Track 1: Sacramento River Brainstorming Workshop
Notes from Small Workgroup Discussions DRAFT

MEETING DATE & TIME:	May 23, 8:00 am - 2:30 pm
MEETING LOCATION:	Holiday Inn, 300 J St, Sacramento, CA 95814
MEETING OBJECTIVES:	▪ Developing a shared understanding of significant issues ▪ Idea generation around solutions (e.g. suggestions for operational and infrastructure changes, habitat, restoration projects)

For each of the breakout tables, notes reflect the conversations over four small group discussions. Table topics included:

- **Rearing**
- **Spawning**
- **Emigration**
- **Predation**

1. Rearing

(a) Food

- Ideas:
  - *Bioreactor approach*
    - *Grow specific food fish need*
    - *Engineer wetland or even tank*
    - *Pump, inject, release to system*
    - *More control*
  - *Rice fields*
    - *Food for flow*
    - *Expose areas to sunlight*
  - *Frequency and duration of flood inundation*
  - *Oxbows to grow insects*
  - *Study restoration sites food*
  - *Species change in food*
  - *Historic vs. now*
  - *Water pollution*
  - *Floodplain habitat*
  - *Deep and shallow water diversity structure*

(b) Temperature

- Ideas:
    - *Vary temperatures*
        - *56 degrees*
    - *Compliance points for spawning or rearing*
        - *Eggs*
    - *Green sturgeon (longer period)*
    - *Keep in mind temperatures going into Sac River*
    - *Riparian shading for temperatures*
    - *Temperature control on smaller tributaries- Black Butte Stoney*
    - *Focus on temperatures at early life-stage*
        - *Provide for next life stage after emergence*
    - *Winter run in LAR*

(c) Hatchery Influence

- Ideas:
    - *Competition with trout & food/space*
    - *Redding, Delta, Colusa/K2 oxbows*
    - *Study mortality above Colusa*
        - *Winter run stop at middle, why?*
    - *Release strategies driven by survival of hatched fish*
    - *Burden by size, understanding interaction*
    - *Let fish grow to a certain size before releasing*
    - *Active management of floodplain reduction from Shasta*
    - *LSNFH winter run influence*
        - *Studies*
        - *Telemetry*
        - *Life history*

(d) Water Quality

- Ideas:
    - *Contaminants*
    - *Runoff*
    - *Salinity*
    - *Flows to move gravel*
    - *Hot spots (areas to be filtered)*
    - *Cache/Sutter Steamboat Slough*
    - *Rest areas along highway*
    - *Setback levees*

(e) Metrics of Success

- Ideas:
    - *Diversity- understanding effects of productivity*
    - *Monitor juvenile production*
    - *Better locations for quality data*

(f) Connectivity: Non-Natal

- Ideas:
    - *Managing of non-natal habitat*
    - *Tributaries cut off sooner*
    - *Small tributary restoration opportunity*
    - *Flows in the tributaries- Stoney Creek*
    - *Predation refugia*
    - *Volitional passage*
    - *Sutter Bypass/Yolo Bypass*
    - *Redding, Delta, Colusa Oxbows*
    - *Middle Red Bluff down Freeport*
    - *Colusa- levee banks*
    - *Study mortality above Colusa*
    - *Utilizing habits along river*
    - *Fish hungry upstream?*
    - *Studies by TNC*
    - *Tisdale improvement*
    - *Fill holes and flows- get them out*
    - *Weir entrainment study*
    - *Limit entrainment/relocations*
    - *Understanding habitat needs*

(g) Diversity

- Ideas:
    - *Different life stages require different food*
    - *Lacking food in Upper Sac*
    - *Complexity- reduce deserts*

(h) Predation

- Ideas:
    - *Creating habitat for rearing places*
    - *Elevated walkways to keep people away*
- Questions:
    - *Do fish rear in the Delta?*
        - *Is there habitat for rearing?*
    - *What's the goal? To rear in the delta or rivers?*
    - *Different models of banks, what's best?*
    - *How are we changing life history strategy?*

2. Spawning

(a) Substrate

- Ideas:
    - *Target gravel to redd locations*
    - *Pulse flows to mobilize in drier years and attract WR adults*

- *Dewatering- design gravel level for spawning habitat*
- *Gravel*
  - *Gravel enhancement in the coldest areas of river*
  - *Find areas with less human interaction*
  - *More targeted gravel*
    - *Pile on edge*
  - *Barge gravel?*
  - *Gravel ripping*
  - *Need 100,000 cubic yards plus augmentation yearly- for spawning*
  - *Cost but necessary to do for spawning*
  - *More gravel augmentation needed in wet years- more sediment flow*
  - *Dirtying of gravel due to land use (polychetes)*
    - *Lack of flushing flow to clean out the gravel*
    - *Causes disease*
- *Flows to mobilize sediment on gravel*

(b) Temperature

- Ideas:
  - *Managing cold water releases when there are warmer streams inflow until we notice spawning*
    - *Don't worry about downstream- no cold water releases*
  - *Possibility of connecting ground water cooling to cool water (river) stream*
  - *Research on temperature/survival relationships*
  - *Shasta inflow temperature to CWP relationship vs. storage*
  - *Reduce lower Klamath flows*
  - *Real-time management based on redd location*
    - *Wait until we see redd temporal and spatial*
  - *Study the relationship between cold water pool and warm inflow*
  - *Shasta enlargement temperature control wise*
  - *Real time temperature management based on where the redds exist*
    - *Maintain it to Jim Anderson model*
  - *Manage water supply where possible to stabilize flow during winter run*
    - *Fall flow smoothing- reduce dewatering*
  - *Different flow strategies*
    - *Save cold water for egg incubation*
    - *Impacts of messing with other natural phenomenon*
      - *Ex: spawning habitat*
      - *Unintended consequences to species*
      - *Running warmer delays spawning*
      - *Contaminants introduced in the stream from land usage around the spawning area*
  - *Improve coordination between state and federal for temperature control*
    - *Manage releases*

        - *Add flexibility*
    - *Upper Sac regulated all the way to Red Bluff diversion dam*
        - *Flexibility in operations for temperature control*
        - *More temperature compliance upstream*
            - *3 points of monitoring temperatures*
    - *More/ better access to Sutter Bypass*
    - *Dredging Shasta vs. raising Shasta*

(c) Fishing

- Ideas:
    - *Prohibition on people standing on redds to fish during incubation period*
        - *Install boardwalk, etc. for fisherman to stand and fish*
            - *Add signs*
    - *Recreational closure in areas with high WR concentration*
    - *Have the right flow to encourage habitat*
    - *Recreational enclosures to reduce human interaction in incubation area during spawning times*
        - *Educating people*

(d) Re-introduction

- Ideas:
    - *Artificial placement of eggs in the river*
        - *Not at a hatchery*
        - *Increase eggs to try to improve survival rate*
        - *Emergency preparedness for drought years*
    - *Ramp up LVSFH wild fish propagation in hatchery to "protect" action for drought instead of emergency action, plan it*
    - *Upstream introduction- above Shasta Dam*
    - *Passage that isn't through turbines*
    - *Mandate to raise Shasta*
        - *This would flood state and federal reserves*
        - *Modification to TCD*
            - *Reconfigure*
            - *Engineering solution*
            - *Address leakage in gates*
            - *Adding more gates*
            - *Long term/permanent solutions*
            - *Plan/not react*

(e) Non-natal spawning

- Ideas:
    - *Mill, Deer, Battle Creek, Feather, Yuba*

- *Restrict fish at confluence- max capacity*

(f) Depth

- Ideas:
  - *Remove rocks from redds to help dewatering*
    - *"Protect" action during drought*
  - *Manage water supply to minimize fall peak spawning/dewatering*
    - *High peak demand in fall for rice decomposition can spread out*

3. Emigration

- Ideas:
  - *Different alternatives analyzed for dry/temperature critical years to use hatchery for wild fish in combination with above Shasta*
  - *Look at floodplains and structures*
    - *Ex: build on floodplains, open gates*
  - *Have a back-up plan for years fish can't grow/survive below Redding*
    - *Hold fish in hatchery like Yakima fish hatchery does*
  - *Is there more predation near rip-rap vs. bioengineered areas?*
  - *Sedimentation floodplain risk?*
    - *Getting agricultural groups' buy in?*
  - *Could Sites Reservoir be used to assist flows?*
  - *Could a second flow be used to augment a natural flow event?*
    - *If less turbidity triggers/helps migration?*
  - *Fremont fish weir/Sutter & Steamboat entrainment*
  - *Toedrain- is an example of a big issue with passage*
    - *Solution being explored for passage?*
  - *Explore pulse flows for turbidity*
  - *Re-evaluate catch index*
  - *Use different monitoring techniques*
    - *Ex: in cases where low-flow, high-visibility*
  - *DCC- get rid of it or fix it*
  - *Study fish population numbers at/with Wallace Weir, Lisbon Slough, tidal changes*
  - *Make it possible for fish to hug the side of the main stem safely*
    - *Rebuild habitat around it*
    - *Another option- setback levees and riparian habitat*
  - *Remove barriers to fish passage like non-functioning fish ladders*
  - *Prioritize focusing on diversity of fish leaving the system*
    - *Encourage fish to use pathways of migration/emigration off the main stem of the Sac River*
  - *Look at other parts of Upper Sac that could support salmon*
  - *Consider the benefit of creating additional storage/flows*
    - *Like Sites Reservoir*
  - *Maximize rearing so emigration concerns can decrease*

    - *Life stage factor*
        - *Ensure juveniles can pass through barriers that adults can pass through*
            - *Removing fish screens, non-physical barriers*
    - *Hatchery release timing*
- Risks:
    - *Adult fish get stranded in Yolo*
    - *Baseline flow levels change, so have to be mindful of solutions to accommodate this*
        - *Waterfix impact to baseline flows is important to consider*
    - *DCC- timing; whether this will be acceptable*
        - *Ex: no releases on Friday's because boater safety*

4. Predation

- *Ideas:*
    - *Amend Fishing Regulations*
        - *Increase bag limits, decrease size limits on predators*
        - *Establish bounty program to encourage fishing of predators that aren't currently fished, like the program on the Columbia*
        - *Create pike minnow derby program*
        - *Decrease regulations that protect predators*
        - *Some hatchery fish are covered under ESA*
    - *Encourage Cultural Shift*
        - *Shift emphasis from bass to salmon*
        - *Political value of fish – ensure coequal goals and joint priorities*
    - *Identify Habitat Changes and Correlation to Predation Problems*
        - *Improve coverage*
            - *Bioengineering shorelines for escape routes & hiding spots*
            - *Non-natal rearing habitat – improve fry separation – emphasize growing numbers and size of fish before exposed to predators*
                - *True seasonally inundated floodplains, woody debris,*
                    - *Studies conducted in the 1930s showing decrease in fish populations when floodplains were originally leveed off*
            - *Cut in more channels/manipulate bathymetry of river*
        - *Identify and remove/decrease access to hotspots*
            - *Fill scour holes*
            - *Emphasize site-specific solutions*
            - *Keep Chinook away from hotspots, don't limit focus to decreasing predators at hotspots*
        - *Priority corridor diversity*
        - *Increase native predator environmental conditions*
        - *Improve fry separation – emphasize growing numbers and size of fish before exposed to predators*
            - *True seasonally inundated floodplains, woody debris,*

        - *Studies conducted in the 1930s showing decrease in fish populations when floodplains were originally leveed off*
    - *Cut in more channels/manipulate bathymetry of river*
- *Modify structures to minimize predator refuge & access*
    - *Change system hydraulics*
    - *Bridge, dam, intake sites*
    - *Predator exclusion from side channels*
- *Assess effectiveness of different restoration projects and prioritize*
- *Prioritize certain habitat areas*

- *Identify Poaching Issues and Correlation to Predation Problems*
    - *Increase penalties for WRCS*
    - *Education or reporting catches*
        - *Create an app or database, like E-Bird App*
        - *Incentivize participation by providing permit discounts for next year*
    - *Simplify reporting requirements*
- *Use Adaptive Management to target actions for management and restoration*
    - *How to manage, with monitoring*
    - *Collaborate with state partners*
    - *Outreach to base groups to enhance public involvement, for example CA Sportfishing Alliance*
- *Fish Release sites at same place and time enable predation by fish and bird predators*
    - *Rotate release locations, increase number of locations, potentially release off barges*
    - *Have protections in place when releasing*
    - *Monitor where fish travel after release: increased monitoring or telemetry in system*
- *Address Non-Physical Barriers*
    - *Temperature, substrate*
- *Reduce harmful effects and increase beneficial effects of overwater and in-water structures, such as boat docks, gates, weirs*
    - *Identify best practices (Motion lights on pumps instead of lights always on that enable increased predation) and fund to improve infrastructure*
    - *Cut in more channels/manipulate bathymetry of river*
- *Identify comprehensive list of invasive fish: catfish, smallmouth bass, spotted bass, sunfish, hatchery steelhead smelt*
- *Create predator traps*
    - *Artificial hotspots*
    - *Timing peak predator diversity*
    - *Identify netting operations that might work*
- *Assess where the disruption in natural predation is: migration? Spawning?*
- *Emphasize management of the system, not just projects to decrease populations of predators*
- *Assess impact of management and operations on other species*

        - *Ex: impact of resident trout on egg predation – is this a result of steelhead management actions?*
- Risks:
    - *Cultural issues*
    - *Cost*
    - *Rip rap doesn't last near levees*
    - *Need partner for cost of setback levees*
    - *Poaching penalties hard to enforce*
    - *False reporting*
- Studies:
    - *CVPIA studies*
    - *CDFW finding striped bass in floodplains*
    - *DWR mark and recapture study*
    - *Predation removal studies have mixed results*
    - *Manage different parts of Delta*
        - *Bass south of Delta*
    - *Telemetry program*
        - *Study hatchery releases to identify predation hot spots, predators, etc.*
        - *Monitor predator migration*
    - *Chico State studies*
        - *Took gates out of RB so predators can move up*
        - *Identify where, what species*
            - *Bass, resident trout, sea lions*
        - *Hatchery timing, location*
            - *Identify management issues*