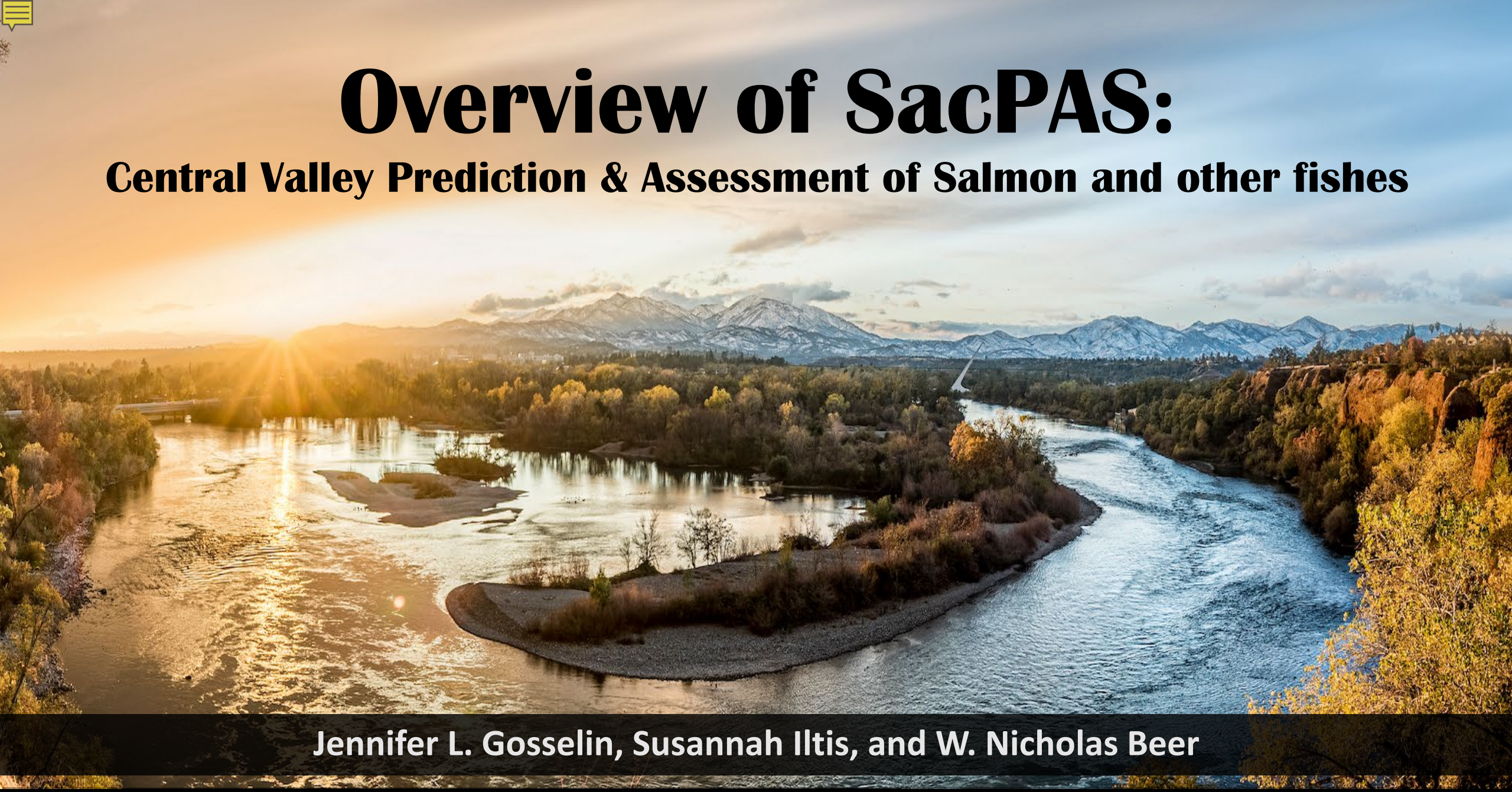
Overview of SacPAS:

Central Valley Prediction & Assessment of Salmon and other fishes



Jennifer L. Gosselin, Susannah Iltis, and W. Nicholas Beer

SCHOOL OF AQUATIC AND FISHERY SCIENCES

COLLEGE OF THE ENVIRONMENT
UNIVERSITY of WASHINGTON

COLUMBIA BASIN RESEARCH

Presentation Goals

AWARENESS
of **SacPAS tools**
available

APPROACH
of how we provide
SERVICE

Kickstart at workshop
for
FEEDBACK
and
COLLABORATION

Photos and icons from Public Domain; purchased iStock; unsplash; and thenounproject.

Outline

- CBR History & Philosophy
- Sneak peak of new SacPAS website

I. Data Queries & Alerts

II. Work Groups & Teams

III. Models: survival, migration, etc.

- Recap of presentation to setup for:
  - Open Discussion
  - Office Hours

History & Philosophy of CBR

- Three decades ago,
  Prof. Anderson and Skalski
  started Columbia Basin Research

- Provide practitioners easy access to data, info, and analytical methods, for in-season fish & river management meetings.

- That is what we continue to strive to provide:
  - access to data,
  - value-added visualizations,
  - statistical & modeling tools

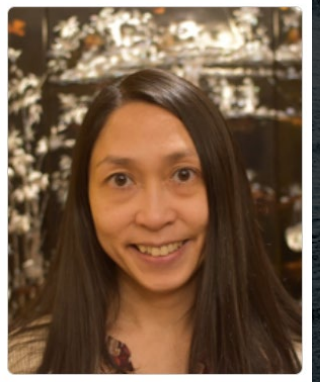
  customized to the needs of the users.

James J. Anderson
CBR Co-Founder

John R. Skalski
CBR Co-Founder

Anderson / Gosselin Lab

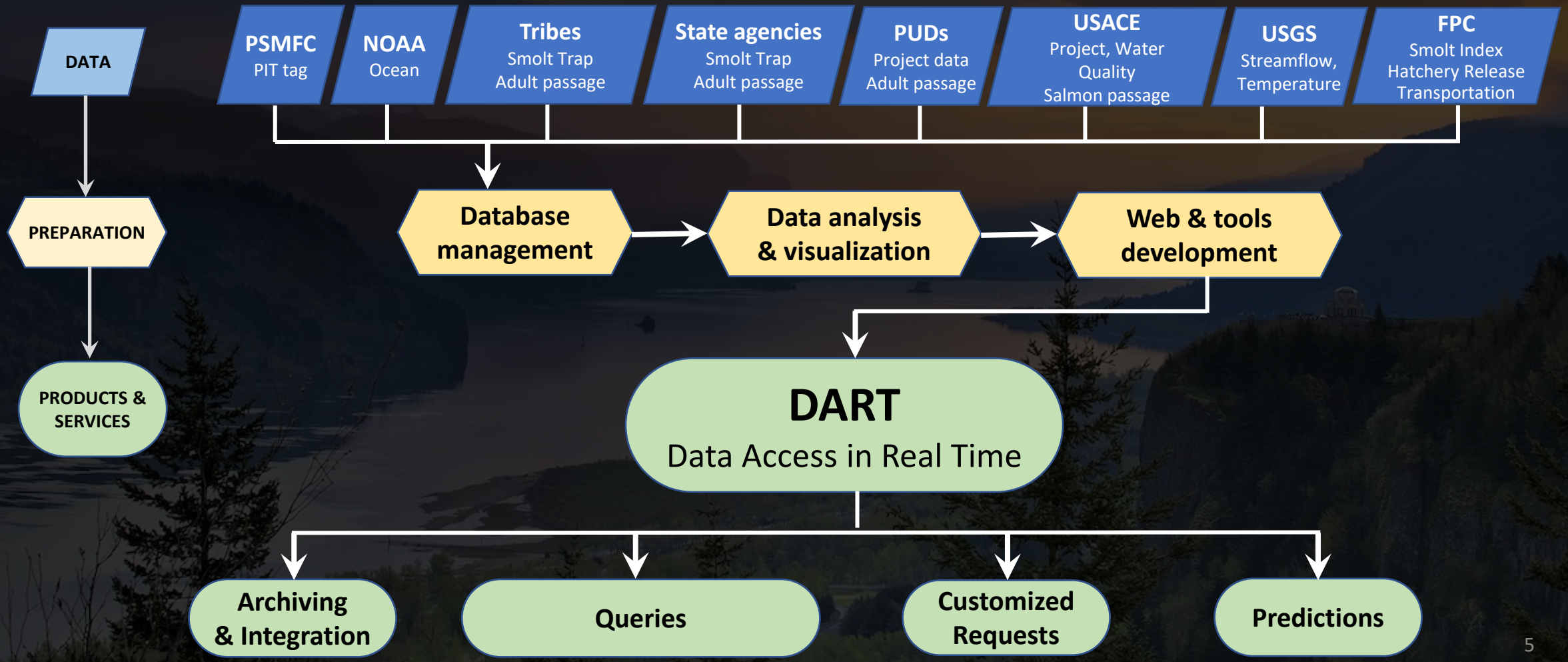
Skalski / Buchanan Lab

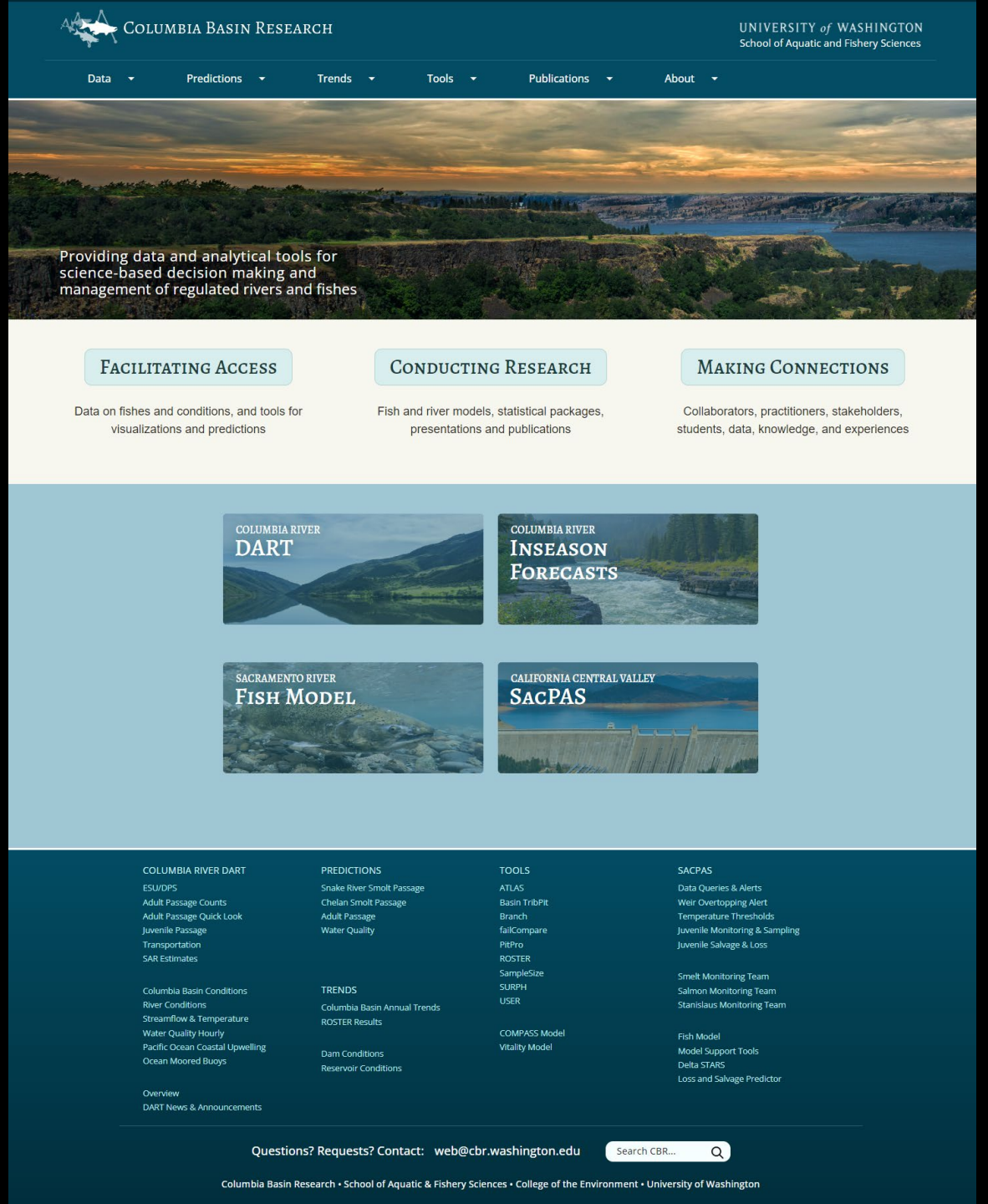


Jennifer L. Gosselin
CBR Co-Director

Rebecca A. Buchanan
CBR Co-Director

DART: SECONDARY DATA REPOSITORY, CENTRALIZED AND INTEGRATED DATA SETS





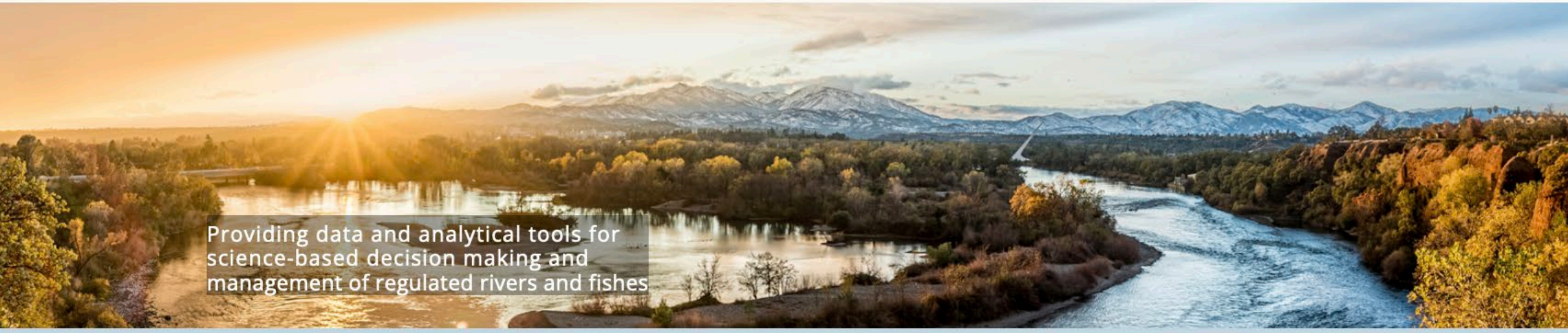
https://www.cbr.washington.edu/

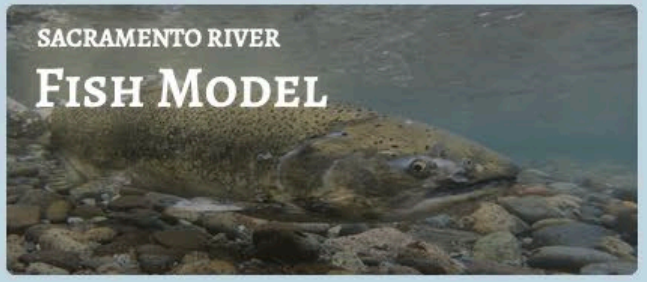
SacPAS website updates in progress…

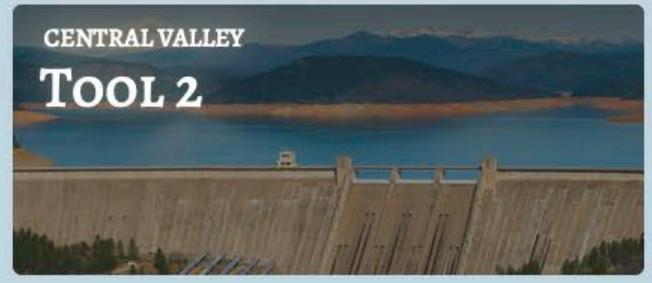
SacPAS: Central Valley Prediction and Assessment of Salmon

UNIVERSITY of WASHINGTON
Columbia Basin Research

Data & Alerts | Workgroups & Teams | Tools & Models | 4th Dimension | About







SacPAS: Central Valley Prediction and Assessment of Salmon

UNIVERSITY of WASHINGTON
Columbia Basin Research

Data & Alerts | Workgroups & Teams | Tools & Models | 4th Dimension | About

Data & Alerts

Publicly accessible, web-based query and reporting system of historical and current fish, environmental, and hydrologic information, vital to year-round planning and adaptive management of the Central Valley Project and State Water Project. Data uploads provide the most up-to-date data as it is made available, whether it be daily, biweekly, monthly or annually.

Basic conditions, performance measures, and threshold-based alerts are available through data aggregation and analysis of environmental conditions.

RESOURCES

- Overview of Data&Alerts
- Access all Data&Alerts tools
- Metadata and Glossaries
- Data Inventory
- Data Site Maps
- News and Announcements
- Data Feedback

RIVER CONDITIONS

- River Graph&Text
- Daily River Table
- All Years Graph
- Basin Conditions
- Exposure Index
- more

TEMPERATURE THRESHOLDS

- Clear Creek
- Lower American
- Sacramento
- Stanislaus Flow&Temp

ALERTS

- Weir Overtopping

JUVENILE MONITORING & SAMPLING

- Cohort Juvenile Monitoring
- Current Catch
- Juvenile Salmonid Monitoring
- Red Bluff Daily Table
- Red Bluff Daily Graph
- Cohort Migration Timing
- more

JUVENILE SALVAGE & LOSS

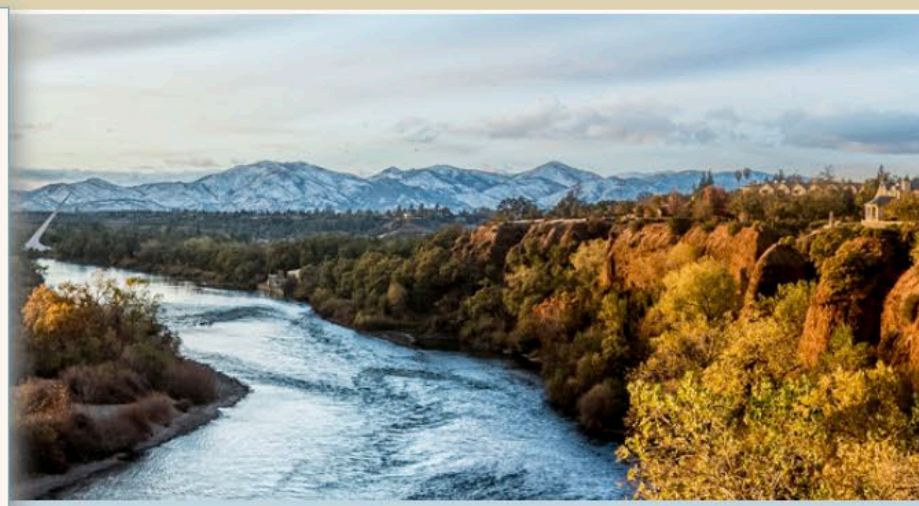
- Salvage and Loss Summary
- Delta Loss Graphs
- Delta Salvage Graphs
- Salvage Timing
- Hatchery Chinook Loss Tables
- Salvage and Loss Detail
- more

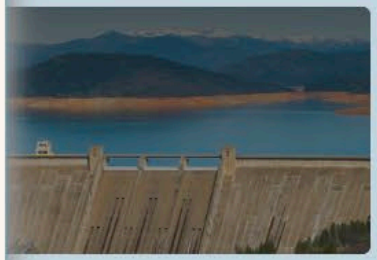
SMOLT-TO-ADULT RETURN

- CWT SAR Survival

ADULT ESCAPEMENT

- CDFW GrandTab





SACPAS

- Data Queries & Alerts
- Temperature Thresholds
- Juvenile Monitoring & Sampling

SacPAS: Central Valley Prediction and Assessment of Salmon

UNIVERSITY of WASHINGTON
Columbia Basin Research

Data & Alerts | Workgroups & Teams | Tools & Models | 4th Dimension | About

Workgroups & Teams

Customized data visualizations, critical limits, and data tables of current conditions in real-time to facilitate monitoring and management by Central Valley Work Groups and Monitoring Teams.

RESOURCES

Water Operations and Watershed Monitoring Technical Teams, BDO, BOR

SALMON MONITORING TEAM (SAMT)

- DCC Operations
- Alerts for flow
- Juvenile Sampling Summary
- Migration Pattern for "Today"
- Species Distribution Estimates
- Loss&Salvage Predictor Est.
- Delta STARS Estimates
- Single-Year Loss Thresholds
- more

SMELT MONITORING TEAM (SMT)

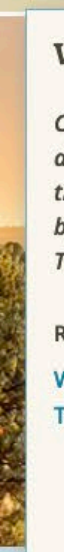
- Delta Smelt Current
- Water Temperature
- Onset of OMR Management
- Turbidity Bridge Avoidance
- Larval&Juv. Delta Smelt Protect.
- End of OMR Management
- Operations and Hydrology
- Chipps Island Detail
- EDSM Detail
- Daily & Hourly Data
- more

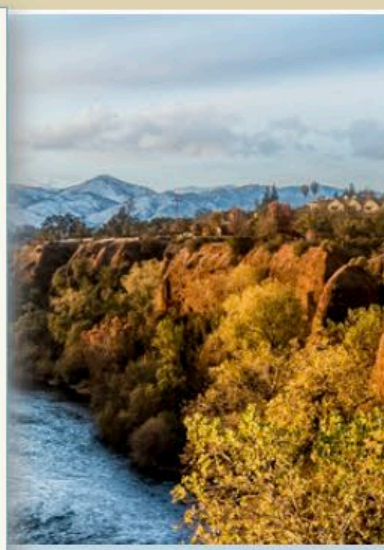
STANISLAUS WATERSHED TEAM (SWT)

- Temperature and Flow
- Juvenile Sampling Summary
- Current River Conditions
- Water Temp. Min, Max, Avg
- Water Temperature Historical
- Dissolved Oxygen
- Goodwin Dam Discharge
- Data Locations Map
- more

SAN JOAQUIN RIVER RESTORATION PROGRAM (SJRRP)

- Allocation Inventory
- Restoration Flow Released
- Allocation Management
- Flow Hydrograph
- Flow Snapshot
- more





SacPAS: Central Valley Prediction and Assessment of Salmon

UNIVERSITY of WASHINGTON
Columbia Basin Research

Data & Alerts | Workgroups & Teams | Tools & Models | 4th Dimension | About

Tools & Models

Interactive statistical software and models for prediction of loss/salvage and analysis of fish growth. Shiny Apps developed by SacPAS in support of various tools and models.

Includes implementation of 3rd Party Tools.

FISH MODEL

- Egg-to-Fry model
- Migration models
- more

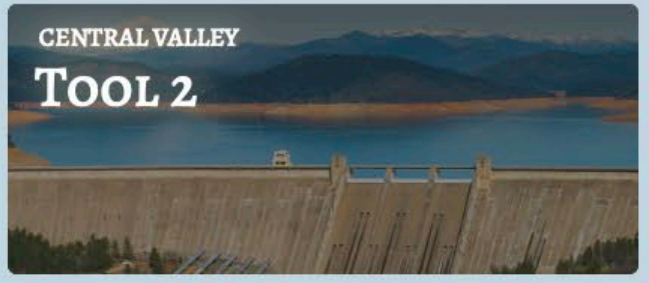
3RD PARTY TOOLS

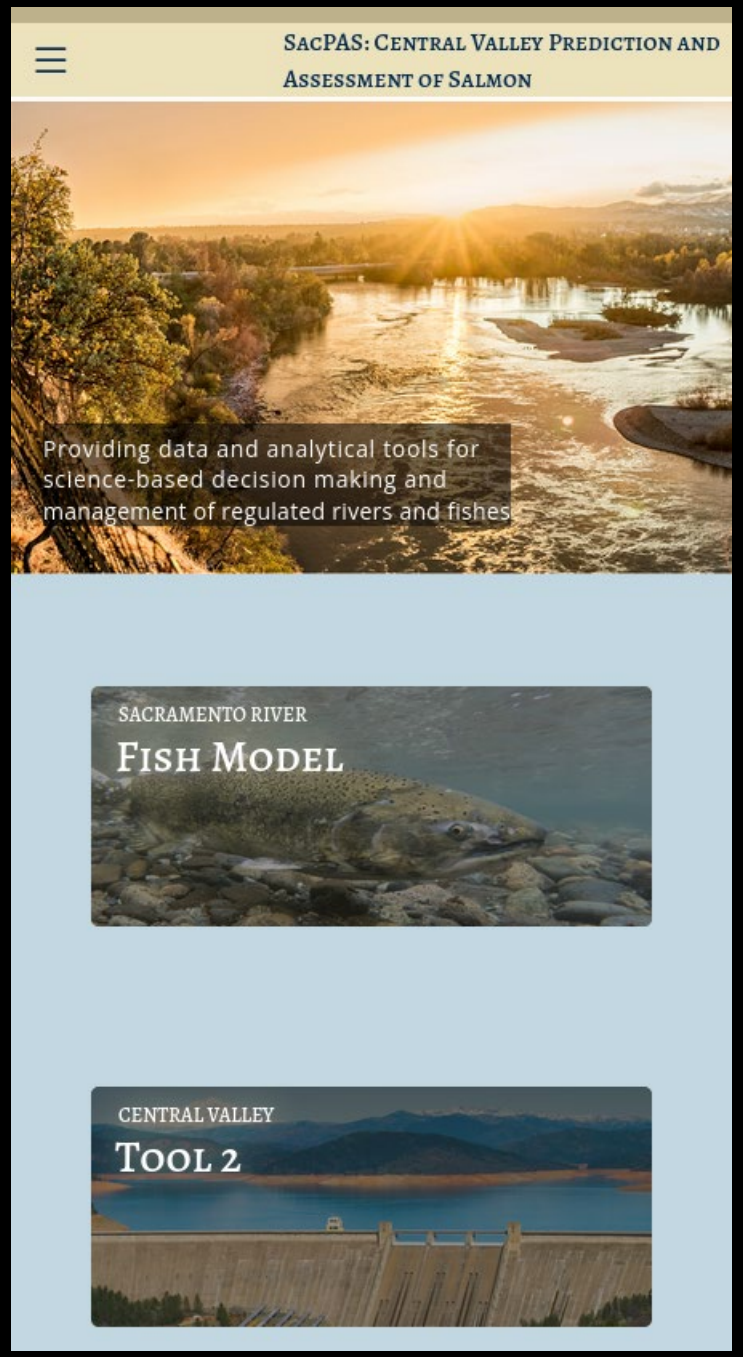
- Delta STARS
- Loss & Salvage Predictor
- WRCLM

SUPPORTIVE TOOLS

- Egg Growth Model
- EGGGROWTEMPS Shiny app
- EGG_SURV Shiny app
- SURVDEMO Shiny app
- MIGR_DISTRIB Shiny app
- TEMPMAKER Shiny app

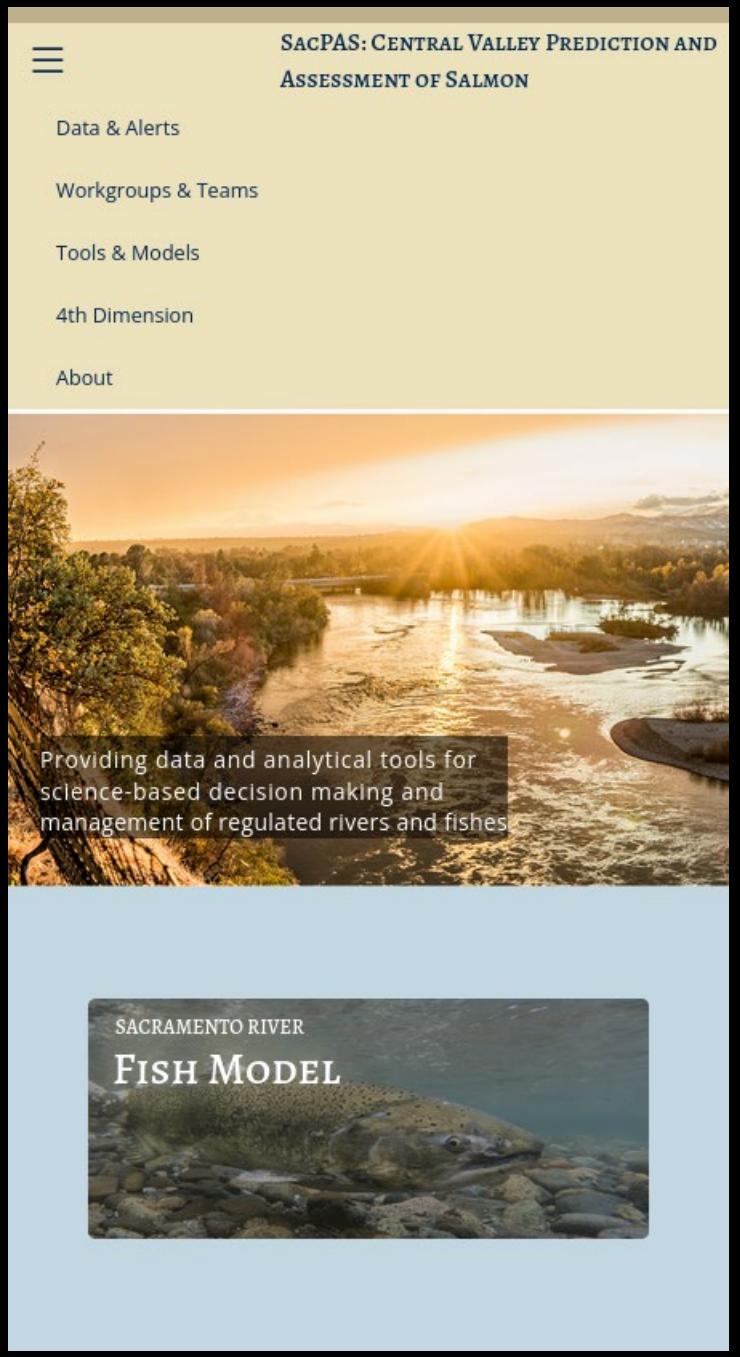
Providing
science-ba
manageme

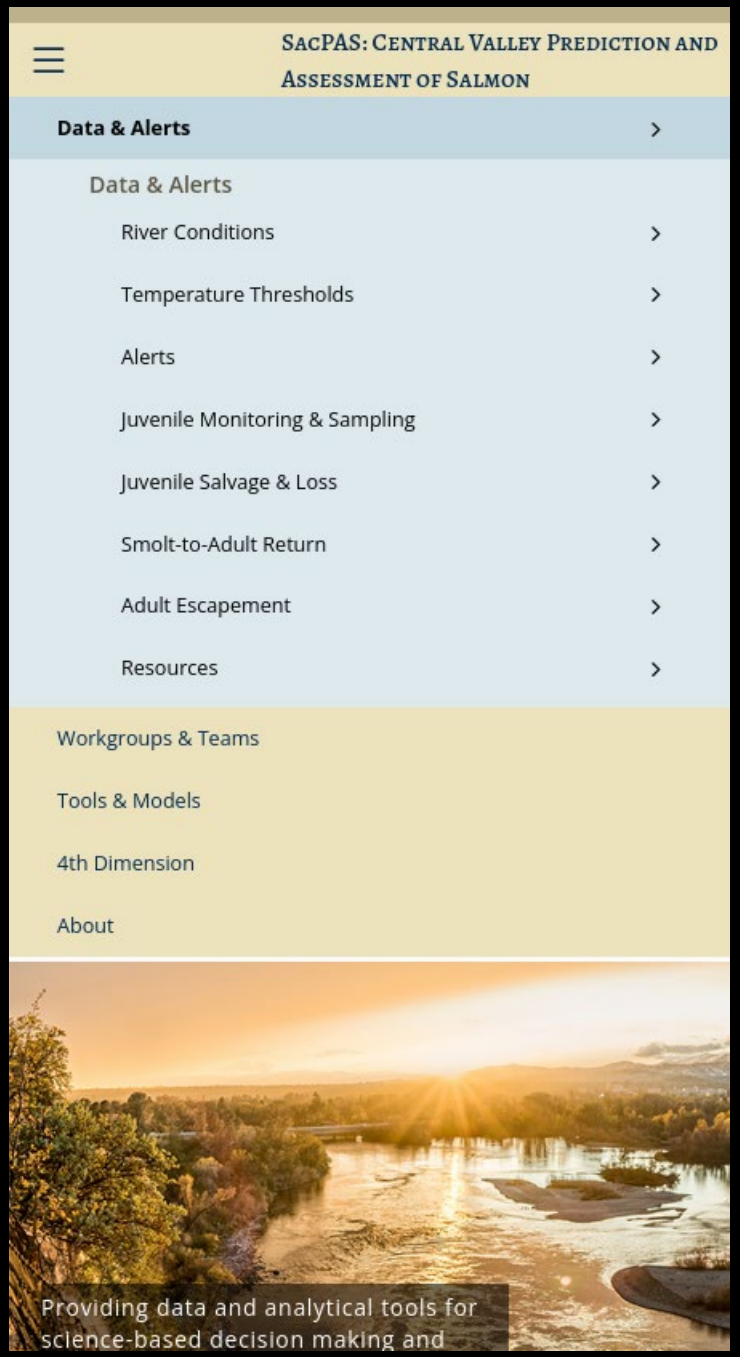




Mobile version

in development


SacPAS: Central Valley Prediction and Assessment of Salmon
Data & Alerts
Workgroups & Teams
Tools & Models
4th Dimension
About
Providing data and analytical tools for science-based decision making and management of regulated rivers and fishes
SACRAMENTO RIVER
Fish Model


SacPAS: Central Valley Prediction and Assessment of Salmon
Data & Alerts
Data & Alerts
River Conditions
Temperature Thresholds
Alerts
Juvenile Monitoring & Sampling
Juvenile Salvage & Loss
Smolt-to-Adult Return
Adult Escapement
Resources
Workgroups & Teams
Tools & Models
4th Dimension
About
Providing data and analytical tools for science-based decision making and

SacPAS: Central Valley Prediction and Assessment of Salmon

Data & Alerts

Workgroups & Teams

Workgroups & Teams

Salmon Monitoring Team (SaMT)

Smelt Monitoring Team (SMT)

Stanislaus Watershed Team (SWT)

San Joaquin River Restoration Program (SJRRP)

Tools & Models

4th Dimension

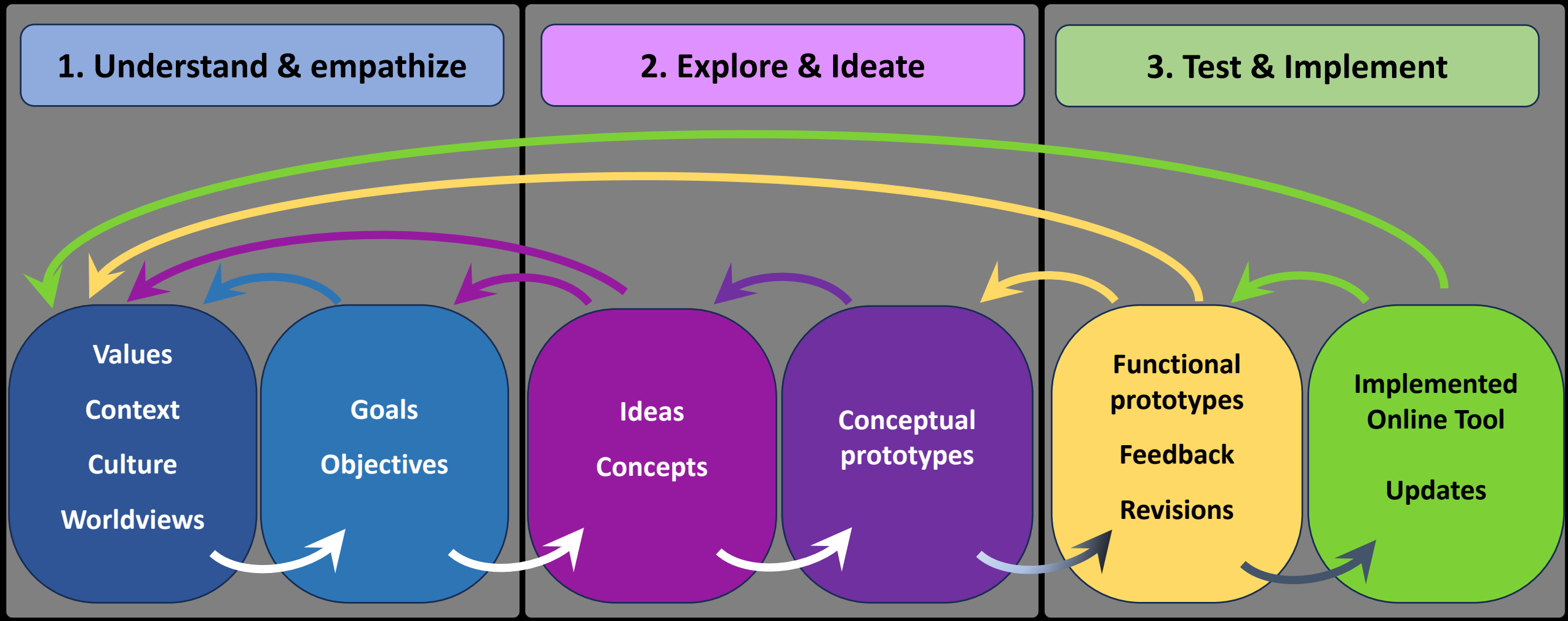
About

SACRAMENTO RIVER

Assistance in accessing data and addressing knowledge-action gaps

SacPAS Tools & Services:

Developing with Design Thinking & Human-Centered Design in mind



SacPAS tools

I. Data Queries & Alerts

II. Work Groups & Teams

III. Models: survival, migration, etc.

I. SacPAS Data Queries & Alerts

What

- SacPAS provides users:
  - Access to data and visualizations
  - Data downloads
  - Summaries of relevant metrics
  - Customized query interfaces & user-centered tools

How

- SacPAS does so with:
  - Attribution to data owners
  - Transparency of methods
  - Value-added services
  - Human centered design

I. SacPAS Data Queries & Alerts

1. Juvenile Monitoring & Sampling

2. Juvenile Salvage & Loss

3. Adult Escapement

4. Temperature Thresholds

5. River Conditions

6. Exposure Index

Common Elements of SacPAS Query Interface

Query Title / Type

Data Attribution

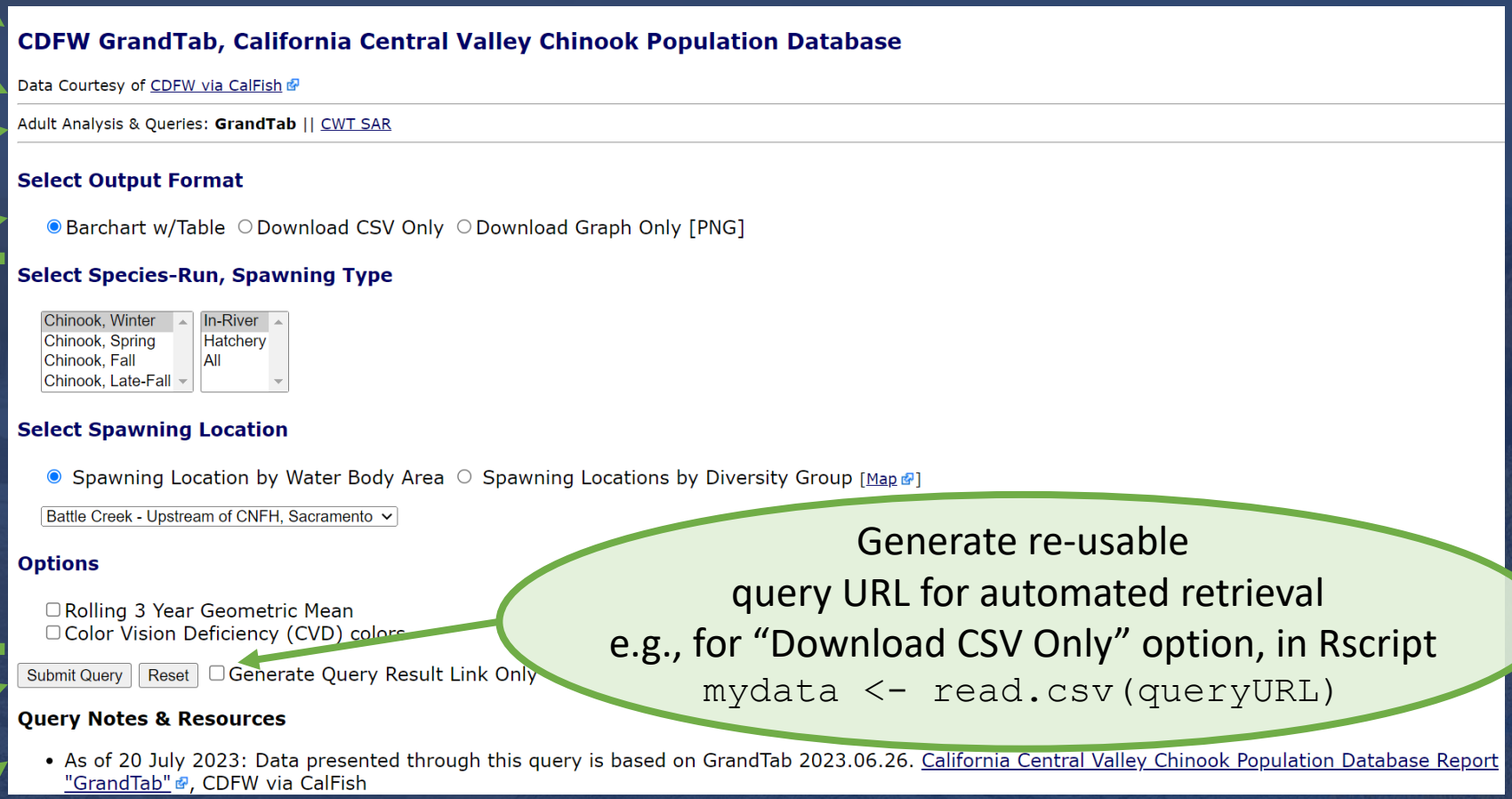
Topic Area Queries

Output Formats

Selections:
customized to data
and query

Submit button

Query Notes &
Resources



Generate re-usable
query URL for automated retrieval
e.g., for “Download CSV Only” option, in Rscript
`mydata <- read.csv(queryURL)`

1. Juvenile Monitoring & Sampling

Cohort Juvenile Monitoring

Current Catch

Migration Timing and Conditions

SacPAS: Central Valley Prediction & Assessment of Salmon

UW Columbia Basin Research

Home | Data Queries & Alerts | Work Groups & Teams | Fish Model | Tools | Contact

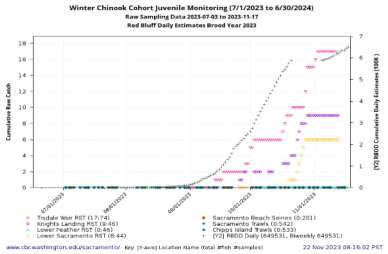
Data Queries & Alerts | Alert: Weir Overtopping | Temperature Thresholds | Juvenile Monitoring & Sampling | Juvenile Salvage & Loss | Adult Escapement | River Conditions | Exposure Index | Data Sites & Inventory

Juvenile Monitoring & Sampling

Analysis & Queries: Cohort Juvenile Monitoring || Current Catch || Juvenile Salmonid Monitoring || Red Bluff Daily Table with Biweekly || Red Bluff Daily Graph with Biweekly || Migration Timing and Conditions

Cohort Juvenile Monitoring

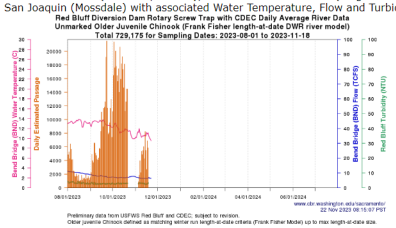
♦ Cohort Juvenile Monitoring at Sacramento River rotary screw traps, beach seines, and trawls with Red Bluff Estimates



updated: *Wednesday, 22-Nov-2023 08:16:02 PST*

Juvenile Salmonid Monitoring

Unmarked ♦ Older Chinook, ♦ Fry/Smolt Chinook, and ♦ Steelhead at Sacramento River (Red Bluff, Tisdale), Lower Sacramento River (Knights Landing, Sacramento Trawls, Chipps Island) and San Joaquin (Mossdale) with associated Water Temperature, Flow and Turbidity

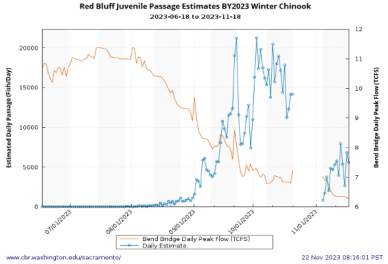


Red Bluff Daily Table

♦ Red Bluff Juvenile Daily Estimates Table Query with Biweekly Totals

Red Bluff Daily Graph

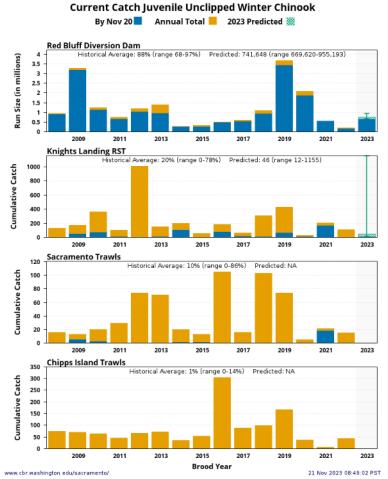
♦ Red Bluff Daily Graph with Biweekly Estimated Totals, Fork Length, Flow, Turbidity, Water Temperature (C), or Water Temperature (F)



updated: *Wednesday, 22-Nov-2023 08:16:01 PST*

Current Catch

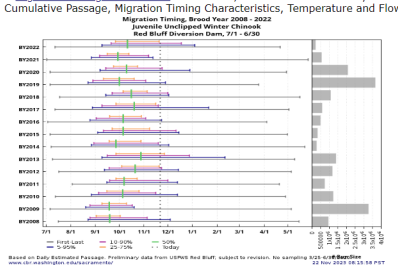
Unmarked ♦ Winter Chinook, ♦ Spring, ♦ Fall, ♦ LateFall, and ♦ Steelhead at Sacramento River (Red Bluff) and Lower Sacramento River (Knights Landing, Sacramento Trawls, Chipps Island) monitoring locations



updated: *Tuesday, 21-Nov-2023 08:49:10 PST*

Migration Timing and Conditions

♦ Migration Timing & Conditions at Red Bluff, Sacramento River rotary screw traps, beach seines, and trawls w
Cumulative Passage, Migration Timing Characteristics, Temperature and Flow Exposure

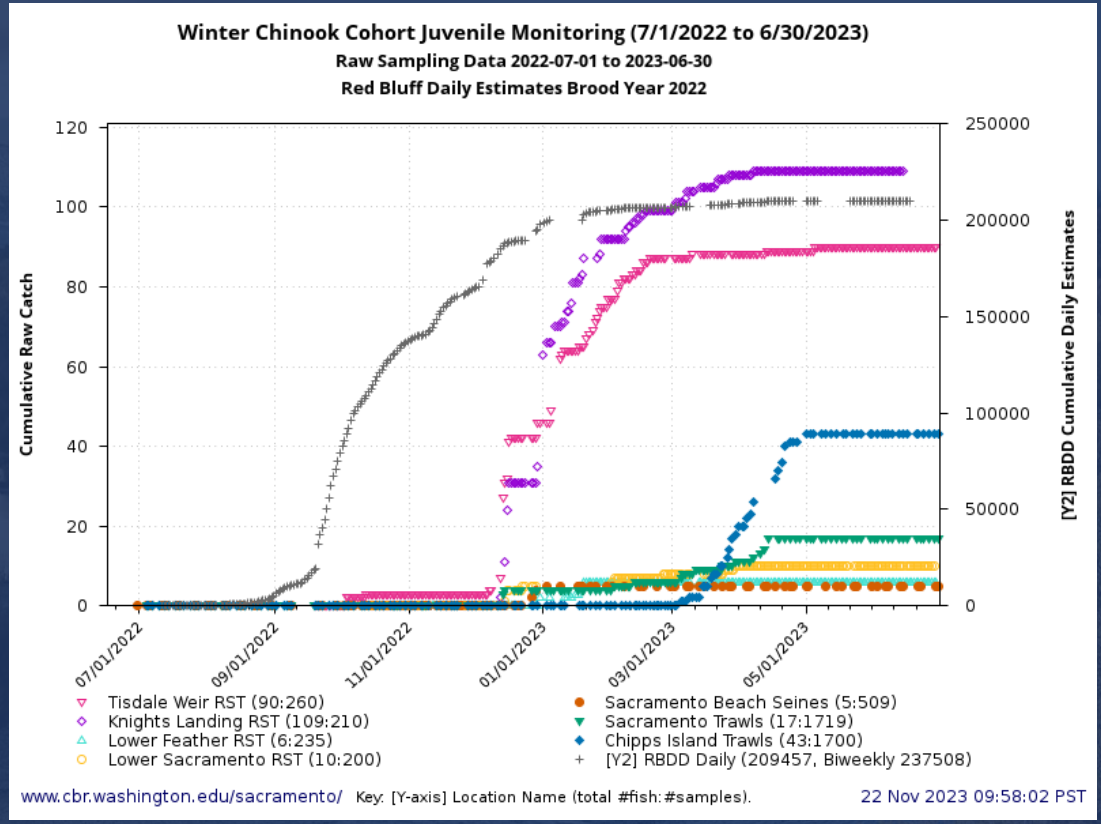


updated: *Wednesday, 22-Nov-2023 08:16:00 PST*

cbr.washington.edu/sacramento/data/juv_monitoring.html

Juvenile Monitoring & Sampling –
Single Brood Year, Multiple Locations

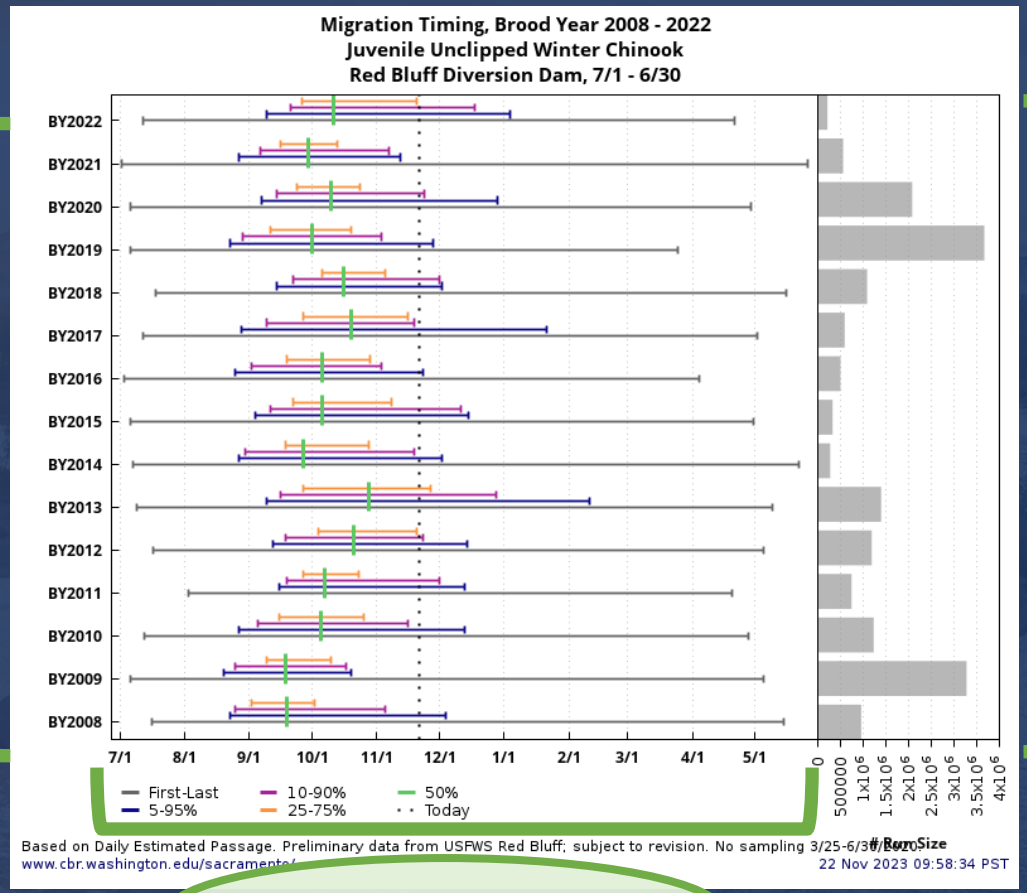
- Rotary Screw Traps, Beach Seines, Trawls, and Red Bluff Diversion Dam catch
- Single point query access
- Brood Year cohorts
  - Red Bluff Diversion Dam
  - Length-at-Date model run assignments
- Tracking migration downstream



"Cohort Juvenile Monitoring" cbr.washington.edu/sacramento/data/query_sampling_graph.html

Juvenile Monitoring & Sampling –
Multiple Brood Years, Single Location

Brood Years



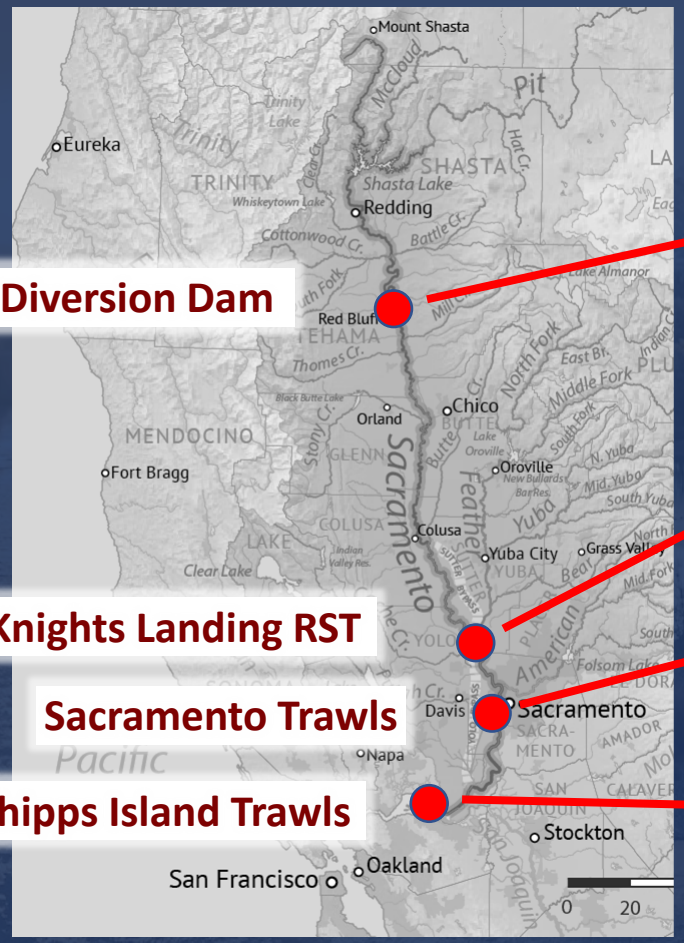
Total
Passage Estimates
or Catch

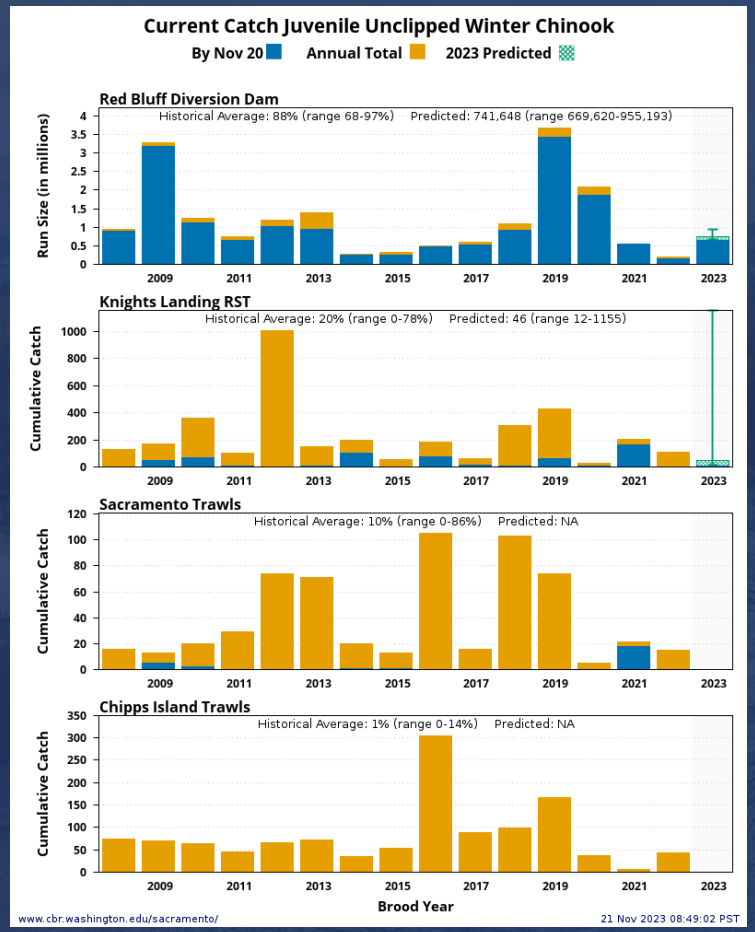
Date Range period

"Migration Timing and Conditions" cbr.washington.edu/sacramento/data/query_hrt.html

Juvenile Monitoring & Sampling –

Multiple Brood Years, Multiple Locations
Simple “Prediction” based on Historical & Current Years

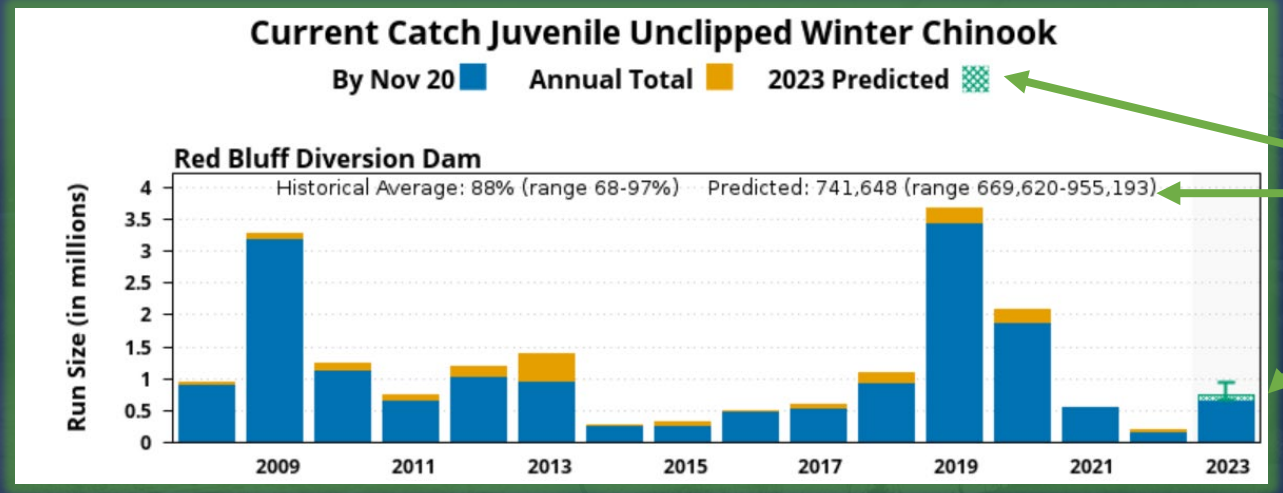




“Current Catch” cbr.washington.edu/sacramento/data/currcatch.html

Juvenile Monitoring & Sampling –

Multiple Brood Years, Multiple Locations
Simple “Prediction” based on Historical & Current Years



November 20th, Winter Chinook Red Bluff BY2023 Prediction

“Current Catch” cbr.washington.edu/sacramento/data/currcatch.html

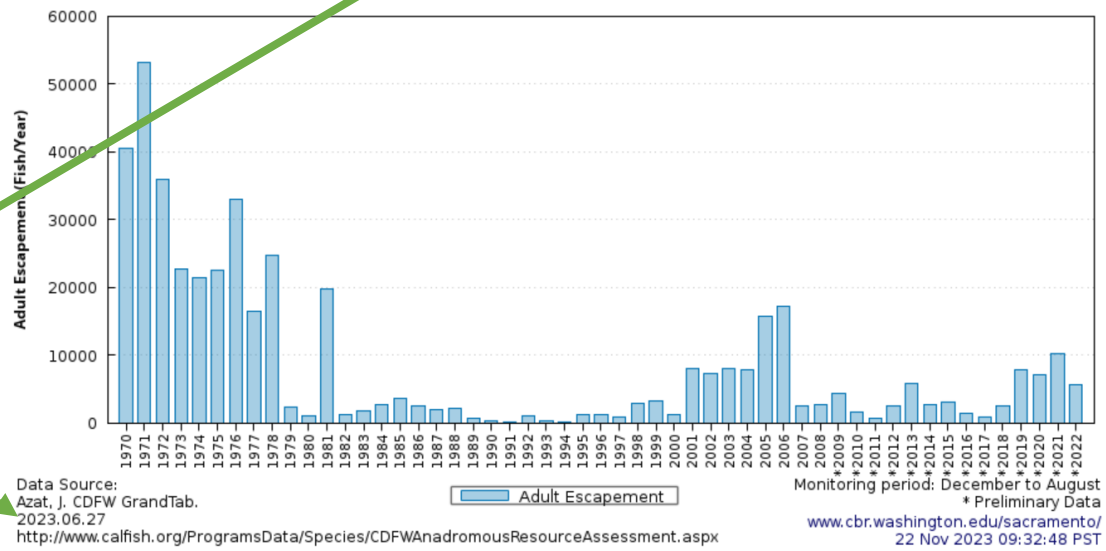
3. Adult Escapement

Detailed title and footnote included in the figure for transparency

CDFW GrandTab Adult Escapement Graph

< browser back << return to query page download CSV

California Central Valley Chinook Population Database Report CDFW GrandTab Adult Escapement
Basalt and Porous Lava Diversity Group
In-River Winter Chinook
Spawn Years 1970-2022
2 Sub Populations
Battle Creek - Upstream of CNFH, Mainstem - Upstream of RBDD
3 GrandTab Data Notes exist for dataset



Data Source:
Azat, J. CDFW GrandTab.
2023.06.27
http://www.calfish.org/ProgramsData/Species/CDFWAnadromousResourceAssessment.aspx

Monitoring period: December to August
* Preliminary Data
www.cbr.washington.edu/sacramento/
22 Nov 2023 09:32:48 PST

GrandTab Data Notes

1. Winter In-River Battle Creek - Upstream of CNFH: Fish passed upstream of Coleman Weir.
2. Winter In-River Mainstem - Upstream of RBDD: Upstream mainstem in-river estimates prior to 2001 were based on RBDD counts. Subsequent estimates are based on carcass surveys. Numbers using RBDD data are adjusted for angler harvest.
3. * Indicates annual escapement and mean are not final, data is Preliminary status.

Query Notes

1. To each population in the GrandTab report, CBR assigned a Diversity Group as outlined by NOAA Fisheries in California Central Valley Salmon & Steelhead Recovery Plan.

"CDFW GrandTab" cbr.washington.edu/sacramento/data/query_adult_grandtab.html

Adult Escapement

CDFW GrandTab, California Central Valley Chinook Population Database

Data Courtesy of CDFW via CalFish

Adult Analysis & Queries: **GrandTab** || CWT SAR

Select Output Format

◉ Barchart w/Table ○ Download CSV Only ○ Download Graph Only [PNG]

Select Species-Run, Spawning Type

Chinook, Winter	In-River
Chinook, Spring	Hatchery
Chinook, Fall	
Chinook, Late-Fall	

Select Spawning Location

○ Spawning Location by Water Body Area ◉ Spawning Locations by Diversity Group [Map]

Basalt and Porous Lava DG

Options

☐ Rolling 3 Year Geometric Mean
☐ Color Vision Deficiency (CVD) colors

Submit Query | Reset | ☐ Generate Query Result Link Only

Query Notes & Resources

- As of 20 July 2023: Data presented through this query is based on GrandTab 2023.06.26. California Central Valley Chinook Population Database Report "GrandTab", CDFW via CalFish

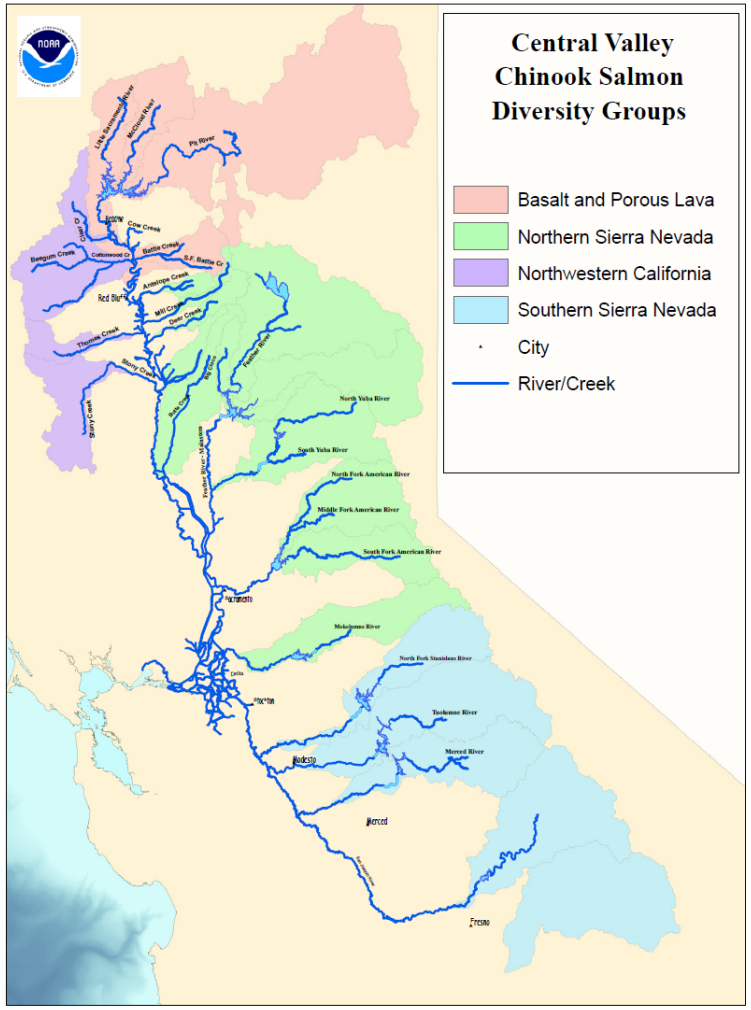


Figure 1. Central Valley Recovery Domain map of diversity groups and watersheds.
Source: Lindley *et al.* 2007

"CDFW GrandTab" cbr.washington.edu/sacramento/data/query_adult_grandtab.html

5. River Conditions

SacPAS: Central Valley Prediction & Assessment of Salmon

UW Columbia Basin Research

Home | Data Queries & Alerts | Work Groups & Teams | Fish Model | Tools | Contact

Data Queries & Alerts | Alert: Weir Overtopping | Temperature Thresholds | Juvenile Monitoring & Sampling | Juvenile Salvage & Loss | Adult Escapement | River Conditions | Exposure Index | Data Sites & Inventory

River Conditions Graph & Text Query

Data Courtesy of CDEC

Queries: **River Graph&Text** || River Graph&Text Map || Daily River Table || All Years River Graph || Basin Conditions

Select Output Format

◉ Graph ○ Day of Year [DOY] Data Table ○ Calendar Date [mm/dd] Data Table
○ Download CSV Only [mm/dd] ○ Download CSV Only [single data pt/row] ○ Download Graph Only [PNG]

Limit Locations by Hydrologic Area or Explore by Map

◉ All Locations ○ Sacramento River Basin ○ San Joaquin River Basin ○ Delta

Select Calendar Year, Location, River Data

2023	Sacramento R blw Georgiana Slough (GES)	Reservoir Storage (AF)
2022	Sacramento R at Hamilton City-Main Ch (HMC)	River Flow (CFS)
2021	Sacramento R upstream of Hwy 44 (SAC)	River Stage (ft)
2020	Sacramento R at Jellys Ferry (JLF)	Spillway Discharge (CFS)
2019	Sacramento R, Keswick Reservoir (KES)	Turbidity (NTU/FNU)
2018	Sacramento R, Keswick, WQ (KWK)	Water Temperature

Water Temperature Unit ◉ °F ○ °C

Multiple selections allowed for each (hold Ctrl key and click individual items to select multiple in a list).
Query is calendar year based, not water year.
Maximum 2 y-axes for graph output.
Please refer to the River Parameters inventory below to look up location-parameter availability.

Set Date Range

Start 1/1 **End** 12/31 mm/dd *Remove dates to automatically scale graph.*

Select 10 Year Averages

☐ Reservoir Outflow (CFS) ☐ Reservoir Storage (AF) ☐ River Flow (CFS)
☐ River Stage (ft) ☐ Spillway Discharge (CFS) ☐ Water Temperature

Multiple selections for 10 Year River Data Parameters allowed.

None **10 Year Range**

Customize Graph

☑ **Combine like Data Types on Axis** ☐ **Graph Nulls** ☑ **Grid** ☐ **Monochrome w/Symbols** ☐ **Plot Symbols**

Min **Max** **First Y-Axis**

Min **Max** **Second Y-Axis**

Medium (640 x 480) **Graph Size**

Submit Query | Reset ☐ Generate Query Result Link Only

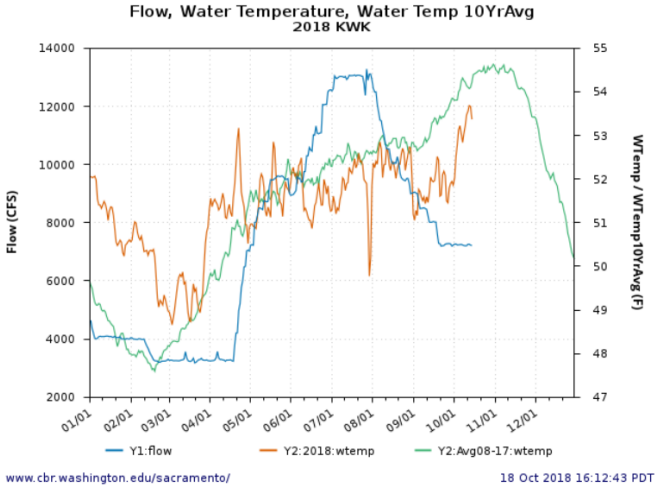
"River Conditions Graph & Text" cbr.washington.edu/sacramento/data/query_river_graph.html

5. River Conditions

River Parameters Location and Date Range Inventory

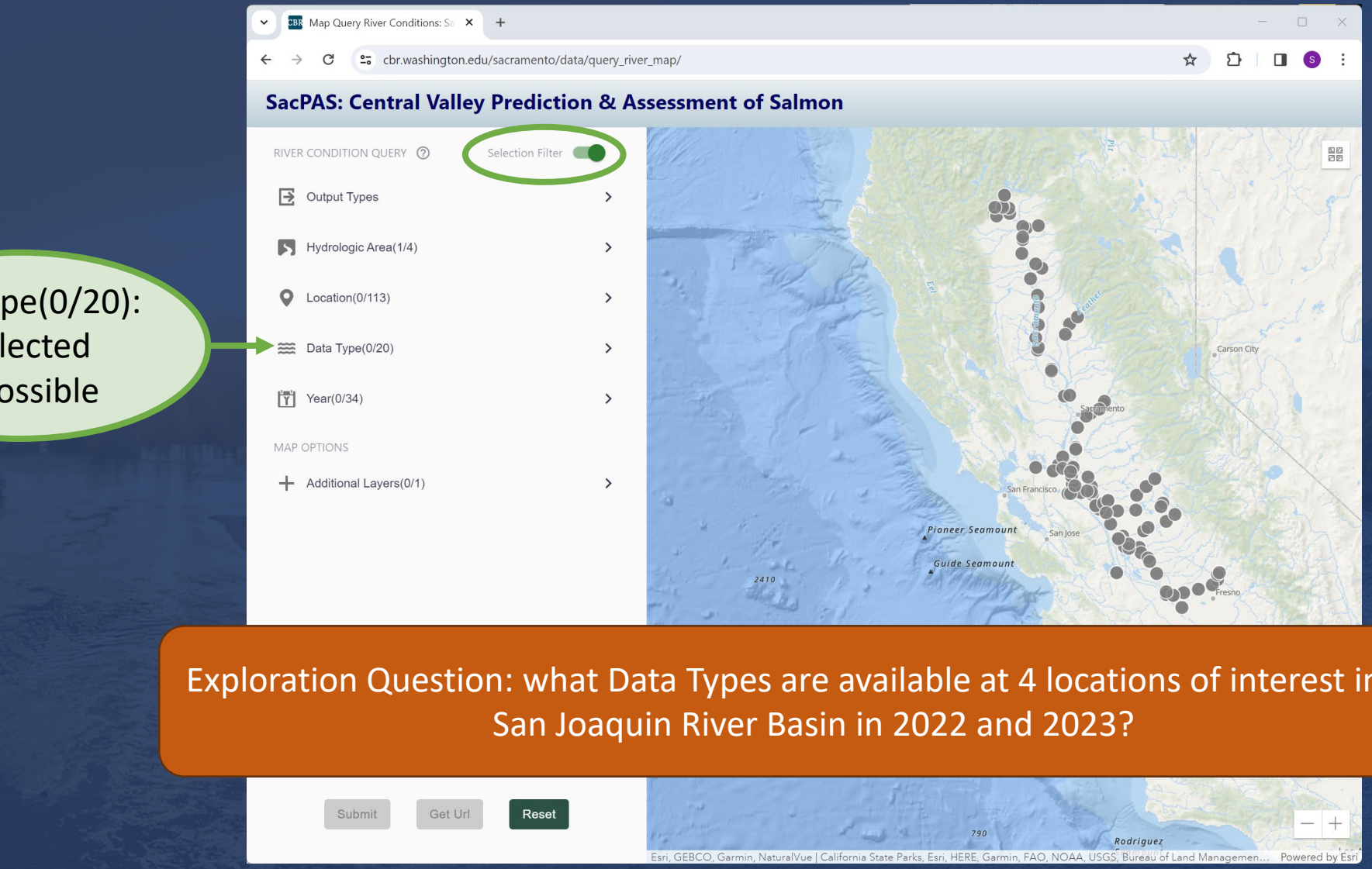
- Air Temperature (F)
- Air Temperature Maximum (F)
- Control Regulating Discharge (CFS)
- Dissolved Oxygen (mg/L)
- Electrical Conductivity (uS/cm)
- Full Natural Flow (CFS)
- Pumping Discharge (CFS)
- Reservoir Elevation (ft)
- Reservoir Outflow (CFS)
- Reservoir Storage (AF)
- River Flow (CFS)
- River Stage (ft)
- Spillway Discharge (CFS)
- Turbidity (NTU)
- Water Temperature (F)
- Water Velocity (ft/s)

Example Daily Data Graph



"River Conditions Graph & Text" cbr.washington.edu/sacramento/data/query_river_graph.html

Map Interface for River Conditions Query

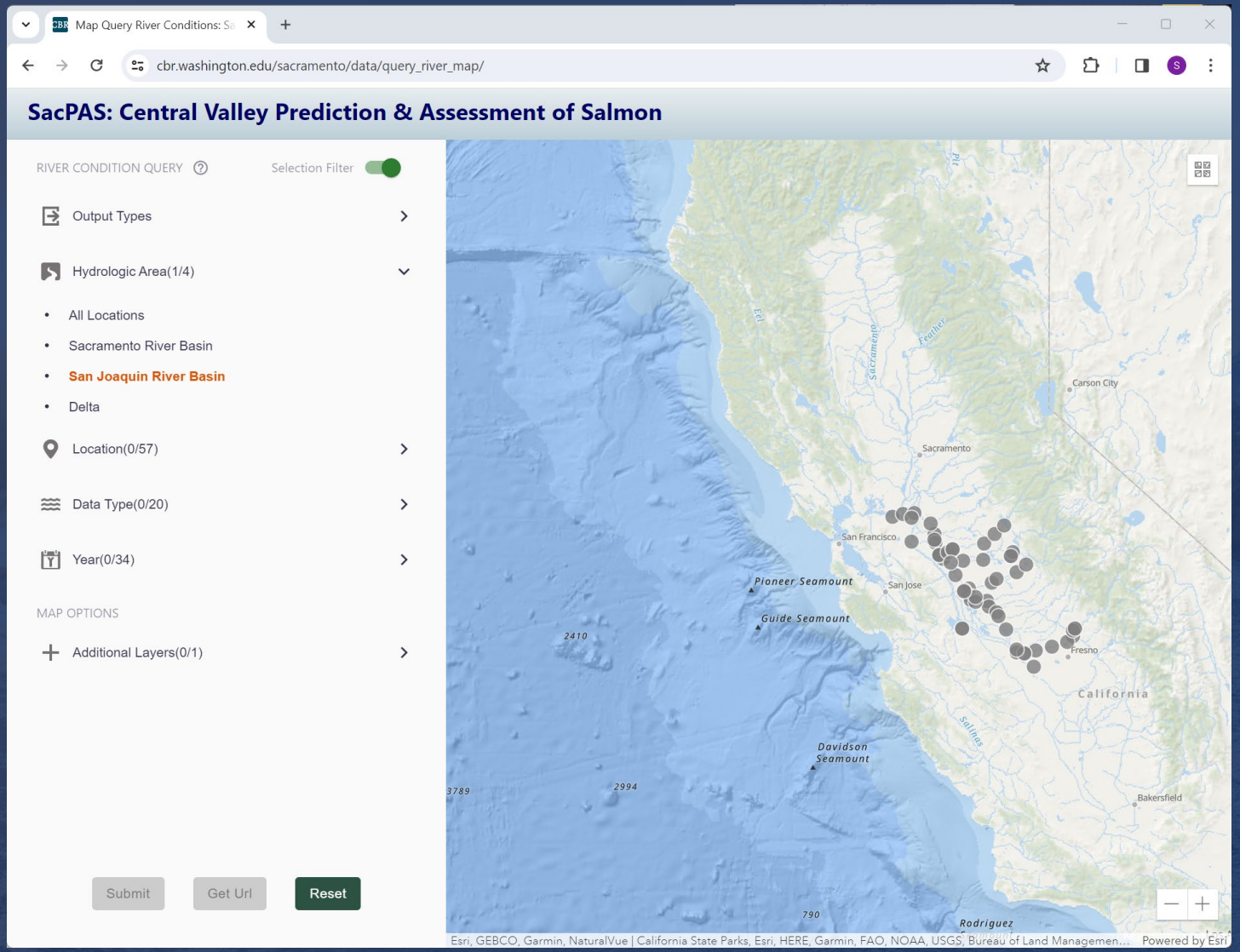


Data Type(0/20):
0 selected
20 possible

Exploration Question: what Data Types are available at 4 locations of interest in the San Joaquin River Basin in 2022 and 2023?

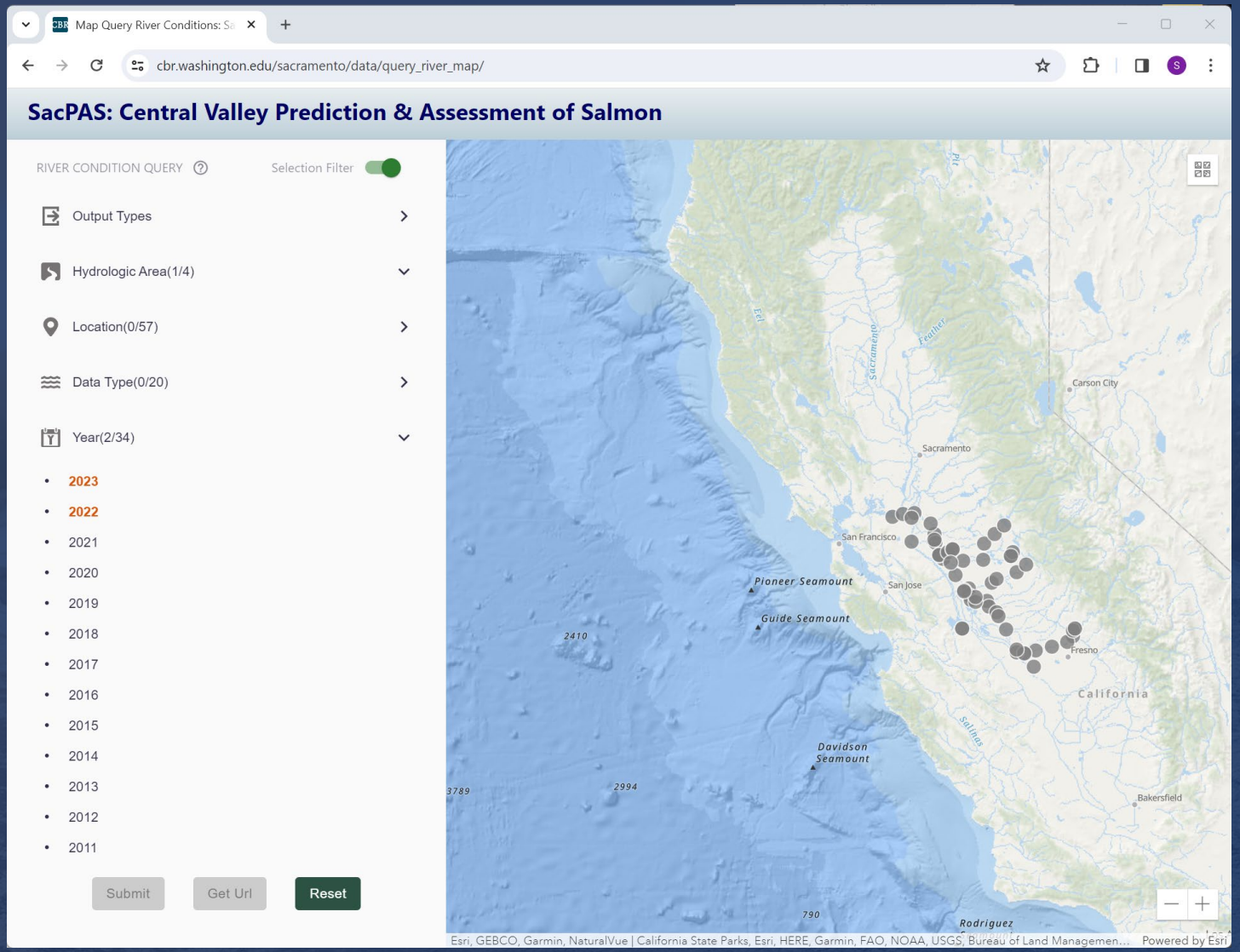
cbr.washington.edu/sacramento/data/query_river_map/

Map Interface for River Conditions Query



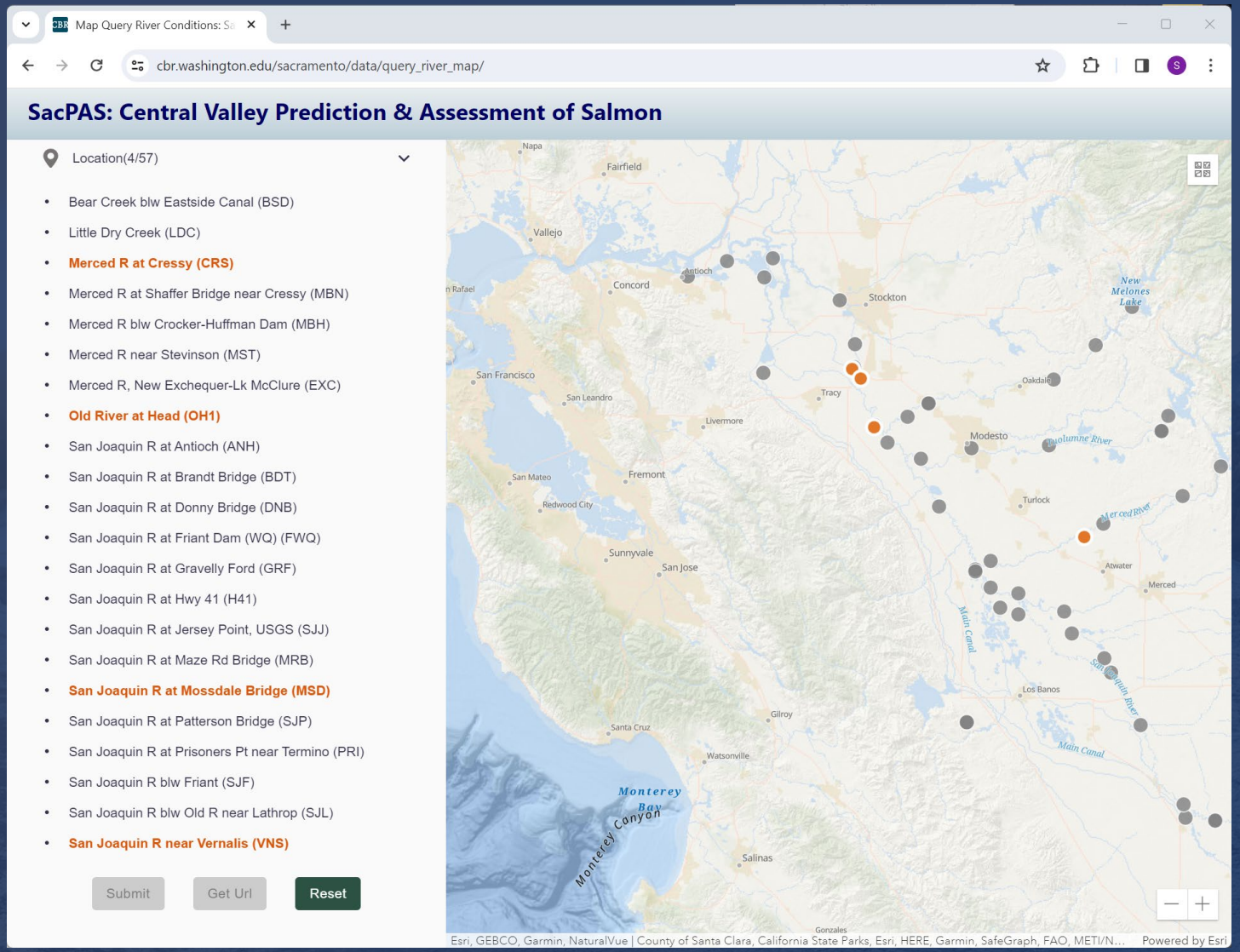
cbr.washington.edu/sacramento/data/query_river_map/

Map Interface for River Conditions Query



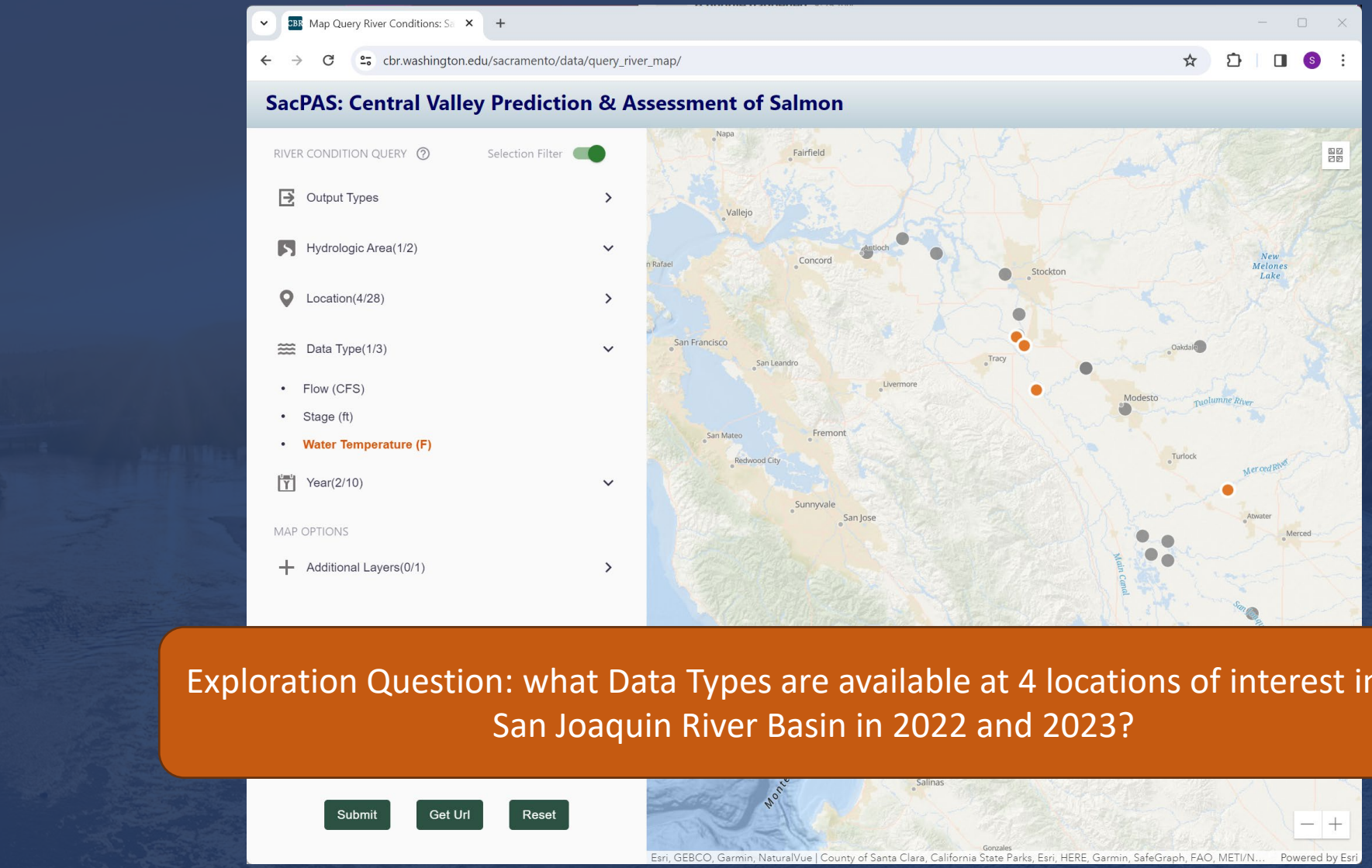
cbr.washington.edu/sacramento/data/query_river_map/

Map Interface for River Conditions Query



cbr.washington.edu/sacramento/data/query_river_map/

Map Interface for River Conditions Query

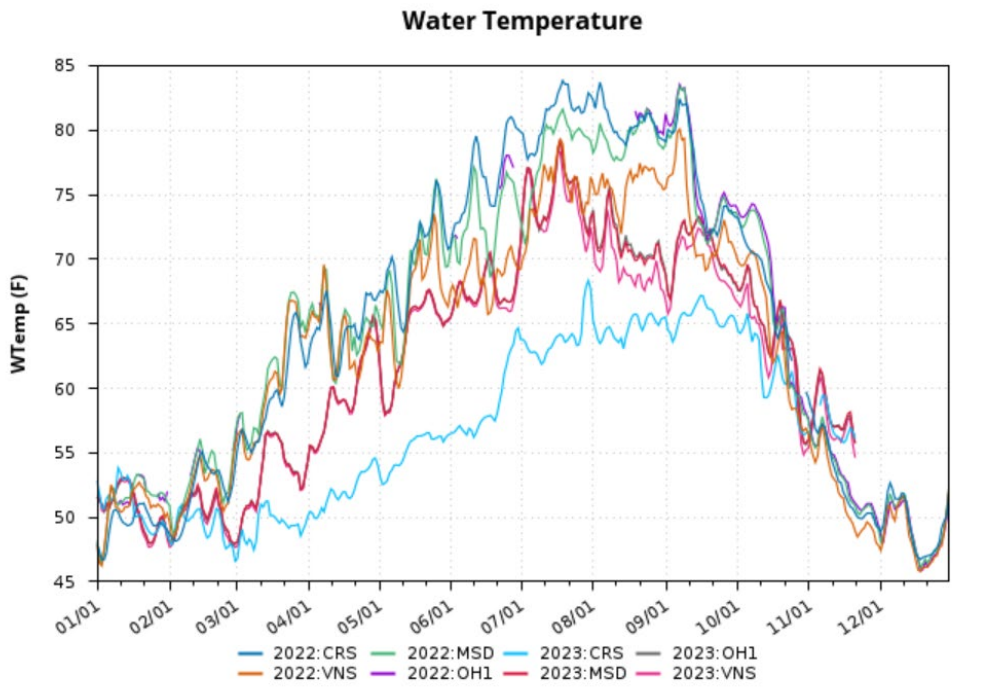


Exploration Question: what Data Types are available at 4 locations of interest in the San Joaquin River Basin in 2022 and 2023?

cbr.washington.edu/sacramento/data/query_river_map/

River Conditions Results

download CSV



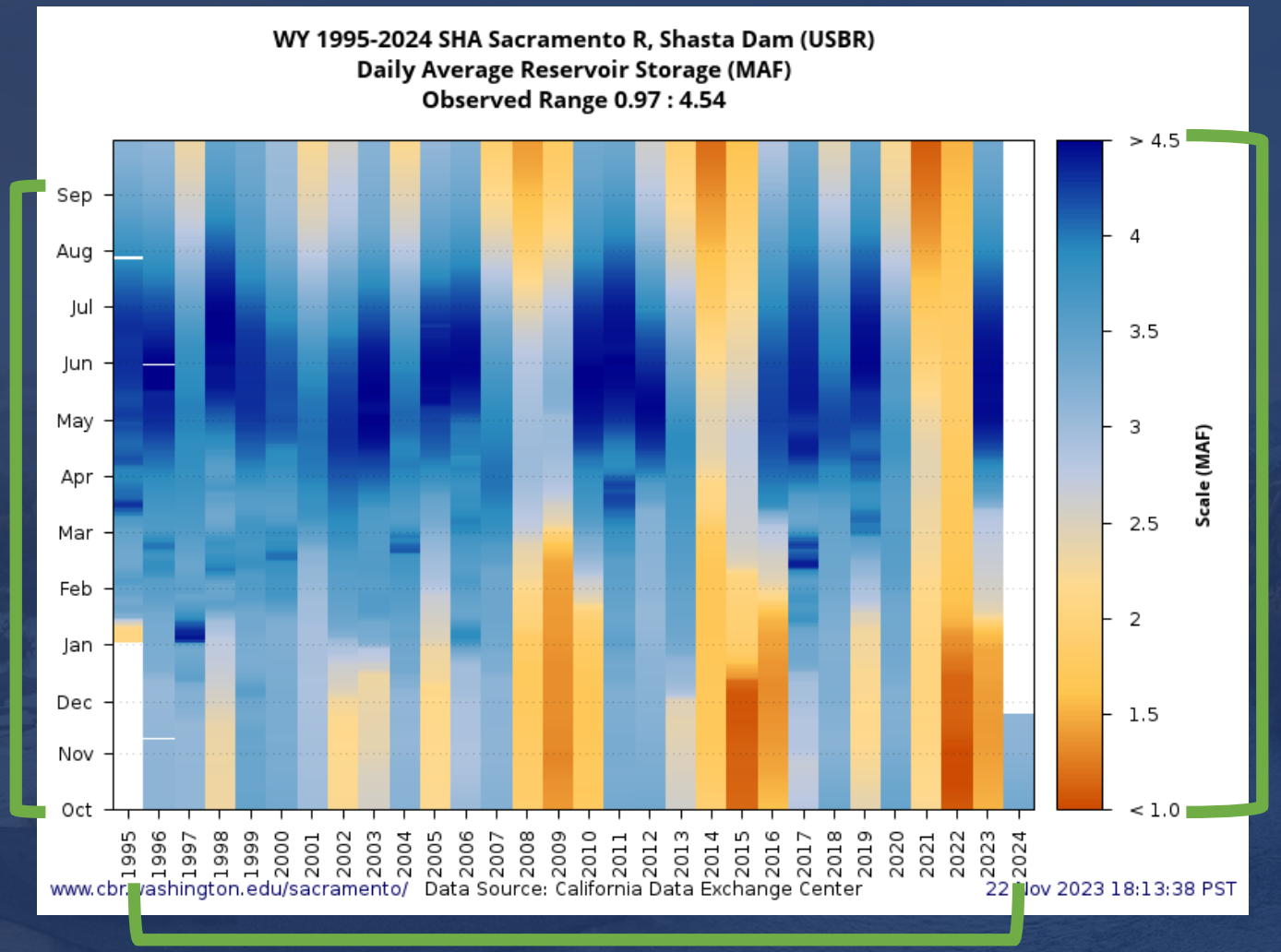
download CSV

mm/dd	2022:CRS:wtemp (F)	2022:VNS:wtemp (F)	2022:MSD:wtemp (F)	2022:OH1:wtemp (F)	2023:CRS:wtemp (F)	2023:MSD:wtemp (F)	2023:OH1:wtemp (F)	2023:VNS:wtemp (F)
1/1	47.933	47.788	48.158		52.838	51.613	51.571	51.635
1/2	47.363	46.468	47.050		51.871	51.413	51.229	51.710
1/3	46.729	46.235	46.388	46.800	50.792	50.979	51.058	50.510
1/4	46.708	47.488	47.425		50.650	50.567	50.446	50.435
1/5	47.263	49.093	48.842		51.442	51.113	51.021	50.630
1/6	48.679	50.990	51.042		51.704	50.774	50.630	50.623
1/7	49.779	52.535	52.283		51.308	51.217	51.033	51.193
1/8	50.500	51.808	52.250		51.513	51.546	51.425	51.305
1/9	50.596	50.765	51.142		52.171	52.183	52.071	51.973
1/10	50.404	50.720	50.942	51.100	53.829	52.646	52.475	52.610
1/11	49.933	50.398	51.179	51.285	53.467	52.908	52.742	52.993
1/12	49.600	50.480	51.221	50.979	52.971	53.092	53.046	52.805
1/13	49.504	50.810	51.496	51.092	52.967	53.046	52.942	52.745
1/14	49.354	50.788	51.496	51.196	53.229	53.071	53.004	52.858
1/15	49.408	50.975	51.492	51.007	52.771	52.875	52.817	52.588
1/16	49.546	51.943	52.213	52.200	51.504	52.288	52.225	52.025
1/17	50.158	52.235	52.900		50.096	51.708	51.675	51.290
1/18	50.838	52.453	53.321	53.317	50.038	50.708	50.704	50.390
1/19	51.058	52.708	53.313	53.242	50.208	50.388	50.346	50.105
1/20	51.033	52.385	53.138	53.258	50.108	49.450	49.458	49.108
1/21	51.083	52.175	52.979	53.075	49.675	48.921	48.913	48.598
1/22	50.596	51.620	52.050	52.100	49.271	48.592	48.567	48.268
1/23	50.208	51.418	51.996		48.921	48.033	48.025	47.690
1/24	49.721	50.720	51.742		48.713	48.017	47.975	47.713
1/25	49.363	50.938	51.671		48.646	48.171	48.113	47.953
1/26	49.325	50.810	51.692		48.767	48.700	48.625	48.523
1/27	49.500	51.028	51.567	51.840	49.058	49.321	49.229	49.243
1/28	49.600	50.840	51.925	51.338	49.379	49.963	49.858	49.843
1/29	49.429	50.675	51.875	51.539	49.696	50.104	50.046	49.985
1/30	49.183	49.985	51.633	51.253	49.467	49.588	49.488	49.303
1/31	49.050	50.300	51.150	52.000	48.650	48.650	48.579	48.238
2/1	48.679	49.618	50.904		48.154	48.129	48.071	47.683
2/2	48.400	48.283	49.171		47.875	47.983	47.908	47.818
2/3	48.171	48.643	48.633		48.779	48.392	48.271	48.335
2/4	48.167	49.018	49.288	49.475	49.800	49.108	48.975	48.988
2/5	48.313	49.828	50.088	49.863	50.692	50.117	50.008	49.970

"River Conditions Graph & Text" cbr.washington.edu/sacramento/data/query_river_graph.html

"Map Interface River Conditions" cbr.washington.edu/sacramento/data/query_river_map/

5. River Conditions



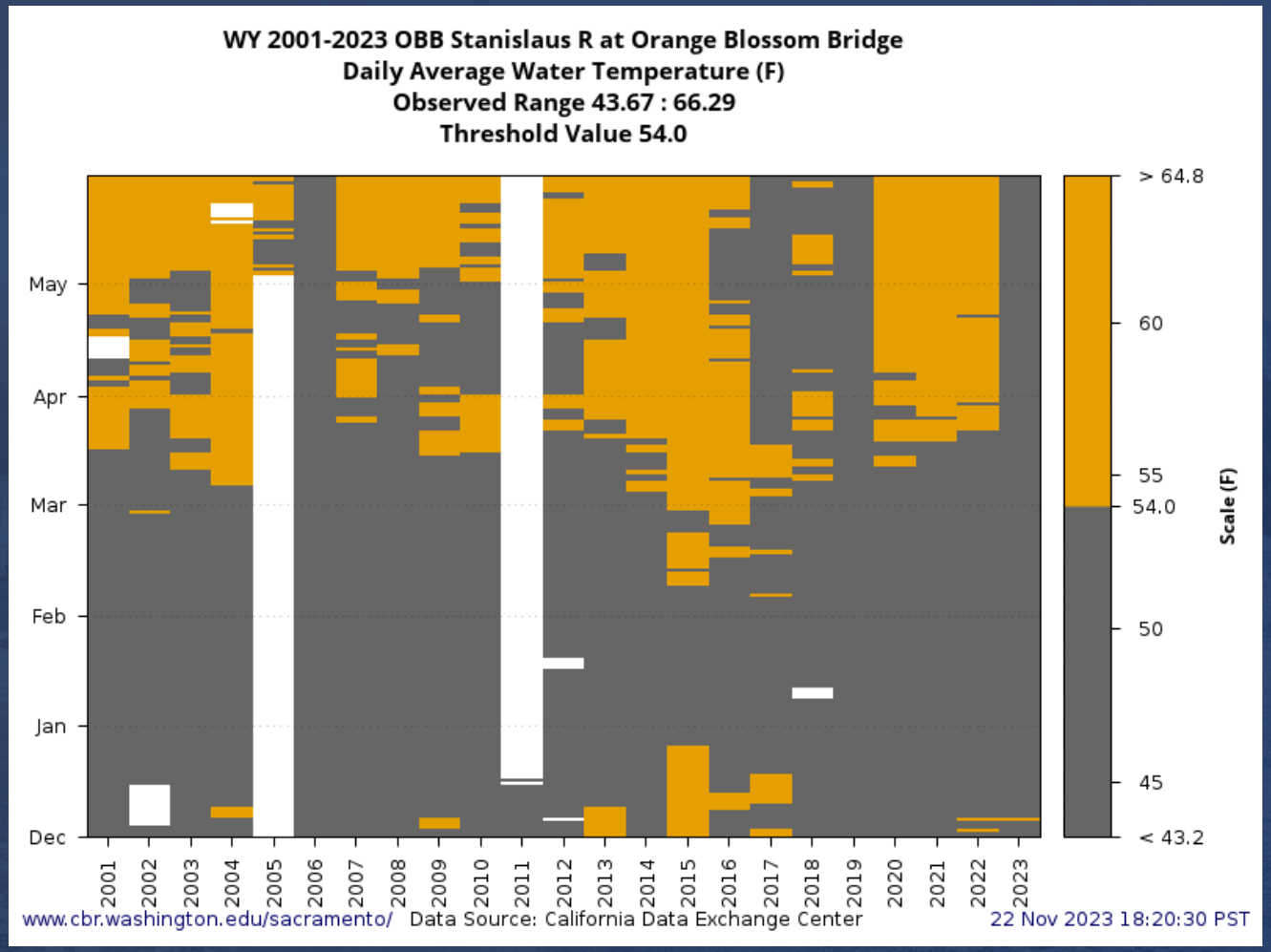
Months through the Water Year

Color Legend (MAF)

Water Years 1995-present

"All Years River Graph" cbr.washington.edu/sacramento/data/query_river_allyears.html

All Years River Graph with Threshold Value

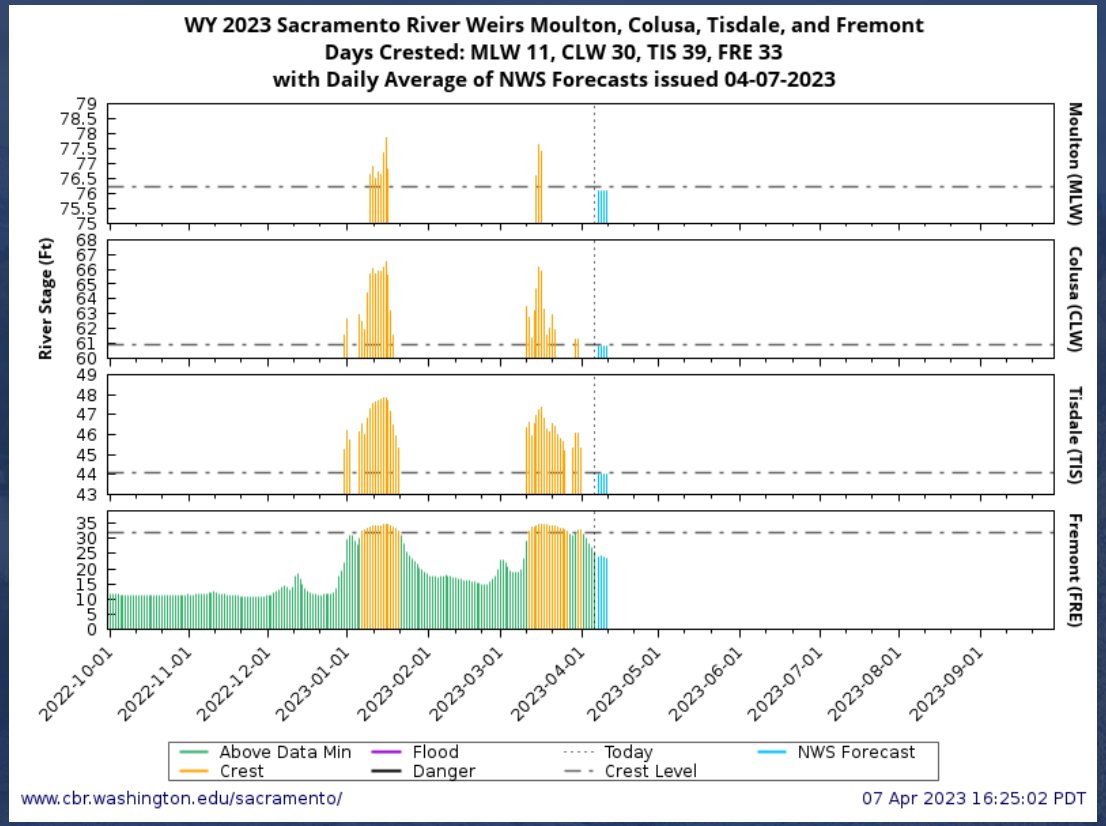


"All Years River Graph" cbr.washington.edu/sacramento/data/query_river_allyears.html

Customized Tools from Requests

Example:

- Weir Overtopping Alert tool
  - Customized web page
  - Email alert service



cbr.washington.edu/sacramento/data/alert_weirs.html

I. SacPAS Data Queries & Alerts

1. Juvenile Monitoring & Sampling

2. Juvenile Salvage & Loss

3. Adult Escapement

4. Temperature Thresholds

5. River Conditions

6. Exposure Index

SacPAS tools

I. Data Queries & Alerts

II. Work Groups & Teams

III. Models: survival, migration, etc.

II. SacPAS Work Groups & Teams

On SacPAS website:

- Salmon Monitoring Team
- Smelt Monitoring Team
- Stanislaus Watershed Team

In development:

- San Joaquin River Restoration Program

When requests are made:

We aim to provide process/product

- Automated
- Repeatable
- Public
- Consistent
- Current

All products and services are designed, developed, and refined in collaboration with team members and liaisons.

cbr.washington.edu/sacramento/workgroups/

Help with your tasks that are repeatable

- Data visualization tools online
  - Integrated data (hourly and daily river, fish sampling, salvage)
  - Summary or calculated metrics
  - Reference lines or thresholds
  - Alerts in real-time
- Periods of Coverage
  - Pre-season
  - In-season
  - Historical
  - Annual summaries

- Portions of handouts
  - Data tables and figures
  - Updated in real-time before meeting
  - All accessible from one place (rather than manual compilation)

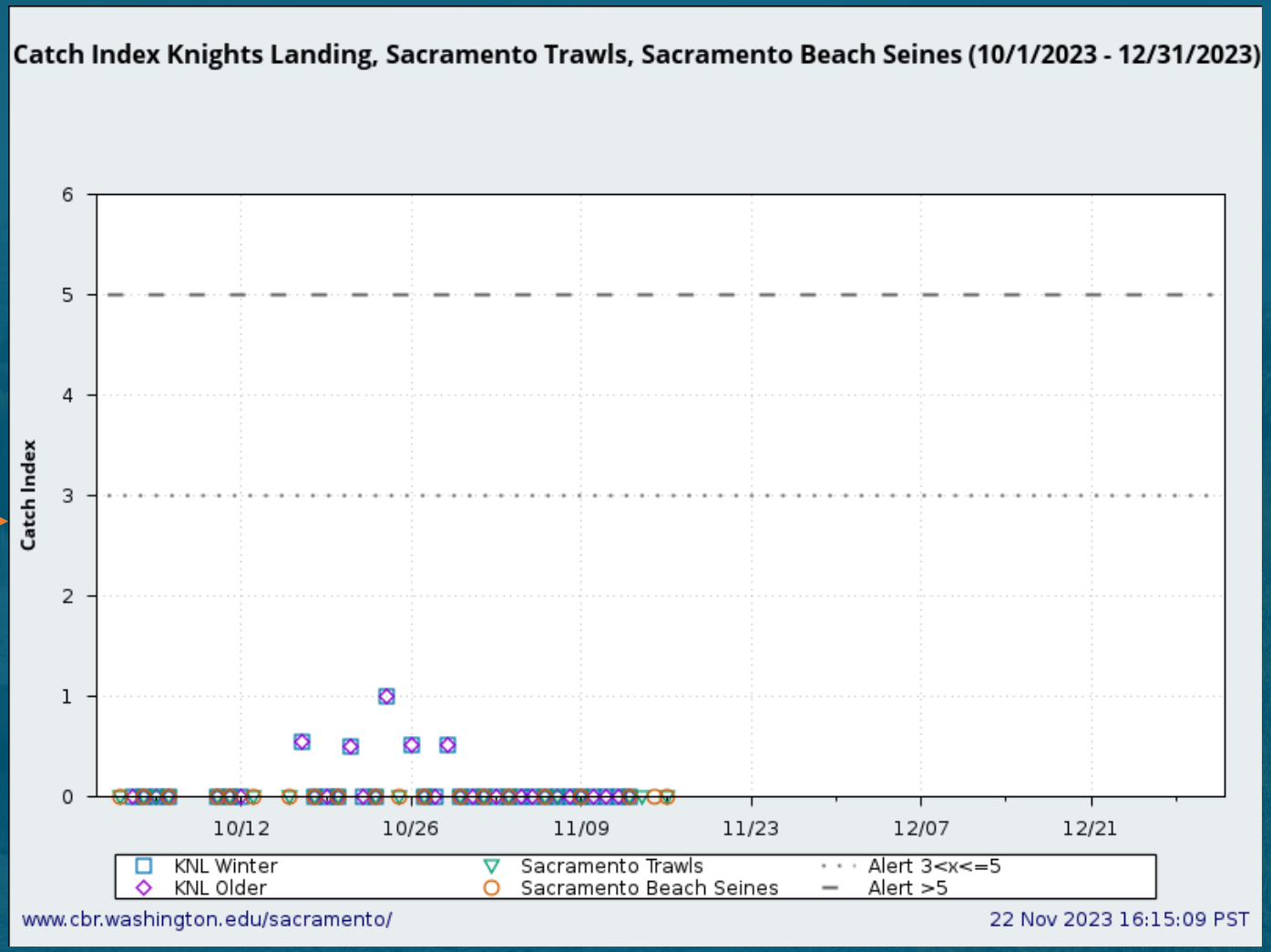
cbr.washington.edu/sacramento/workgroups/

Salmon Monitoring Team: Products Example

WY2024 Salmon Monitoring Current Conditions

- DCC Operations (10/1 - 11/30)
- Alerts: Deer Creek, Mill Creek, Wilkins Slough, Knights Landing
- Juvenile Sampling (14 days)
- Historical Migration Pattern for "Today"
- Species Distribution Estimates
- Loss&Salvage Predictor Estimates
- Delta STARS Estimates
- Single-Year Loss Thresholds

Fish data to support trigger decision : DCC operations by Knights Landing or Sacramento Catch Indices (2019 BiOp PA 4-56)



cbr.washington.edu/sacramento/workgroups/salmon_monitoring.html

Smelt Monitoring Team: Products Example

Smelt Monitoring Current Conditions

Includes data for Delta and Longfin smelt in Enhanced Delta Smelt Monitoring (EDSM), Chipps Island Trawl, and Salvage, and monitoring of current conditions.

- Water Temperature
- Onset of OMR Management
- Turbidity Bridge Avoidance
- Larval and Juvenile Delta Smelt Protection
- End of OMR Management
- Operations and Hydrology

Data Source with Data Quality attribute

EDSM WY 2024 (10/01/2023 - 09/30/2024)

Delta Smelt and Longfin Smelt caught in Enhanced Delta Smelt Monitoring (EDSM)

Sample Date Time	Species	Mark Code	nfish	Fork Length (mm)	Subregion	Stratum	Region	Method	Source
2023-10-05 10:24:00	Delta Smelt	None	1	60	Sacramento River near Rio Vista	Lower Sacramento	North	Kodiak Trawl	EDSM Provisional, USFWS Lodi
2023-10-24 12:24:00	Delta Smelt	None	1	53	Lower Sacramento River	Lower Sacramento	West	Kodiak Trawl	EDSM Provisional, USFWS Lodi
2023-11-15 09:17:00	Delta Smelt	None	1	57	Lower Sacramento River	Lower Sacramento	West	Kodiak Trawl	EDSM Provisional, USFWS Lodi
2023-10-02 09:12:00	Longfin Smelt	None	1	48	Suisun Marsh	Suisun Marsh	West	Kodiak Trawl	EDSM Provisional, USFWS Lodi
2023-10-03 11:16:00	Longfin Smelt	None	1	60	West Suisun Bay	Suisun Bay	Far West	Kodiak Trawl	EDSM Provisional, USFWS Lodi
2023-10-03 11:16:00	Longfin Smelt	None	1	61	West Suisun Bay	Suisun Bay	Far West	Kodiak Trawl	EDSM Provisional, USFWS Lodi
2023-10-03 11:33:00	Longfin Smelt	None	1	69	West Suisun Bay	Suisun Bay	Far West	Kodiak Trawl	EDSM Provisional, USFWS Lodi
2023-10-04 08:45:00	Longfin Smelt	None	1	53	Grizzly Bay	Suisun Marsh	West	Kodiak Trawl	EDSM Provisional, USFWS Lodi
2023-10-04 08:45:00	Longfin Smelt	None	1	54	Grizzly Bay	Suisun Marsh	West	Kodiak Trawl	EDSM Provisional, USFWS Lodi
2023-10-05 10:41:00	Longfin Smelt	None	1	49	Grizzly Bay	Suisun Marsh	West	Kodiak Trawl	EDSM Provisional, USFWS Lodi

cbr.washington.edu/sacramento/workgroups/delta_smelt.html

Stanislaus Watershed Team: Products Example

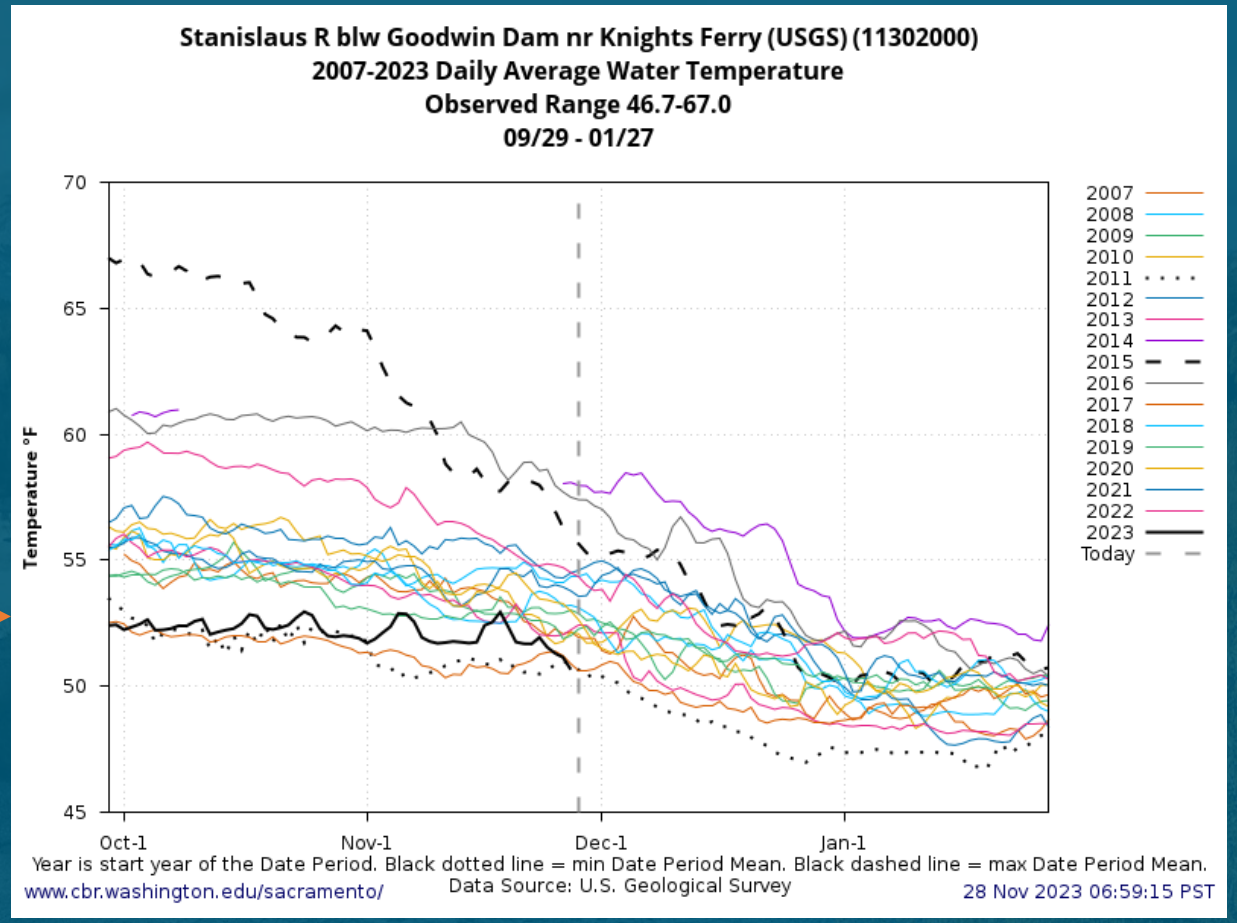
WY2024 Stanislaus Watershed Monitoring Current Conditions -- In Development

- Stanislaus Temperature and Flow
- Current River Conditions
- Water Temperature Min, Max, Average
- Water Temperature Historical
- Hourly Dissolved Oxygen
- Goodwin Dam Spillway Discharge

Previous Seasons

- WY2023 Stanislaus Watershed Monitoring

Visual prediction of near-term conditions : moving 60-day window for current and historical Water Temperature on either side of today



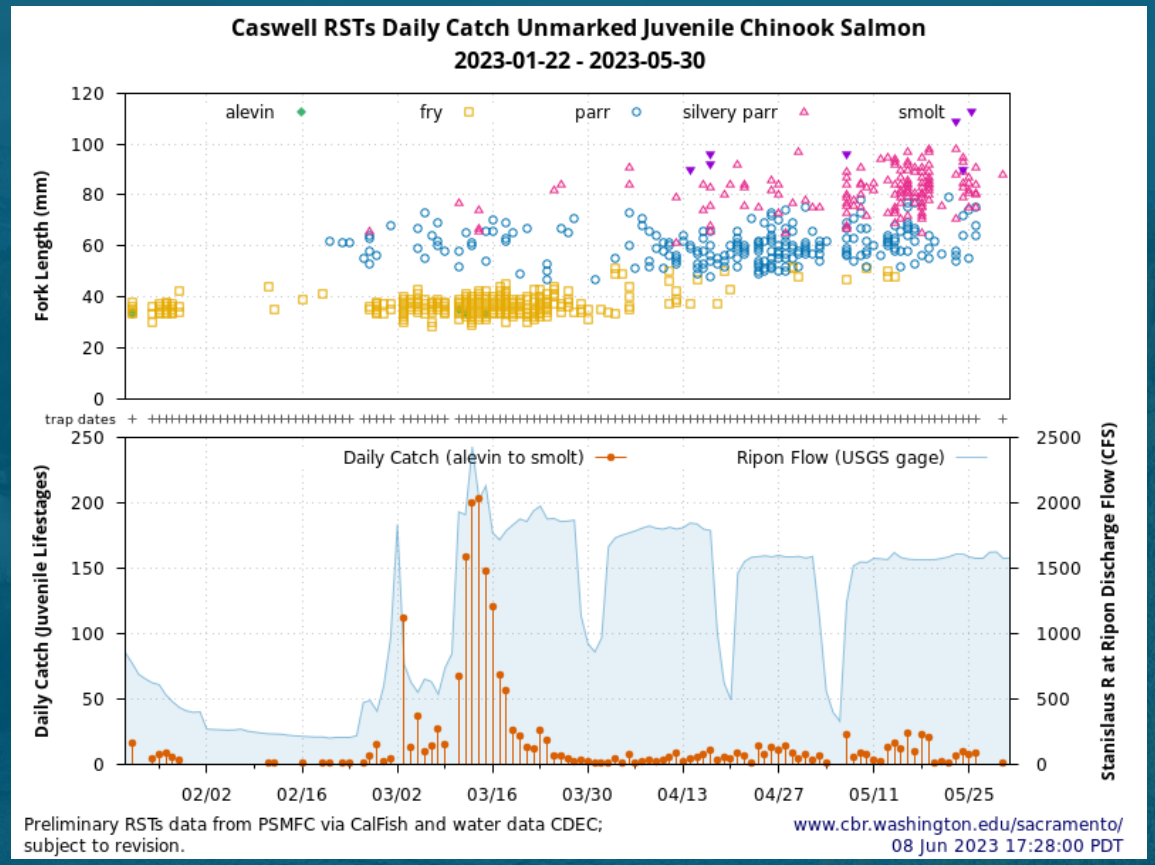
cbr.washington.edu/sacramento/workgroups/stanislaus_watershed.html

Stanislaus Watershed Team: Process to Product

The Process

Stanislaus Watershed Team meeting with SacPAS	Initial team needs discussion. Additional needs and content discussions.
SacPAS reach out to PSMFC Caswell RST data contact	Possible to provide data publicly? Any data publishing requirements or concerns?
SacPAS reach out to CalFish	Request to coordinate with Caswell RST data contact to establish data upload process.
SacPAS Database	Design table structures for data. Develop retrieval, processing, and loading data procedures. Verify with primary source. Implement and update daily.
SacPAS Website	Design visualization based on existing figures. Develop query and visualization code. Implement publicly and update daily.

The Product



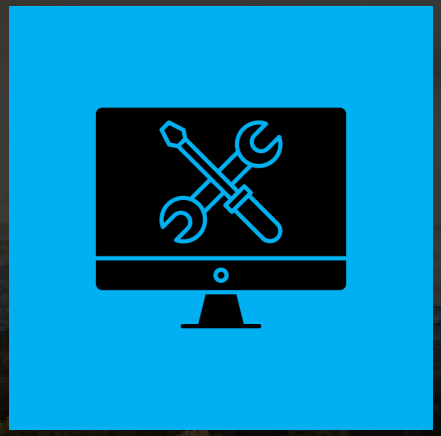
Presentation Goals

AWARENESS
of **SacPAS tools**
available

APPROACH
of how we provide
SERVICE

Kickstart at workshop
for
FEEDBACK
and
COLLABORATION

SacPAS tools



I. Data Queries & Alerts

II. Work Groups & Teams

III. Models: survival, migration, etc.

Models: Survival, Migration, etc.

- **Fish Model**
  - **Egg-to-Fry model**

    (Anderson et al. 2022, Martin et al. 2016)

- **Loss & Salvage Model**

  (Tillotson et al. 2022)

- **STARS Model**

  (Survival Travel And Routing Simulation; Perry et al. 2018, Hance et al. 2021)

Models: Survival, Migration, etc.

- **Fish Model**
  - **Egg-to-Fry model**

    (Anderson et al. 2022, Martin et al. 2016)

- **Loss & Salvage Model**

  (Tillotson et al. 2022)

- **STARS Model**

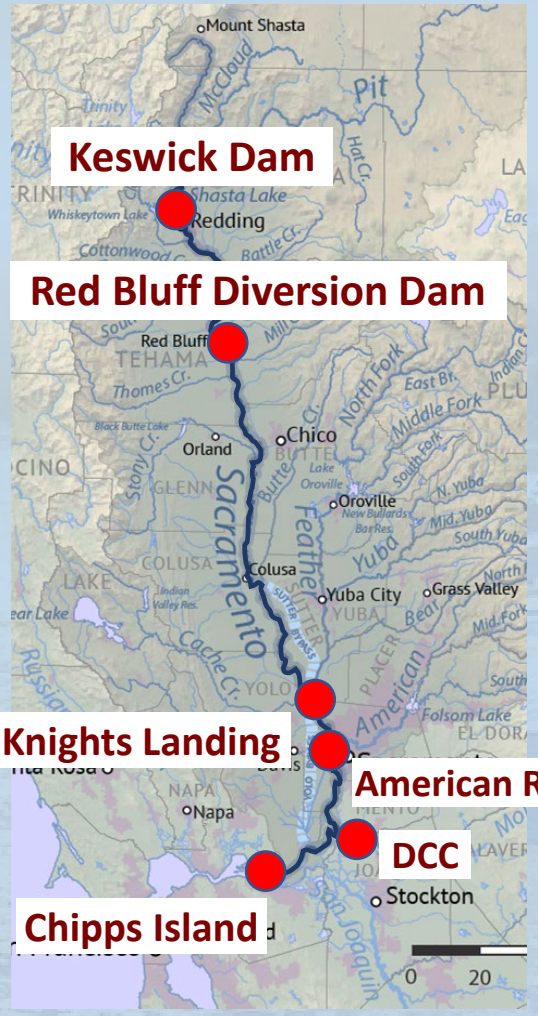
  (Survival Travel And Routing Simulation; Perry et al. 2018, Hance et al. 2021)

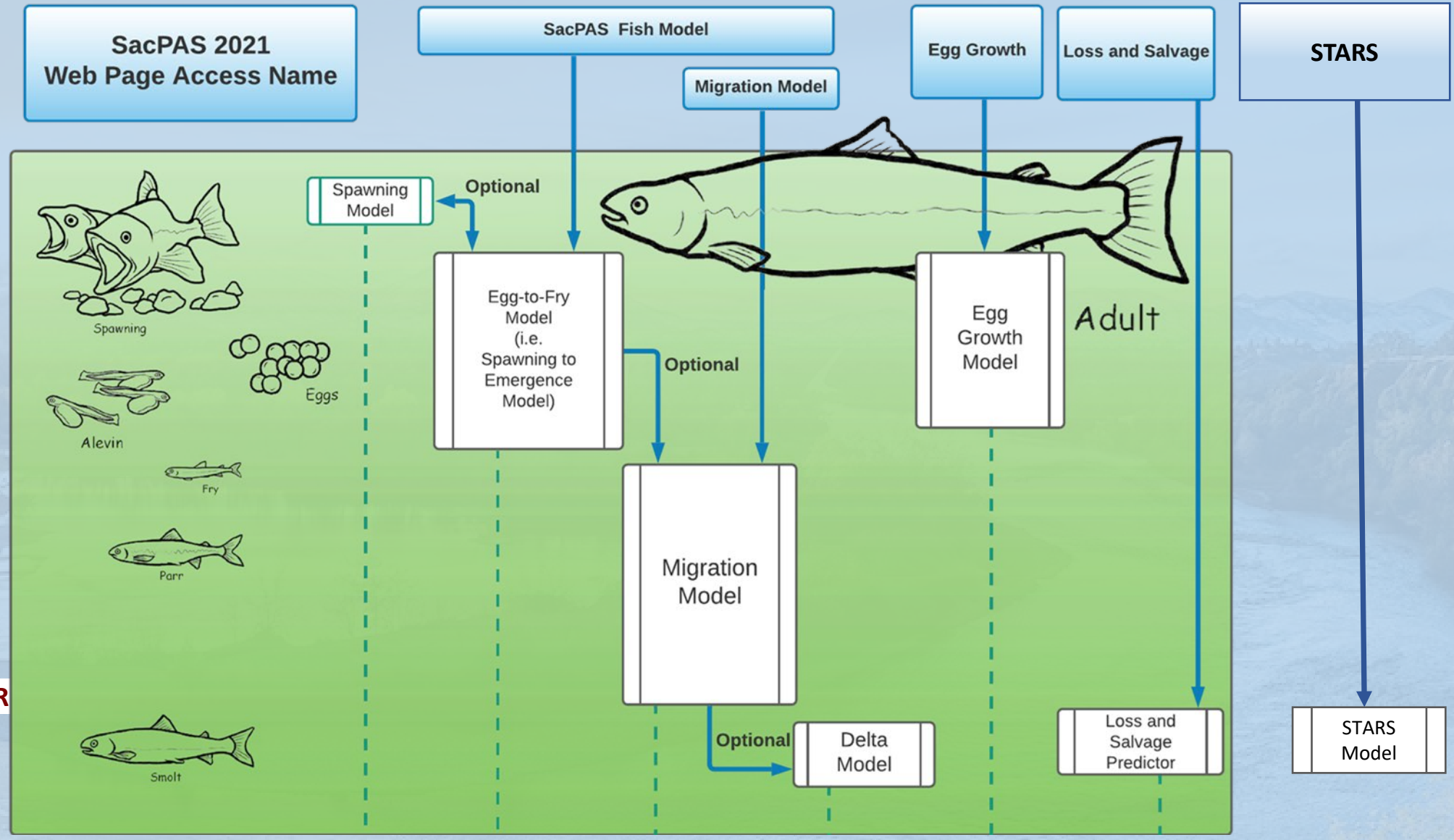
Exploratory tools

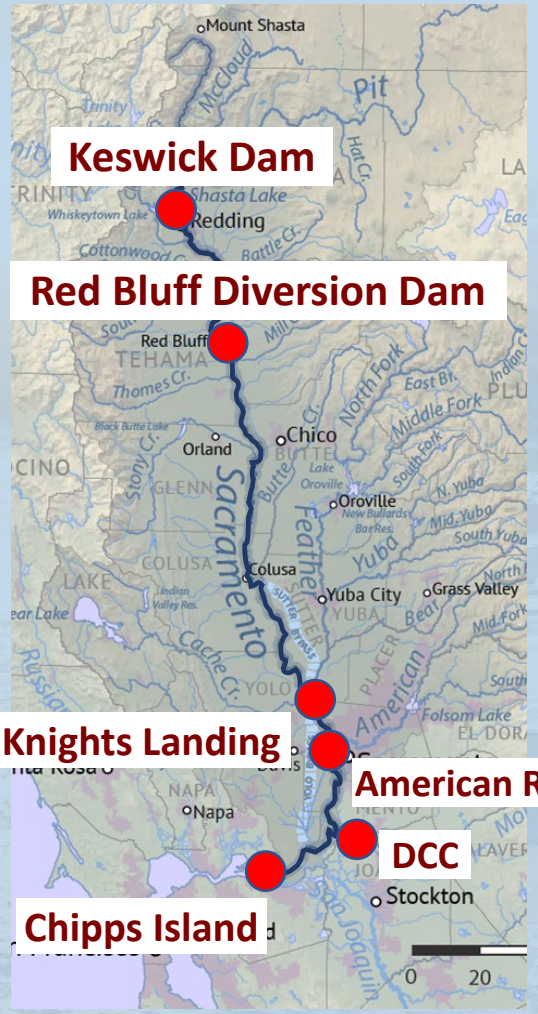
(Shiny apps)

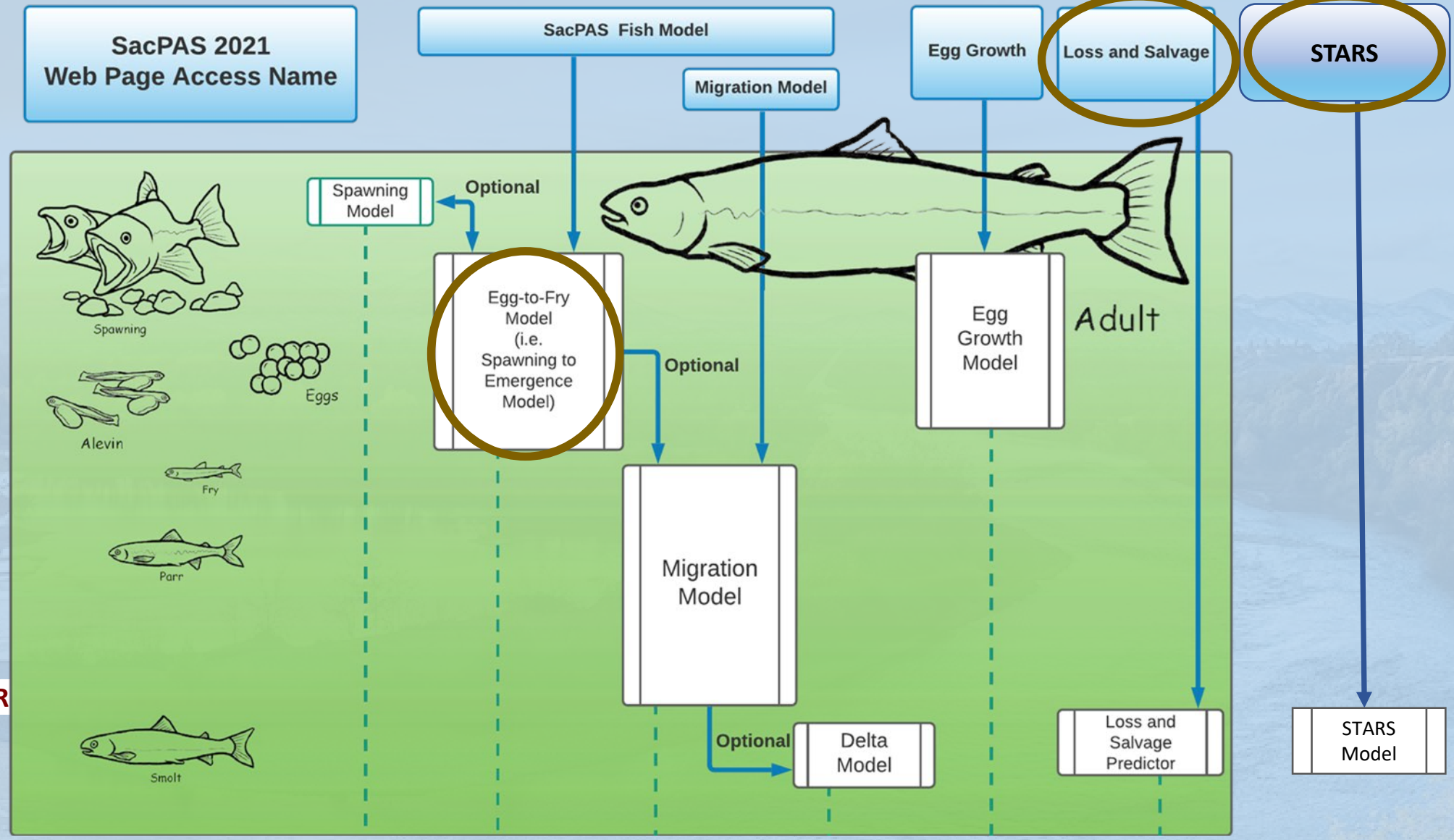
- **Growth model**
- **Survival Model**
- **Migration Model**
- **Temperature Profiler**

etc.


Mount Shasta
Keswick Dam
Redding
Red Bluff Diversion Dam
Red Bluff
Chico
Orland
Oroville
Colusa
Yuba City
Grass Valley
Knights Landing
American R
Napa
DCC
Stockton
Chipps Island
0
20


SacPAS 2021
Web Page Access Name
SacPAS Fish Model
Migration Model
Egg Growth
Loss and Salvage
STARS
Spawning Model
Optional
Spawning
Eggs
Alevin
Fry
Parr
Smolt
Egg-to-Fry Model (i.e. Spawning to Emergence Model)
Optional
Egg Growth Model
Adult
Migration Model
Optional
Delta Model
Loss and Salvage Predictor
STARS Model


Mount Shasta
Keswick Dam
Redding
Red Bluff Diversion Dam
Red Bluff
Chico
Orland
Oroville
Colusa
Yuba City
Grass Valley
Knights Landing
American R
Napa
DCC
Stockton
Chipps Island
0
20


SacPAS 2021
Web Page Access Name
SacPAS Fish Model
Migration Model
Egg Growth
Loss and Salvage
STARS
Spawning Model
Optional
Egg-to-Fry Model (i.e. Spawning to Emergence Model)
Optional
Egg Growth Model
Adult
Migration Model
Optional
Delta Model
Loss and Salvage Predictor
STARS Model
Spawning
Eggs
Alevin
Fry
Parr
Smolt

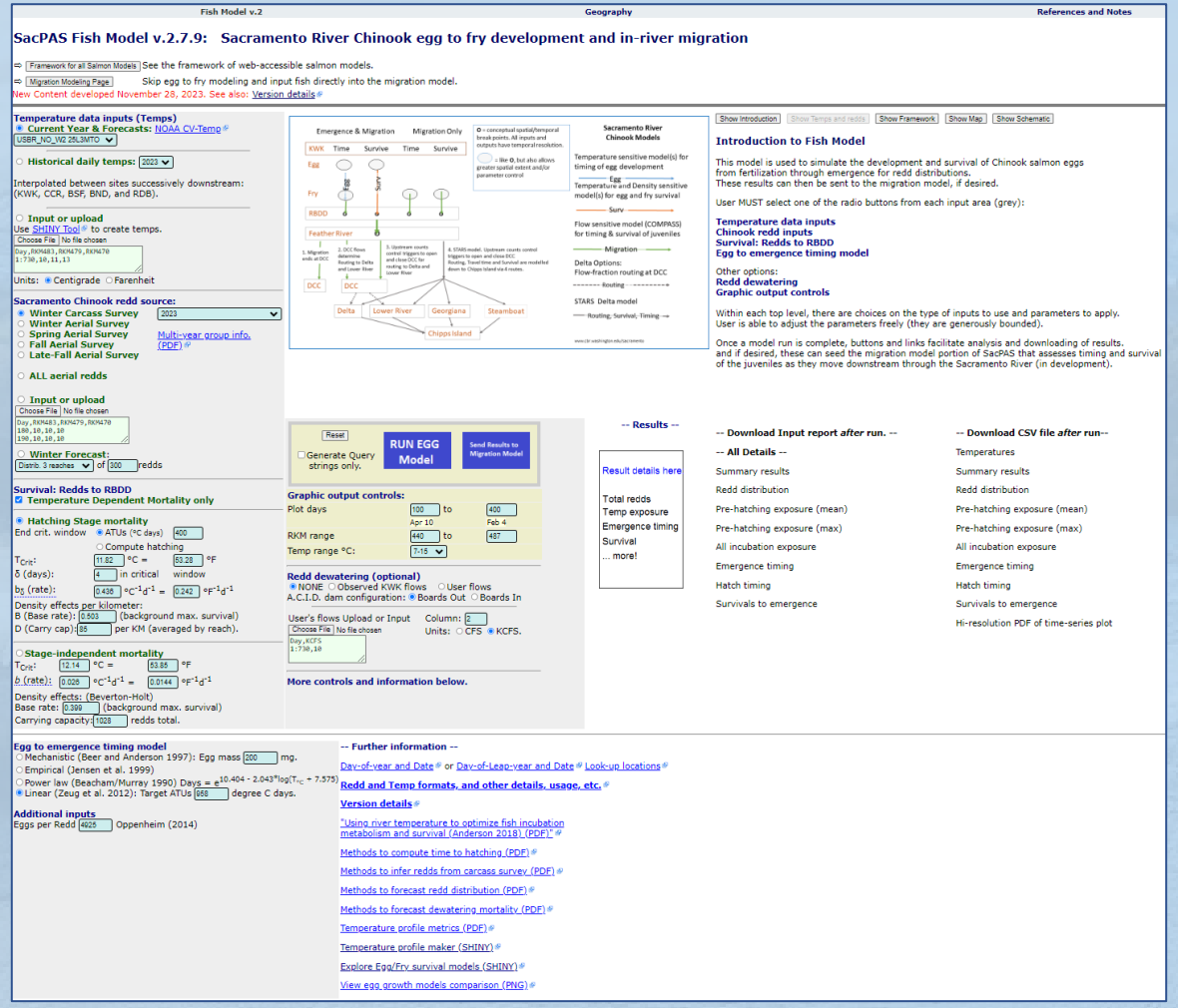
Short-term Forecasting and Scenarios

Model	Forecasting Timeframe	Scenario Generation	Data Input
Egg-to-Fry (survival & emergence timing)	~ months	Unlimited	River temperature timeseries Redds or carcasses timeseries Flow timeseries Mathematical parameters
Loss & Salvage	7 days	7 days	Exports; SJR flow; DCC gate status; SR flow; OMR flow; precipitation at Stockton; Water temperature, Mallard Island
STARS (Delta Survival Travel And Routing Simulation)	5 days	NA	SR temperature, Freeport; Fremont Weir stage & overtopping; Discharge, SR at Freeport & Rio Vista, Yolo Bypass at Woodland; incl. forecasts from CA NV River Forecast Center
	NA	Fish distribution	Hypothetical Arrivals at Knights Landing

Fish Model on SacPAS:

Egg-to-Fry Model Online Tool

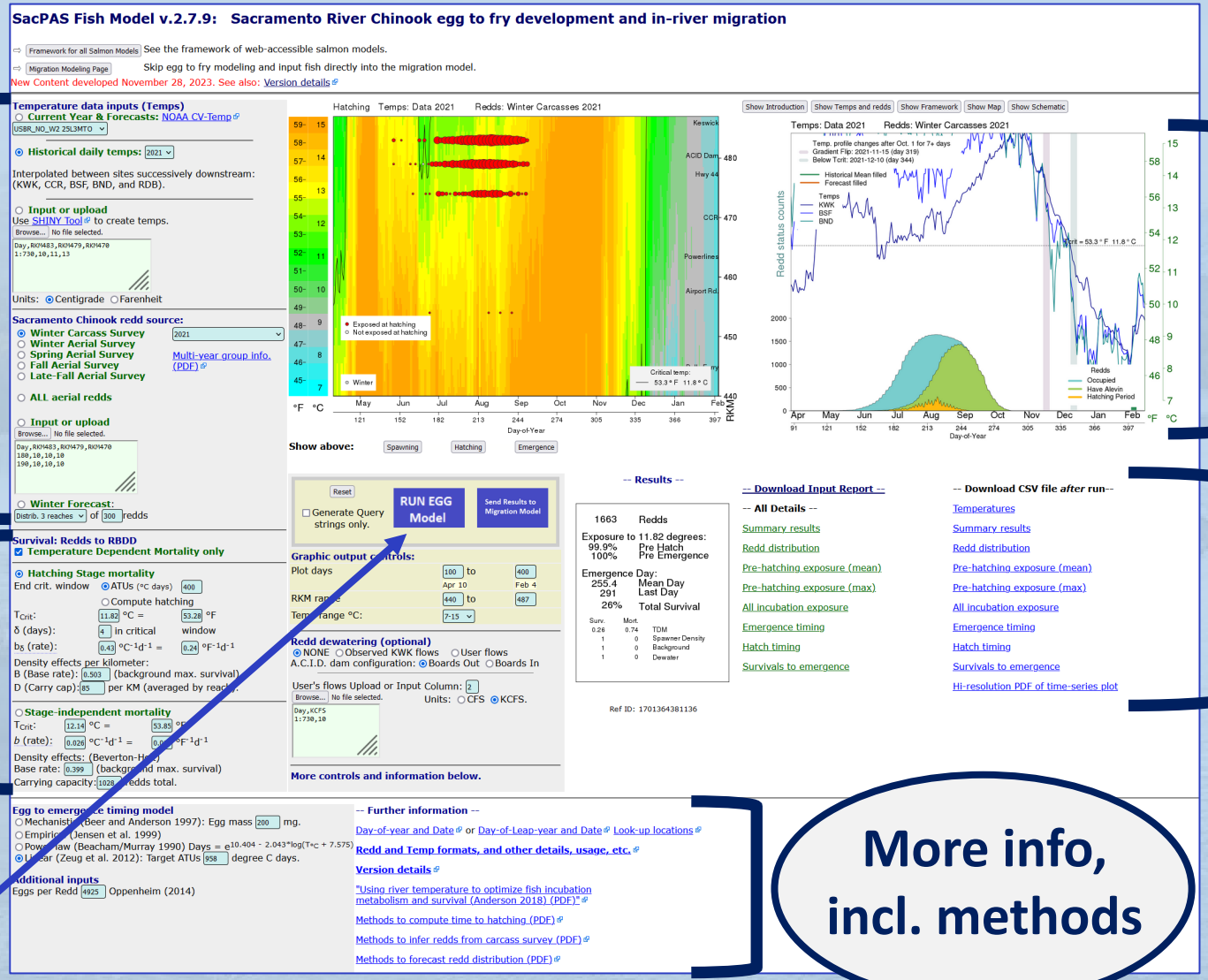
- Model focusing on thermal stress during egg incubation for Sacramento River Chinook salmon
- Predict survival & emergence timing
- Allows resource managers and the public equal access to evaluate water operation plans



https://www.cbr.washington.edu/sacramento/fishmodel/

Fish Model on SacPAS:

Egg-to-Fry Model Online Tool



Temperature, redds, carcasses data inputs

Survival model specifications

Run Model

Graphs

Results output, incl. downloads

More info, incl. methods

Fish Model on SacPAS:

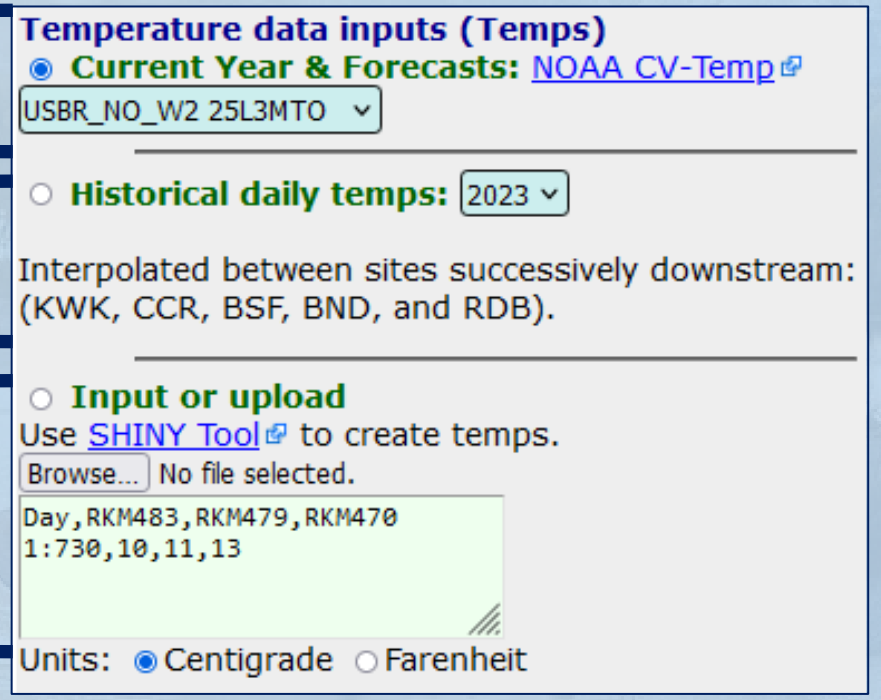
Egg-to-Fry Model Online Tool

Temperature data input:

Forecasted (NOAA; USBR)

Historical (CDEC)

Custom (text; upload; Shiny tool)

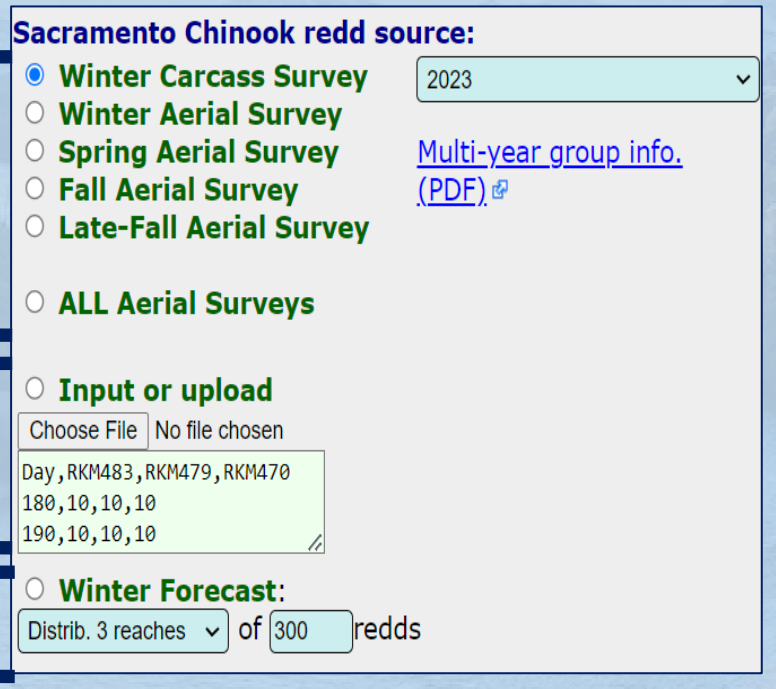


Salmon redds data input:

Redd, Carcass Survey data (CDFW)

Custom (text; upload)

Forecast



https://www.cbr.washington.edu/sacramento/fishmodel/

Fish Model on SacPAS:

Egg-to-Fry Model Online Tool

Survival model specifications:

Check-mark option:

Temperature-dependent mortality *only* is ON

- No density-dependent effects
- No background mortality rate for fry

Input values:

- Default values from studies
- Enter custom values

Survival: Redds to RBDD

☑ **Temperature Dependent Mortality only**

◉ **Hatching Stage mortality**

End crit. window ◉ ATUs (°C days) 400

○ Compute hatching

T_{Crit}: 11.82 °C = 53.28 °F

δ (days): 4 in critical window

$b_δ$ (rate): .436 $°C^{-1}d^{-1}$ = 0.24 $°F^{-1}d^{-1}$

Density effects per kilometer:

B (Base rate): 0.503 (background max. survival)

D (Carry cap): 85 per KM (averaged by reach).

○ **Stage-independent mortality**

T_{Crit}: 12.14 °C = 53.85 °F

b (rate): 0.026 $°C^{-1}d^{-1}$ = 0.014 $°F^{-1}d^{-1}$

Density effects: (Beverton-Holt)

Base rate: 0.399 (background max. survival)

Carrying capacity: 1028 redds total.

Critical stage:

Stage-dependent: Egg Hatching Stage

Stage-independent: All of egg incubation

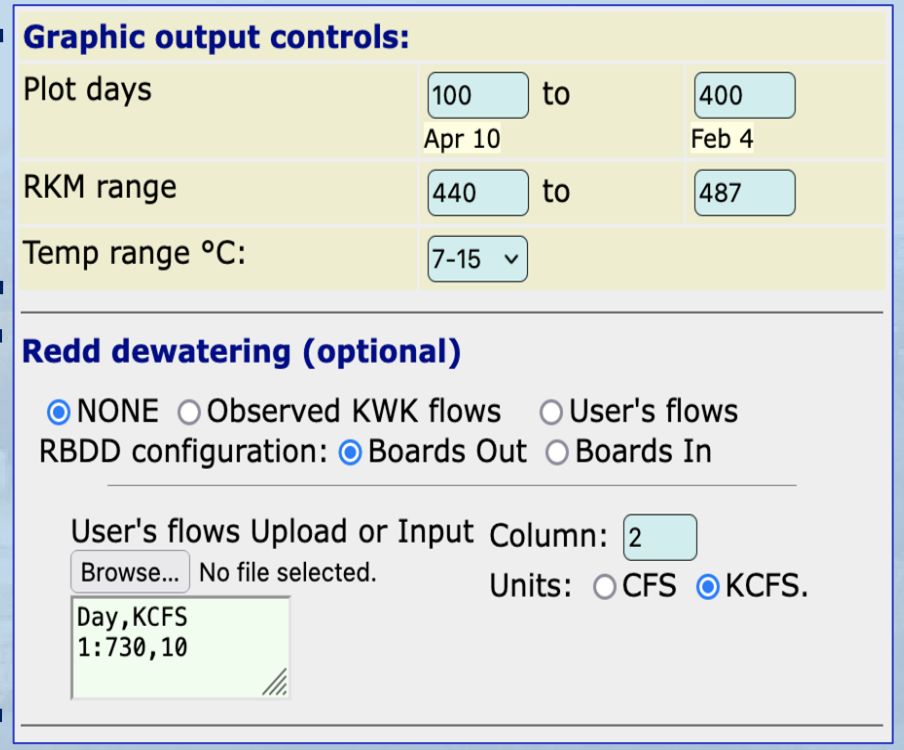
https://www.cbr.washington.edu/sacramento/fishmodel/

Fish Model on SacPAS:

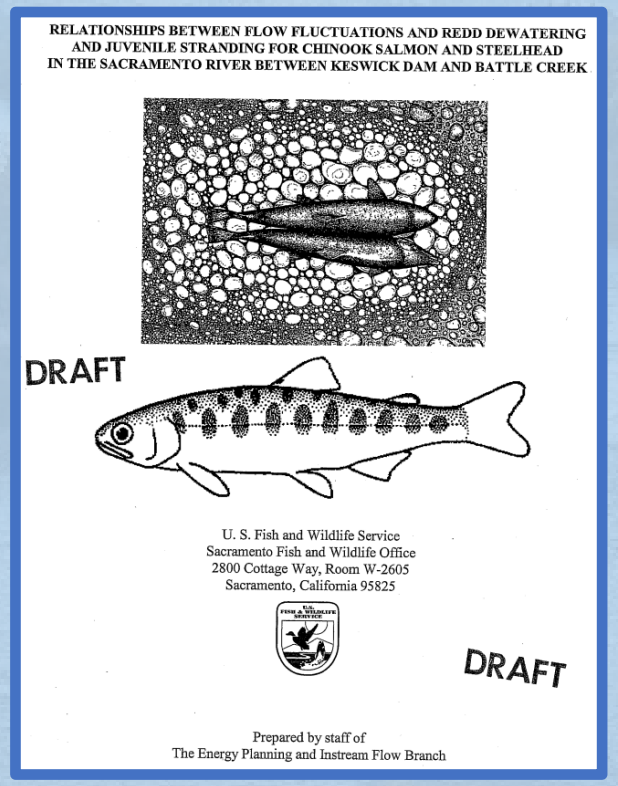
Egg-to-Fry Model Online Tool

Graphic output controls

Redd dewatering specifications (optional)



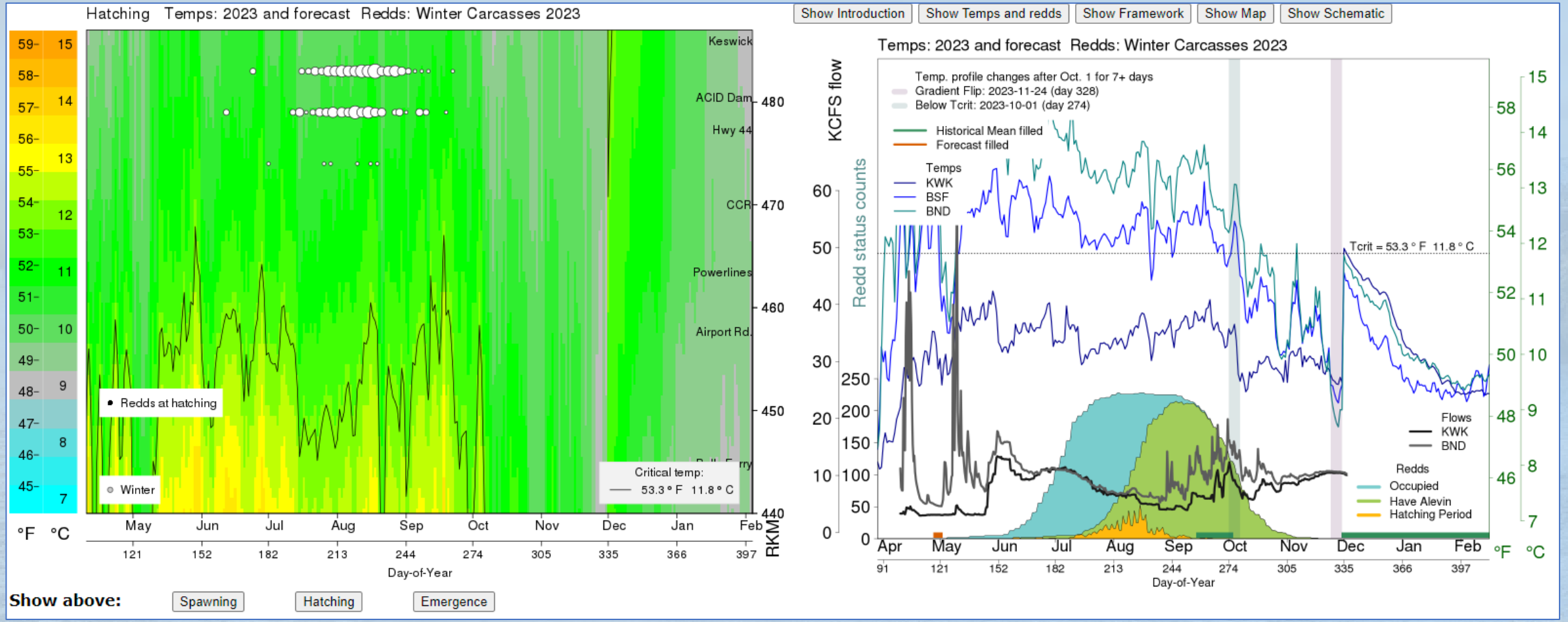
https://www.cbr.washington.edu/sacramento/fishmodel/



https://www.noaa.gov/sites/default/files/legacy/document/2020/Oct/07354626849.pdf

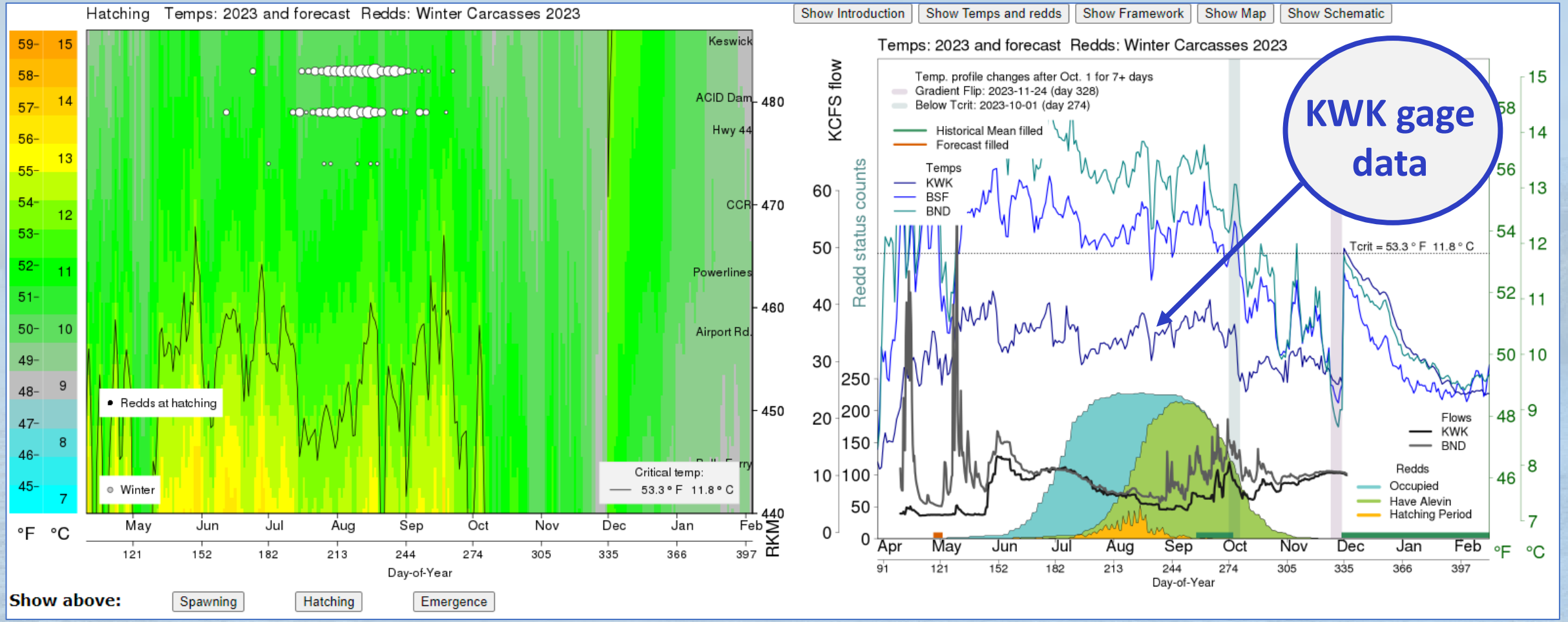
Fish Model on SacPAS:

Egg-to-Fry Model Online Tool



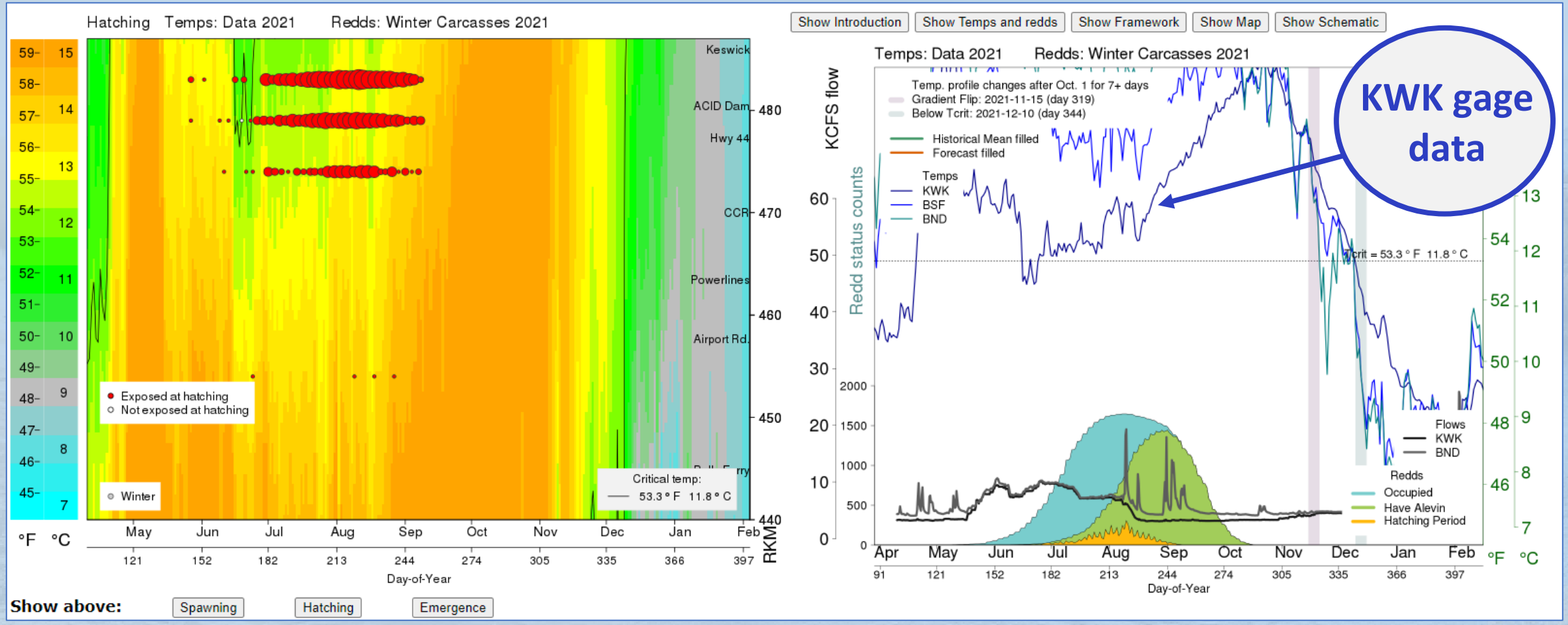
Fish Model on SacPAS:

Egg-to-Fry Model Online Tool



Fish Model on SacPAS:

Egg-to-Fry Model Online Tool



Fish Model on SacPAS:

Egg-to-Fry Model Online Tool

Check the box

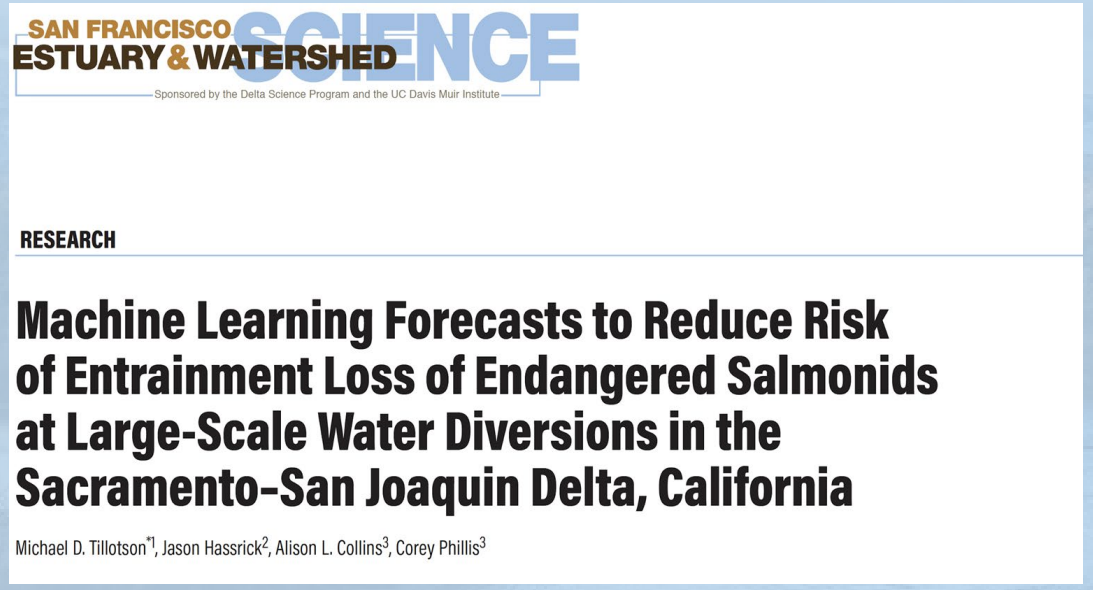
```
# Results Summary has several metrics:
https://www.cbr.washington.edu/sac-bin/fishmodel/getandplottemp.pl?
TcritC=12&TcritF=53.6&dirUseId=TEST0&redds=dbAll&reddyear=2020
&tempsource=dbtemp&tempyear=2020&temponly=on&raw=13
```

```
                    What,Value
              Redd source,All Aerial 2020
               Redd count,2897
                Redd year,2020
                Temp year,2020
                   TcritC,12
            Critical Days,4
     Prehatch Exposure %,55.5
    PreEmerge Exposure %,87
      Mean Emergence Day,385.2
      Last Emergence Day,511
     Incubation Survival,0.884
           TDM mortality,0.1164
 Spawner Density mortality,0
       Dewater mortality,0
    Background mortality,0
Temp. watch period in days,7
      Temp profile flips,2020-11-07
    Temp profile <TcritC,2020-11-30
```

Send Results to Migration Model

Loss & Salvage Predictor

- Weekly forecasts of Steelhead & Chinook loss at the pumps
- Using historical observations of loss & environmental conditions
- Tillotson et al. (2022)
  - Quantile regression forest approach



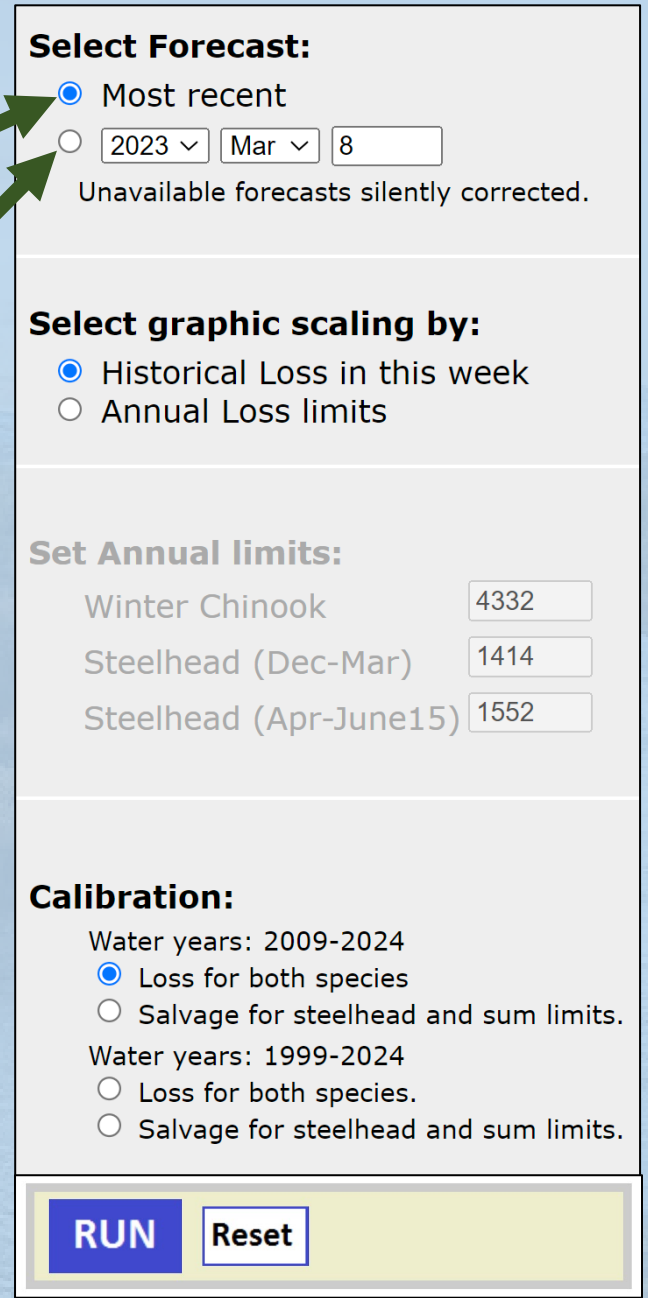
Loss & Salvage Predictor Online Tool: https://www.cbr.washington.edu/sacramento/lossandsalvage/

Historical & real-time data: https://www.cbr.washington.edu/sacramento/data/delta_loss_summary.html/

Loss & Salvage Predictor

Get latest **forecast** and access scenario forecasting

Hindcast



SacPAS Loss and Salvage Predictor

Select Forecast:
- Most recent
- 2023 Mar 8

Unavailable forecasts silently corrected.

Select graphic scaling by:
- Historical Loss in this week
- Annual Loss limits

Set Annual limits:

Winter Chinook	4332
Steelhead (Dec-Mar)	1414
Steelhead (Apr-June15)	1552

Calibration:

Water years: 2009-2022
- Loss for both species
- Salvage for steelhead and sum limits.

Water years: 1999-2022
- Loss for both species.
- Salvage for steelhead and sum limits.

RUN Reset

You can explore how next week's environmental conditions will affect loss/salvage.

Week: 26

omr sum: 9583

exports: 10859

sac: 85000

sjr flow: 35000

temp mal: 12

precip: 0.14

DCC closed: Open:

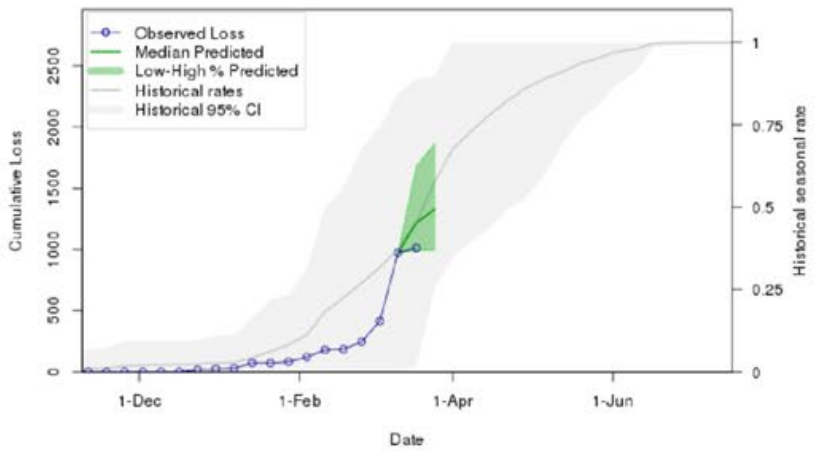
Results and Forecast summary:

Most recent year is modeled with the calibration selected.
Results are subject to revision in format and content.

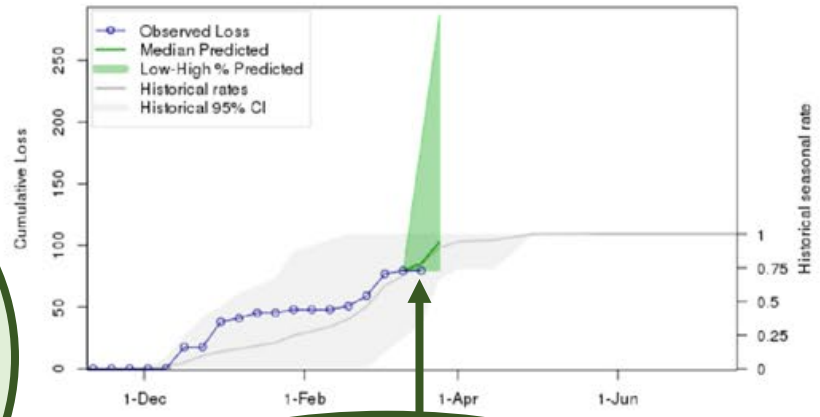
Week	25	26
	Model	
Steelhead.Low	17	1
Steelhead.Median	243	110
Steelhead.High	705	185
Winter.Run.Low	0	0
Winter.Run.Median	6	17
Winter.Run.High	104	104
	Data	
Steelhead.Observed.loss	37	NA
Winter.Run.Observed.loss	0	NA
Steelhead.Cumulative.loss	1011	1011
Winter.Run.Cumulative.loss	80	80

This week's averages. They are projected to the next week except "sac" flow which user has raised and the text is now colored **green.**

Steelhead Loss 2023-03-24 Water Year: 2023 & WY.week 25



Winter Run Loss 2023-03-24 Water Year: 2023 & WY.week 25



Counts are very low compared to historical numbers, so model was forecasting a "catch-up" and thus a wide confidence band

Environmental details:

The 'most recent' forecast assumes that next week's environmental variables are the same as the current week, unless changed

wy = water year
temp = °C
sac = Sacramento flow (cfs),
om.sum = Old + Middle River flow (cfs)
mal = MallardIsland
precip = Inches of rain (5 day running sum)
dcc = Delta Cross Channel (open/closed)

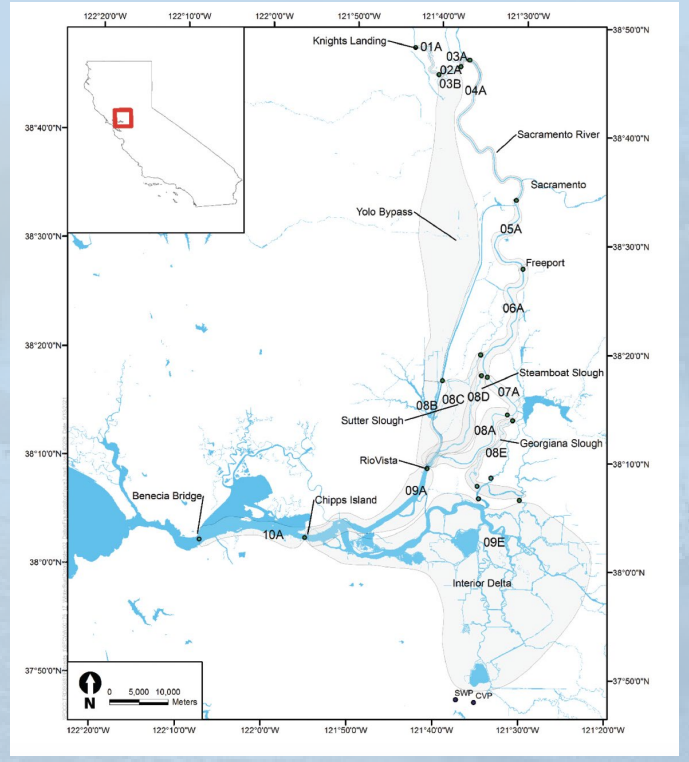
Sources here

Water Year	2023	2023
Week	25	26
	Data	Forecast
temp.mal	12.1	12.0
precip	0.14	0.14
om.sum	9583	9583
sac	73939	85000
dcc	osed	closed
sjr	36078	35000
export	10859	10859
steelhead.pw	560.11	242.76
winter.pw	2.60	5.76

The forecast now includes an adjusted Sacramento flow

STARS

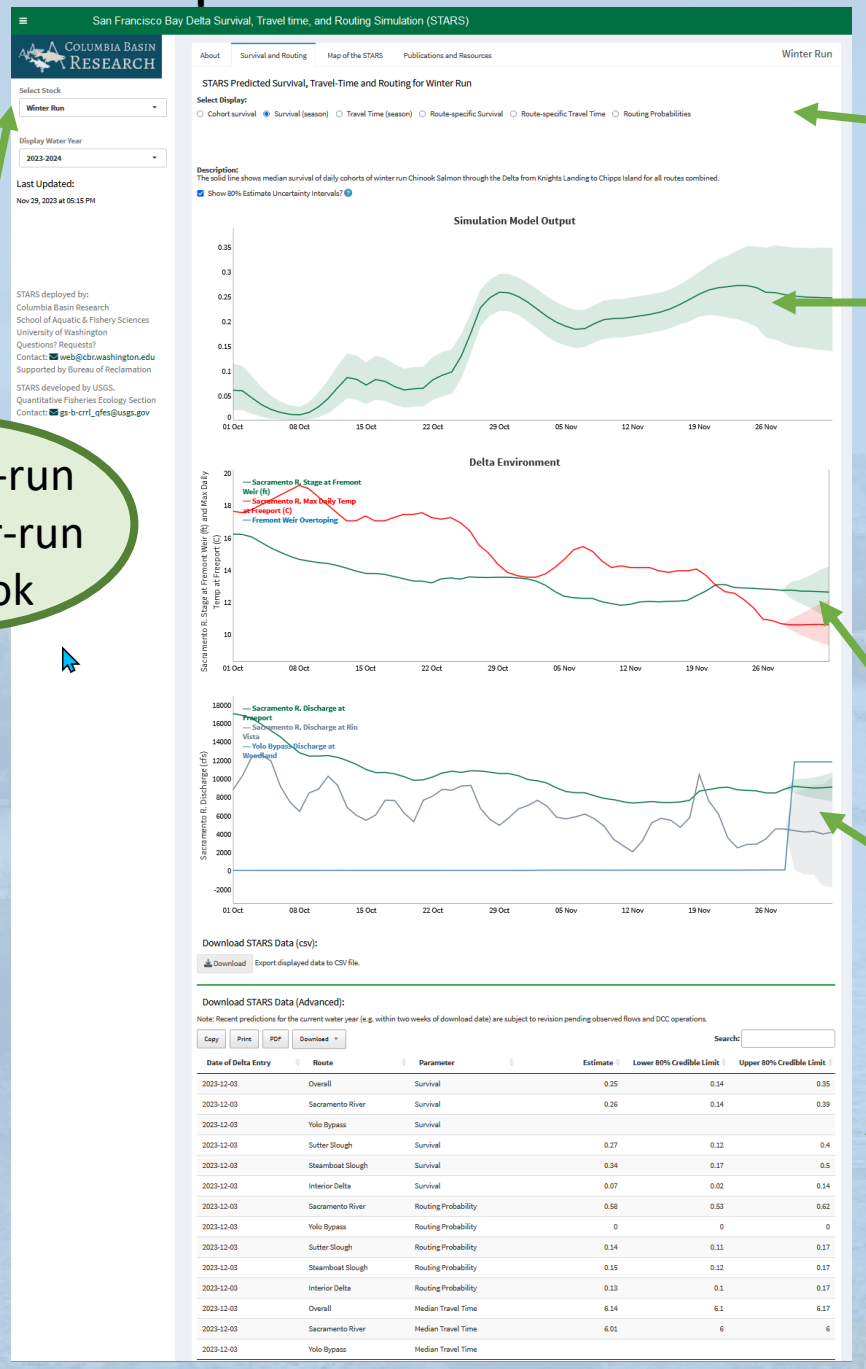
(Delta Survival Travel And Routing Simulation; Perry et al. 2018, Hance et al. 2021)



https://www.cbr.washington.edu/shiny/STARS/

https://oceanview.pfeg.noaa.gov/shiny/FED/CalFishTrack/

Example with Winter-Run Chinook Salmon



Late Fall-run & Winter-run Chinook

Select Display:

Cohort survival,

Survival (season), Travel Time (season),

Route-spec. Survival, Route-spec. Travel Time

Delta Environment, Sacramento River:

Fremont Weir stage (ft) & overtopping (0/1)

Freeport Temp. (°C) Freeport Discharge (cfs)

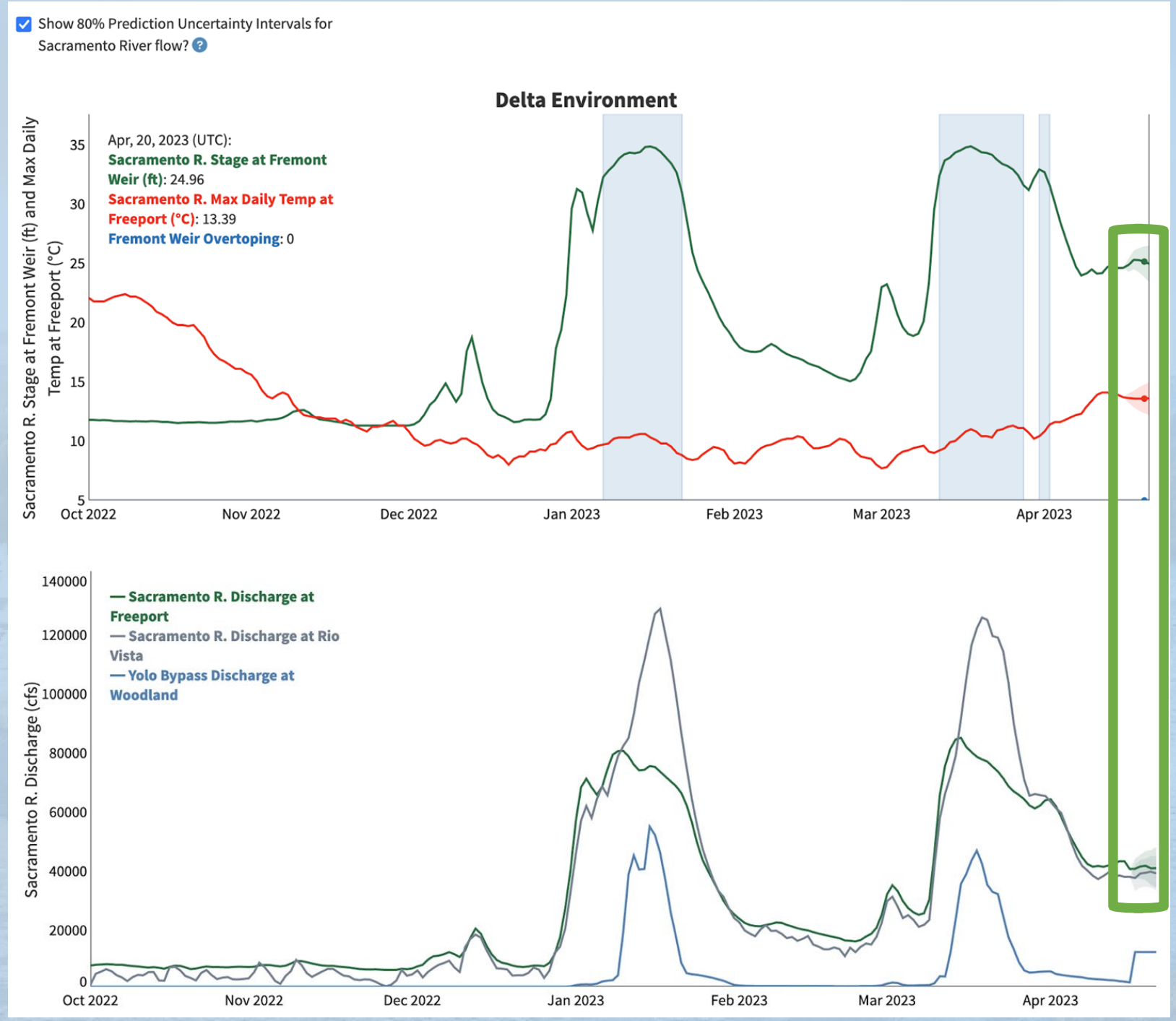
Rio Vista Discharge (cfs)

Yolo Bypass Discharge at Woodland (cfs)

Download data (Advanced)

STARS

Example with Winter-Run Chinook



5-day forecasted flows & temperature

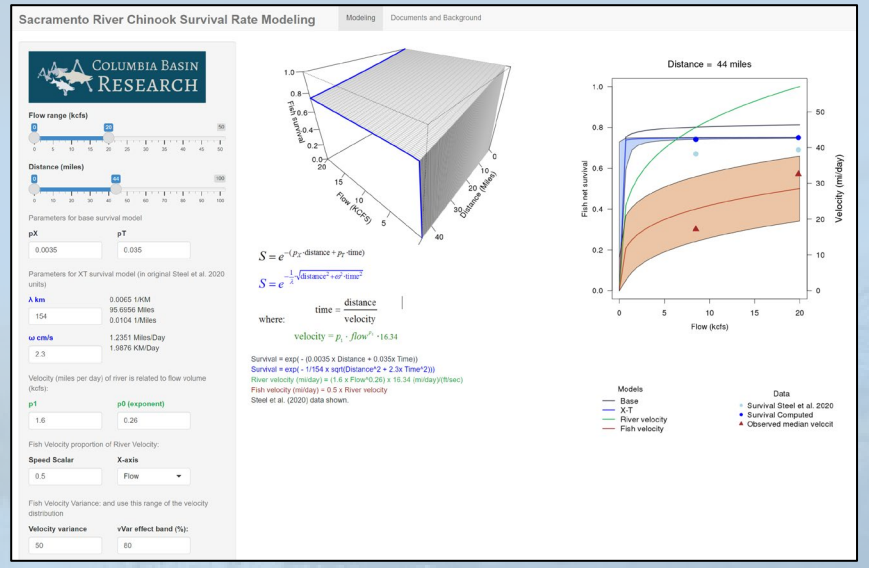
(data from CA NV River Forecast Center)

https://www.cbr.washington.edu/shiny/STARS/

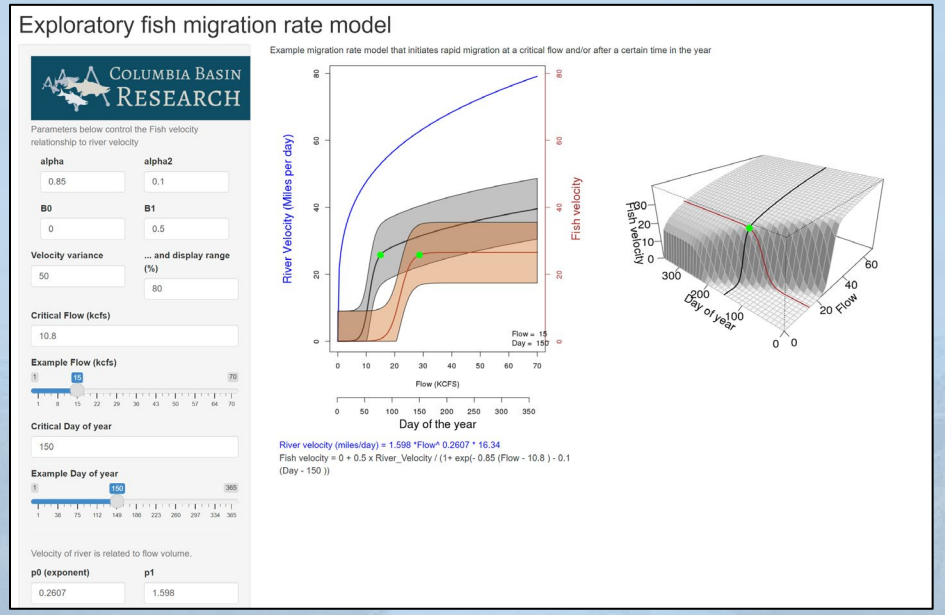
Exploratory Shiny apps

Examples from https://www.cbr.washington.edu/sacramento/tools/

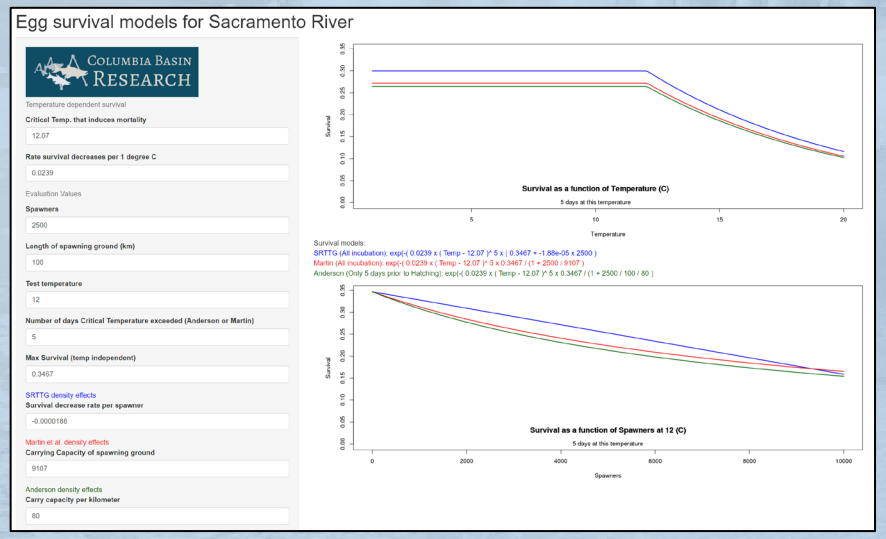
Migration Survival



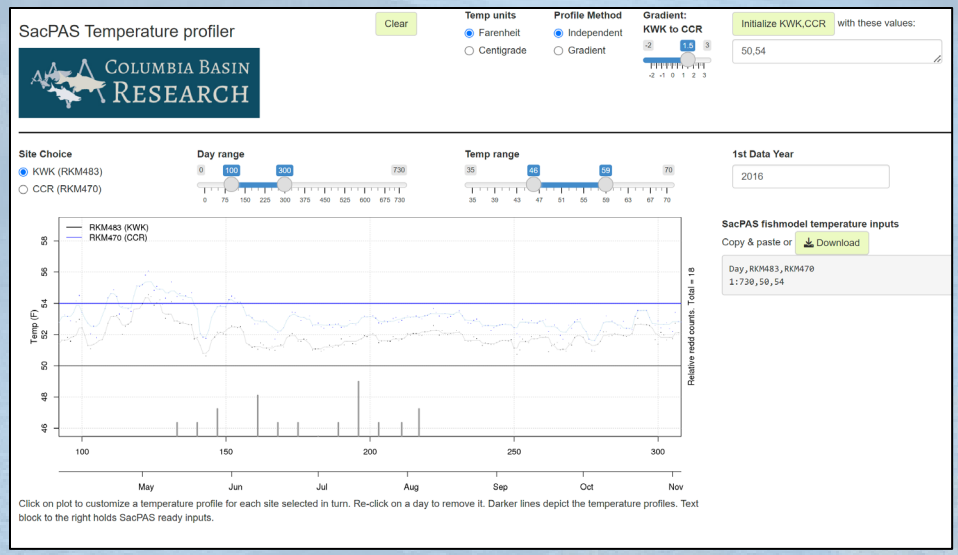
Flow-pulse Migration Rate



Egg Survival



Temperature Profiler for Fish Model



SacPAS tools & services

I. Data Queries & Alerts

- Juvenile Monitoring & Sampling
- Juvenile Salvage & Loss
- Adult Escapement
- Temperature Thresholds
- River Conditions
- Exposure Index
- Weir Overtopping

II. Work Groups & Teams

- Salmon Monitoring Team
- Smelt Monitoring Team
- Stanislaus Watershed Team

III. Models

- Fish Model
  - Egg-to-Fry Model (Anderson et al. 2022)
- Loss & Salvage (Tillotson et al. 2022)
- STARS (Perry et al. 2018; Hance et al. 2021)
- Exploratory tools (Shiny apps)

Assistance in accessing data and addressing knowledge-action gaps

… as we go about our work,

adopt new lenses,

deepen our understanding…

- FAIR & CARE principles
- Online Tools; handouts # 1 & 2
- Mechanistic modeling
- Science communication
- Human-computer interactions; UI/UX

Hello!

web@cbr.washington.edu

- We seek your feedback
  - Errors/bugs
  - Refinement of tools
  - New customized tools
- We look forward to new collaborations

We are grateful for USBR in funding our SacPAS work.

We thank Catarina Pien, Elissa Buttermore, Josh Israel, and many more for their guidance, support, collaboration...