



# DELTA FISH EFFECTS TESTIMONY



## OVERVIEW OF TESTIMONY

- **INTRODUCTION**
- **DELTA SMELT AND LONGFIN SMELT**
- **SALMONIDS AND GREEN STURGEON**
- **BDCP-COVERED SPECIES AND OTHER AQUATIC SPECIES OF PRIMARY MANAGEMENT CONCERN**



## INTRODUCTION

- **Testimony based on CWF FEIR/S, BA, ITP Application, USFWS and NMFS BOs, ITP, other materials**
- **Effects analyses reflected extensive collaboration, review, and feedback provided by USFWS, NMFS, DFW, DWR, and Reclamation**



# INTRODUCTION

- **Many biological models**
  - Comparisons of scenarios (not absolute predictions)
  - Weight of evidence from multiple models
  - Limited ability to capture real-time operations



# OVERVIEW OF OPINIONS



## OPINIONS: DELTA SMELT AND LONGFIN SMELT

- **Construction effects avoided, minimized, and mitigated**
- **Maintain or potentially increase protection from South Delta entrainment risk**
- **NDD screening and habitat restoration mitigating potential restricted access to upstream areas**
- **Protection of Delta Smelt fall rearing habitat**
- **Spring outflow criteria protection for Longfin Smelt**
- **Delta habitat changes limited or mitigated**



## OPINIONS: SALMONIDS/GREEN STURGEON

- **Construction effects avoided, minimized, and mitigated**
- **Maintain or potentially increase protection from South Delta entrainment risk**
- **NDD screening and numerous pre- and post-construction studies**
- **NDD bypass flow criteria, real-time operational adjustments, and mitigation**
- **Head of Old River Gate to protect San Joaquin River basin salmonids**
- **Limit or mitigate potential changes in habitat suitability**
- **Protection of unlisted salmonids and Pacific Salmon EFH**



## OPINIONS: UNLISTED FISHES COVERED BY BDCP AND OTHER AQUATIC SPECIES OF PRIMARY MANAGEMENT CONCERN

- **General protection of other unlisted fishes and other aquatic species of primary management concern**





# DELTA SMELT AND LONGFIN SMELT



## DELTA SMELT AND LONGFIN SMELT

- **Construction**
- **South Delta entrainment**
- **North Delta Diversions**
- **Delta Smelt fall rearing habitat**
- **Longfin Smelt spring outflow**
- **Other habitat effects**



## CONSTRUCTION EFFECTS AVOIDED, MINIMIZED, AND MITIGATED

- **Primary protective measure: in-water work windows**
- **Little spatial overlap at any time of the year**
- **Environmental commitments, avoidance and minimization measures, and conservation measures to limit potential effects**
- **Shallow water/tidal habitat restoration: 1,828 acres to offset losses (prior to losses)**



## MAINTAIN OR POTENTIALLY INCREASE PROTECTION FROM SOUTH DELTA ENTRAINMENT RISK

- **Protective OMR flow criteria of 2008-09 BiOps**
- **NDD → Less South Delta pumping → Potential for less entrainment**



# MAINTAIN OR POTENTIALLY INCREASE PROTECTION FROM SOUTH DELTA ENTRAINMENT RISK

### Adult migration December-March

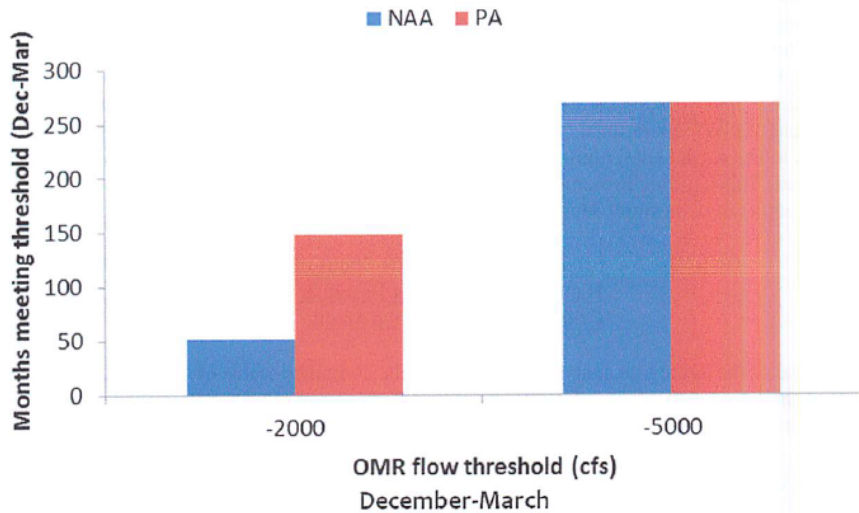


Figure 9.2.3.3.4-12. Comparison of the frequency of months that the NAA and PA were modeled to meet two OMR flow thresholds during the delta smelt adult migration period (December-March). Each month was modeled 82 times for a potential maximum frequency of 82 months times a four month period or 328 on the y-axis.

### Larval and juvenile transport March-June

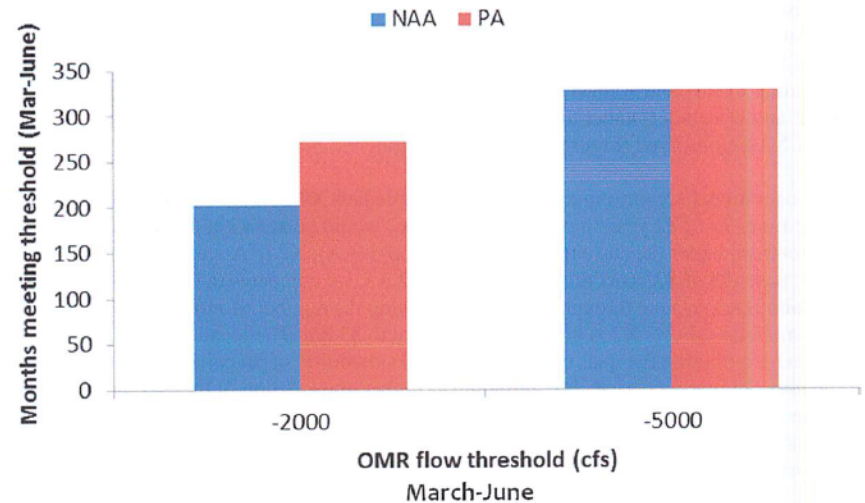


Figure 9.2.3.3.2-1. Comparison of the frequency of months that the NAA and PA were modeled to meet two OMR flow thresholds during the delta smelt larval and juvenile transport period (March-June). Each month was modeled 82 times for a potential maximum frequency of 82 months times a four month period or 328 on the y-axis.



## MAINTAIN OR POTENTIALLY INCREASE PROTECTION FROM SOUTH DELTA ENTRAINMENT RISK

- **Generally reduced entrainment potential for Longfin Smelt**
  - Real-time management to avoid/minimize effects from potential increased entrainment (HOR Gate operations) suggested by some modeling



## NDD SCREENING AND HABITAT RESTORATION MITIGATING POTENTIAL RESTRICTED ACCESS TO UPSTREAM AREAS

- **NDD fish screens design**
  - 1.75-mm opening (prevents entrainment of smelts > 21-22 mm)
  - 0.2 ft/s approach velocity (USFWS-recommended criterion) to limit screen contact injury potential
  - Suite of pre- and post-construction studies
- **NDD upstream of main smelt range**
- **Potential passage restriction → ~1,750 acres mitigation**



## PROTECTION OF DELTA SMELT FALL REARING HABITAT

- **CWF includes Fall X2 criteria (USFWS 2008 BO)→Abiotic rearing habitat extent similar between NAA and CWF**
- **USFWS BO included analysis of spring/summer rearing habitat (X2)**
  - CWF adaptive management program to address uncertainty in summer rearing habitat
    - Addresses potential H3+ reduction in summer (August)
  - Other processes (Delta Smelt Resiliency Strategy and reinitiation of 2008-09 BiOps consultation)





## SPRING OUTFLOW CRITERIA PROTECTION FOR LONGFIN SMELT

- **Positive relationship between winter/spring Delta outflow (X2) and abundance indices**
- **Spring outflow criteria developed in coordination with DFW to minimize potential long term changes in outflow**

**Table 4.2-13. Mean Annual Longfin Smelt Relative Abundance Index (Fall Midwater Trawl Survey), Estimated from General Linear Model Based on Mean January–June X2<sup>1</sup>, Grouped by Water Year Type, Comparing PP with Longfin Smelt Spring Outflow Criteria to NAA.**

Water Year Type	NAA	PP (With Longfin Smelt Spring Outflow Criteria)	PP (With Longfin Smelt Spring Outflow Criteria) vs. NAA <sup>2</sup>
Wet	770	759	-11 (-1%)
Above Normal	390	390	0 (0%)
Below Normal	125	132	7 (6%)
Dry	107	107	1 (0%)
Critical	42	42	0 (-1%)



## DELTA HABITAT CHANGES LIMITED OR MITIGATED

- **Water temperature: little difference (atmospheric conditions)**
- **Turbidity: sediment reintroduction plan to mitigate sediment entrainment at NDD**
- ***Microcystis*: little potential for effect (Dr. Bryan testimony)**
- **Selenium: little potential for effect**
- **Food web material entrainment at NDD: Little effect (in situ production, less south Delta pumping, and potential for greater SJR contribution)**



# SALMONIDS AND GREEN STURGEON



## SALMONIDS AND GREEN STURGEON

- **Construction**
- **South Delta entrainment**
- **North Delta Diversions**
- **Head of Old River Gate**
- **Habitat suitability**
- **Unlisted salmonids and Pacific salmon Essential Fish Habitat**



## CONSTRUCTION EFFECTS AVOIDED, MINIMIZED, AND MITIGATED

- **Primary protective measure: in-water work windows**
- **Environmental commitments, avoidance and minimization measures, and conservation measures to limit effects**
  - Addresses potential overlap (primarily Steelhead adults and Green Sturgeon juveniles)
- **Habitat restoration to offset losses: tidal perennial (154.8 acres); channel margin (4.3 miles) (prior to losses)**



## MAINTAIN OR POTENTIALLY INCREASE ENTRAINMENT PROTECTION FROM SOUTH DELTA ENTRAINMENT

- **Protective OMR flow criteria of 2008-09 BiOps**
- **NDD → Less South Delta pumping → Potential for less entrainment**



## NDD SCREENING AND NUMEROUS PRE- AND POST-CONSTRUCTION STUDIES

- **NDD fish screens design**
  - 1.75-mm opening (NMFS salmonid fry standard)
  - 0.2 ft/s approach velocity (more protective than 0.33 ft/s NMFS fry standard)
  - Sweeping velocity  $\geq 2 \times$  approach velocity (DFW standard)
- **Pre- and post-construction studies to reduce uncertainty in potential effects**



# NDD SCREENING AND NUMEROUS PRE- AND POST-CONSTRUCTION STUDIES

Table 2-163. Estimated Proportion of No Adversely Impacts at the NDD Intake Screens on Juvenile Salmonids (50% of Population Exposed to Screens).

Run/Species	Probability of no entrainment at one screen	Probability of no screen injury at one screen	Probability of no screen mortality at one screen	One Intake: probability of no injury or mortality occurring	Three Intakes: Probability of no injury or mortality occurring
WRCS	99.988%	98.75%	98.15%	96.91%	91.02%
SRCS	99.988%	98.75%	98.15%	96.91%	91.02%
FRCS	99.646%	98.75%	98.15%	96.58%	90.09%
LFRCS	97.271%	98.75%	98.15%	94.28%	83.80%
RBT/SH	99.28%	98.75%	98.15%	96.22%	89.10%

Table 2-164. Analysis of Population Proportion Screen Exposure.

Run/Species	Probability of no entrainment at one screen (%)	Probability of no screen injury at one screen (%)		Probability of no screen mortality at one screen (%)		One Intake: probability of no injury or mortality occurring (%)		Three Intakes: Probability of no injury or mortality occurring (%)	
		33% <sup>1</sup>	25% <sup>1</sup>	33%	25%	33%	25%	33%	25%
WRCS	99.988	99.175	99.375	98.779	99.075	97.95	98.44	93.98	95.40
SRCS	99.988	99.175	99.375	98.779	99.075	97.95	98.44	93.98	95.40
FRCS	99.646	99.175	99.375	98.779	99.075	97.62	98.11	93.02	94.43
LFRCS	97.271	99.175	99.375	98.779	99.075	95.29	95.77	86.53	87.84
RBT/SH	99.28	99.175	99.375	98.779	99.075	97.26	97.75	92.00	93.39

Notes:

<sup>1</sup>Percentage of population exposed to screens





# NDD SCREENING AND NUMEROUS PRE- AND POST-CONSTRUCTION STUDIES

## Pre-construction

- |   |  |
|---|--|
| 1. Site Locations Lab Study                   | 9. Predator Density and Distribution                                     |
| 2. Site Locations Mathematical Modeling Study | 10. NDD Intake Reach Listed Juvenile Chinook Salmon Survival Rates       |
| 3. Refugia Lab Study                          | 11. Baseline Smelts Survey   |
| 4. Refugia Field Study                        | 12. Through-Delta Baseline Listed Juvenile Chinook Salmon Survival Rates |
| 5. Predator Habitat Locations                 | 13. Monitoring Sacramento River Reverse Flow                             |
| 6. Predator Reduction Methods                 | 14. Delta Smelt Life Cycle Model   |
| 7. Flow Profiling Field Study                 | 15. Longfin Smelt Life Cycle Model                                       |
| 8. Deep Water Screens Study                   | 16. Winter- and Spring-Run Chinook Salmon Life Cycle Models              |

## Post-construction

- |  |  |
|--|--|
| 1. Hydraulic Screen Evaluations to Set Baffles | 9. Predator Density and Distribution   |
| 2. Long-term Hydraulic Screen Evaluations      | 10. NDD Intake Reach Listed Juvenile Chinook Salmon Survival Rates               |
| 3. Periodic Visual Inspections                 | 11. Postconstruction Smelts Survey   |
| 4. Velocity Measurement Evaluations            | 12. Through-Delta Postconstruction Listed Juvenile Chinook Salmon Survival Rates |
| 5. Refugia Effectiveness                       | 13. Monitoring Sacramento River Reverse Flow                                     |
| 6. Sediment Management                         | 14. Delta Smelt Life Cycle Model   |
| 7. Evaluation of Screen Impingement            | 15. Longfin Smelt Life Cycle Model   |
| 8. Screen Entrainment                          | 16. Winter- and Spring-Run Chinook Salmon Life Cycle Models                      |



## NDD BYPASS FLOW CRITERIA, REAL-TIME OPERATIONAL ADJUSTMENTS, AND MITIGATION

- **Bypass flow criteria and real-time operational adjustments informed by fish monitoring**
- **Georgiana Slough barrier and tidal habitat restoration**
- **Adaptive management of post-construction study findings/monitoring**
- **Addresses potential for reduced survival at/downstream of NDD**
  - Less flow → reduced survival (e.g., longer travel time)
  - Predation losses at NDD



## HEAD OF OLD RIVER GATE TO PROTECT SAN JOAQUIN RIVER BASIN SALMONIDS

- **HOR Gate will keep more juvenile listed salmonids (and flow) in the main stem San Joaquin River**
  - Greater survival potential
  - Design to limit predation risk
- **Maintains fall dissolved oxygen for upmigrating adult salmonids**



## LIMIT OR MITIGATE POTENTIAL CHANGES IN HABITAT SUITABILITY

- **Riparian and wetland bench inundation**
  - 4.3 miles channel margin restoration to mitigate potential reduced inundation
- **Water temperature: little difference (atmospheric conditions)**
- **Selenium: less than significant**
- **Olfactory cues for upstream migration: less than significant**
- **Delta outflow (sturgeon year class strength)**
  - NAA and H3+ similar
  - Uncertainty to be reduced prior to full operation



## PROTECTION OF UNLISTED SALMONIDS AND PACIFIC SALMON EFH

- **NMFS BO Fall-/Late fall-run Chinook Salmon analysis:**
  - Prey base for listed Southern Resident Killer Whale
  - Surrogate for listed salmonids
  - Inform EFH analysis
- **Similar issues as listed salmonids → generally same analysis methods**



## PROTECTION OF UNLISTED SALMONIDS AND PACIFIC SALMON EFH

- **Construction effects limited by in-water work windows, avoidance and minimization measures, and habitat restoration**
- **Potential for less south Delta entrainment**
- **Protection from potential for reduced survival from NDD by:**
  - Bypass flow criteria and real-time management
  - Environmental commitments (habitat restoration, Georgiana Slough barrier, predatory fish relocation)



# BDCP-COVERED SPECIES AND OTHER AQUATIC SPECIES OF PRIMARY MANAGEMENT CONCERN



## BDCP-COVERED SPECIES AND OTHER AQUATIC SPECIES OF PRIMARY MANAGEMENT CONCERN

- **BDCP-covered species: White Sturgeon, Sacramento Splittail, Pacific and River Lamprey**
- **Other species: Striped Bass, American Shad, Largemouth Bass, Sacramento Tule Perch, Threadfin Shad, Bay Shrimp**





## GENERAL PROTECTION OF OTHER UNLISTED FISHES AND OTHER AQUATIC SPECIES OF PRIMARY MANAGEMENT CONCERN

- **Similar issues to listed fish, unlisted salmonids, and Pacific salmon EFH**
  - Avoidance/minimization/mitigation of construction effects
  - Limited operational effects (e.g., less south Delta exports, NDD screening)
- **Minor differences between NAA and CWF H3/H4 from flow-abundance relationships**



## GENERAL PROTECTION OF OTHER UNLISTED FISHES AND OTHER AQUATIC SPECIES OF PRIMARY MANAGEMENT CONCERN

- **Striped Bass and American Shad egg/larval entrainment at NDD**
  - Most spawning upstream of NDD
    - Striped Bass eggs/larvae drift downstream to Delta
    - Many American Shad rear upstream
  - Some protection from spring flow criteria (less exports)