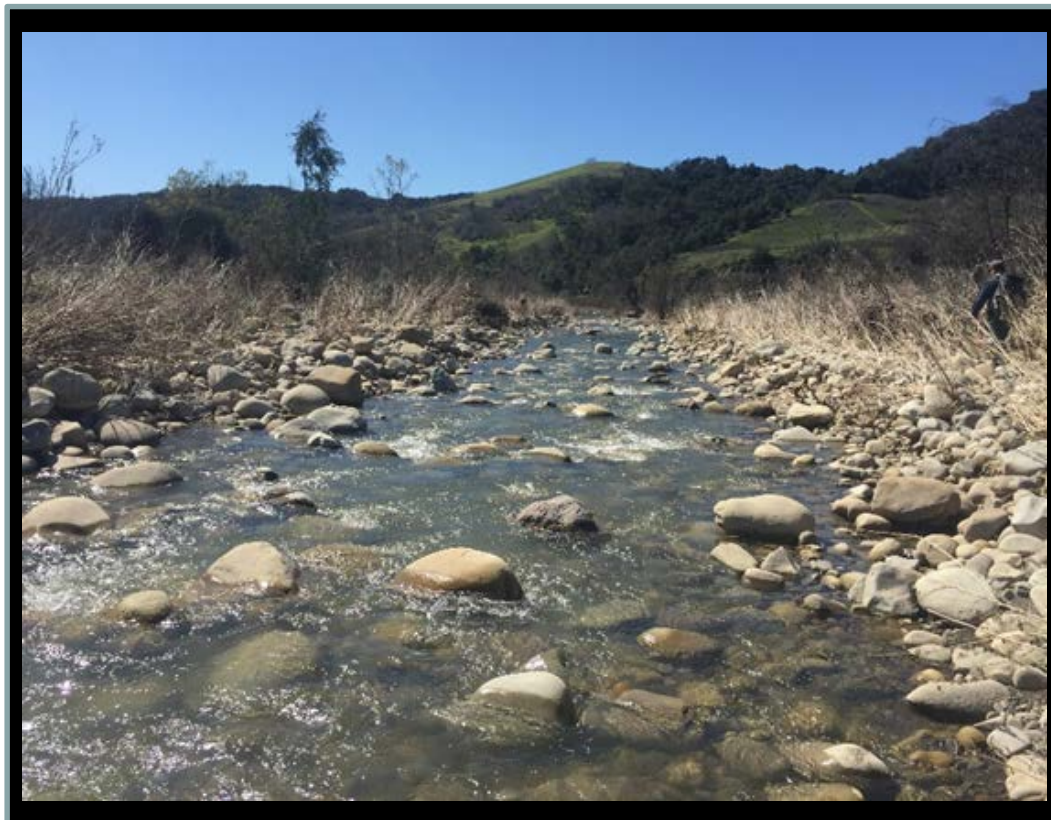


Question-Driven Flow Criteria: Overview of Regional and Site-Specific Approaches for Assessing Instream Flow Needs in CA



Robert W. Holmes

SWRCB Science Symposium Instream Flow Workshop

June 30, 2017



Overview

Question-Driven Flow Criteria

Selecting Appropriate Methods/Models to Address Questions

- Terminology
- Considerations (Flow Components/Flow Regimes)
- Methods/Models for Different Questions

Design and Implementation of Two CDFW Study Types

Site Specific Studies

- Water Allocation and Permitting Decisions

Regional Study

- General Information for Planning/Priority Setting



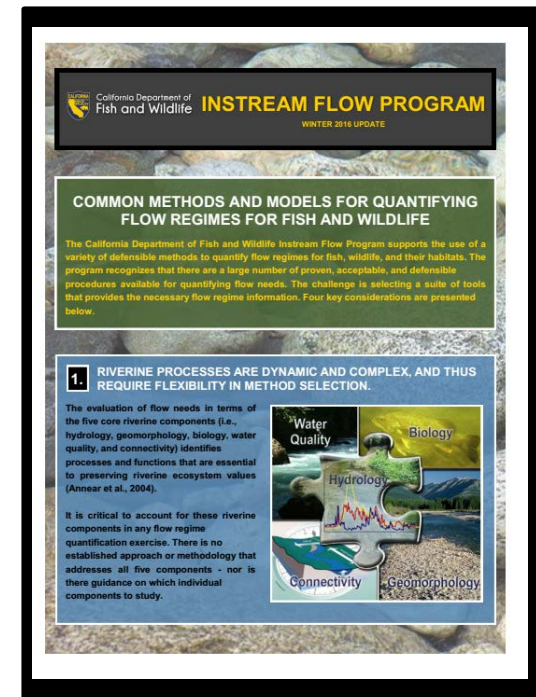
Terminology

- **Flow Criteria**
 - Numerical standards
 - Many potential uses
 - May or may not develop into flow recommendations
- **Flow Recommendations**
 - Proposed flow criteria transmitted by CDFW Director to SWRCB for their *consideration* in water allocation and basin planning
 - May or may not develop into flow objectives
- **Flow Objectives**
 - Developed and implemented by the State Water Board to balance and protect public trust resources and beneficial uses



Considerations: Flow Components and Flow Regimes

- There is usually not just one flow level that a river needs to stay healthy.
- Use hydrology, biology, connectivity, geomorphology, and water quality to identify flow regimes for fish and wildlife.
- Inter- and intra-annual flow prescriptions are needed to preserve the ecological health of a river.
- *Think flow regimes!*



Selecting Appropriate Methods and Models

- Standard-setting methods
 - Single minimum thresholds (bottom up) – *how much water the stream needs to reach a desired level of protection*
 - Presumptive standard (top down) – *how much water to leave in stream*
- Incremental methods
 - Evaluate habitat vs. flow relationships
 - Relates to a single or multiple variables
- Holistic methods
 - Integrates more than one component at a time
 - The next generation (environmental flows)



Importance of Site Representation

Site representation strategies vary among flow assessments projects

Consider:

- Planned uses of data
- Study questions
- Methods and models
- Time and resources



Importance of Linking Hydrology

- Water availability varies by water year and month types
- Flow criteria/recommendations should accurately link to water availability patterns to be scientifically-defensible
- It is important to know what you are asking for
- Be prepared to defend the request
- Many streams contain losing and gaining reaches – very important for compliance efforts

Ultimate goal is to protect fish, wildlife, and their habitats



Site Specific Study Questions

Big Sur River



Ventura River



Big Sur River Study Questions

Biology

Steelhead Rearing Micro-Habitat Preference?

Steelhead Spawning Locations/Reaches?

Steelhead Rearing and Spawning Flows?

Big Sur River Low-Flow Ecological Threshold?

Connectivity

Steelhead Passage and Habitat Connectivity Flows?

Longitudinal Flow Losses/Gains?

Geomorphology

Channel Forming/Maintenance Flows?

Hydrology

Unimpaired Hydrology?

Monthly Hydrological Condition Types?

Water Quality

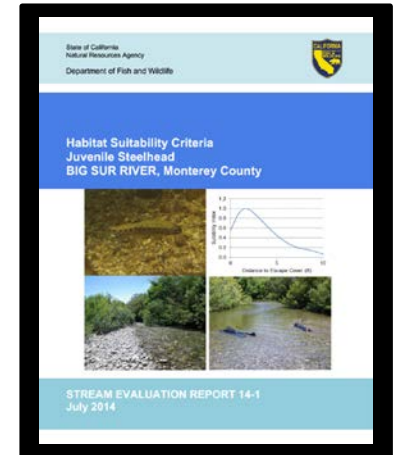
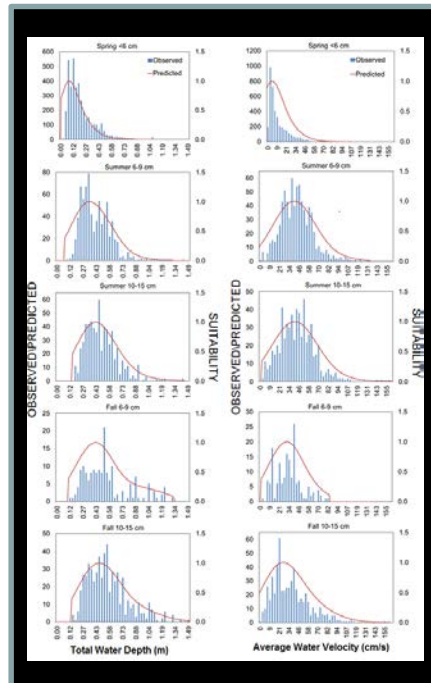
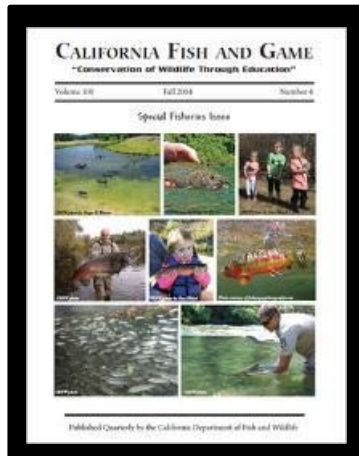
Lagoon and Riverine Temperature and D.O.?



Big Sur River Steelhead Micro-Habitat Preference?

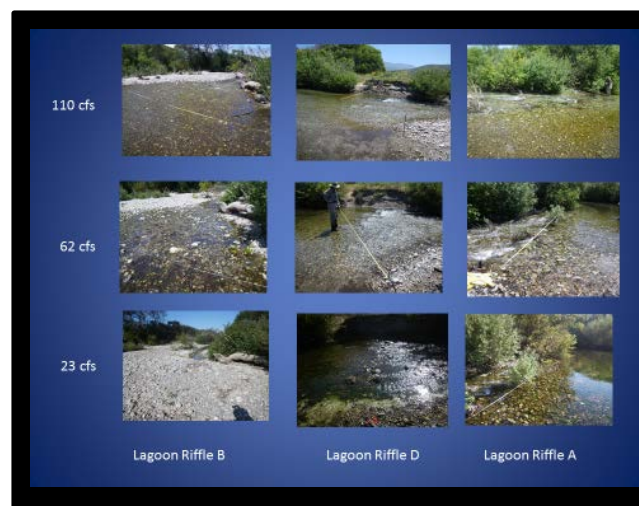
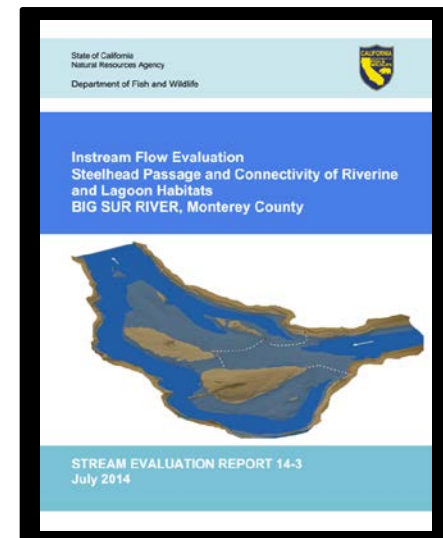
Assess juvenile rearing steelhead habitat preference using equal-area design (CDFW 2008)

Evaluate habitat availability, habitat use, and habitat preference at various flows.



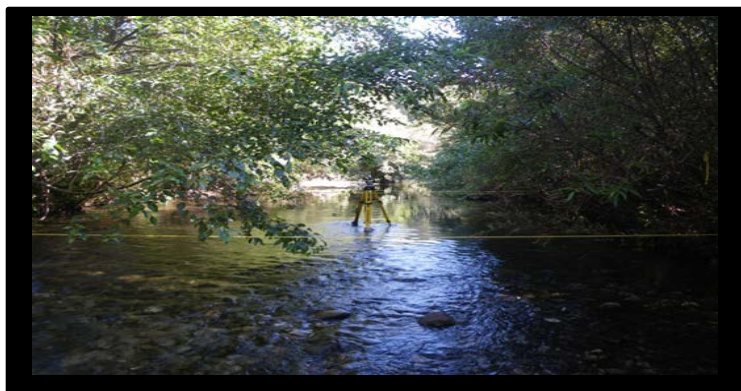
Big Sur River Steelhead Passage Flows?

Use 2D modeling to evaluate steelhead passage and habitat connectivity flows at critical riffle sites.

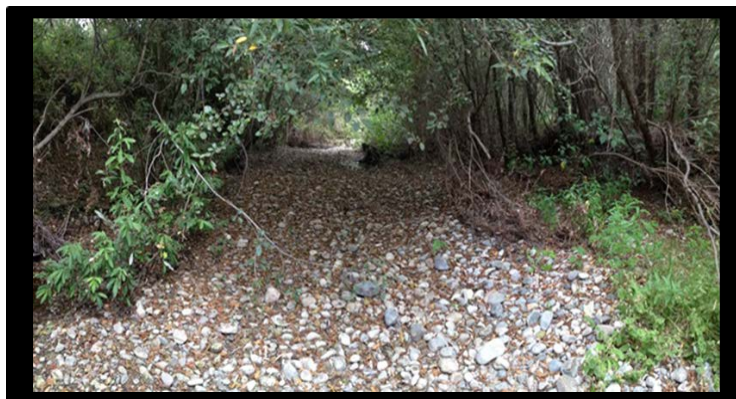
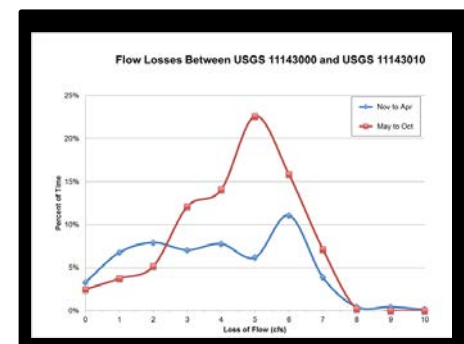


Big Sur River Gains and Losses?

Assess flow losses between USGS 11143000 (Campground Reach) and USGS 11143010 (Lower Molera Reach)



← Summer 2012



← Summer 2014:

Flow at USGS
11143000 ~ 7 cfs



Ventura River Study Questions

Biology

Movement and Survival Flows for Steelhead?

Ecological/Benthic Invertebrate Productive Riffle Flows?

Habitat Maintenance Flows?

Ventura River Low-Flow Ecological Threshold?

Connectivity

Steelhead Passage and Habitat Connectivity Flows?

Longitudinal Flow Losses/Gains?

Geomorphology

Channel Forming/Maintenance Flows?

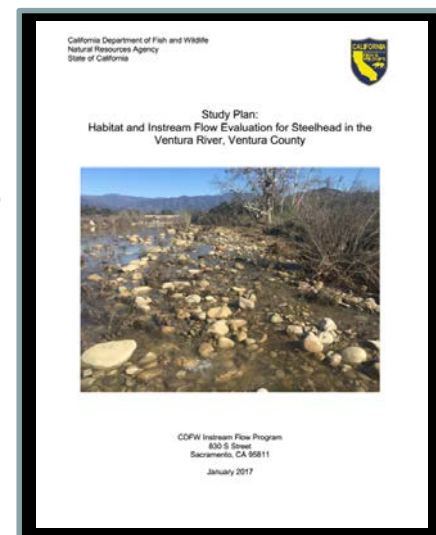
Hydrology

Unimpaired Hydrology?

Monthly Hydrological Condition Types?

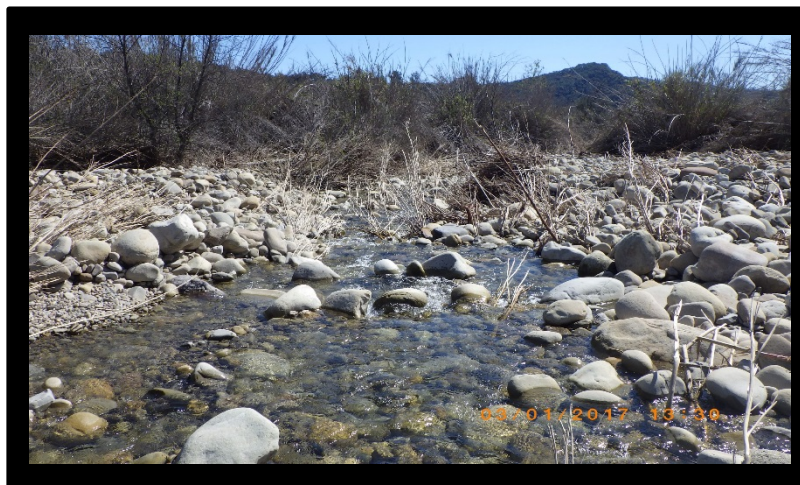
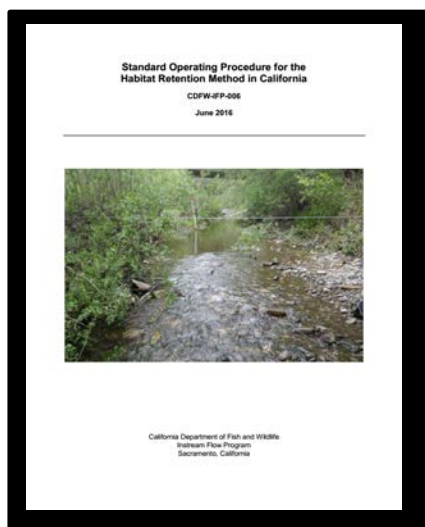
Water Quality

Live Reach Temperature and D.O.?



Ventura River Movement and Survival Flows?

Use Habitat Retention Method SOP to determine movement and survival flows for steelhead.



Ventura River Low-Flow Threshold?

Use Wetted Perimeter Method SOP and/or desktop hydrology-based approach to determine Low-Flow Threshold.

California Department of Fish and Wildlife **INSTREAM FLOW PROGRAM**
WINTER 2017 UPDATE

What is a Low-Flow Threshold?

A low-flow threshold identifies where flow levels are receding into the "danger zone" for aquatic life (DFO 2013). These are survival-level flows and definitely not "optimal" ecological flows. For example, the breakpoint flow level identified by a 50% wetted perimeter on a wetted perimeter vs. discharge curve identifies the lower ecosystem threshold flow, below which aquatic invertebrate production, habitat, and general ecological health rapidly decline (Annear et al. 2004).






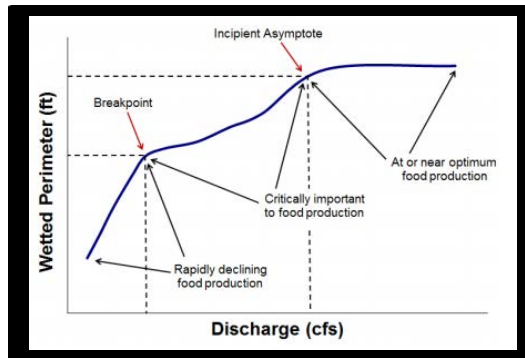
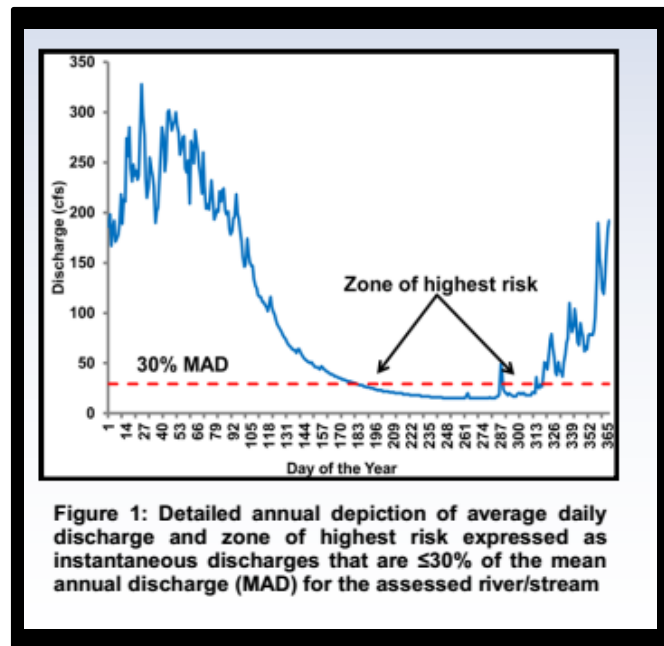
What are the Benefits of Low-Flow Thresholds?

A low-flow (i.e., floor value) is a widely recognized flow-related component that is needed to protect and ensure the long-term persistence of fisheries and aquatic insects (Lorenz et al. 2013; DFO 2013). A low-flow threshold helps prevent the reduction of natural base flow levels of a stream or river hydrograph by water withdrawal or other water management activities. The establishment of a seasonally appropriate low-flow threshold helps protect fishery productivity during critically low-flow time periods by supporting stream channel forms and riparian communities that directly affect aquatic life (Annear et al. 2004).

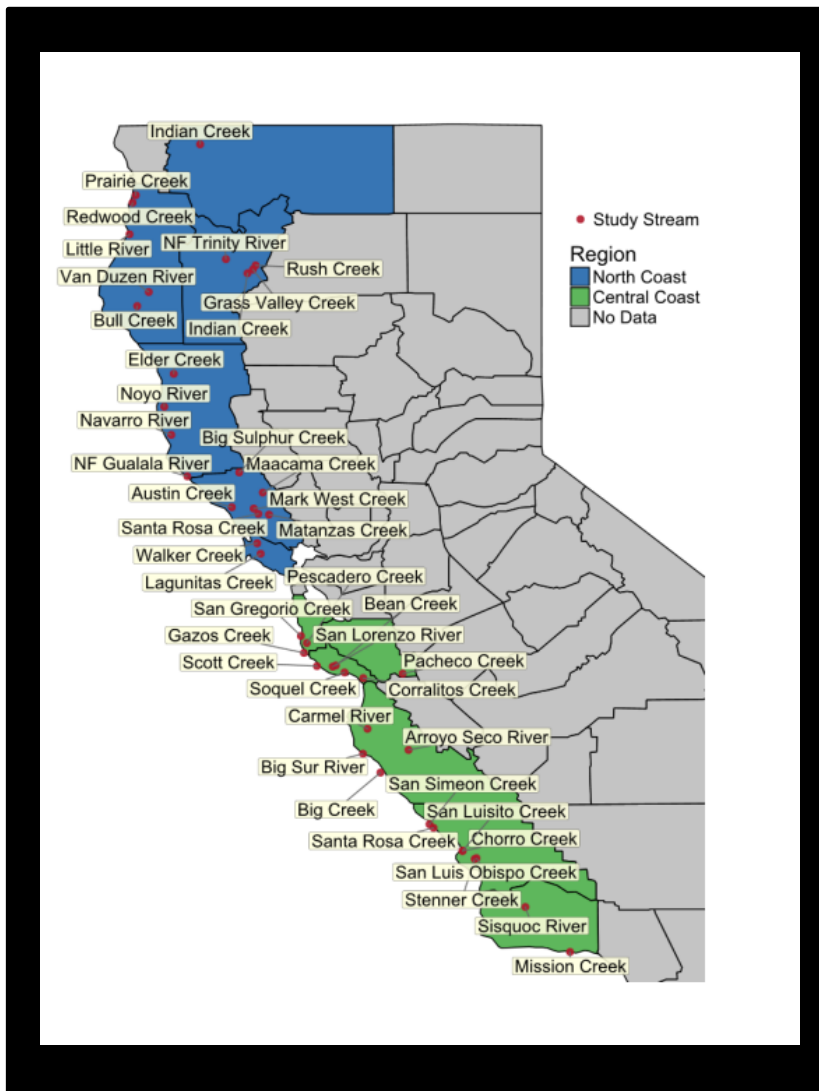
Standard Operating Procedure for the Wetted Perimeter Method in California
COFW #FP-004
August 2013



California Department of Fish and Wildlife
Instream Flow Program
Sacramento, California



Regional Study Example: Coastal Streams



CDFW IFP/CCRWQCB Pilot Study:

- 40 gaged streams Ventura to Siskiyou
- General information and priority setting

Focus:

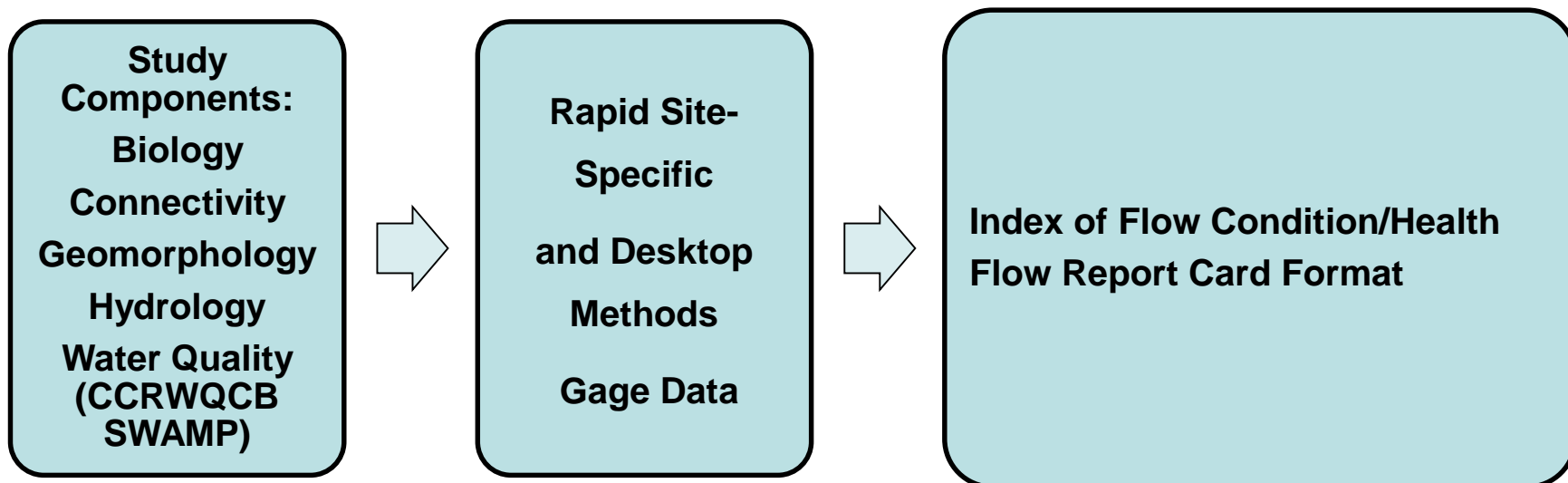
Integrate multiple flow components and models into a regional watershed health report card:

- threshold-based scoring approach
- data from readily available sources
(e.g. long-term gages)
- limited field data collection



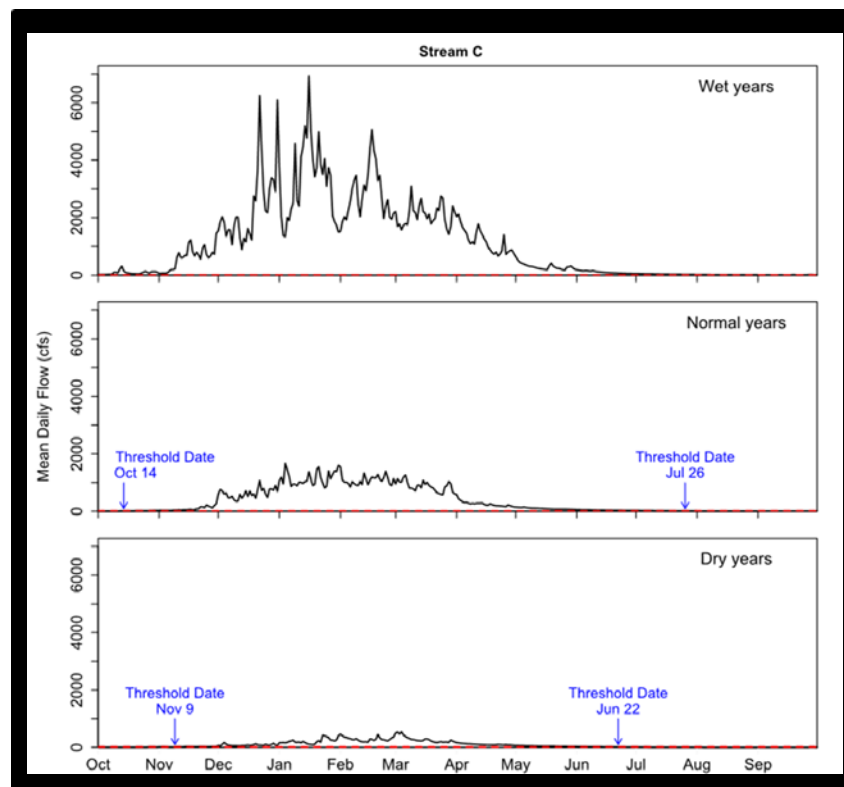
Coastal Streams Study: Study Question, Components, Methods, and Products

Q: How do flow conditions for aquatic life (anadromous fish emphasis) compare among coastal streams through time?



Coastal Streams Study: Additional Study Questions

- When do coastal stream flows naturally recede below biological thresholds?
- Do the data help identify site- and region-specific forbearance periods: time periods when stream diversions may need to be limited or ceased?



Promoting Data Consistency and Sharing

- Use question-driven study designs
- Consider Quality Assurance
 - Known and documented data
 - Scientifically valid
 - Two-stage peer review
 - Consistent/comparable methods/indicators
 - Study Plans reviewed and approved *before* work starts
- Sample site representation consistent with use of data and study questions



What About Professional Judgment?



The challenge is to pick the right suite of tools for the situation.

None of the technical methods described today or used anywhere in the world are capable of making decisions of flow in the absence of objective interpretations.



Conclusion

- Questions should drive assessments
- Many methods and models to choose from
- Planning and upfront review are critical
- QA and sample site representation varies by study
- Assess flow needs using a suite of methods



Think flow regimes!



Moving Forward

CDFW IFP is:

- 1) continuing to explore new ways to evaluate flow data and develop flow information for various CDFW and SWRCB informational needs
- 2) continuing to identify opportunities to enhance data consistency/sharing
- 3) participating with evolving flow science efforts (i.e., tier 2 environmental flows effort)



SAVE THE DATE!

INSTREAM FLOW COUNCIL **FLOW 2018** SCIENCE • LAW • POLICY • PUBLIC DIALOGUE

Managing Rivers, Reservoirs, and Lakes in the Face of Drought

Practical Tools and Strategies for Sustaining and Protecting Ecological Values of Water



INSTREAM FLOW COUNCIL
*Protecting, Maintaining, and
Restoring Aquatic Ecosystems*

Fort Collins, Colorado

April 24-26, 2018



Thank you!

Robert W. Holmes
Instream Flow Program Unit Supervisor
Water Branch
California Department of Fish and Wildlife
830 "S" Street, Sacramento CA. 95811
(916) 324-0838