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# **BDCP Effects Analysis: Preliminary Results of Aquatic Resources**

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Steering Committee Meeting  
July 30, 2010

# Comment Disposition

- Many constructive comments received from multiple sources in response to review of preliminary draft
- Comments have been reviewed, considered, and, where possible, incorporated
- Consultation with agency staff to identify refinements to methods on key issues
- Methods have been refined to reflect comments received
- Disposition of agency comments noted throughout presentation
- Comment response compilation in progress

# Status

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- Preliminary results
- Analysis in progress

# Conclusions to-Date

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- Significant benefits of reduced entrainment to estuarine fish
- Cold water pool and in-stream flow benefits are preserved
- Likely benefit from food production in restored habitat to most covered fish species
- Substantial increase in access to suitable habitat for juvenile rearing located throughout the Delta

# Conclusions to-Date

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- Increased salmonid predation at North Delta intakes. Localized predator control in combination with alternative pathways and habitat benefits would reduce adverse effects
- Collectively, other stressor conservation measures provide additional benefits to covered fish species relative to existing conditions

# Major Ecological Stressor Categories

- Flow
- Food
- Habitat
- Predation
- Entrainment
- Toxics
- Water quality
- Other stressors
- Construction

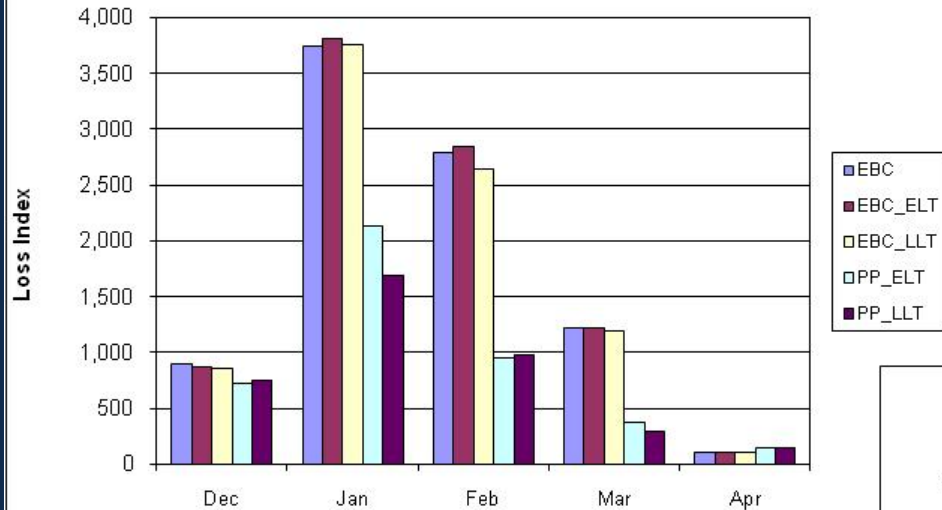
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# DELTA SMELT

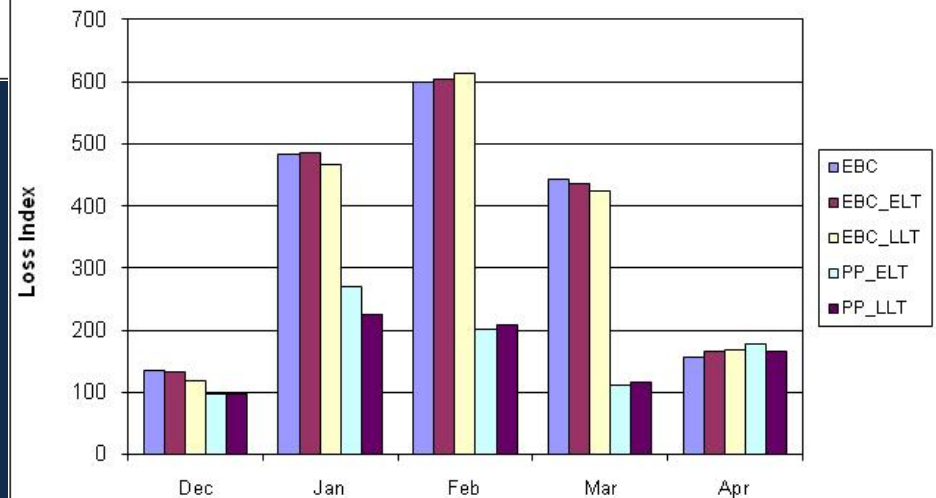
All Results Relative to  
Existing Biological Conditions

# South Delta Entrainment Risk – Adult Delta Smelt

Adult Delta Smelt at SWP



Adult Delta Smelt at CVP





# South Delta

## Results – Entrainment Risk

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- **Larvae:** reduction of 6% to 10%
- **Juvenile**
  - ELT: reduction of 1 to 4%
  - LLT: reduction of 8 to 17%
- **Adult:** reduction of 53-55%

## Results – Fall X2

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- Decrease in Fall X2 habitat under PP relative to EBC
- Conflicting comments have been received as to significance of this effect

# Results – Food Availability

- Chlorophyll production expected to increase significantly from overall hydrologic changes (14% in Suisun Bay alone)
- Additional analysis of foodweb changes from habitat restoration is in progress
- Additional analysis needed to assess magnitude of food contribution (locally and regionally)

# Results - Toxics

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- Variable results to date for effects of water operations on dilution of toxics
- In-Delta reductions due to changed land use
- Biological effects of increased residence time still being evaluated

# Results - Predation

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- Predation
  - Negligible effect at North Delta intakes
  - Reduction in South Delta exports contributes to decrease in predation risk
  - Predator control conservation measure would provide minor benefit

# Results

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- Larval Transport
  - Spring outflow similar in drier years moderately reduced in wetter years
  - Climate change contributes to reduced outflow
- Conservation Hatchery
  - Provides insurance against extinction of wild populations
  - Risk to genetic diversity and fitness
  - Substantial research is required

# Synthesis of Effects on Delta Smelt

## Pros

- Entrainment decreased for all lifestages, very substantially for adults
- Toxics concentrations reduced at Collinsville where delta smelt are most abundant
- Slight benefit from predator control
- Likely benefit from increased food production; still under evaluation
- Conservation hatchery could provide an important genetic refuge

## Cons

- Fall X2 habitat would be substantially reduced in wetter years; conflicting comments received regarding significance
- Toxics concentrations potentially increased in South Delta
- Reduced larval transport in wetter years

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# SALMONIDS

All Results Relative to  
Existing Biological Conditions



# Major Stressors

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- Instream flows and physical habitat
- Exposure to elevated water temperatures
- Migration and attraction flows
- Access to seasonal floodplain and tidal habitat
- Entrainment risk at north and south Delta
- Predation losses at north Delta intakes
- Delta hydrology (OMR and outflow)

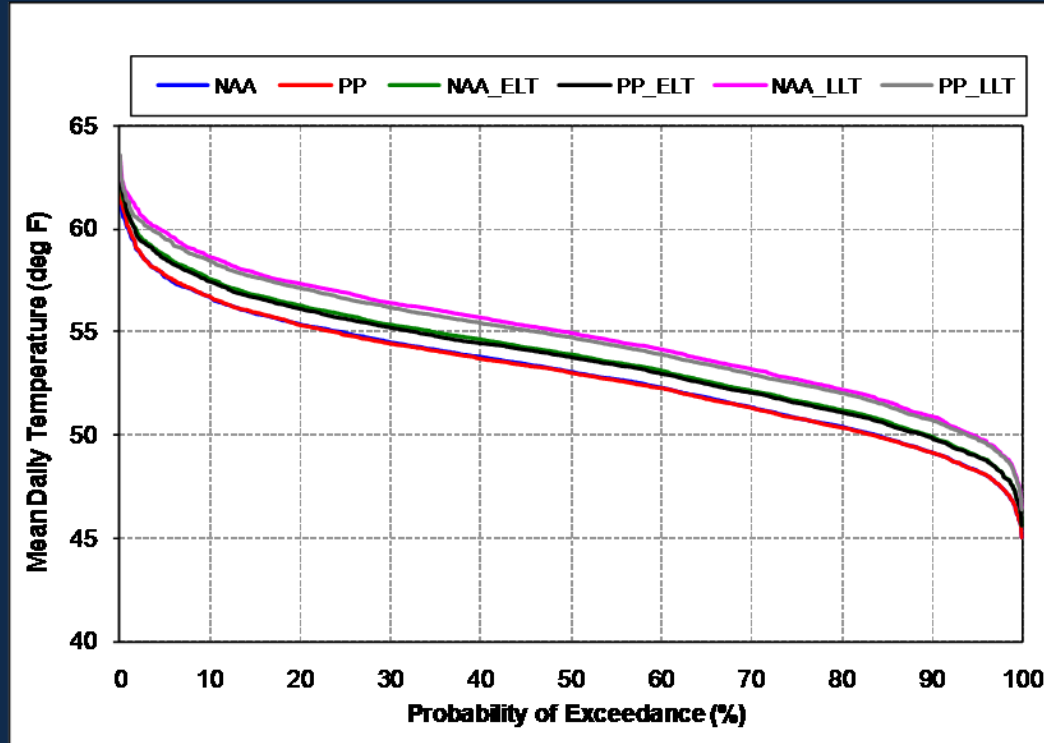
# September Storage Volume (TAF) in Shasta Reservoir

<b>Water Year Type</b>	<b>EBC</b>	<b>EBC ELT</b>	<b>PP ELT</b>	<b>EBC LLT</b>	<b>PP LLT</b>
Wet	3,137	3,020	3,211	2,805	3,026
Above Normal	3,034	2,834	2,910	2,582	2,714
Below Normal	2,857	2,705	2,597	2,518	2,304
Dry	2,407	2,253	2,273	1,944	1,900
Critical	1,181	990	1,108	805	802

# Average Flow (cfs) in the Sacramento River at RBDD During the Juvenile Steelhead Migration Period (January-May)

<b>Water Year Type</b>	<b>EBC</b>	<b>EBC ELT</b>	<b>PP ELT</b>	<b>EBC LLT</b>	<b>PP LLT</b>
Wet	22,040	22,771	23,032	22,997	23,230
Above Normal	15,149	15,303	16,254	15,590	16,115
Below Normal	9,393	9,296	9,861	9,078	9,974
Dry	8,151	8,095	8,340	8,205	8,689
Critical	6,908	6,922	7,051	7,120	7,150

# Sacramento River at Red Bluff Diversion Dam Water Temperature Exceedance For April



# Results - Sacramento River Steelhead Habitat

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- Small changes (+/-) in instream flows and habitat for spawning and rearing
- Instream flows at RBDD comparable
- Shasta September storage similar
- Reduction in adult olfactory cues at Collinsville
- Reduction in Rio Vista adult attraction flows

## Results - Feather River Steelhead Habitat

- September LLT storage greater
- LFC instream flows no difference
- Increase in adult attraction flows

## Results - American River Steelhead Habitat

- September storage similar
- Spawning and rearing flows similar
- Adult attraction/migration flows similar

# Steelhead Habitat in Other Rivers

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- Trinity River – no difference or small improvement
- Clear Creek – no difference
- Stanislaus River – no difference
- San Joaquin River – no difference

# Egg Mortality (%) for Winter-Run Chinook in the Mainstem Sacramento River Based on the Egg Mortality Model

<b>Water Year Type</b>	<b>EBC</b>	<b>EBC ELT</b>	<b>PP ELT</b>	<b>EBC LLT</b>	<b>PP LLT</b>
Wet	0.4	0.8	0.7	1.5	1.5
Above Normal	0.4	0.9	1.0	2.1	2.3
Below Normal	0.9	1.3	1.5	1.8	4.0
Dry	1.8	3.1	3.0	7.4	8.0
Critical	29.0	49.7	42.7	71.2	69.5



# Winter-Run Chinook Salmon Juvenile Production Estimates Based on SALMOD

	<b>EBC</b>	<b>EBC ELT</b>	<b>PP ELT</b>	<b>EBC LLT</b>	<b>PP LLT</b>
Average number produced	3,776,827	3,666,881	3,729,442	3,522,375	3,506,450
Minimum	703,344	59,877	94,234	13,459	8,809
Maximum	4,199,200	4,348,962	4,339,058	4,355,292	4,188,346

# Results - Sacramento River Winter-Run Chinook

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- Decrease in frequency of good spawning habitat
- Egg mortality similar
- Substantial increase in egg mortality in critical years for both EBC and BDCP
- Reduced risk of redd dewatering
- Juvenile production generally similar
- Reduction in Sacramento River flow at Rio Vista and reduced adult attraction

# Egg mortality (%) for Spring-Run Chinook in the Mainstem Sacramento River

<b>Water Year Type</b>	<b>EBC</b>	<b>EBC ELT</b>	<b>PP ELT</b>	<b>EBC LLT</b>	<b>PP LLT</b>
Wet	8.9	14.0	17.3	24.8	34.7
Above Normal	9.8	16.0	21.5	35.0	43.4
Below Normal	11.8	21.1	23.5	41.3	53.6
Dry	22.5	40.7	37.1	76.4	75.1
Critical	71.2	92.1	85.2	96.3	96.2

# Summary of Source Water Fingerprinting for Spring-Run Upstream Migration

Proportion of water at Collinsville originating in Sacramento River during peak upstream migration period (April-May)

	<b>EBC</b>	<b>EBC ELT</b>	<b>PP ELT</b>	<b>EBC LLT</b>	<b>PP LLT</b>
April	77	76	68	75	66
May	70	69	64	66	62

# Results - Sacramento River Spring-Run Chinook

- Increased egg mortality in wet, above normal, and below normal years
- Highest egg mortality among salmonids
- LLT egg mortality 96% under both EBC and BDCP
- Juvenile rearing habitat similar
- Olfactory cues reduced
- Attraction flow at Rio Vista reduced in wet, above normal, and below normal years; increased in dry and critical years

# Results Spring-Run Chinook Habitat in Other Rivers

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- Trinity River: no difference
- Feather River: LFC no difference, similar or increased adult attraction flows
- San Joaquin River: no difference in instream flow for juveniles or adult migration; increased olfactory cues

# Results - Delta Cross-Channel

- Juvenile salmonid survival higher for early and late migrants (increased temporal diversity of migration)
- Reduced attraction and straying of adult Sacramento River salmonids to San Joaquin River and tributaries
- Increased juvenile salmonid migration into Georgiana Slough without a non-physical barrier

# Results - Non-Physical Barriers

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- Reduced juvenile salmonid migration into interior Delta
- Increased juvenile survival
- May result in increased vulnerability to predation
- Limited testing



## Results - Seasonal Floodplain (Yolo Bypass)

- Substantial increase in frequency and duration of access
- Expected increase in juvenile survival, growth, and food supply
- Benefits limited to salmonids produced in Feather and upper Sacramento rivers
- Potential short-duration exposure to small increase in methylmercury concentration
- Alternative migratory pathway that avoids exposure to North Delta intakes, Delta Cross-Channel, and Georgiana Slough
- Improved fish passage for upstream migrants

# Results - Tidal Wetlands – Cache Slough, Mokelumne/Cosumnes, South Delta

- Substantial increase in shallow-water low-velocity juvenile salmonid rearing habitat
- Potential benefit to all Central Valley salmonids;
- Uncertainty regarding food production, juvenile growth, and survival
- Increased predation losses
- Short-duration exposure to small increase in methylmercury concentration (Cache Slough only)
- Local reduction in potential exposure to pesticides

# Results - Suisun Marsh Tidal Wetlands

- Substantial increase (>16,000 acres) in shallow-water low-velocity juvenile salmonid rearing habitat
- Potential benefit to all Central Valley salmonids
- Uncertainty regarding magnitude of benefits
- Located in highly productive region of estuary

# Results - Delta Rearing

- Improved OMR reverse flows in wet, above normal, and below normal years
- No significant change in dry and critical years
- Improved Delta hydrodynamics and net downstream flow

## Results - Net Delta Outflow

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- Survival of juvenile salmonids not strongly related to Delta outflow
- Change in Delta outflow not expected to significantly reduce survival

# Additional Results

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- Entrainment
- Predation
- Toxics
- Population modeling
- Other species

# Next Steps

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- Continue to address comments
- Present results and receive comments on remainder of analysis
- Hold additional technical meetings with knowledgeable experts
- Conduct roll-up analysis and document conclusions for transparency
- Complete Chapter 5, Effects Analysis