Benthic Macroinvertebrate Bioassessment in the San Joaquin River Restoration Area

Presenter:
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Overview

- **Study Approach/Methodology**
- **Preliminary results**
- **Next steps**

Background

- Benthic macroinvertebrates (BMIs) are both bioindicators of stream condition and a food resource for fish.
- BMI communities respond to different types of human disturbance, physical changes in riparian vegetation and instream habitat heterogeneity.
- We do not know whether or not restoration flows will improve physical habitat conditions or elicit changes in the abundance and diversity of BMIs.



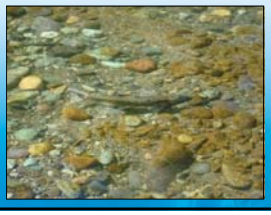
Study Purpose

Purpose and Need

- Benthic macroinvertebrate (BMI) assemblages can be used to indicate water quality and are a primary food source for fish.
- BMI bioassessment will provide information needed to evaluate the impact/benefit of restoration flows on salmonid riverine habitat.

Main objective

- This study addresses habitat objectives set forth in the SJRRP Fisheries Management Plan.
- We have been evaluating the ecological integrity of the Restoration Area as reflected by changes in physical habitat and BMI community composition.



General Approach

Habitat Objective

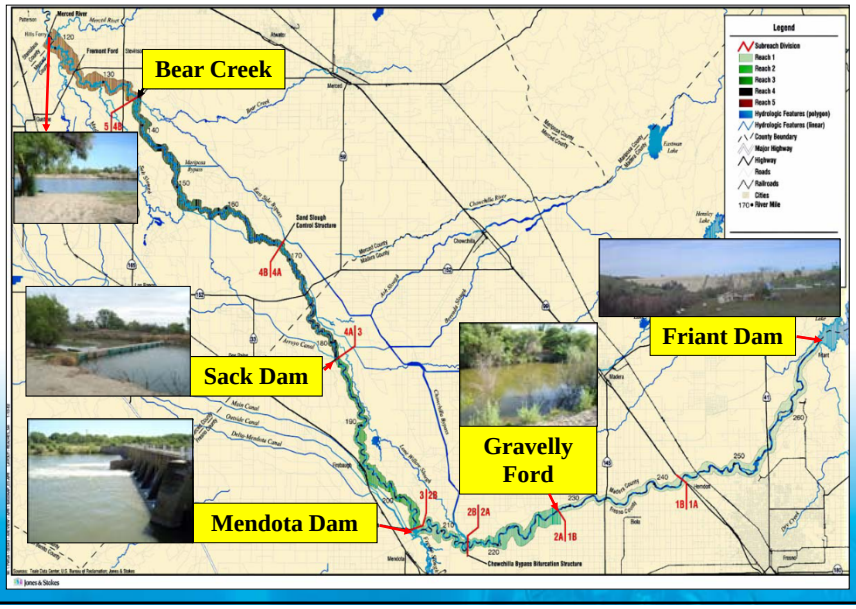
- To determine if the Central Valley Benthic Index of Biotic Integrity for at least 50% of the total target river length show “good condition” (B-IBI= 61-80) or “very good condition” (B-IBI=81-100).
- To ascertain that none of the study sites shows a “very poor condition” (B-IBI=0-20).

Methodology

- Site selection based on Environmental Monitoring and Assessment Program (EMAP) criteria and California’s Surface Water Ambient Monitoring Program (SWAMP) bioassessment procedures
- Physical habitat characterization, sample collection and analysis

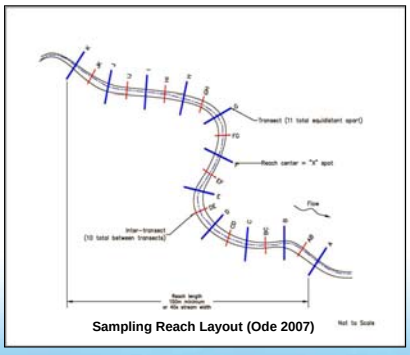


San Joaquin River Program Area



Reconnaissance Surveys

Physical Habitat Characterization



Sampling Reach Layout (Ode 2007)

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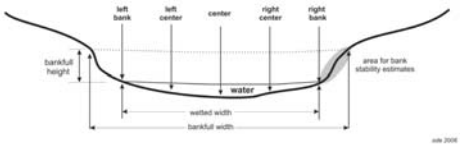
Physical Habitat Characterization (Contd.)

Cross-sectional transect measures



Transect Substrate Measurements

Size Class Code	Size Class Description
RS	bedrock, smooth
RR	bedrock, rough
XB	boulder, large
SB	boulder, small
CB	cobble
GC	gravel, coarse
GF	gravel, fine
SA	sand
FN	fines
HP	hardpan (consolidated fines)
WD	wood
RC	concrete/ asphalt
OT	other

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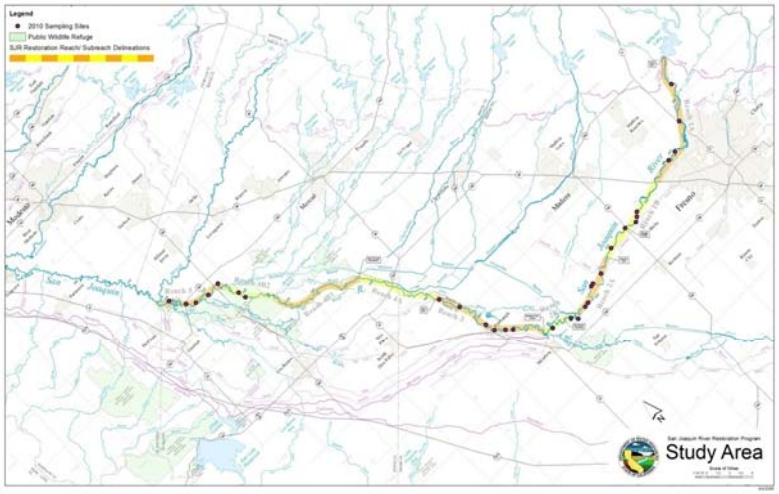
BMI Sample Collection and Analysis

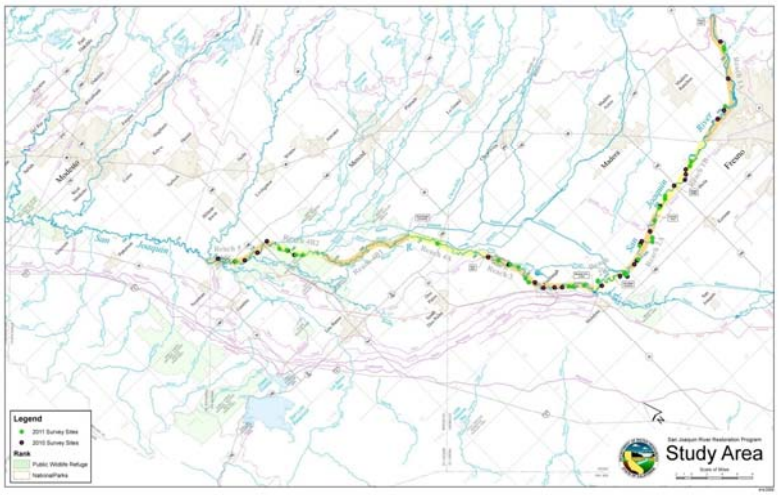
DWR and DFG crew

Aquatic Bioassessment Laboratory

BMI Bioassessment Study Area



BMI Bioassessment Study Sites (2010 and 2011)



Results: Physical Habitat

***In situ* Water Quality measurements**

- Water temperatures during the summer-fall index period in 2010 exceeded recommended thresholds for spring-run Chinook salmon early life stages, except for two sites in Reach 1A. These two sites had the lowest temperatures (12.15˚ C and 15.89˚ C).
- Salinity objectives were exceeded at two sampling sites in Reach 4B1 (1,197 and 1,298µS/cm) and at the three lowermost sites in Reach 5 (1172, 1066 and 1015µS/cm).
- Other measured water quality constituents did not exceed recommended habitat objectives.



Results: Physical Habitat (Contd.)

Bed substrate and bank stability

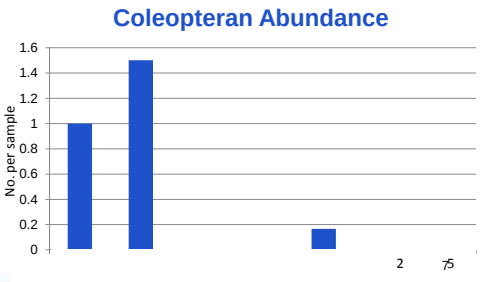
- Cobble substrate was only present in Reach 1A and 1B.
- Fine and coarse gravel substrate became sparse or absent below the San Mateo crossing.
- Sand and fines were predominant throughout the study area.
- Eroded sandy banks dominated all of the study sites in Reach 2A and most sites in Reach 2B.

Flow habitats

- Slow water habitats (pools and glides) dominated fast water habitats (runs and riffles) throughout Reach 2A, 2B, 4B2 and 5.

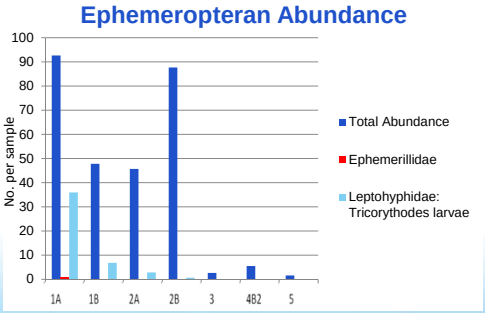


Abundance: Coleoptera



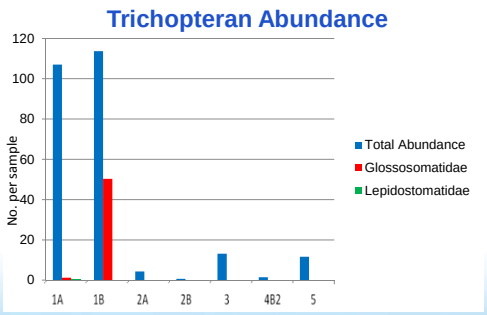
- Coleopterans, commonly known as water beetles, were mostly confined to Reach 1A and 1B.
- Coleopterans did not occur anywhere else downstream, except for one observation in Reach 3.

Abundance: Ephemeropterans



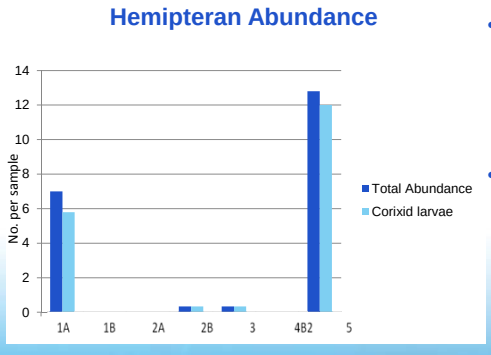
- Ephemeropterans, commonly known as mayflies, include a few sensitive families.
- Two of their families, Ephemerellidae and Leptohyphidae, were predominant in Reach 1A.
- None of these sensitive larvae were recovered at Reaches 4B2 and 5.

Abundance: Trichopterans



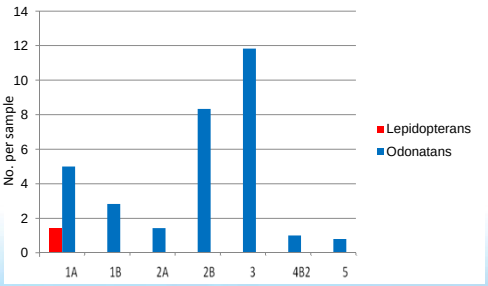
- Trichopterans, commonly known as caddisflies, occurred throughout the study area. However, they were observed in higher numbers in Reaches 1A and 1B.
- The groups with the lowest tolerance occurred mostly or only within Reach 1A and 1B.

Abundance: Hemipterans



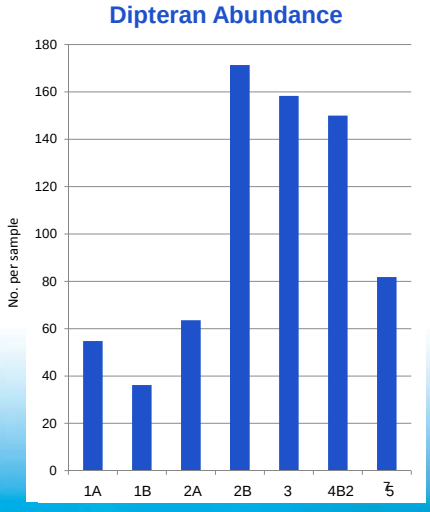
- Hemipterans, also known as true bugs, are considered pollution tolerant and tend to prefer slow water with abundant vegetation.
- Corixid larvae were most abundant in Reach 5.

Abundance: Lepidopterans & Odonatans



- Lepidopterans, also known as aquatic moths, occurred only in Reach 1A.
- Odonatans, also known as dragonflies and damselflies, can be fairly tolerant to environmental degradation. Their benthic larvae occurred throughout the study area.

Abundance: Dipterans



- A large diversity of Dipterans, commonly known as true flies, occurred throughout the study area.
- A few taxa within the Chironomidae family dominated Reaches 2A, 2B and 3.

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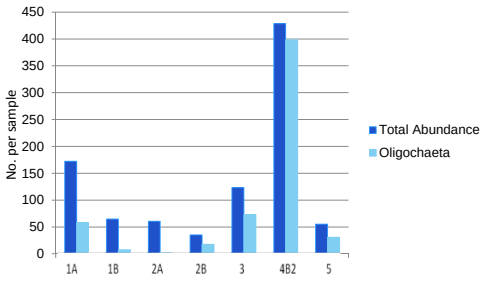
Abundance: Non-insects



- Most non-insects can tolerate water pollution and can live in mud or even low oxygen waters.
- Oligochaeta, also known as segmented aquatic worms, can be found in silty substrate and detritus. Their abundance indicate sedimentation.

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Central Valley Benthic-Index of Biotic Integrity

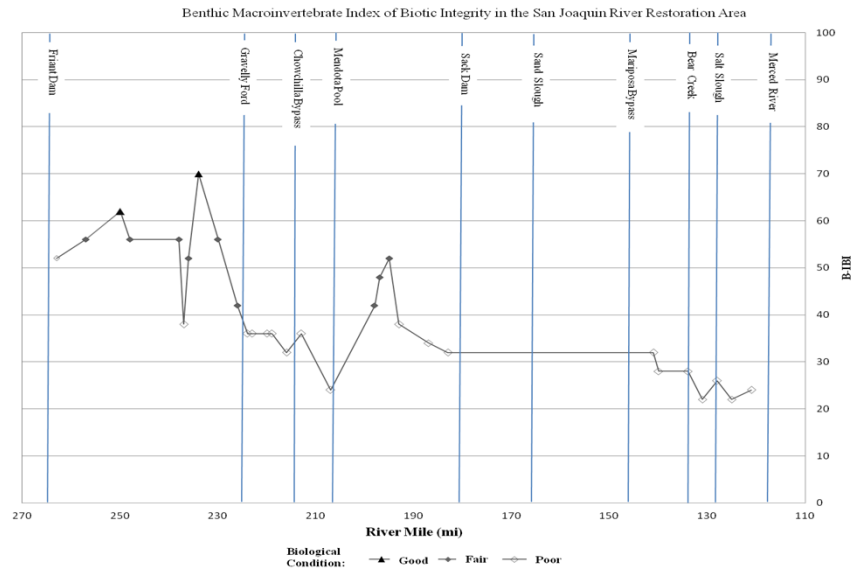
Benthic Index of Biotic Integrity and Component Metics for Benthic Macroinvertebrate Sampling Sites in the San Joaquin River Restoration Area

River Mile	Reach-ID	Collector richness	Predator richness	% EPT taxa	% Clinger taxa	Shannon diversity	Central Valley B-IBI	Biological condition
263	1A-154	7	7	38	36	1.84	52	Fair
257	1A-128	9	8	29	33	1.94	56	Fair
250	1A-144	8	10	28	31	2.62	62	Good
248	1A-132	9	10	31	25	2.21	56	Fair
238	1B-164	8	8	40	29	1.92	56	Fair
237	1B-148	6	5	31	29	1.57	38	Poor
236	1B-105	9	4	44	20	1.95	52	Fair
234	1B-121	9	7	43	40	2.68	70	Good
230	1B-109	9	5	53	31	2.2	56	Fair
226	2A-137	5	7	31	28	1.54	42	Fair
224	2A-129	5	4	40	17	1.29	36	Poor
223	2A-113	6	3	64	22	0.96	36	Poor
220	2A-149	4	5	42	22	1.1	36	Poor
219	2A-133	6	2	50	29	1.08	36	Poor
216	2B-117	5	8	23	0	1.64	32	Poor
213	2B-101	7	5	43	11	1.05	36	Poor
207	2B-125	6	5	14	0	1.73	24	Poor
198	3-134	5	7	17	40	1.83	42	Fair
197	3-106	8	8	21	27	2	48	Fair
195	3-145	6	10	17	27	2.66	52	Fair
193	3-161	6	7	22	25	1.79	38	Poor
187	3-151	4	5	24	40	1.2	34	Poor
183	3-135	6	6	24	25	1.17	32	Poor
141	4B-115	4	4	20	43	1.11	32	Poor
140	4B-136	5	2	22	33	0.64	28	Poor
134	5-120	6	6	16	25	1.22	28	Poor
131	5-104	3	3	22	25	1.26	22	Poor
128	5-186	4	2	18	25	1.67	26	Poor
125	5-139	4	1	25	25	1.17	22	Poor
121	5-143	3	2	17	33	1.31	24	Poor

Key:
B-IBI = Benthic Index of Biotic Integrity
EPT = Ephemeroptera, Plecoptera and Trichoptera

- **Preliminary results:**
  Most of the study sites are in “poor condition” (60%).
- The only two sites with “good condition” occur within Reach 1A and Reach 1B.
- Abundance and distribution of BMI taxa indicate a possible response to relative environmental degradation.

Central Valley Benthic-Index of Biotic Integrity (Contd.)



Next Steps

Applicability

- Results provide spatially-explicit data about potential biological and physical habitat degradation indicators within the Restoration Area.
- The study addresses the need to identify current stream condition and local food sources in the Restoration Area.

Recommendations

- Multivariate analyses could clarify underlying associations between the Central Valley IBI and other multimetric ranking of habitat features.
- By considering benthic and drift survey results, biologists can better understand the prey base and abundance within the Restoration Area.

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Questions?

Partners

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