



Bulletin 250

Fish Passage Improvement

An Element of CALFED's Ecosystem Restoration Program

June 2005

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Governor
State of California

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Secretary for Resources
The Resources Agency

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Director
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Foreword

The inaugural publication of Bulletin 250, Fish Passage Improvement, a joint interagency document through CALFED's Ecosystem Restoration Program, contributes significantly to our understanding of how California can help restore and revitalize our salmon and steelhead fisheries of the Central Valley. We at the Department of Fish and Game, NOAA's National Marine Fisheries Service, US Fish and Wildlife Service, in partnership with the Department of Water Resources welcome such a detailed contribution to the literature of protecting the state's anadromous fish and restoring access to important riverine habitat. There are many reasons for the decline of salmon and steelhead in our rivers and streams—the loss of riparian vegetation, poor water quality, unscreened diversions, and barriers to fish passage. Bulletin 250 identifies man-made structures in the watersheds of the Sacramento and San Joaquin rivers, and details how selected structures impede fish migration and what is being done about them.

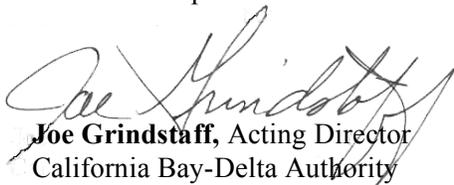
The bulletin represents an important contribution to the protection and recovery of listed anadromous salmonid species in California. It is an example of an integrated process that enhances the ability of agencies to fulfill mandates and collaborate on future efforts to improve fish passage in California.

Through coordinating resources and authorities, a comprehensive California fish passage program is vital toward identifying, prioritizing, and treating migration barriers so that unimpeded migration of California's salmonid populations is achieved. In addition, this information contributes to strategies for ensuring future water supply reliability. These strategies can only be realized through an integrative and cooperative interagency and stakeholder approach. This approach is reflected in this report and fully supported by our agencies.

This publication, with its summary of inventories of potential fish-passage barriers, will help fulfill a portion of the fish passage objectives for CALFED's Ecosystem Restoration Program, and the US Fish and Wildlife Service's Anadromous Fish Restoration Program. It should be recognized that in order to recover anadromous salmonid populations to the point where they no longer require protective measures provided by the Endangered Species Act, it may be necessary to re-establish access to historical habitats that are outside the existing scope of ERP and the Fish Passage Improvement Program. The existing scope of the FPIP is the Sacramento River downstream of Shasta Dam, the San Joaquin River downstream of the confluence with the Merced River, and their major tributary watersheds directly connected to the Bay-Delta system downstream of major dams and reservoirs. If the scope of the program changes to include areas of historical habitat, the FPIP through the FPIP interagency team (DFG, DWR, NMFS, and USFWS) will establish a framework for evaluating fish passage to historical habitat.



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FEB 2 2005

Mr. Ted M. Frink
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Dear Mr. Frink:

On behalf of the U.S. Fish & Wildlife Service (Service), I would like to take this opportunity to thank the California Department of Water Resources (CDWR) for providing stream barrier data for use in enhancing the Fish Passage Decision Support System (FPDSS). The FPDSS is a web-based database and modeling tool that utilizes scientific biological and physical habitat data for assessing resource benefits derived from different barrier removal scenarios, and can be accessed and used by any interested party via the internet. The FPDSS is maintained by the Service with significant contributions from partners, such as the National Marine Fisheries Service and CDWR.

Currently, millions of man-made barriers block fish movement in the United States and contribute to the depletion of migratory fish species, including many that are threatened or endangered. The data that your agency has provided will be critical in identifying and prioritizing potential future barrier removal or fish passage enhancement projects, and to making the most effective use of the resources available to yield the maximum on-the-ground benefits for native fish and wildlife. It is apparent that the fish passage programs of both the Service and the CDWR are complementary initiatives, and are working towards common goals of restoring important habitat, often in direct partnership with local municipalities and private land owners on a voluntary basis. Your efforts provide a model of cooperative conservation between State and Federal agencies in helping to protect, enhance and restore our nation's aquatic resources.

Once again, thank you for working with the Service to conserve America's fisheries, and to restore the habitat that our fisheries rely upon.

Sincerely,

Tom Busiahn

Chief, Division of Fish and Wildlife
Management and Habitat Restoration

Acting

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Metric Conversion Factors

Quantity	To Convert from Metric Unit	To Customary Unit	Multiply Metric Unit By	To Convert to Metric Unit Multiply Customary Unit By
Length	millimeters (mm)	inches (in)	0.03937	25.4
	centimeters (cm) for snow depth	inches (in)	0.3937	2.54
	meters (m)	feet (ft)	3.2808	0.3048
	kilometers (km)	miles (mi)	0.62139	1.6093
Area	square millimeters (mm ²)	square inches (in ²)	0.00155	645.16
	square meters (m ²)	square feet (ft ²)	10.764	0.092903
	hectares (ha)	acres (ac)	2.4710	0.40469
	square kilometers (km ²)	square miles (mi ²)	0.3861	2.590
Volume	liters (L)	gallons (gal)	0.26417	3.7854
	megaliters	million gallons (10 [*])	0.26417	3.7854
	cubic meters (m ³)	cubic feet (ft ³)	35.315	0.028317
	cubic meters (m ³)	cubic yards (yd ³)	1.308	0.76455
	cubic dekameters (dam ³)	acre-feet (ac-ft)	0.8107	1.2335
Flow	cubic meters per second (m ³ /s)	cubic feet per second (ft ³ /s)	35.315	0.028317
	liters per minute (L/mn)	gallons per minute (gal/mn)	0.26417	3.7854
	liters per day (L/day)	gallons per day (gal/day)	0.26417	3.7854
	megaliters per day (ML/day)	million gallons per day (mgd)	0.26417	3.7854
	cubic dekameters per day (dam ³ /day)	acre-feet per day (ac-ft/day)	0.8107	1.2335
Mass	kilograms (kg)	pounds (lbs)	2.2046	0.45359
	megagrams (Mg)	tons (short, 2,000 lb.)	1.1023	0.90718
Velocity	meters per second (m/s)	feet per second (ft/s)	3.2808	0.3048
Power	kilowatts (kW)	horsepower (hp)	1.3405	0.746
Pressure	kilopascals (kPa)	pounds per square inch (psi)	0.14505	6.8948
	kilopascals (kPa)	feet head of water	0.32456	2.989
Specific capacity	liters per minute per meter drawdown	gallons per minute per foot drawdown	0.08052	12.419
Concentration	milligrams per liter (mg/L)	parts per million (ppm)	1.0	1.0
Electrical conductivity	microsiemens per centimeter (μS/cm)	micromhos per centimeter	1.0	1.0
Temperature	degrees Celsius (°C)	degrees Fahrenheit (°F)	(1.8X°C)+32	0.56(°F-32)

Acronyms and Abbreviations

ACFC & WCD	Alameda County Flood Control and Water Conservation District
ACID	Anderson Cottonwood Irrigation District
AFRP	Anadromous Fish Restoration Program
AFSP	Anadromous Fish Screen Program
ARDLNF	Almanor Ranger District, Lassen National Forest
BCWG	Battle Creek Working Group
cfs	cubic feet per second
CNFH	Coleman National Fish Hatchery
CRMP	Coordinated Resource Management Plan
CSUC	California State University, Chico
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DCC	Dry Creek Conservancy
DCWC	Deer Creek Watershed Conservancy
DFG	California Department of Fish and Game
EBMUD	East Bay Municipal Utility District
EFH	essential fish habitat
EPA	US Environmental Protection Agency
ERP	Ecosystem Restoration Program
ESA	Endangered Species Act
ESU	evolutionarily significant units
EWP	Environmental Water Program
FERC	Federal Energy Regulatory Commission
FL	fork length
FPIP	Fish Passage Improvement Program
GCID	Glenn-Colusa Irrigation District
IFIM	instream flow incremental method
JPA	joint powers authority
LMMWC	Los Molinos Mutual Water Company
LPCCC	Lower Putah Creek Coordinating Committee
MCL	maximum contaminant level
MID	Merced Irrigation District
MOA	memorandum of agreement
MRSHEP	Merced River Salmon Habitat Enhancement Project
MSCS	Multispecies Conservation Strategy
MSL	mean sea level
NHI	Natural Heritage Institute
NID	National Inventory of Dams
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCAP	Operations Criteria And Plan
RBDD	Red Bluff Diversion Dam
RM	river mile
ROD	Record of Decision

SCVW	Santa Clara Valley Water District
SEIS/REIR	Supplemental Environmental Impact Statement/ Revised Environmental Impact Report
SEWD	Stockton East Water District
SFCWC	San Francisquito Creek Watershed Council
SFPUC	San Francisco Public Utilities Commission
SRFG	Stanislaus River Fish Group
SWP	State Water Project
SWRCB	State Water Resource Control Board
TCCA	Tehama-Colusa Canal Authority
TID	Turlock Irrigation District
TDF	through-Delta facility
USACE	US Army Corps of Engineers
USBR	US Bureau of Reclamation
USDA	US Department of Agriculture
USGS	US Geological Survey
USFWS	US Fish and Wildlife Service
WEP	Water Exchange Program
WUA	weighted usable area
YOY	young-of-the-year