wildlife Service 2007). It should be noted that NMFS also estimated 2006 ocean sport fishing expenditures for California. The NMFS estimate of trip-related expenditures is substantially lower than the USFWS estimate, while the NMFS estimate of equipment expenditures is substantially larger than the USFWS estimate (Gentner and Steinback 2008).

Based on a total output multiplier of 1.78 for saltwater fishing (Southwick Associates 2008), saltwater salmon fishing expenditures generated total economic output valued at $269 million in 2006. Based on the total employment multipliers estimated for California sport fishing by Southwick Associates (2008), saltwater salmon fishing generated a total of approximately 2,700 jobs in the state in 2006.

Most trip-related spending associated with ocean salmon fishing occurs in port communities such as Crescent City, Eureka, Fort Bragg, San Francisco, and Monterey.

Commercial Salmon Fishing

Most commercial salmon fishing historically has occurred in spring and summer in California. Many commercial salmon fishers target other fish or shellfish during the remainder of the year. Most of California's commercial salmon catch originates in the Sacramento–San Joaquin and Klamath–Trinity River systems. Other coastal streams also supply salmon to California's ocean fishery, including out-of-state rivers, such as the Rogue and Columbia Rivers. Conversely, California's rivers supply a portion of the commercial salmon catch for all Pacific coast states and provinces. All DFG salmon hatcheries except the Mad River and Warm Springs Hatcheries contribute to Sacramento–San Joaquin or Klamath–Trinity River stocks.

Commercial salmon fishing off California has been restricted to Chinook salmon since 1996, and commercial fishing for Chinook salmon has collapsed in recent years (Pacific Fishery Management Council 2009). From 1978 to 2005, statewide Chinook salmon landings averaged 484,750 fish per year. For 2006–2007, landings averaged 91,934 fish. As a result of recent sharp declines in runs of returning salmon to the Sacramento River, no commercial salmon fishing occurred in 2008 or 2009.

The Pacific Fishery Management Council compiles commercial salmon catch data for the California ports of Crescent City, Eureka, Fort Bragg, San Francisco, and Monterey. The 2005 and 2006 statewide commercial salmon catches were 4.98 million pounds and 1.19 million pounds, respectively (National Marine Fisheries Service 2006). The 2005 and 2006 average prices paid for salmon landed in California were $2.58 per pound and $4.43 per pound, respectively. Thus, even with an average price increase of 72%, the value of the 2006 catch declined from $12.8 million in 2005 to $5.27 million in 2006. In 2006, salmon accounted for 0.47% of the total sales of the state's commercial fishing industry. Based on multipliers estimated by the Pacific Fishery Management Council (2007) for the state's commercial salmon fishing industry, salmon fishing generated total income of $24.4 million in 2005 and $8.9 million in 2006. Approximately one-half of this income occurred in the San Francisco area in 2005 and 2007, and two-thirds of it occurred there in 2006 (Pacific Fishery Management Council 2007). In 2008 and 2009, there was no commercial salmon fishing in California and thus no related economic activity. Commercial salmon fishers received federal emergency funds to mitigate losses resulting from recent fishing closures; additional relief funding has been authorized for 2009 (National Oceanic and Atmospheric Administration 2009).

Environmental Consequences

This section describes the methods used to evaluate the recreation and economic effects of the DFG Program in California and then describes those effects.

Methods

Estimating Statewide Sport Fishing Attributable to Hatchery Production

Fishing use attributable to DFG hatchery production was estimated by dividing the estimated total statewide sport fishing effort (Table 5-1) into its hatchery-dependent and wild fish–dependent components. Procedures for performing this division for trout, steelhead, and Chinook salmon fishing are described below. Results are shown in the following Table 5-6.

Table 5-6. Sport Fishing Days Attributable to Fishing for Hatchery-Produced Fish

Trout	Salmon (Inland)	Steelhead	Chinook Salmon (rivers)	Chinook Salmon (ocean)
6,618–7,446	252.5	11.1	126.0–151.2	908

Trout and Inland Salmon

Assessing fishing activity dependent on stocked fish at the state or regional level is a problem inherently difficult to solve precisely. Except for waters that support either entirely wild or entirely stocked fisheries, the relative dependence of fishing on fish stocking is subjective, and dependence estimates are necessarily inexact. If the recreation analysis were based on accumulating fishing activity at individual sites, precise determinations of hatchery-dependence made for waters known to be occupied entirely by wild or stocked fish could have been used to improve the precision of the statewide or regional recreation activity levels. However, because more than 1,000 fishing sites could be affected under the proposed project or alternatives, and because little or no reliable use data is available for most of these sites, an analysis approach based on estimating fishing use at each individual site and accumulating the results was infeasible. As discussed below, the best feasible approach for assessing statewide and regional hatchery-dependent fishing use was determined to be one that relied on experts' knowledge of popular fishing sites and their dependence on hatchery fish, and on a semi-quantitative aggregation of results for these popular waters.

One means of inferring the relative effort allocated to fishing for stocked fish in a specified water is based on the relative abundance of stocked versus wild fish in that water. For waters stocked with trout and inland salmon, local DFG fisheries managers are among the most knowledgeable people regarding the waters' dependence on stocked fish. As summarized in Table 5-3, DFG fisheries managers identified all inland waters in their region that they considered popular fishing destinations and then ranked each water's dependence on stocked fish.

Average hatchery dependence of trout fishing was calculated for each DFG region by averaging the dependence rankings for all waters identified as popular (see the "Recreation" section and Table 5-2). In the absence of sufficient site-specific data on fishing use, each listed water was weighted equally in calculating average regional dependence. Unranked high-mountain lakes in Region 1 were not included in that region's average. Dependence rankings were converted to a percentage basis as shown below in Table 5-7.

Table 5-7. Average Hatchery Dependence of Trout Fishing by DFG Region

Region	Average Dependence Rank[a]	Average Dependence Percentage[a]
1	4.14	79
2	4.29	82
3	4.44	86
4	4.75	94
5	4.57	89
6	4.42	85

Notes:

[a] 1 = no dependence (0%), 2 = low dependence (25%), 3 = moderate dependence (50%), 4 = high dependence (75%), 5 = total dependence (100%).

These averages show that dependence of popular inland waters on stocked trout ranges from high to nearly total throughout the state, but dependence is lower in the Northern and North Central Regions (Regions 1 and 2) and highest in the Central Region (Region 4). The unweighted average dependence percentage across all regions is 86%. To account for the lack of precision involved in developing this estimate, a range of 80%–90% hatchery dependence was assumed to apply to trout fishing statewide. For 2006, of the estimated 8,273,000 days spent trout fishing statewide, 6,618,000–7,446,000 are estimated to be attributable to hatchery production.

Freshwater salmon fishing participation in California in 2006 was estimated at 505,000 days (U.S. Fish and Wildlife Service 2007). In lieu of empirical or survey data on the relative proportions of freshwater salmon fishing occurring in inland lakes and rivers, it was assumed that equal numbers of fishing days occurred in each of these types of waters. Fishing for inland salmon was thus assumed to total 252,500 days in 2006, all of which was hatchery-dependent. As with all estimates of hatchery-dependent fishing use presented in this chapter, these estimates are imprecise and intended to be used to describe relative differences in recreation impacts among EIR alternatives, as opposed to absolute differences.

Steelhead Fishing

Steelhead fishing dependence on stocked fish was inferred from the proportion of the catch reported as hatchery-reared as opposed to wild on steelhead report cards in 2003–2005 (Jackson 2007). As discussed in the section "Steelhead Fishing Participation," catch levels may be overstated in that some anglers may have classified resident rainbow trout as steelhead. Results are summarized below in Table 5-8 for waters in Regions 1–4, which accounted for all but two reported steelhead fishing trips in the state.

Table 5-8. Average Hatchery Dependence of Steelhead Fishing by DFG Region

Region	Trips[a]	Hatchery Catch[b]	Wild Catch and Release[b]	Hatchery Dependence (%)
1	17,936	10,807	14,670	42
2	6,161	3,711	3,532	51
3	642	177	288	40
4	504	67	271	21

Notes:

[a] Average annual reported trips, 2003–2005 (from Jackson 2007).
[b] Average annual reported catch, 2003–2005 (from Jackson 2007).

Weighting regional dependence percentages by the proportion of trips in the region, the statewide average steelhead fishing dependence on hatchery fish is 44%. Based on this average dependence, approximately 11,100 days were spent fishing for hatchery steelhead annually in 2003–2005.

River Chinook Salmon Fishing

Unweighted averages of hatchery dependence rankings for Chinook salmon fishing in rivers in each DFG region are shown below (Table 5-9). Considering the predominance of river salmon fishing in Regions 1–3 relative to Region 4, the statewide dependence ranking for river fishing was assumed to be in the range of 50%–60%. Based on this assumption and the further assumption that 50% of

freshwater salmon fishing in California occurs in rivers, river fishing for hatchery-reared Chinook salmon is estimated to account for 126,000–151,200 recreation days per year.

Table 5-9. Average Hatchery Dependence Rank and Percentage for River Chinook Salmon Fishing by DFG Region

Region	Average Dependence Rank[a]	Average Dependence Percentage[a]
1	2.8	47
2	3.8	72
3	3.0	50
4	2.0	25

Note:

[a] 1 = no dependence (0%), 2 = low dependence (25%), 3 = moderate dependence (50%), 4 = high dependence (75%), 5 = total dependence (100%).

Ocean Chinook Salmon Fishing

Ocean Chinook salmon fishing days off California in 2006 were estimated at 1,009,000 days. Approximately 90% of this fishing, or 908,000 days, was dependent on hatchery production (Barnett-Johnson et al. 2007; Borok pers. comm.).

Estimating Direct Employment Impacts

The number of jobs attributable to DFG fish hatchery and stocking operations was determined based on information supplied by DFG (Starr pers. comm.). Jobs attributable to hatchery-dependent sport fishing were inferred from employment coefficients estimated by Southwick Associates (2008) for California freshwater and saltwater fishing applied to the estimated number of fishing days attributable to hatchery production (Table 5-6) multiplied by average daily sport fishing expenditures estimated by the USFWS (2007). Jobs attributable to hatchery-dependent commercial fishing were calculated from employment coefficients estimated for California using IMPLAN multiplied by the hatchery-dependent component of the estimated output value of the commercial salmon fishing industry. (IMPLAN is a regional economic impact assessment model that simulates the exchanges of goods and services resulting from specified economic activities or events.)

Estimating Secondary Economic Impacts

Secondary (i.e., indirect, induced, and total) economic impacts on income and employment associated with industries directly affected by hatchery operations were estimated using multipliers obtained from published sources (e.g., Southwick Associates 2008; Pacific Fishery Management Council 2009) whenever available. For economic effects for which reported multipliers have not been identified (e.g., DFG hatchery and stocking operations), the relevant multipliers were estimated for California using IMPLAN.

Impacts and Mitigation Measures

The current DFG Program has a positive influence on recreational fishing opportunities in the state, as noted above in the "Environmental Setting" section. According to the USFWS (2007) and Jackson (2007), nearly 10 million days of recreational fishing were expended in California in 2006. This total

included fishing for trout, steelhead, inland salmon, and ocean salmon Impacts on economics in California from the Program would be considered beneficial because over $1 billion dollars is attributed to freshwater fishing expenditures and over $24 million to ocean fishing. This discussion will form the basis for the comparative impact analysis prepared for Alternatives 2 and 3 in Chapter 7.