Overview of the DFG Instream Flow Program and Public Resources Code (PRC) 10000-10005

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California Department of Fish and Game

Salmonid Restoration Conference
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Outline

DFG Instream Flow Program

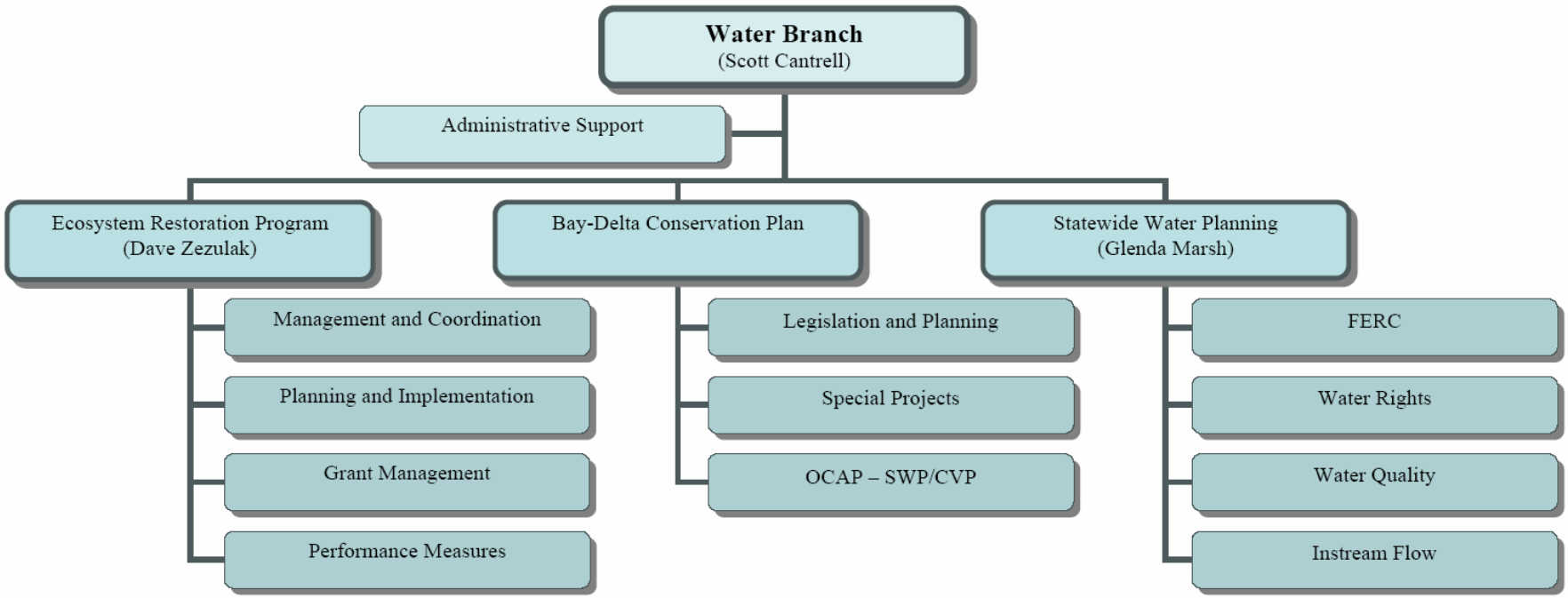
- Overview of DFG Instream Flow Program
- Public Resources Code (PRC) 10000-10005
- Instream Flow Incremental Methodology (IFIM) Policy

Analytical Measures of the Big Sur River Flow Study

- Habitat Suitability Criteria (HSC) for Juvenile South Central Steelhead
    a) HSC Overview:
        Categories, Data Collection, Limitations
    b) Big Sur River HSC Approach

Overview of DFG Instream Flow QA Program

Instream Flow Program - Organizational Setting



Overview of DFG Water Branch Instream Flow Program

(Left to right) Robert Holmes – Instream Flow Coordinator
Diane Hass – Delta Tributaries
Don Baldwin – Delta Tributaries
Bill Cowan – Delta Tributaries Lead
Candice Heinz – Scientific Aid
Mike Hancock – Scientific Aid

Instream Flow Program – Overall Duties

- Departmental Instream Flow Staff Coordination
- Establish Instream Flow Assessment Priorities and Policies
- Develop and Provide Training to Staff
- Maintain Partnership with SWRCB
- Provide Technical Oversight and Review

- *Ensure Best Available Science for Decision Making*

Instream Flow Program – Specific Duties

- Identify Priority Streams
- Conduct Stream Flow Needs Investigations
- Transmit Flow Recommendations to SWRCB
- Testify at SWRCB Water Rights Hearings

- *Defend DFG Instream Flow Recommendations*

Public Resources Code (PRC) § 10000-10005

DIVISION 10. STREAMFLOW PROTECTION STANDARDS

10001: “The Director of Fish and Game shall identify and list those streams…. throughout the state for which minimum flow levels need to be established…”

10002: “The Director shall prepare proposed streamflow requirements, which shall be specified in terms of cubic feet of water per second, for each stream or watercourse identified ...” “ …. the Director shall transmit these … requirements to the State Water Resources Control Board.”

10003-10004: “The Department shall initiate studies to develop proposed streamflow requirements for streams or watercourses in each fiscal year … and shall complete studies within 3 years.”

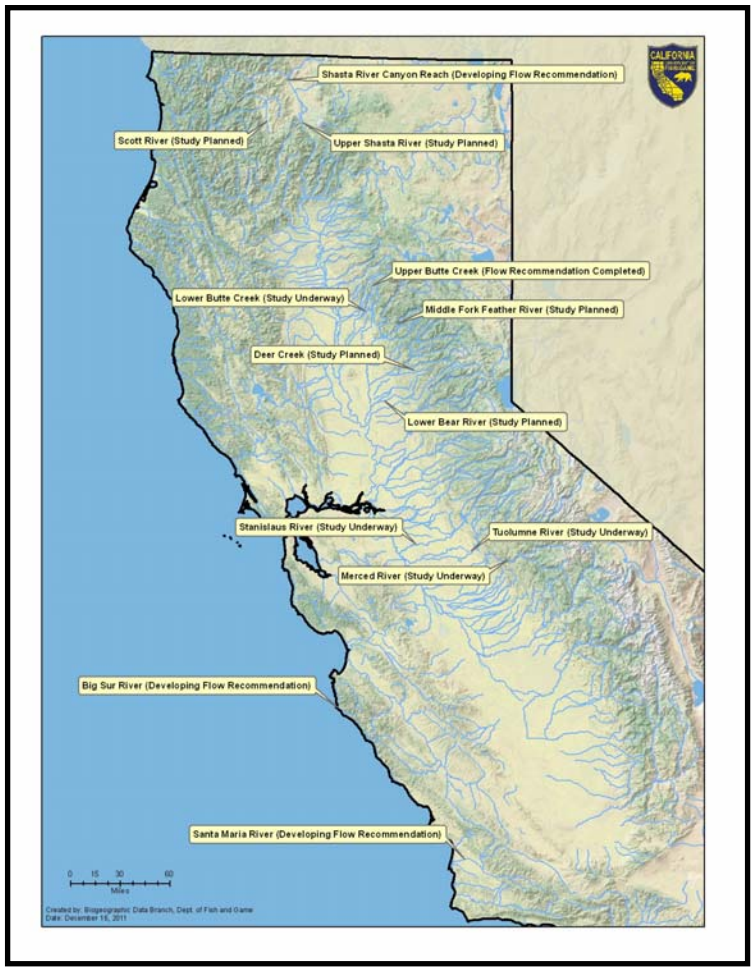
10005: “The Department … shall impose and collect a filing fee of $850.00 to defray costs of identifying streams and providing studies … “

The State Water Board shall consider DFG’s flow recommendations when exercising its water rights authority.

DFG 2008 Priority Streams List

Rank	Stream or Watercourse	DFG Region and County
1	Butte Creek	2 Butte
2	Tuolumne River (below La Grange Dam)	4 Stanislaus
3	San Gregorio Creek (lower)	3 San Mateo
4	North Fork of Navarro River	1 Mendocino
5	Big Sur River	4 Monterey
6	Santa Maria River	5 Santa Barbara
7	Redwood Creek (tributary to Maacama)	3 Sonoma
8	Bear River (below Camp Far West)	2 Placer and Nevada
9	Shasta River	1 Siskiyou
10	Carmel River	4 Monterey
11	Santa Margarita River	6 Riverside
12	Merced River (below Crocker-Huffman Dam)	4 Merced
13	Redwood Creek (tributary to Napa)	3 Napa
14	Scott River	1 Siskiyou
15	Mattole River (near Whitethorn)	1 Humboldt
16	Dry Creek (tributary to Napa River)	3 Napa
17	Deer Creek (tributary to Yuba River)	2 Nevada
18	Mojave River	6 San Benadino
19	Carpinteria Creek	5 Santa Barbara
20	Santa Ana River	6 Riverside, San Bernardino
21	Middle Fork Feather River	2 Plumas
22	Dos Pueblos Creek	5 Santa Barbara

Studies Planned, Underway, and Complete in 2012



DFG Priority Streams List Studies

Studies Planned:

- Scott River
- Shasta River (Upper)
- Deer Creek (Delta Trib)
- Middle Feather River (Delta Trib)
- Lower Bear River (Delta Trib)

Studies Underway:

- Big Sur River
- Lower Butte Creek (Delta Trib)
- Merced River (Delta Trib)
- Stanislaus River (Delta Trib)
- Tuloumne River (Delta Trib)

Studies Complete in 2012:

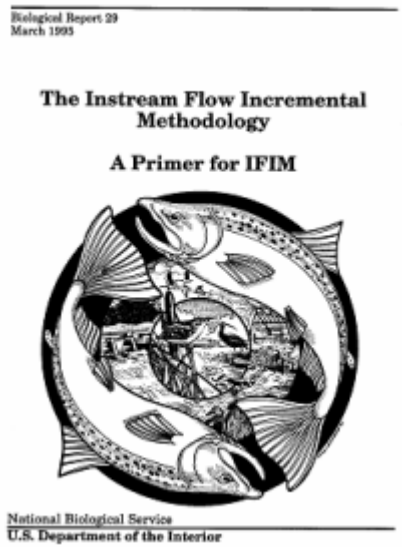
- Santa Maria River
- Shasta River Canyon Reach

The Instream Flow Incremental Methodology (IFIM)

- The most-used technique worldwide, commonly accepted to scientifically determine environmental flow regimes.

- Multidisciplinary, transparent and collaborative approach, providing incremental results and techniques to interpret, understand, and negotiate instream flow recommendations.

- Application in California is commonplace
  - Hydroelectric project relicensing
  - Water rights for resource protection



DFG IFIM Policy

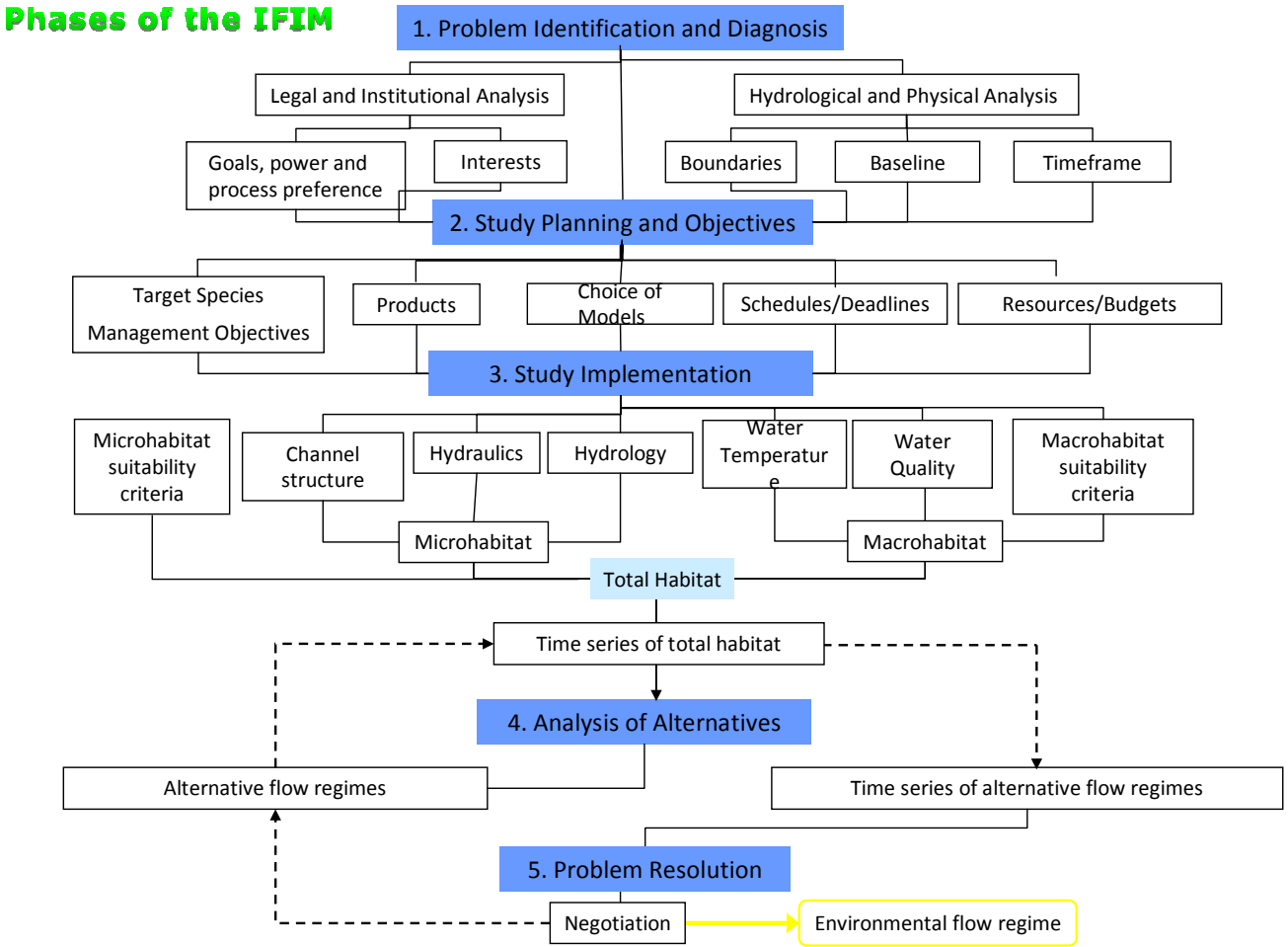
- "In view of its benefits and defendability, the Instream Flow Incremental Methodology (IFIM) will be used in the evaluation of and to develop instream flow recommendations…."

- *IFIM is a process/methodology….not a method.*

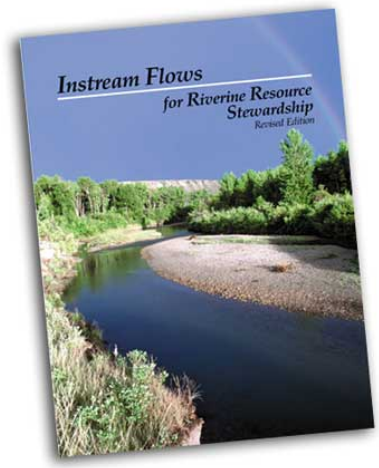
The Instream Flow Incremental Methodology
Information Paper No. 12 (Bovee 1982)
Stream Habitat Analysis (Bovee et al. 1998)
http://www.mesc.usgs.gov/Products/Software/IFIM

DFG recommends ongoing consultation: *"Coordinate early and often."*

Phases of IFIM

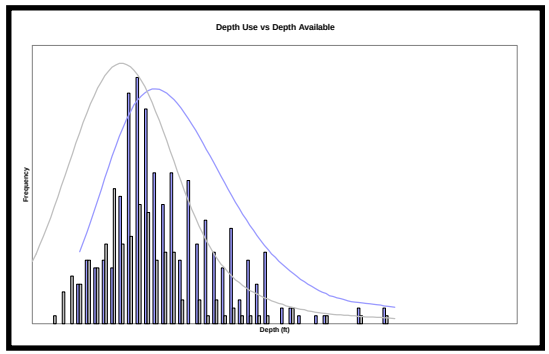


Instream Flow Concepts to Consider



- There is not a “silver bullet” to identifying instream flow needs.
- Flow regimes are best identified by preserving the processes and functions of river ecosystems.
- The structure and function of riverine systems are based upon five riverine components: hydrology, geomorphology, biology, water quality, and connectivity (Annear, et al., 2004).

Analytical Measures of The Big Sur River Flow Study: Habitat Suitability Criteria (HSC) for Juvenile South-Central Steelhead



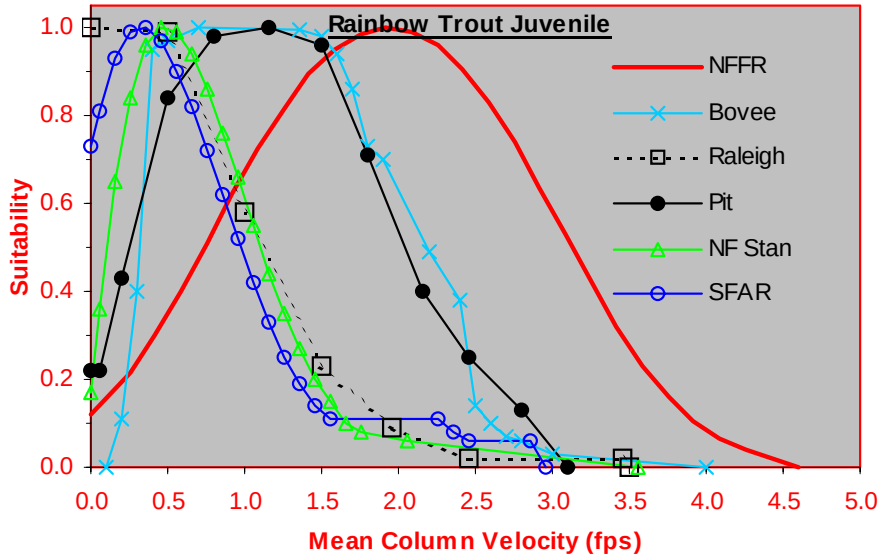
HSC: The Biological Component of Instream Flow

HSC are an integral component of instream flow modeling using habitat-based modeling approaches and have significant affect on estimating flow-habitat relationships.

Flow studies are reliant upon accurate HSC - critical to protecting species and their habitats.

What are HSC?

- HSC incorporate the behavioral response of a species to habitat variability.
- Standard variables are depth, velocity, and substrate and/or cover.
- Range of suitability for each variable is between 0.0 (unusable) and 1.0 (usable).



HSC Categories

- Category I “Professional Judgement” HSC
  - Literature and/or Professional Judgment
- Category II “Use” HSC
  - Not Accounting for Habitat Availability
  - Represent “Relative Probability” of Habitat Use
  - Dependent Upon Microhabitats Available
- Category III “Preference” HSC
  - Takes Habitat Availability into Account
  - Represent “Habitat Selection” Given all Microhabitats are Equally Available to the Fish From Which to Select

HSC Data Collection

Category I HSC: Professional Judgement Criteria

- Literature sources
- Professional judgment

Type II (Use) and Type III (Use Accounting for Habitat Availability) HSC

- Surface observation,
- Underwater observation,
- Underwater video,
- Biotelemetry,
- Electrofishing,
- Netting.

Limitations of HSC Types

- Category I HSC
  - Data often not collected for HSC purposes
  - HSC can be influenced by participant experience
  - No validation of HSC applicability to study area
  - Accuracy Unknown

- Category II HSC
  - Does not account for habitat availability:
    a) Favored habitat with low availability can show low suitability
    b) Unfavored habitat with high availability can show high suitability
    c) Can confuse optimal habitat with merely tolerable habitat

- Category III HSC
  - Overall sample sizes
  - Respective U and A sample sizes
  - Frequency interval (bin) width selection
  - Data smoothing before vs. after forage ratio adjustments
  - Outlier influences

HSC - Comments by USFWS Instream Flow Group

"Category I criteria are as valid in an application of IFIM as data-based criteria, if they are supported by a consensus of opinion among the stakeholders." (Bovee et al. 1998)

"Criteria verification is always a good idea." (Bovee et al. 1998)

"When it becomes impossible to obtain consensus among the stakeholders, however, it may be necessary to conduct an empirical verification test." (Bovee et al. 1998)

DFG recommends ongoing consultation: *"Coordinate early and often."*

Background: Big Sur River, Monterey County

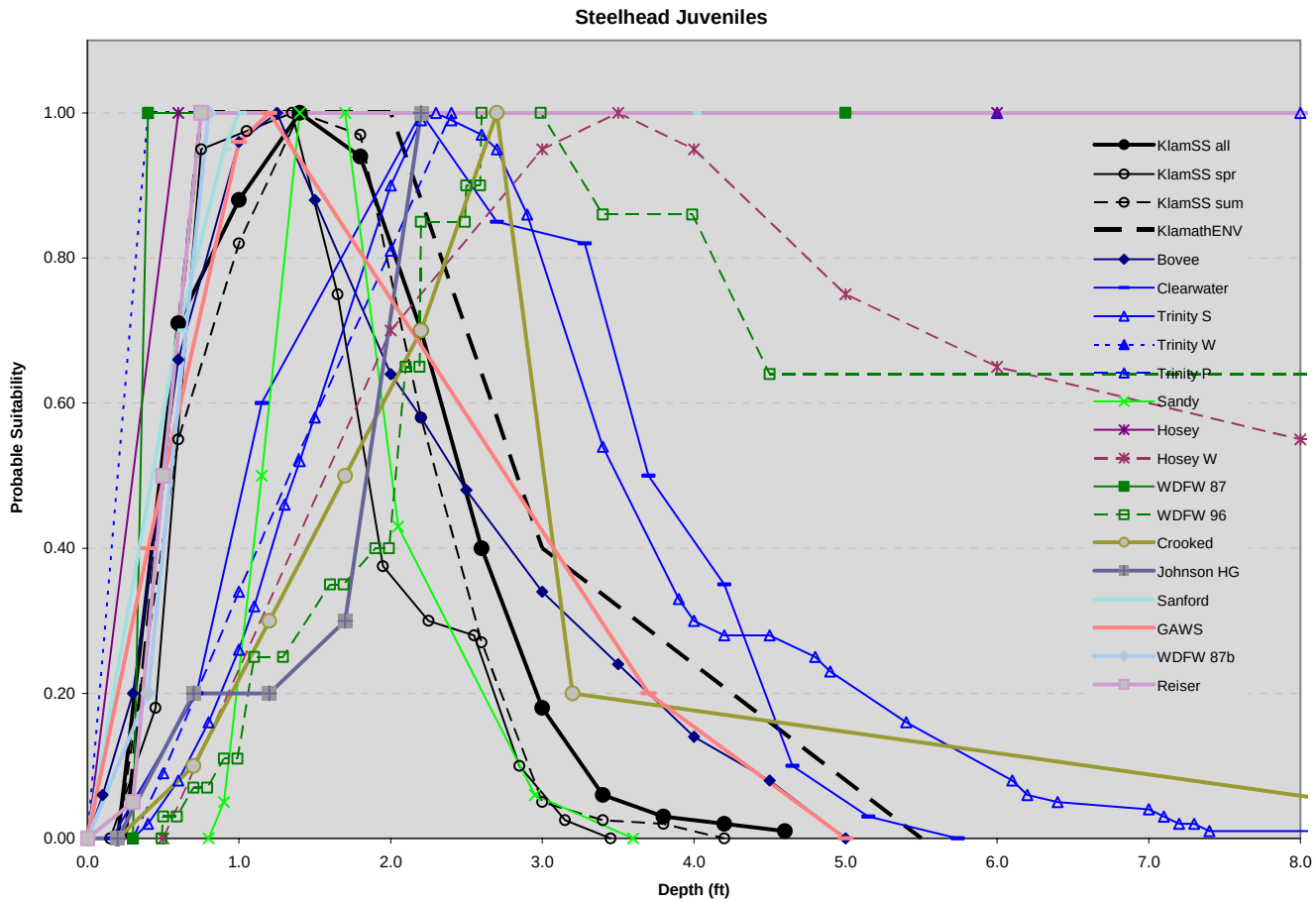
The Big Sur River originates in Ventana Wilderness and flows northwest through two state parks (Pfeiffer Big Sur and Andrew Molera) and a lagoon before reaching the Pacific Ocean.

The Big Sur River is among the larger watersheds south of San Francisco Bay currently supporting south-central steelhead.

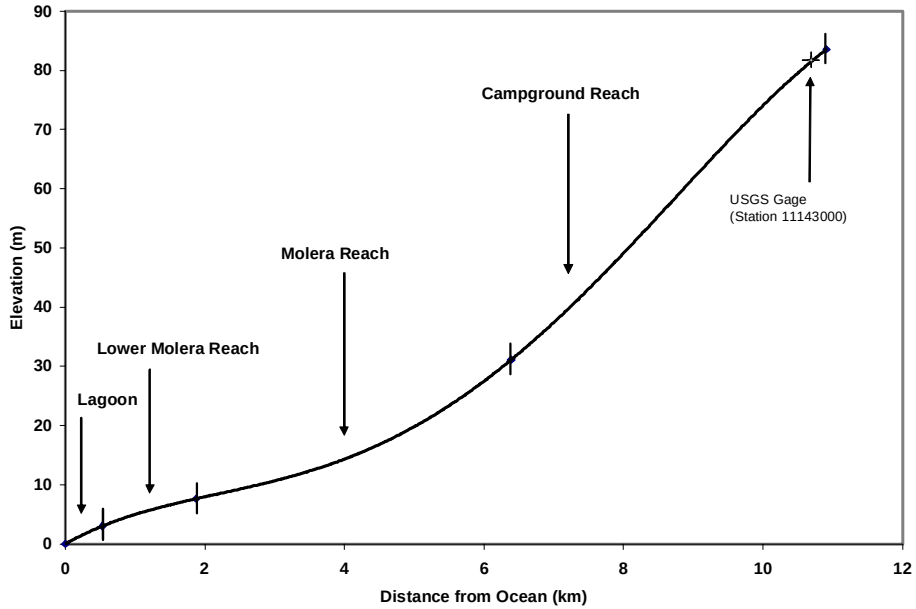
The Big Sur River is considered a stronghold for south-central steelhead on the Central Coast.

Site-specific HSC are component of instream flow study underway assessing relationships between flow and habitat.

Available Juv. Steelhead HSC? CA? Central Coast?

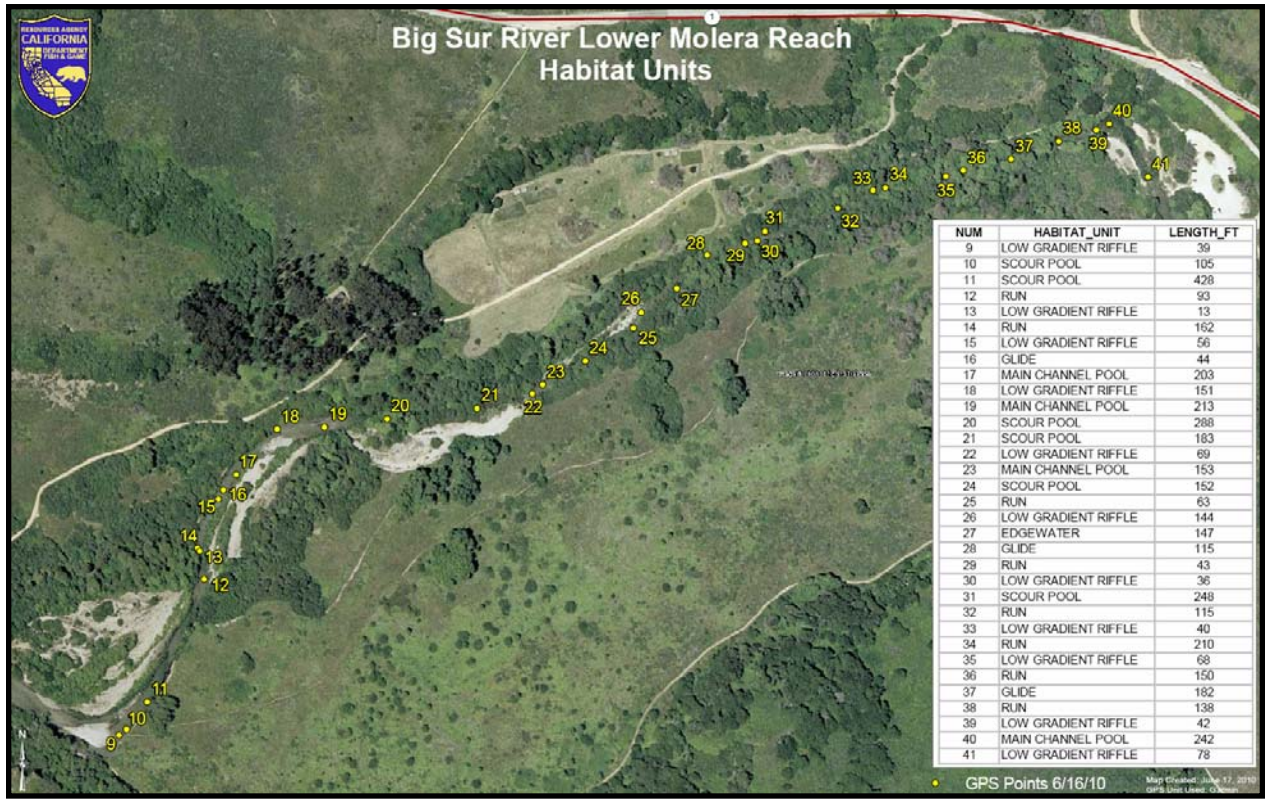


Identify Study Boundaries and Sampling Reaches



Stream reaches are relatively long sections of stream typified by geographically homologous flow regime.

Habitat Mapping of Mesohabitat Types

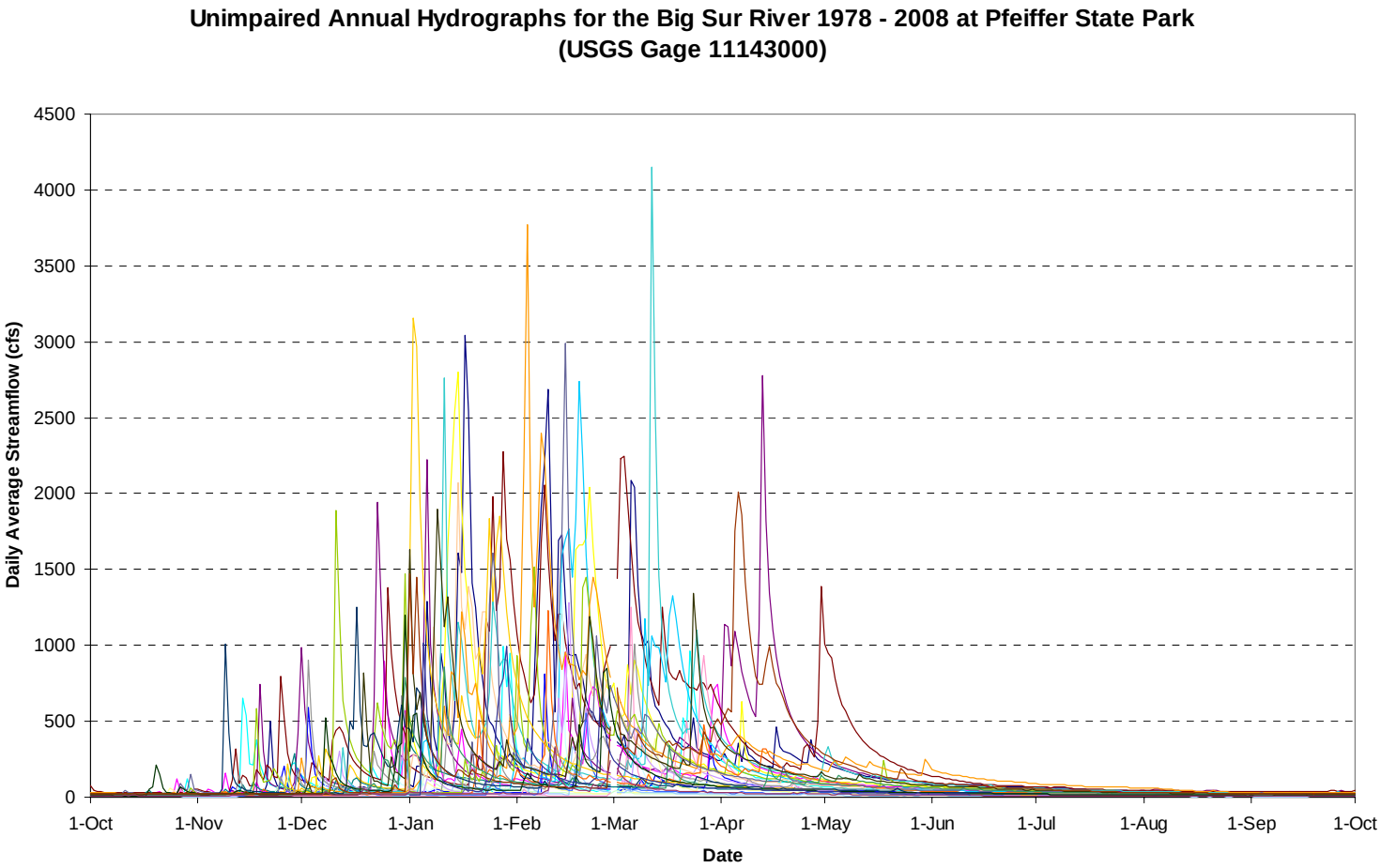


NUM	HABITAT_UNIT	LENGTH_FT
9	LOW GRADIENT RIFFLE	39
10	SCOUR POOL	105
11	SCOUR POOL	428
12	RUN	93
13	LOW GRADIENT RIFFLE	13
14	RUN	162
15	LOW GRADIENT RIFFLE	56
16	GLIDE	44
17	MAIN CHANNEL POOL	203
18	LOW GRADIENT RIFFLE	151
19	MAIN CHANNEL POOL	213
20	SCOUR POOL	288
21	SCOUR POOL	183
22	LOW GRADIENT RIFFLE	69
23	MAIN CHANNEL POOL	153
24	SCOUR POOL	152
25	RUN	63
26	LOW GRADIENT RIFFLE	144
27	EDGEWATER	147
28	GLIDE	115
29	RUN	43
30	LOW GRADIENT RIFFLE	36
31	SCOUR POOL	248
32	RUN	115
33	LOW GRADIENT RIFFLE	40
34	RUN	210
35	LOW GRADIENT RIFFLE	68
36	RUN	150
37	GLIDE	182
38	RUN	138
39	LOW GRADIENT RIFFLE	42
40	MAIN CHANNEL POOL	242
41	LOW GRADIENT RIFFLE	78

Habitat mapping is an on-site inventory of the mesohabitat types for the stream under investigation. Habitat mapping is used to determine the proportion of habitat types in each reach.

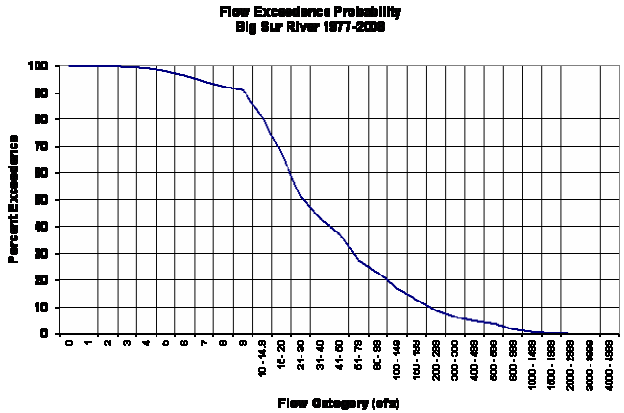
Stratified Random Site Selection Process and Equal Area Sampling

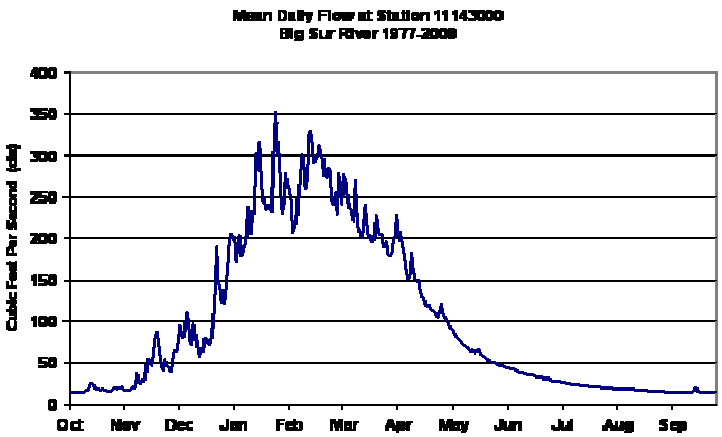
Identification of Target Flows for Sampling



Identification of Target Flows for Sampling

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Adult Migration												
Spawning												
Egg Incubation												
Emergence/Fry												
Juvenile Rearing												
Smolt Emigration												





Three flows targeted based upon flow exceedance data (20% - 80%) and juvenile steelhead life history timing:

- flow range: 100 cfs – 10 cfs
- steelhead fry (< 5 cm)
- steelhead juveniles (5 – 15 cm)

Habitat Availability Assessment

- Habitat availability measurements collected in each sampled mesohabitat unit using randomized approach.
- Habitat availability measurements sampled in proportion to the size of the habitat.

Ensures habitat availability data are collected in same locations and in same proportions as habitat use data.

Big Sur River HSC Approach

- Focus is south-central juvenile steelhead

Type II ½ Criteria:

- Direct underwater observation
- Equal area approach to sampling
- Habitat availability assessed
- Sampling conducted at various flows

Approach accounts for flow and habitat availability affect on fish meso- and microhabitat selection

- *Let the fish tell us what they prefer/need.....*

Overview of DFG Instream Flow QA Program

QA Program Overview

- QA Research Group (Moss Landing Marine Laboratories)
- QA Program – Data Needs
- Known and Documented Quality
- Comparability
- QA Program
  - Tools
  - Implementation
  - Partners and Outreach
- Closing Remarks

The QA Research Group at Moss Landing Marine Laboratories

Six staff members specializing in the Quality Assurance associated with all areas of environmental science

- ✓bioassessment
- ✓physical habitat
- ✓algae
- ✓field measurements
- ✓toxicity testing
- ✓statistical analysis
- ✓project design
- ✓instream flow
- ✓data assessment
- ✓database structures
- ✓aquatic ecology
- ✓chemistry including ultra-trace, speciation, and emerging contaminants

Instream Flow QA Program Goal

Defensible data are necessary for the Department to meet it's statutory mandates. Only data of *"known and documented quality"* are defensible.

California Fish and Game Code 5937: Fish in Good Condition

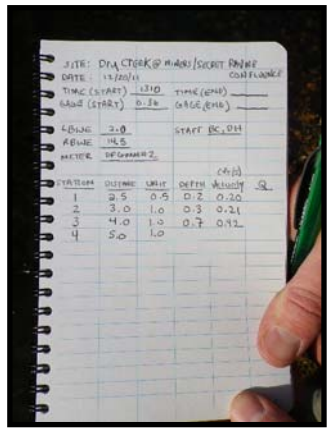
PRC 10000 -10005: Identify flows for protection of fish and wildlife

Comparable data are important as part of Delta Watershed Tributary Studies and being able to make broader statements about flow needs in tributaries of the Delta Watershed.

Comparable data benefit everyone by allowing data leveraging (results in better informed decision making), saves time and money, and provides known confidence in the data (key to defensibility).

QA Program – Data Needs

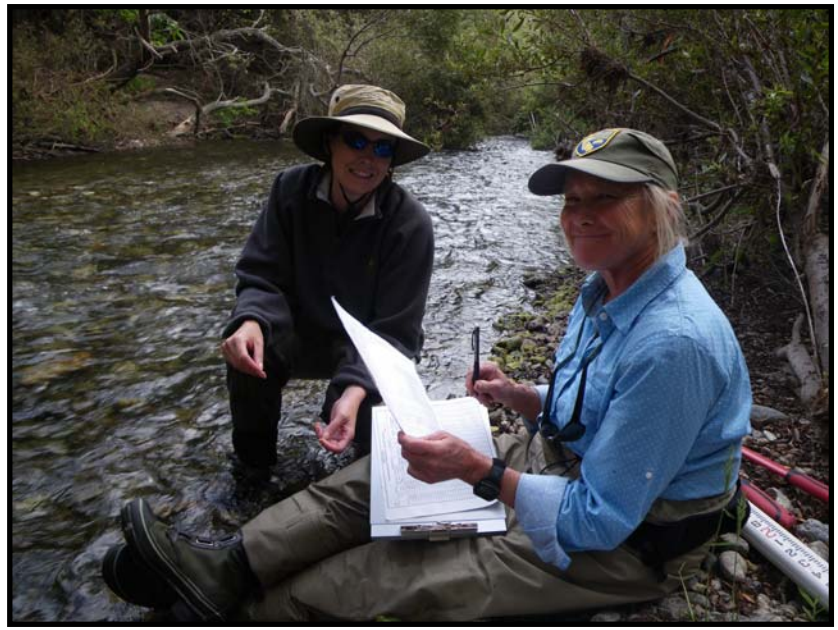
- To understand/document the quality of the data
- Staff and public have asked for flow guidance



- Resource protection depends on it!

QA Program – Data Needs

- Defensible
  - Known and documented quality
  - Scientifically defensible
- Comparable (consistent) – dependent upon how data will be used in decision making
- Using data that is provided to DFG
  - DFG uses data from internal and external sources
  - DFG can not collect all the data
  - Need to be able to take a report from an outside party and to defend what is in the report as-is



Known and Documented Quality

- Defined by the program
- Systematically vetted a plan for data collection, analysis, and reporting
- Program document(s) explaining definition

Undocumented + unknown = undefensible = unuseable

Instream Flow Standard Operating Procedures (SOPs) – *tentative list*

- Surveying Water Surface and Stream Bed Elevations
- Critical Riffle Analysis
- Discharge Measurements
- Target Flows Assessment
- Wetted Perimeter
- Hydraulic Modeling
- Total Station
- Habitat Suitability Criteria
- Data Management and Reporting
- Field Procedure Assessment
- Field Cross-check Exercise
- Corrective Actions
- Unimpaired and Regulated Hydrology Analysis
- Habitat Polygon Mapping
- Water Temperature Modeling
- Data Collection on 1D and 2D Transects
- Benthic Invertebrate Production in Riffles
- Determination of Fishing-Flow Steam Closure

Tools - SOPs

"Recipes" for the procedures.....

Provide easy-to-follow guidance and protocols for staff/others

- Ensure data is:
  - Scientifically defensible
  - Known and documented quality
  - Consistent (comparable)
- Allow other interested parties to provide usable data to DFG

Surveying Water Surface and Stream Bed Elevations

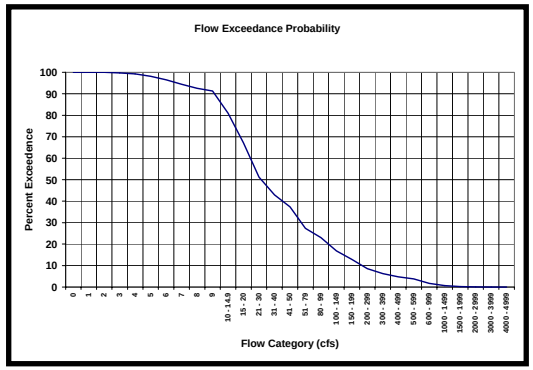
- Adopted from *Differential Leveling Survey Specifications* (CALTRANS, 2006) and *Surveying Principles and Applications*, 4th ed. (Prentice-Hall Eaglewood Cliffs, N.J.

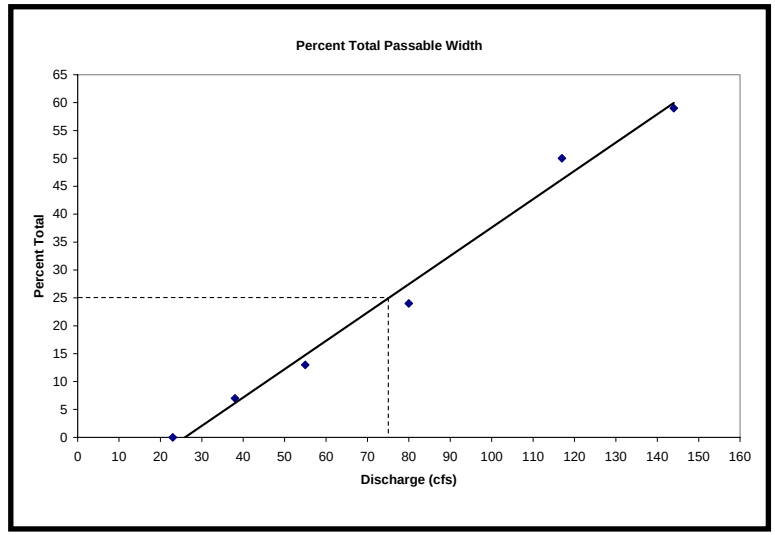
- Auto level and tripod set up, use of graduated measuring rod (stadia rod)
- Establishing a vertical benchmark and closing the level loop
- Tying vertical benchmarks together
- Measuring stage of zero flow
- Collecting Water Surface Elevations (WSELs)
- Collecting wetted bed profile and dry bed elevations

Critical Riffle Analysis

- Adopted from Oregon Department of Fish and Wildlife (ODFW)

Critical riffles are those riffle habitats which may be particularly sensitive to changes in stream flow, and as such may prevent adult anadromous fish passage to and from spawning areas and/or may prevent movement of rearing juvenile salmonids (i.e., steelhead) between adequate summer rearing habitats.

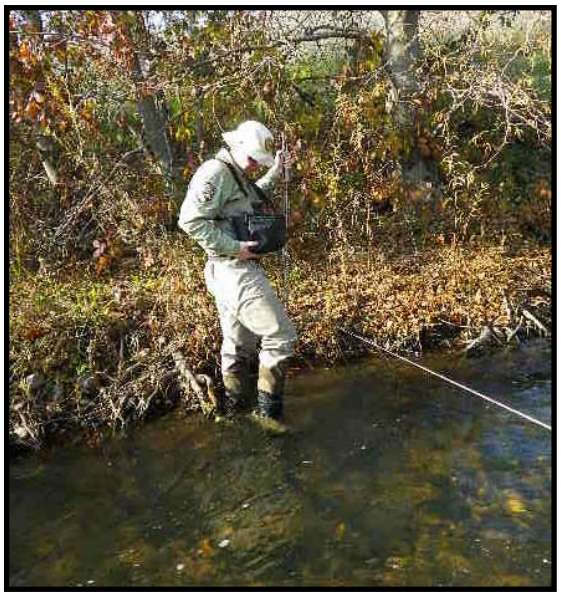




Species	Minimum Depth (ft)
Steelhead (adult)	0.7
Coho (adult)	0.6
Chinook (adult)	0.9
Salmonid (juvenile)	0.4

Discharge Measurements

- Adopted from the U.S. Geological Survey (USGS)



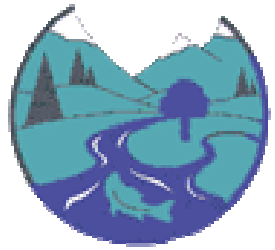
- General use and calibration of the Model 2000 and USGS Top-Setting Wading Rod
- Collecting data with and data logger functions of the Model 2000
- Guidelines for site selection to measure discharge
- Discharge calculations

Instream Flow FAQs

"Considerations in Selecting an Instream Flow Approach and Method"

- Goals and objectives of study (incl. PRC and DFG 5937)
- DFG Priority Streams List
- Regional priorities
- Stakeholder Interest
- Aquatic species and lifestages
- Listed species present
- Use of stream reach (e.g. passage, spawning, rearing, etc…).
- Existing available biological, hydrological, and water quality information.
- Criteria available/needed (habitat suitability criteria, fish passage criteria, temperature)
- Overall defensibility needed

Instream Flow FAQs



1) What is instream flow?

2) Why is instream flow important?

3) How does one determine how much flow a river needs?

There is usually not just one flow level that a river needs to stay healthy. If the objective is to preserve riverine values, that can only be done by preserving the processes and functions of the river ecosystem. The structure and function of riverine systems are based on five riverine components; hydrology, geomorphology, biology, water quality, and connectivity. Inter- and intra-annual flow prescriptions are needed to preserve the ecological health of a river. And some flow needs, such as those that flush sediments from stream substrates or maintain channel integrity, may be quite high.

4) Isn't instream flow really an issue of "water for fish" vs "water for people"?

..from the Instream Flow Council

http://www.instreamflowcouncil.org/

Tools - Timeline

June 2012	June 2013	Jan 2014	June 2014
Methods Phase I •Surveying Water Surface & Stream Bed Elevations •Critical Riffle Analysis •Discharge Measurements •Wetted Perimeter	**Methods Phase II** •Total Station •Data Collection on 1D and 2D Transects •Habitat Suitability Crit.	**QA Program Plan** FINAL	**Methods Phase III** •Corrective Actions •Unimpaired and Regulated Hydrology Analysis •Habitat Polygon Mapping •Data Management and Reporting
FAQs Phase I •IFIM Process •Consideration in Selecting and Instream Flow Method	**FAQs Phase II** •How to be Consistent w/DFG Instream Flow QA		
QA Web Page			
QA Program Plan OUTLINE – tentative date	**QA Program Plan** DRAFT		

Outreach and Partners

- Moss Landing Marine Laboratories QA Research Group

- State Water Resources Control Board Division of Water Rights (DWR)

- State Water Resources Control Board Division of Water Quality (DWQ)

  Surface Water Ambient Monitoring Program (SWAMP)

Closing Remarks

- There is not a "*silver bullet*" to identifying instream flow needs.
- A suite of *QA tools* provides flexibility to identifying instream needs.
- *Defensible data* are necessary to address mandates (PRC, DFG 5937).
- *Comparable data* benefit everyone by allowing data leveraging and better informed decision making.
- Understanding and documenting *quality of data* are essential for defensibility.
- Ultimate goal is protection of the species and the habitats they depend upon.

For more information contact:

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DFG Instream Flow Program information at:
http://www.dfg.ca.gov/water/instream_flow_docs.html