Analytical Framework and Consultation Approach

Jana Affonso, Assistant Field Supervisor - Endangered Species

Jeopardy

* Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

Adverse Modification

* Section 7(a)(2) of the ESA requires that Federal agencies insure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat.

* The regulatory definition of "destruction or adverse modification" was revised on February 11, 2016 (81 FR 7214).

* "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

Analytical Framework: Jeopardy

(1) the **Status of the Species**, which describes the rangewide condition of the species, the factors responsible for that condition, and its survival and recovery needs;

(2) the **Environmental Baseline**, which analyzes the condition of the species in the Action Area, the factors responsible for that condition, and the relationship of the Action Area to the survival and recovery of the species;

(3) the **Effects of the Action**, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and

(4) the **Cumulative Effects**, which evaluates the effects of future, non-Federal activities in the Action Area on the species.

Analytical Framework: Adverse Modification

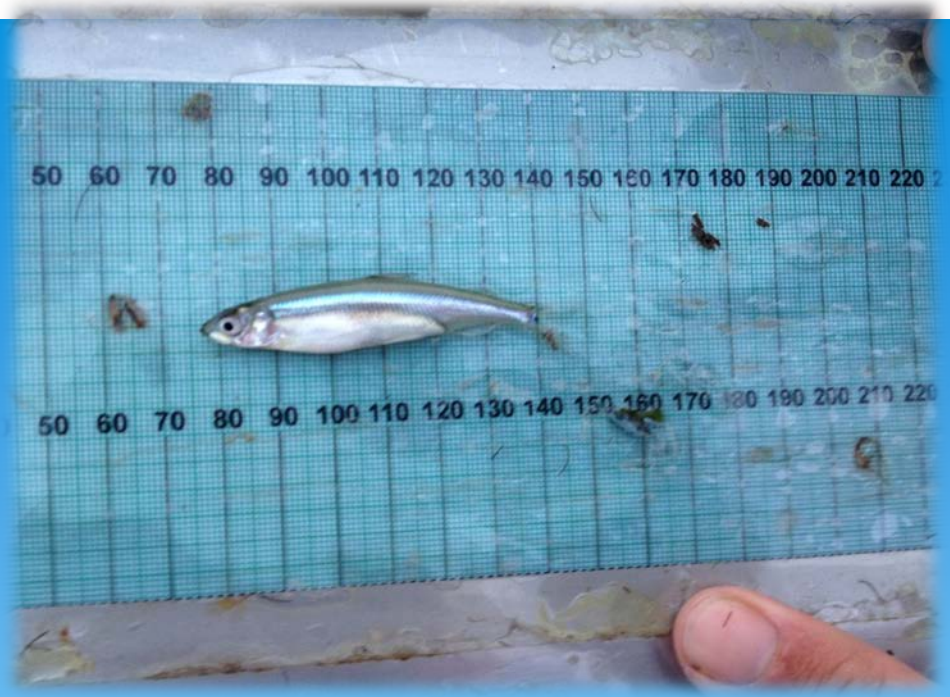
* (1) the **Status of Critical Habitat**, which describes the range-wide condition of the critical habitat in terms of the key components that provide for the conservation of the listed species, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the listed species;
* (2) the **Environmental Baseline**, which analyzes the condition of the critical habitat in the Action Area, the factors responsible for that condition, and the value of the critical habitat in the Action Area for the conservation/recovery of the listed species;
* (3) the **Effects of the Action**, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the conservation value of the affected critical habitat; and
* (4) **Cumulative Effects**, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the Action Area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the conservation value of the affected critical habitat.

Key Points

* Range-wide or designation-wide
* Importance of action area
* Critical habitat: conservation role

CWF Consultation Approach

* Mixed programmatic action, as defined in 50 CFR 402.03.
* Subsequent consultations will be initiated by either Reclamation or the Corps (depending on the specific project element)
* Reinitiation triggers



Delta Smelt and its Critical Habitat: Status and Baseline

Matt Nobriga, Assistant Field Supervisor

Modeling and Water Operations Program

Definitions

* Action Area = Locations affected by the Proposed Action
* Designated Critical Habitat = Locations the Service determined were necessary to the recovery of delta smelt
* Permanent habitat = places delta smelt always occupy
* Seasonal habitat = places delta smelt occupy every (or nearly every) year during the wet season which includes the reproductive season
* Transient habitat = places delta smelt have sometimes been observed
* Environmental Baseline: all previous and current impacts, changes, regulations and other environmental conditions affecting delta smelt at the time of consultation

Things a science panel should know

* The analytical work is in the BA; the BiOp is simple, often qualitative interpretations of the information in the BA (in light of our understanding of the literature)

* The Service's LCMs are not developed to a point they could be used for the CWF consultation

* Kenny Rose did not have time to vet CALSIM II-based alternatives in his LCM

Individual-Based Modeling of Delta Smelt Population Dynamics in the Upper San Francisco Estuary: I. Model Description and Baseline Results

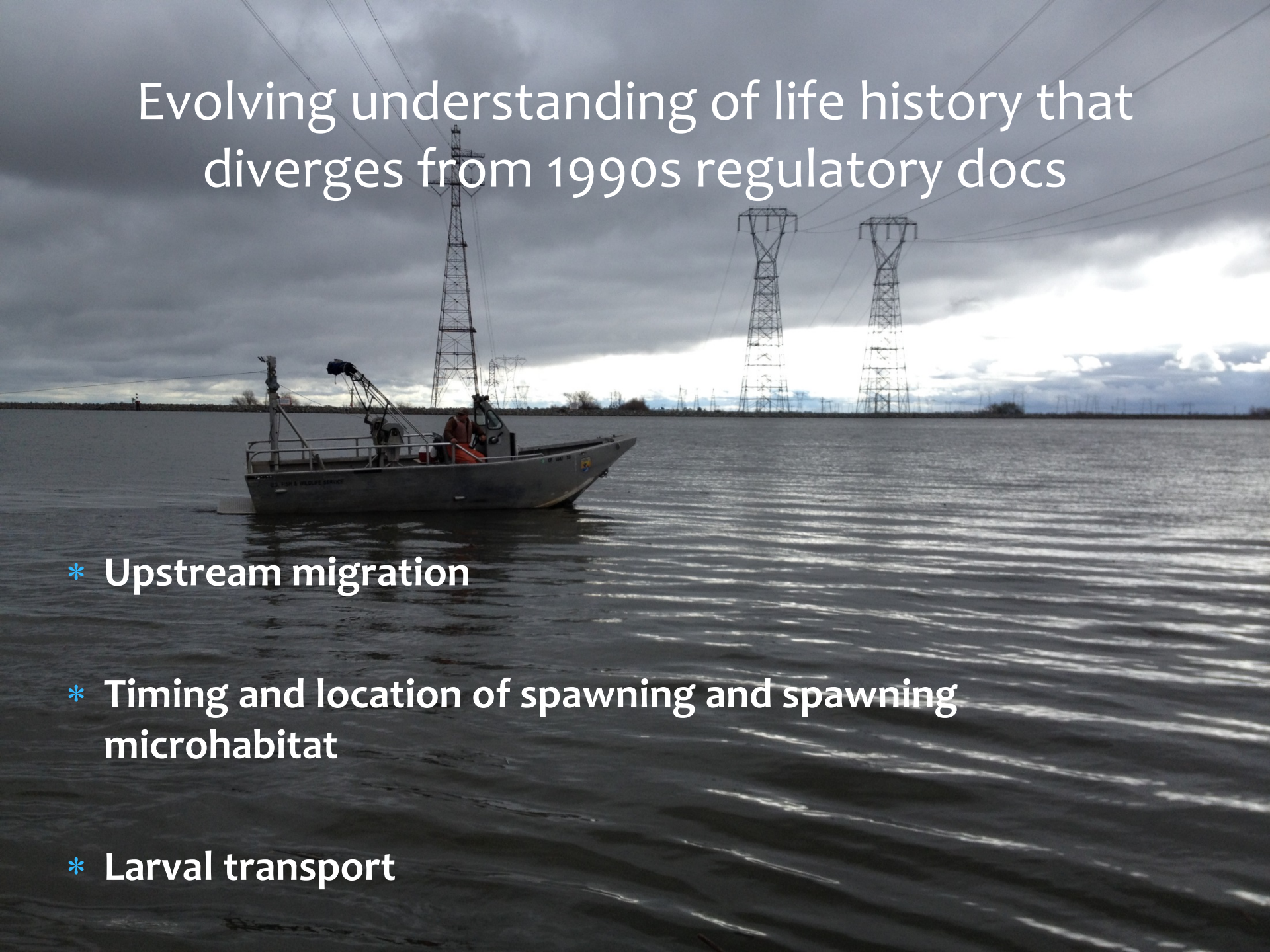
Kenneth A. Rose [a], Wim J. Kimmerer [b], Karen P. Edwards [c] & William A. Bennett [d]

Punchlines

* Status of delta smelt: endemic annual fish at very low abundance; may be increasingly reliant on wet conditions

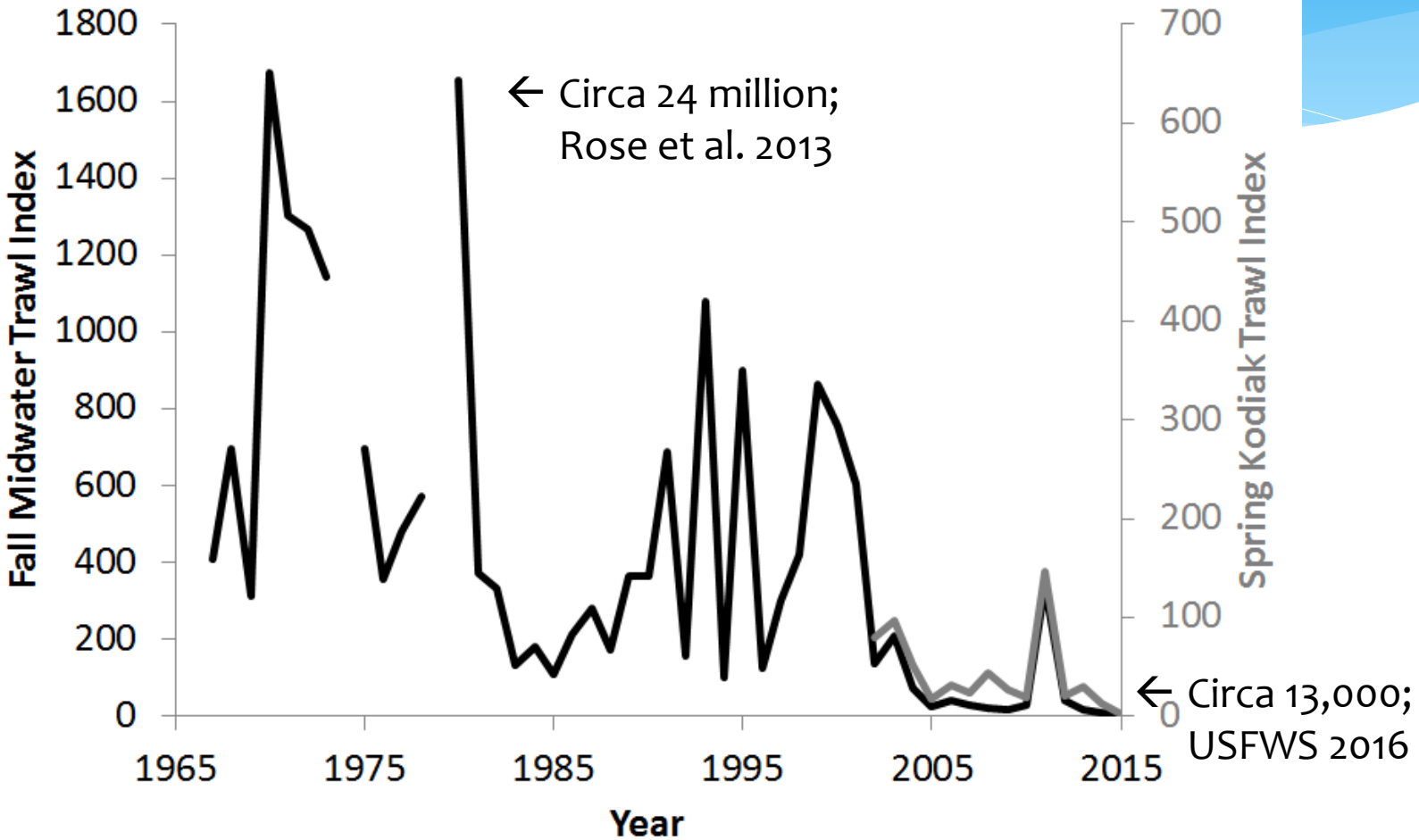
* Status of designated Critical Habitat: Steadily altered for more than 150 years

Evolving understanding of life history that diverges from 1990s regulatory docs



* **Upstream migration**
* **Timing and location of spawning and spawning microhabitat**
* **Larval transport**

Status of delta smelt:
The long-term trend is down



Which driver of change started the extinction debt clock ticking?

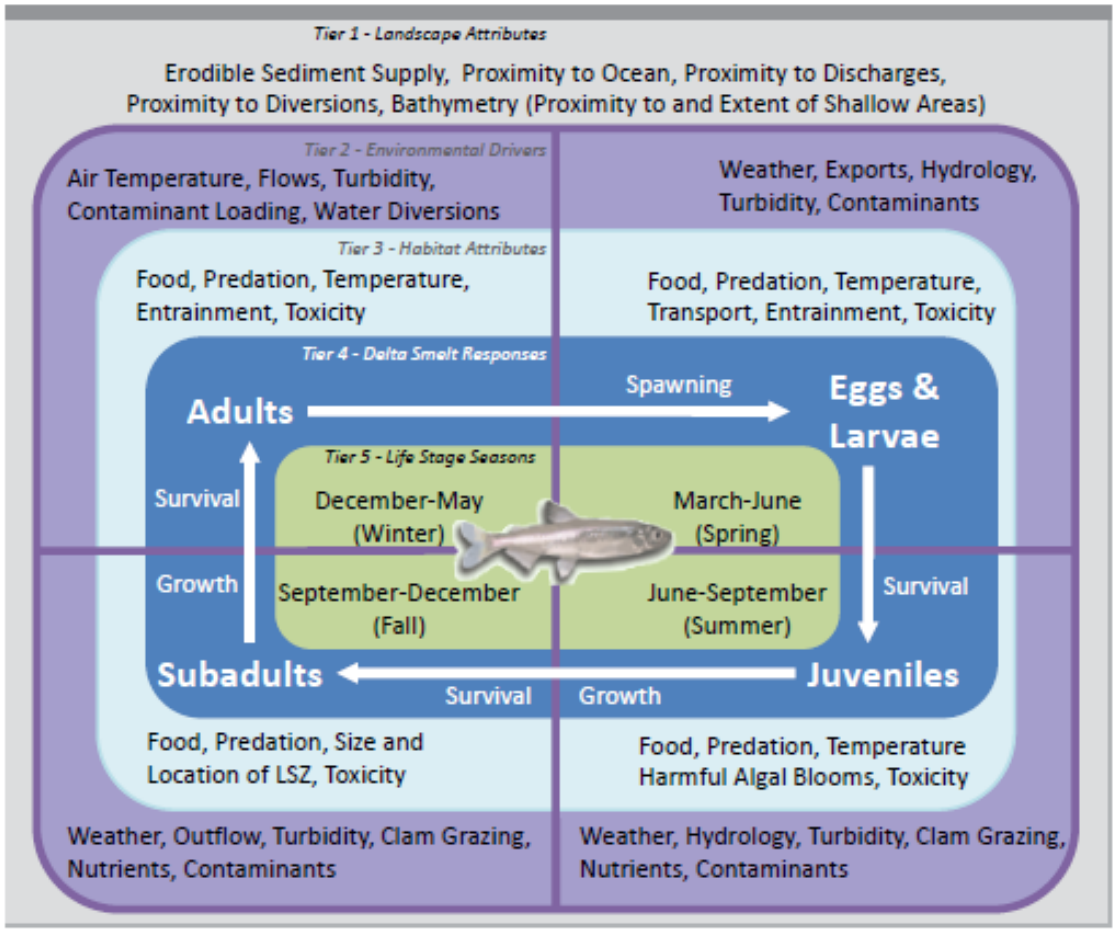
Hint: the answer is we'll never know

* Land conversion for ag?
* Intraguild predation by striped bass?
* Rim dam effects on flow regime and sediment?
* Water exports from the Delta?
* Intraguild predation by Mississippi silversides?
* Declines in crustacean plankton production?

There might be a lot of important reasons for recent declines

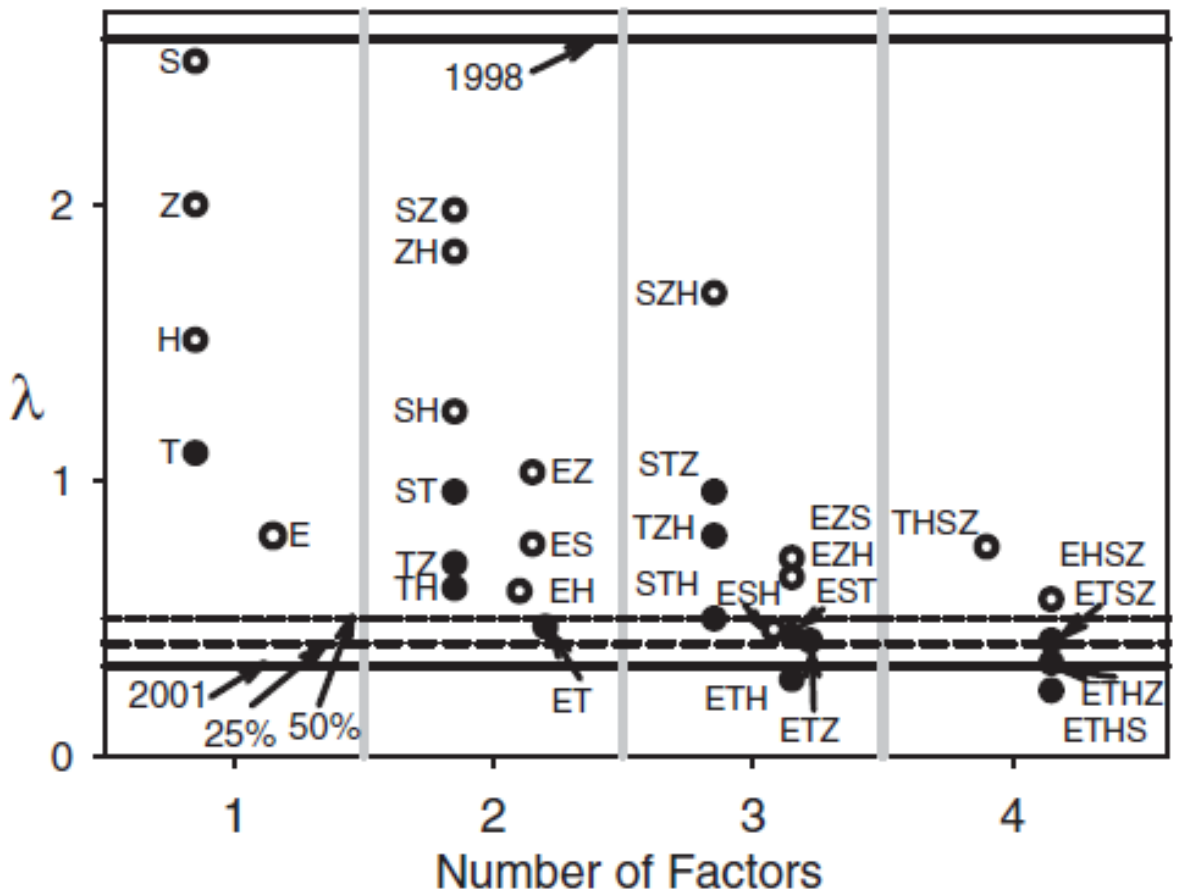
source: IEP 2015

Figure 45. Delta Smelt general life cycle conceptual model.



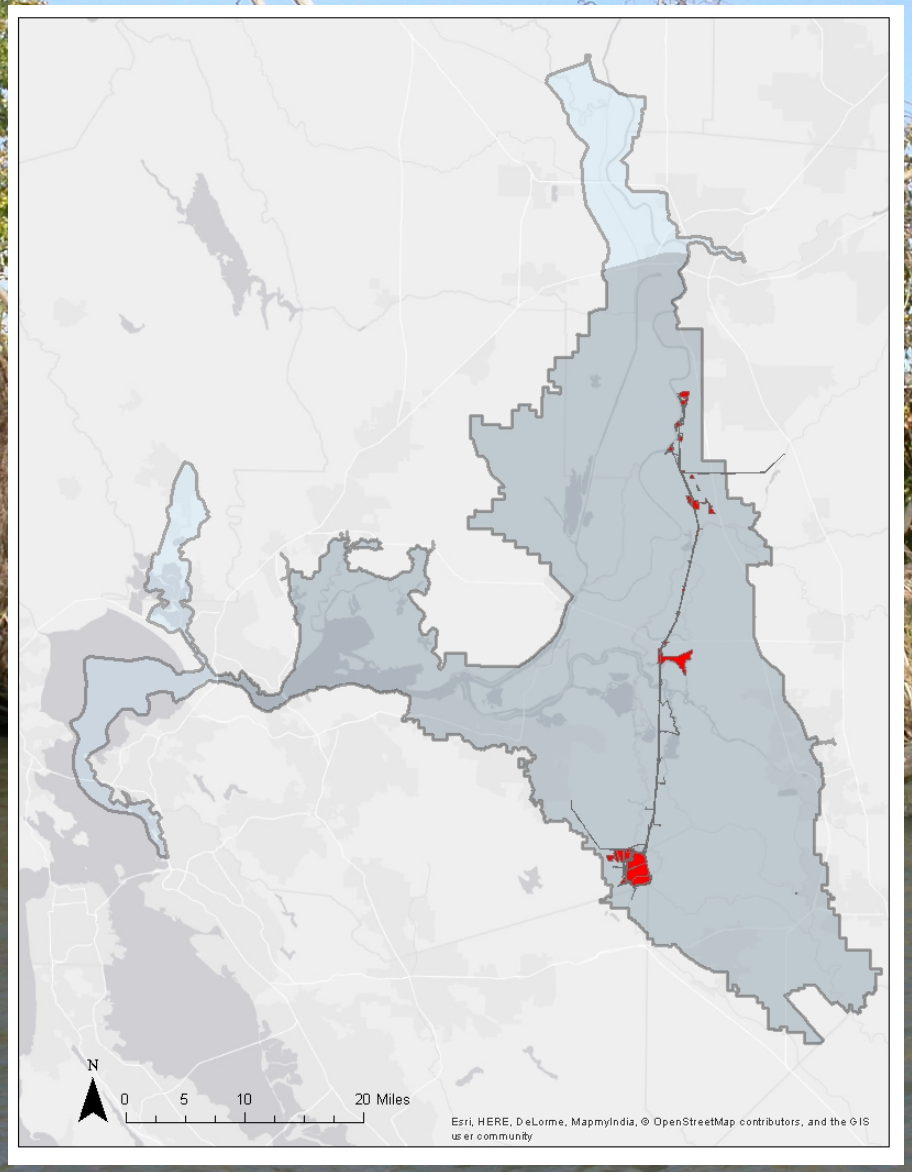
… or just a couple of really big ones

source: Rose et al. 2013 number 2



Range vs Designated Critical Habitat

CWF Action Area = Designated Critical Habitat < Range



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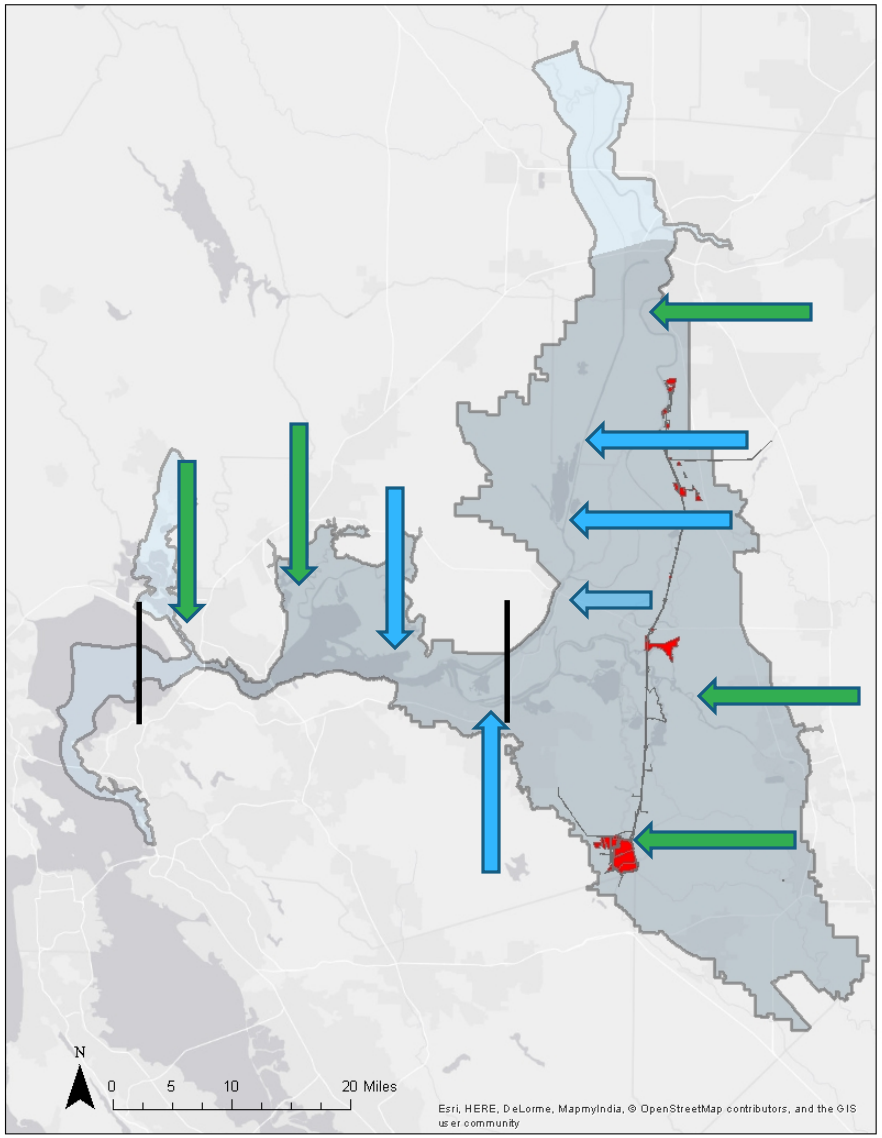


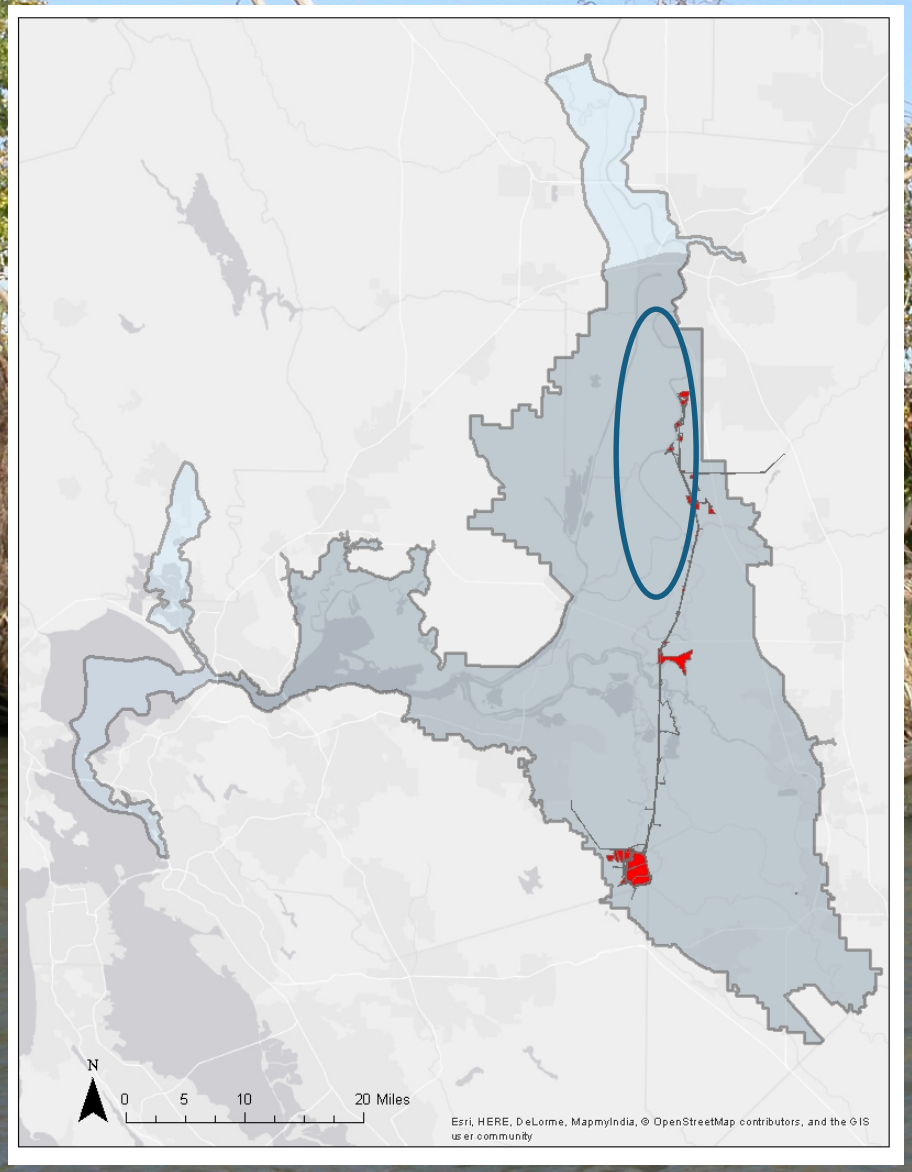
Approximate seasonal distribution limit

Approximate permanent distribution limit

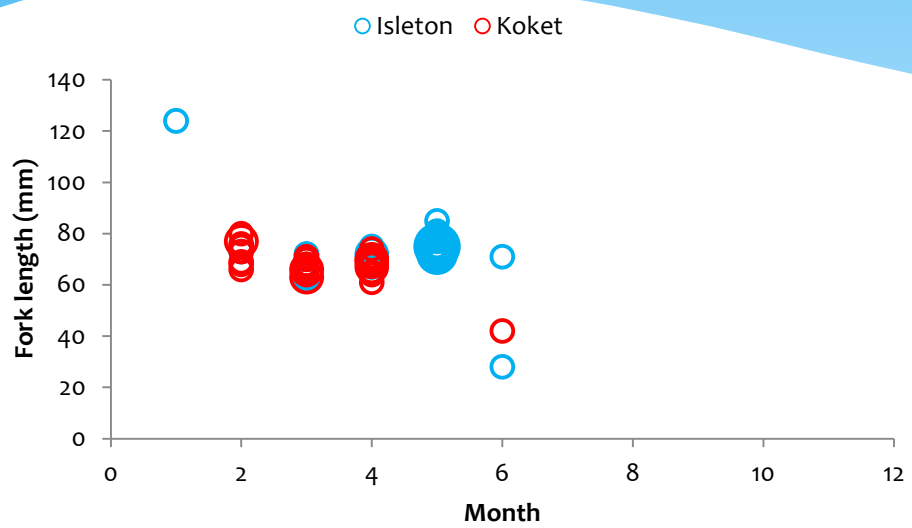
Daily X2 extremes from DAYFLOW

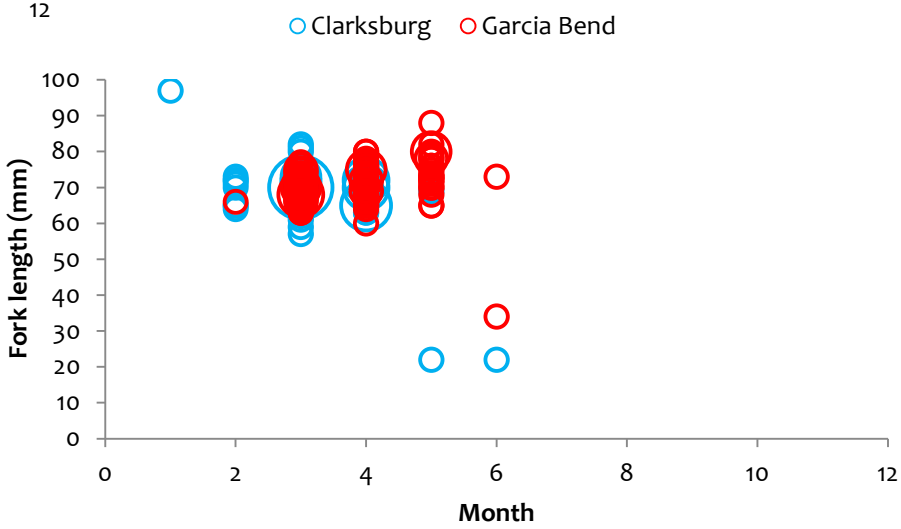
Range vs Designated Critical Habitat

CWF Action Area = Designated Critical Habitat < Range

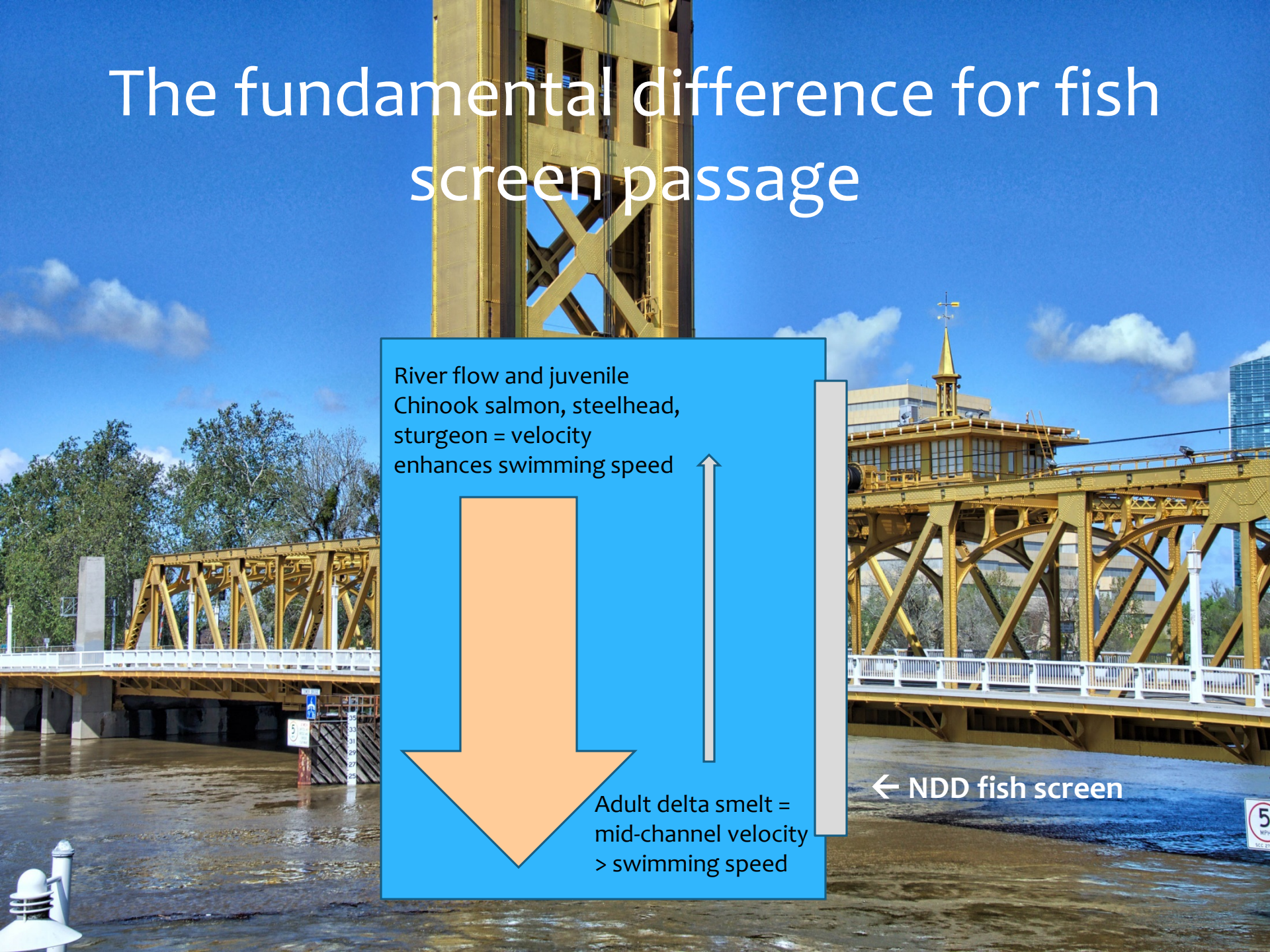


Some delta smelt spawn near the proposed NDDs



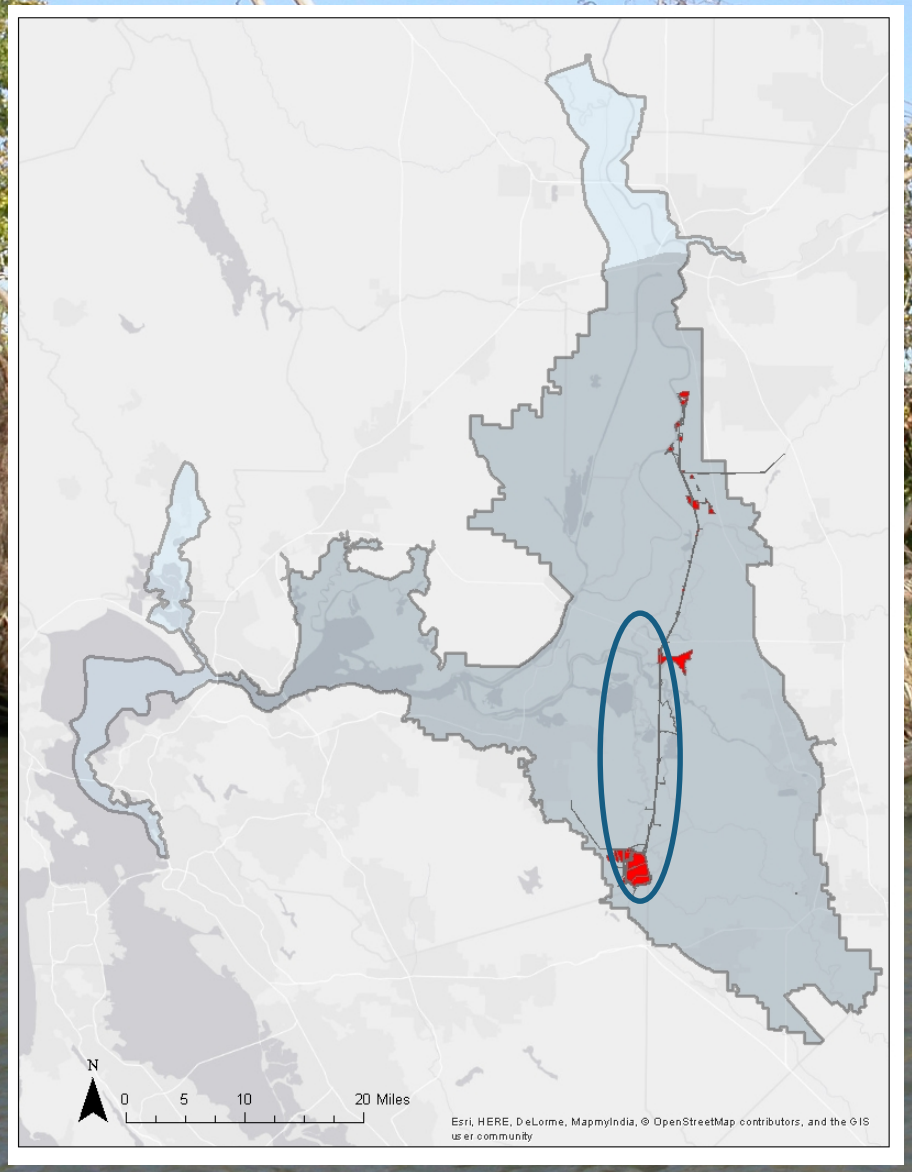


The fundamental difference for fish screen passage

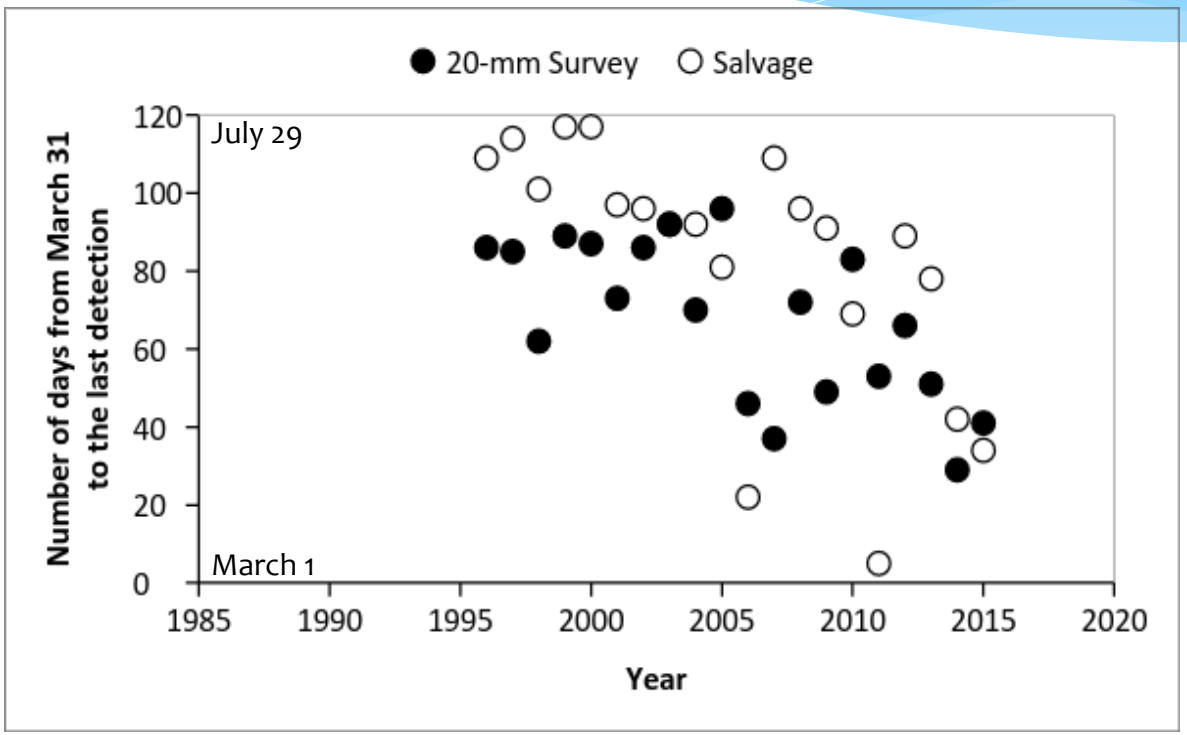


Range vs Designated Critical Habitat

CWF Action Area = Designated Critical Habitat < Range



Delta smelt move away or are lost from all habitats near the alignment by the end of July



Effects to Delta Smelt from the Proposed Action

Heather Swinney, Senior Fish and Wildlife Biologist
San Francisco Bay-Delta Fish and Wildlife Office

Overview

- Preconstruction and Construction Effects
- Operation Effects
- Effects of the PA on survival
  - Numbers
  - Reproduction
  - Distribution
- Effects of the PA on recovery

I Street Bridge
Sacramento
North Delta
Cache Slough
Complex
Suisun Marsh
Suisun
Bay
West Delta
East Delta
Central
Delta
South
Delta
N
0
5
10
20 Miles
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS
user community

Preconstruction & Construction

PA includes:

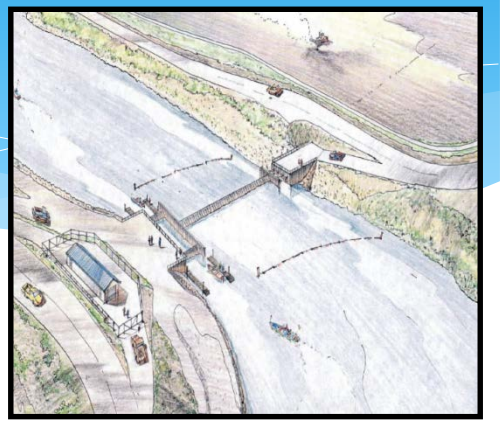
* Overwater Geotechnical Explorations
* Barge Landings
* NDDs
* HORG
* CCF, Pumping Plant, and Connections

Proposed In-Water Work Windows

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Geotechnical Explorations												
Barge Landings												
North Delta Diversions												
Clifton Court Forebay												
Connections to the Jones Pumping Plant												
Head of Old River Gate												

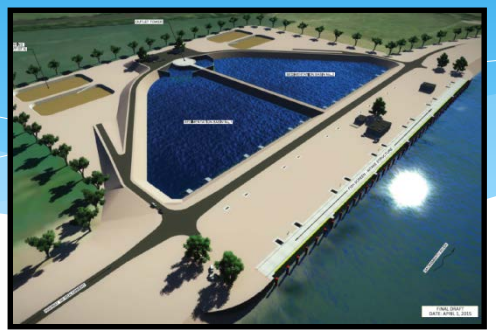
Delta smelt expected to be rearing near the LSZ during the summer and fall

Preconstruction & Construction



* Effects to individuals, if present, include:
  * injury or mortality from heavy equipment
  * increased turbidity and suspended sediment
  * exposure to contaminants and disturbance of contaminated sediments
  * underwater noise and vibrations
  * increased risk of predation
  * loss or degradation of habitat
* Expected low probability of delta smelt being injured or killed

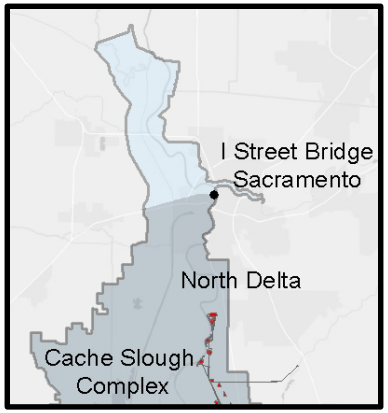
North Delta Diversions

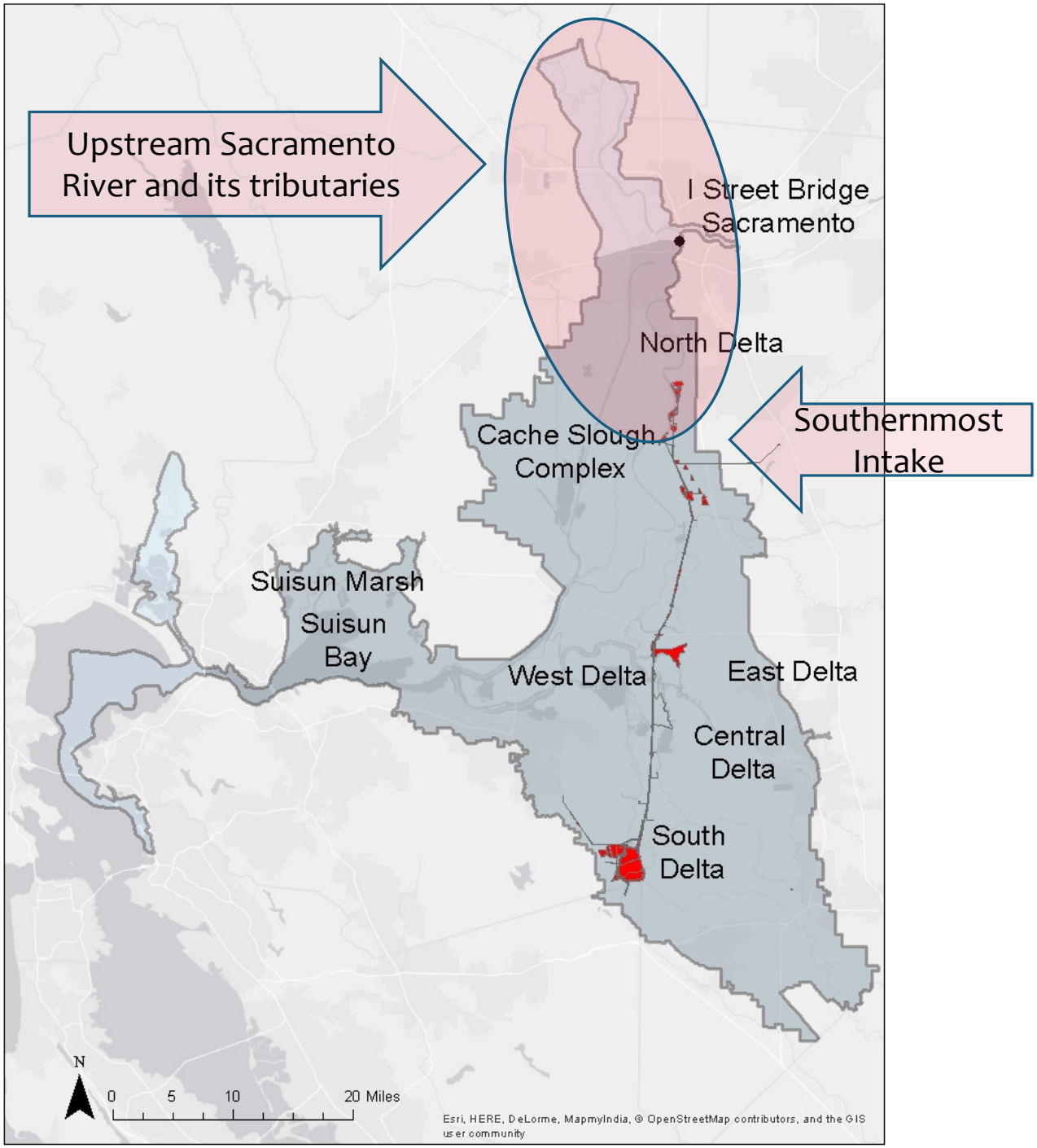


* Underwater Noise and Vibrations
  * Potential to minimize effects using vibratory and non-impact pile driving
    * Uncertainty
  * Effects analysis assesses noise levels with and without attenuation
  * BA used criteria from the Fisheries Hydroacoustic Working Group
  * Potential for injury or mortality 3,280 feet in distance or greater from the pile driving at Intakes 2, 3, and 5

North Delta Diversions

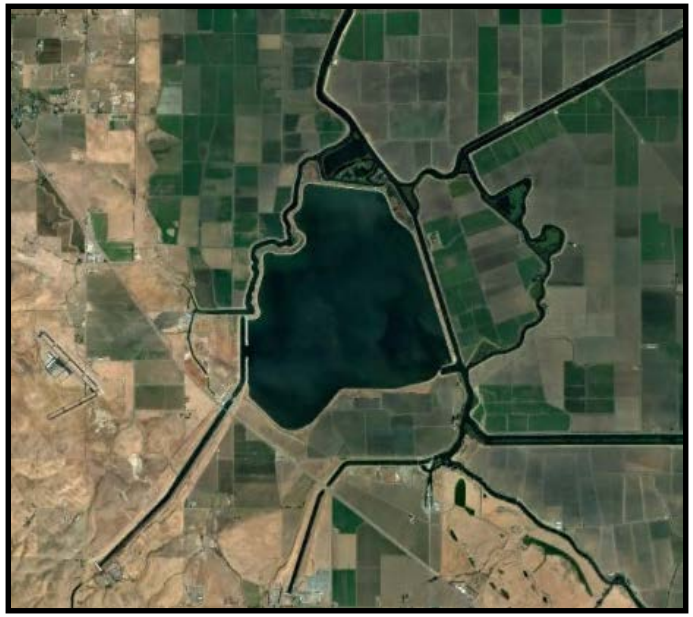
* Restricted access to migrating delta smelt
  * Upstream spawning habitat
  * Constrained channel width (cofferdam)
  * Less available spawning (sandy beaches) available
  * Altered behavior
  * Predation
* Compensatory mitigation will minimize, but not fully offset or replace the value of this habitat




Upstream Sacramento River and its tributaries
I Street Bridge Sacramento
North Delta
Southernmost Intake
Cache Slough Complex
Suisun Marsh
Suisun Bay
West Delta
East Delta
Central Delta
South Delta
N
0
5
10
20 Miles
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Clifton Court Forebay, Pumping Plant, and Connections

* Changes to the CCF may alter salvage estimates
* Too speculative to determine how salvage will change



Habitat Loss and Restricted Access

Shallow water Habitat

* Barge Landings 22.4 acres (3:1 ratio)
* North Delta Diversions 5.6 acres (5:1 ratio)
  * 245 acres of restricted access (1:1 and 3:1 ratio)
  * BiOp qualitatively discusses area above I St. bridge
* Head of Old River Gate 2.9 acres (3:1 ratio)

Total of 273 acres of compensatory mitigation

Summary of Preconstruction and Construction Effects to Delta Smelt

* Reduce number of individuals
  * Harm, injury, and mortality
  * Loss of habitat
* Overall low risk to individuals
  * In-water work restrictions
  * Seasonal and transient use
  * Record low abundance

Summary of Preconstruction and Construction Effects to Delta Smelt

* Permanent constriction/reduction in available habitat
  * Restricted upstream access
  * Supports migration, spawning, transport, and rearing processes necessary for the reproduction and survival
* DWR has proposed to minimize and compensate for these effects to habitat with varying ratios of 1:1 to 5:1
* These compensatory mitigation will not fully offset the loss and function that is being effected, but minimize the effects

Operations

* Uncertainties
  * CWF BA describes one operational scenario under a dual conveyance system
  * Long-term operations will be influenced by near-term processes such as:
    * State Water Resources Control Board's Water Quality Control Plan Update
    * Reinitiation of near-term operations
    * And other processes

Operational Scenario Analyzed in the CWF BA

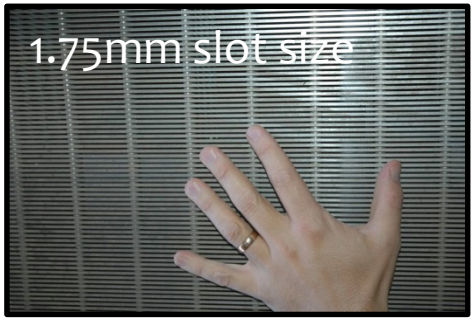
* Entrainment
* Impingement/Screen Contact
* Increased Risk in Predation
* Effects to Habitat

Entrainment, Impingement, and Predation Risk

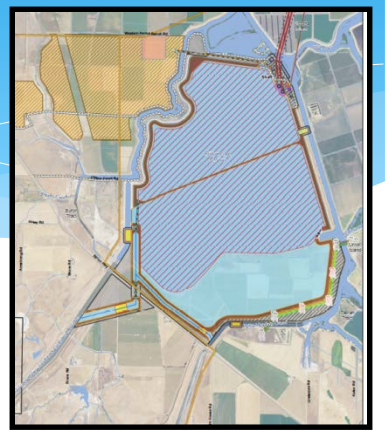
* Head of Old River Gate
* Delta Cross Channel
* Suisun Marsh Facilities
* Clifton Court Forebay Aquatic Weed Control Program
* Other Facilities as defined in the CWF BA

North Delta Diversions: Entrainment & Impingement

* Entrainment
  * Expect to observe mostly adults migrating upstream
  * Reduced spawning success = less offspring
  * Body depth to body length ratios: exclude 20-21 mm or greater
  * Minimization of 0.2 ft/sec approach velocity criteria
* Impingement/Screen Contact
  * Larger-sized delta smelt to attempting to migrate pass the fish screens
* Uncertainty
  * Some may become:
    * injured from screen contact or
    * become predated upon or
    * spawn un/successfully downstream
  * The BiOp discusses the various potential sources of injury/mortality associated with the PA

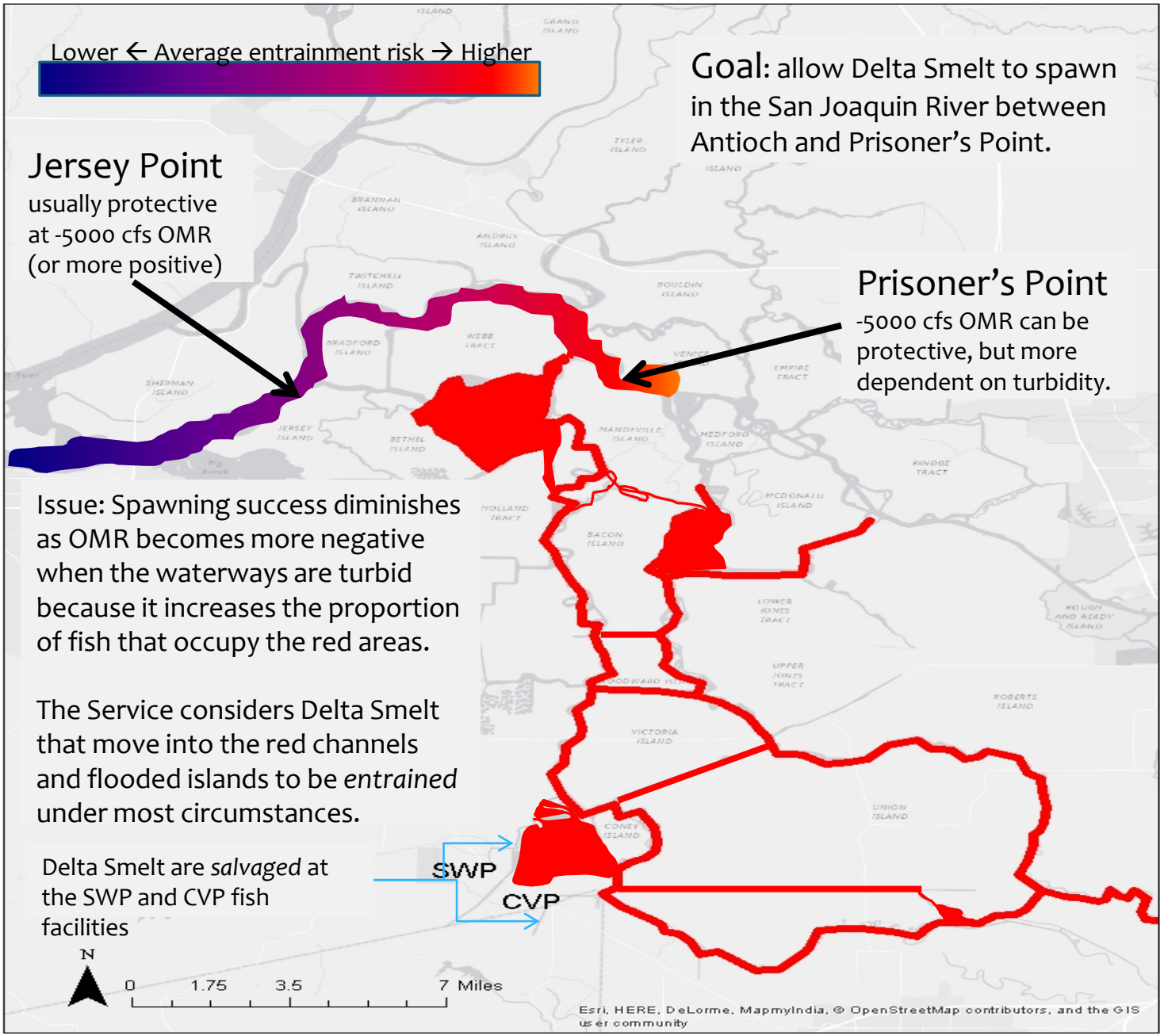


South Delta Water Facilities



* Larval, Juvenile, & Adult Entrainment
  * Reductions in south Delta exports
  * Increased flexibility under a dual conveyance
    * Observe a decrease in estimated entrainment during the migration/spawning period & larval transport phases
    * Allow for delta smelt to utilize portions of the San Joaquin River for spawning and their offspring to escape entrainment more frequent
  * Except when there is a heavy reliance on the South Delta Water Facilities when operational criteria restrict the use of the NDDs
    * Observe entrainment estimates similar to the project baseline condition

BASELINE CONDITION: Entrainment footprint



Effects to Habitat

- **Small Effects to:**
  - **Increase in water temperature**
  - **Changes in turbidity (Sediment Removal and Water Clarity)**
  - **Entrainment of food web materials**
  - **Increased exposure to *Microcystis***
  - **Increased exposure to Selenium**

- **Adverse Effects to Salinity**

Salinity

* Quality & quantity of summer and fall contribute to juvenile recruitment of increasing population size
* When X2 moves eastward into the Delta channels, this intersection occurs much less frequently and delta smelt are harmed by poor habitat conditions
  * Elevated vulnerability to predators
  * Increased exposure to *Microcystis* blooms
  * Increased water temperatures, etc…

Effects to Recovery

* Decrease abundance of delta smelt
* Decrease in quality and quantity of suitable and available habitat

Effects of the PA: Reproduction

* Largest threat is the constriction/reduction in habitat
  * Support migration, spawning, transport, and rearing processes necessary for survival and recovery

1) Permanent physical habitat loss from NDDs, HORG, new south Delta water facility, and barge landings
2) Limit upstream Sacramento River access
3) Continued south Delta entrainment footprint, albeit reduced to allow for improved spawning and offspring success
4) Changes in X2 movement, bringing X2 eastward during some months
   * Creating unsuitable salinity conditions in the Suisun area
   * Constricting delta smelt to areas more channelized

* Loss of rearing juveniles and adult spawners from poor habitat conditions will affect survival and recruitment leading into the next generation

Effects of the PA: Numbers

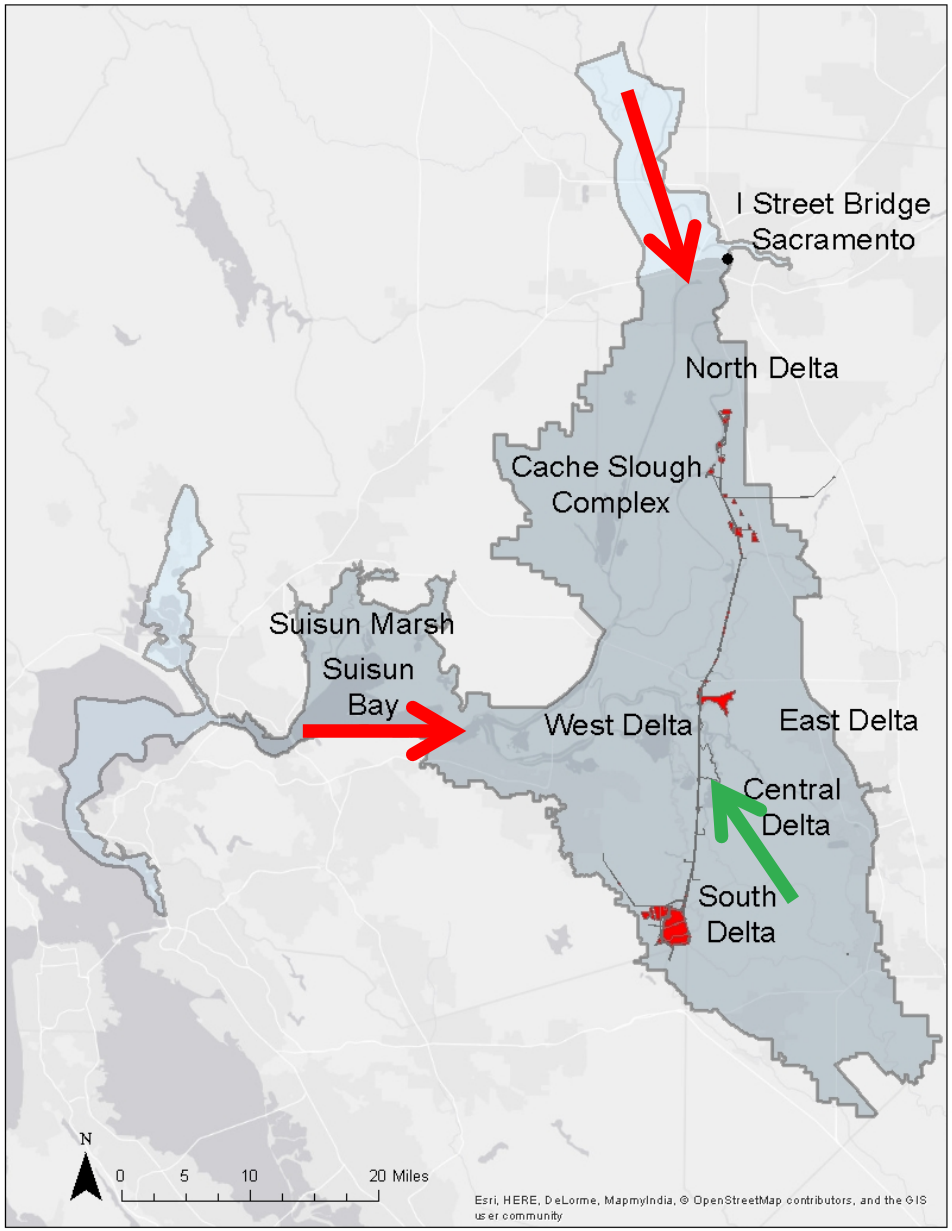
* Adverse effects to individuals
  * Preconstruction (*e.g.*, exposure to contaminants, noise, disturbance)
  * Construction (*e.g.*, direct contact, altered turbidity, exposure to contaminants, noise, stranding, predation, habitat loss)
  * Operations (*e.g.*, entrainment, impingement, predation, **habitat loss**)

Effects of the PA: Numbers

These habitat changes will reduce the numbers of delta smelt by:

* Altering their feeding behavior
* Altering their swimming behavior
* Reducing the quality and availability of food supply
* Increasing favorable predator habitats
* Decreasing cover/shelter
* Decreasing reproductive success

Effects of the PA: Distribution



Summary of Effects on Recovery

* Need a hydrograph that more closely resembles historic unimpaired flow conditions
* Optimal X2 habitat conditions
* More productive food web
* Remove or control predators and competitors
* Reduced toxins and pollutants
* Reduced aquatic invasives

* **Overall, baseline conditions are maintained or deteriorated from implementation of the PA**

Operations

* Reclamation and DWR have reinitiated consultation on the long term operation of the CVP and SWP
* Also, the State Water Resources Control Board's Water Quality Control Plan will be updated
* Both of these processes will likely result in changes to CWF operations
* These changes are not reflected in the PA because the operational standards are not yet known
* CWF operations will be addressed in the reinitiated consultation
* The operational scenario that is described in the CWF BA will almost certainly change between now and when the dual conveyance system goes online

Effects of the Proposed Action to Designated Critical Habitat

Leanna Zweig, BDFWO
Fish and Wildlife Biologist

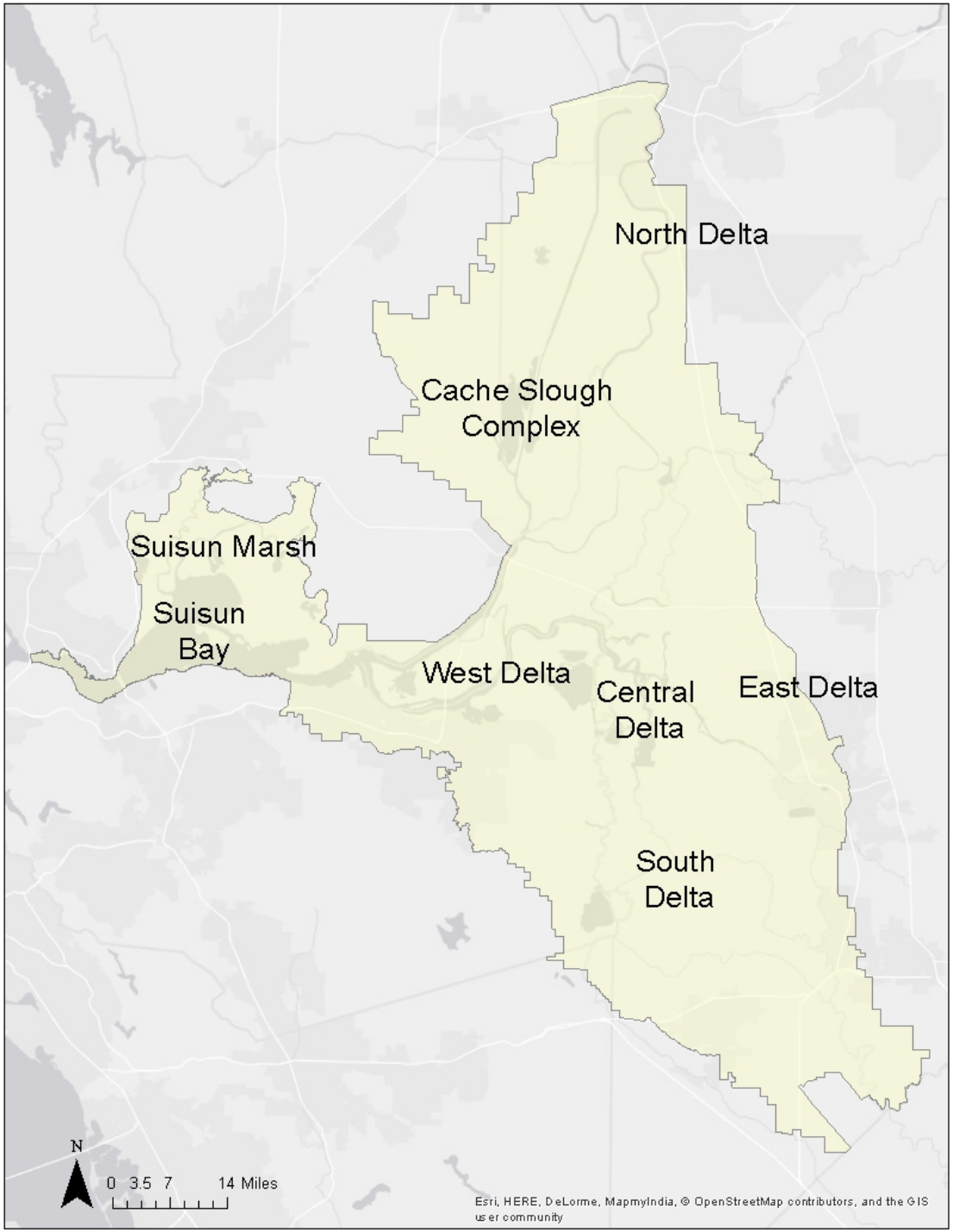
Overview

* ESA context of the critical habitat effects analysis
* Review the elements of Delta Smelt Critical Habitat
* Review of the effects of the Proposed Action on Critical Habitat

Role of Critical Habitat in Species Conservation

* Role of critical habitat is species recovery
* Receives protection under the Act and is treated as a separate entity under section 7
* Delta smelt critical habitat designated in 1994 and addresses needs of four delta smelt life stages:
  1. Migrating adults
  2. Spawning adults
  3. Dispersing larvae and juveniles
  4. Rearing larvae and juveniles

Delta smelt designated critical habitat



Delta smelt Primary Constituent Elements (PCEs)

PCE 1: Physical habitat

- Structural components of habitat
- For a pelagic fish this is spawning substrate and water depth variation

PCE 2: Water (quality)

- Suitable quality to support all life stages
- Biotic and abiotic
  - temperature
  - turbidity
  - food availability
  - contaminants

Delta smelt Primary Constituent Elements (PCEs)

PCE 3: River flow

- Transport flow to facilitate spawning migration, and transport of offspring to LSZ habitats
- Inflow, outflow and OMR flow influence entrainment risk

PCE 4: Salinity

- Low Salinity Zone (0.5-6.0 ppt).
- X2 (2 ppt isohaline) is an indicator of the LSZ habitat
- LSZ location determined by outflow
- LSZ location determines suitability of rearing habitat

Status of science on habitat: improvements since 1994 designation

Spawning habitat:

* February-June
* Likely anywhere with sandy substrate that avoids silt which could suffocate eggs
* Based on SKT data, Grizzly Island, Sherman Island and Cache/Liberty are key locations for spawning

Larval/Juvenile transport:

* March-June
* Transportation flows away from the SDD

Status of science on habitat: improvements since 1994 designation

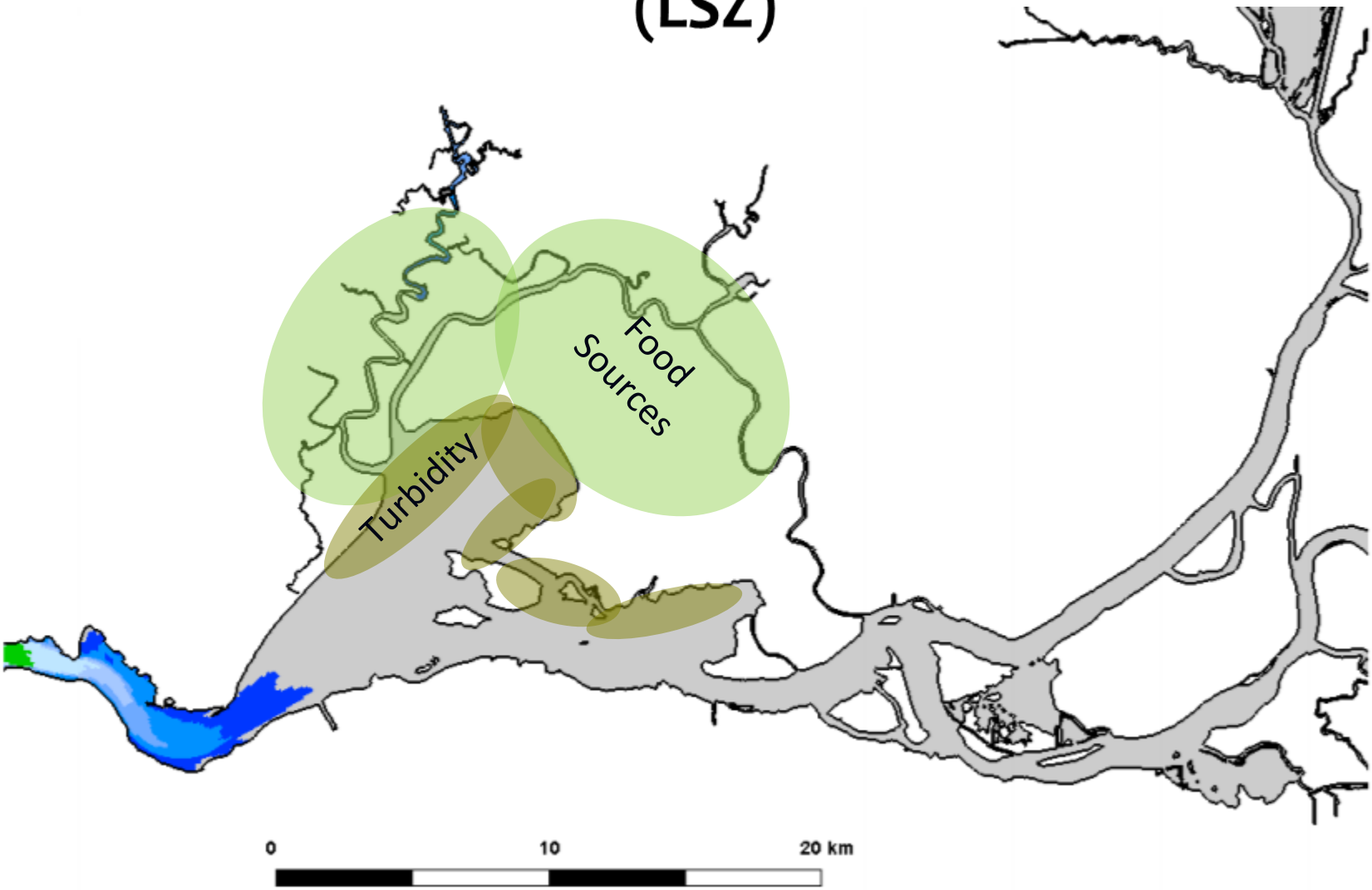
Rearing habitat:

* July-December
* At Low Salinity Zone (LSZ)
* LSZ provides suitable habitat at a location which provides varying water depth, adequate turbidity, water quality and food

Adult migration:

* December-March
* Unrestricted access to spawning habitat, adequate flow, suitable water quality

Location of the Low Salinity Zone (LSZ)



Effects of the project on designated critical habitat

Small effects to PCE 2: Water quality

* **Food entrainment**
* **Sediment load**
* Temperature
* *Microcystis*
* Selenium
* Construction sediment resuspension and associated contaminants

Food entrainment

* Conceptual model-
  * Water exports entrain phyto and zooplankton with water
  * The PA should result in:
    * A reduction in entrainment of San Joaquin River and Delta plankton
    * An increase in Sacramento River plankton entrainment

* Methods- BA provided an analysis of plankton carbon biomass FWS selected conceptual outcome predicted by Jassby and Cloern (2000)

* Findings-
  * The BA reported small annual reductions in carbon biomass by the NDD
  * Conceptually, we relied on analysis by Jassby and Cloern (2000) that south Delta increases would be ≥ NDD entrainment losses

Sediment load

* Conceptual model- Entrainment of Sacramento River suspended sediment could reduce the available sediment pool and thus increase water clarity

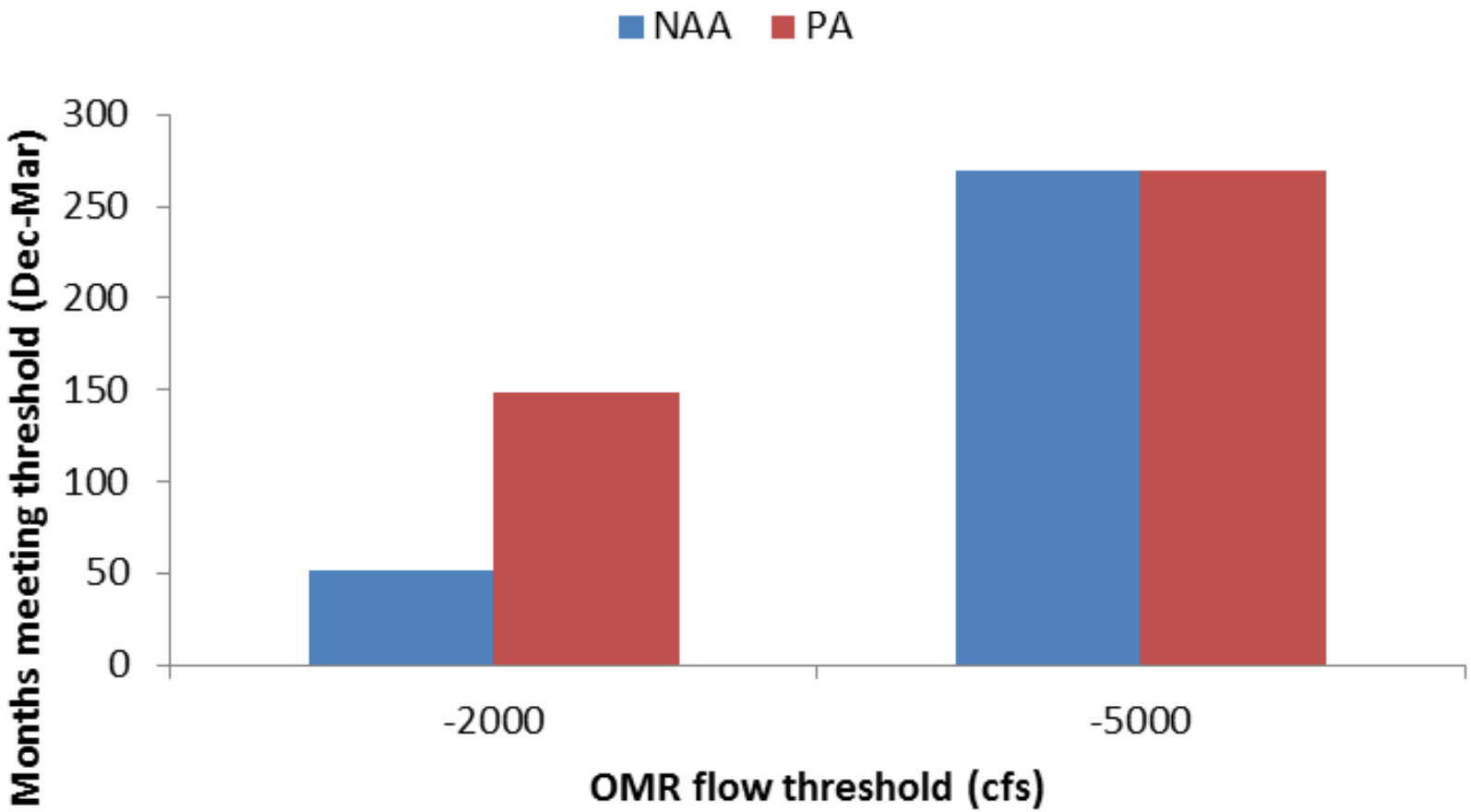
* Methods- The Service's analysis is qualitative and based on PA

* Conclusion-
  * The PA includes a Conservation Measure to reintroduce material from the NDD settling basins back into the watershed
  * We concluded that the reintroduction would minimize the effects of Sacramento River sediment entrainment

Effects to physical habitat, river flow and salinity (PCEs 1,3,4) by life stage

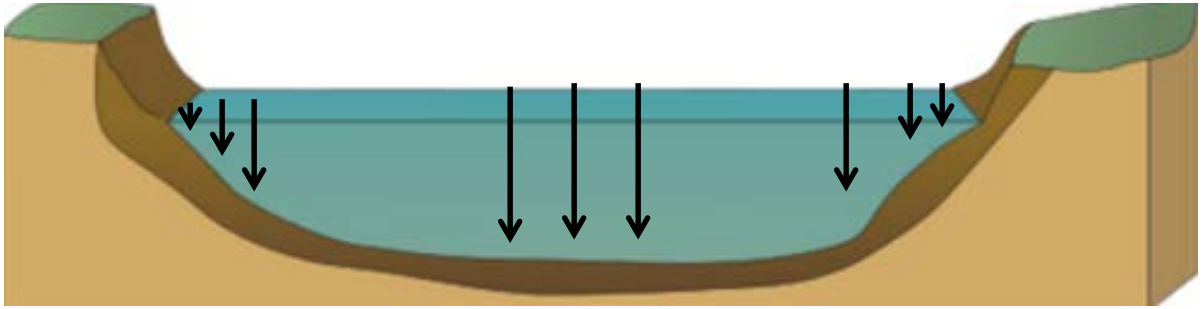
1. Adult migration flows
2. Spawning habitat
3. Larval and juvenile transport
4. Rearing habitat

Adult migration
December-March

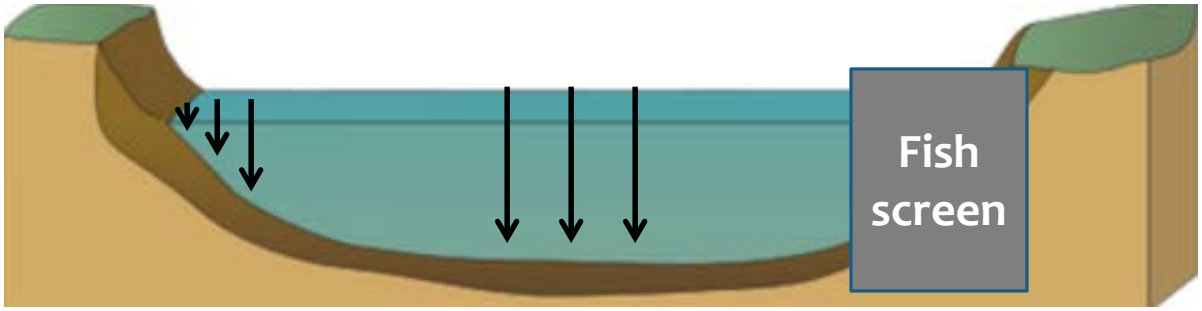


December-March

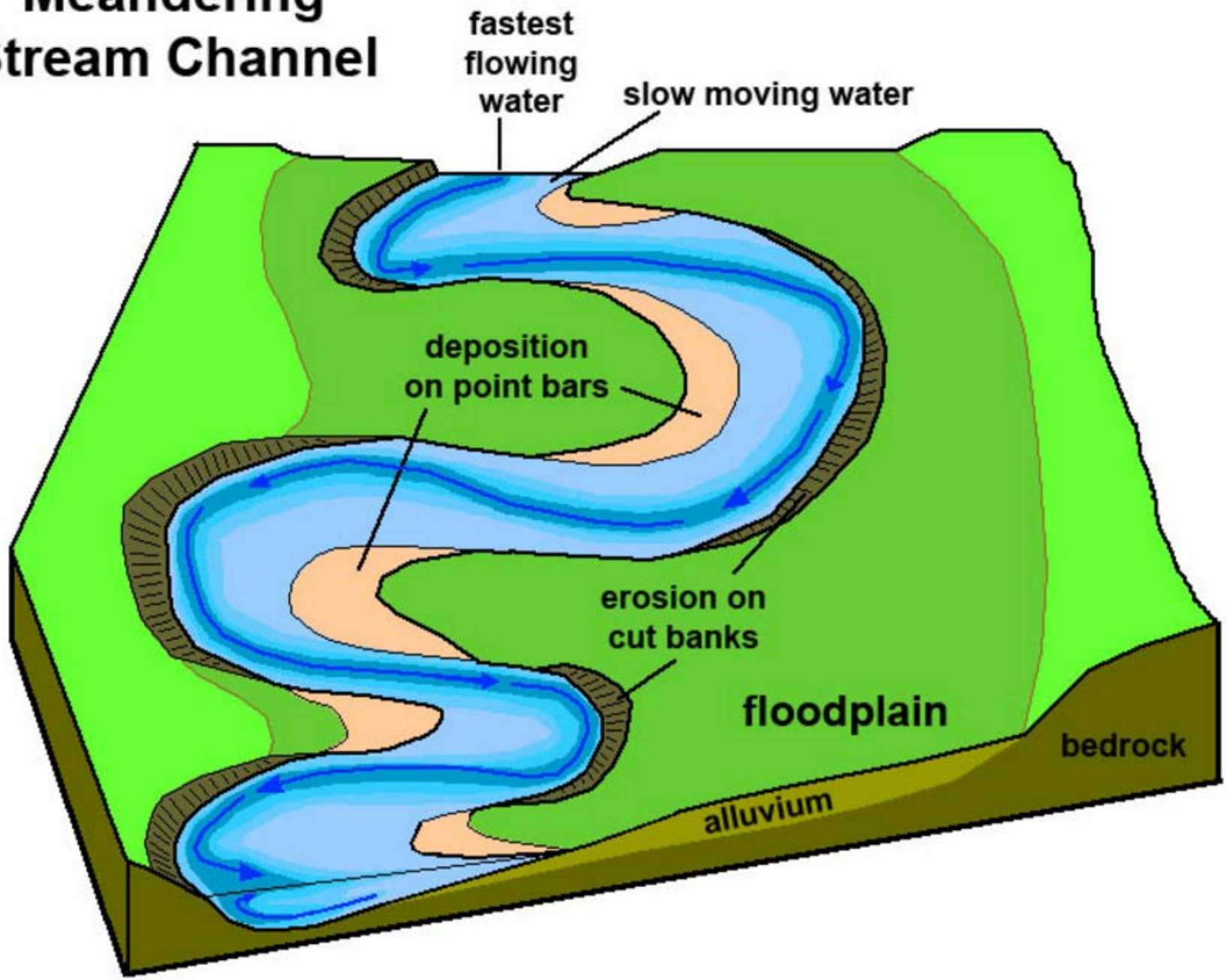
Before

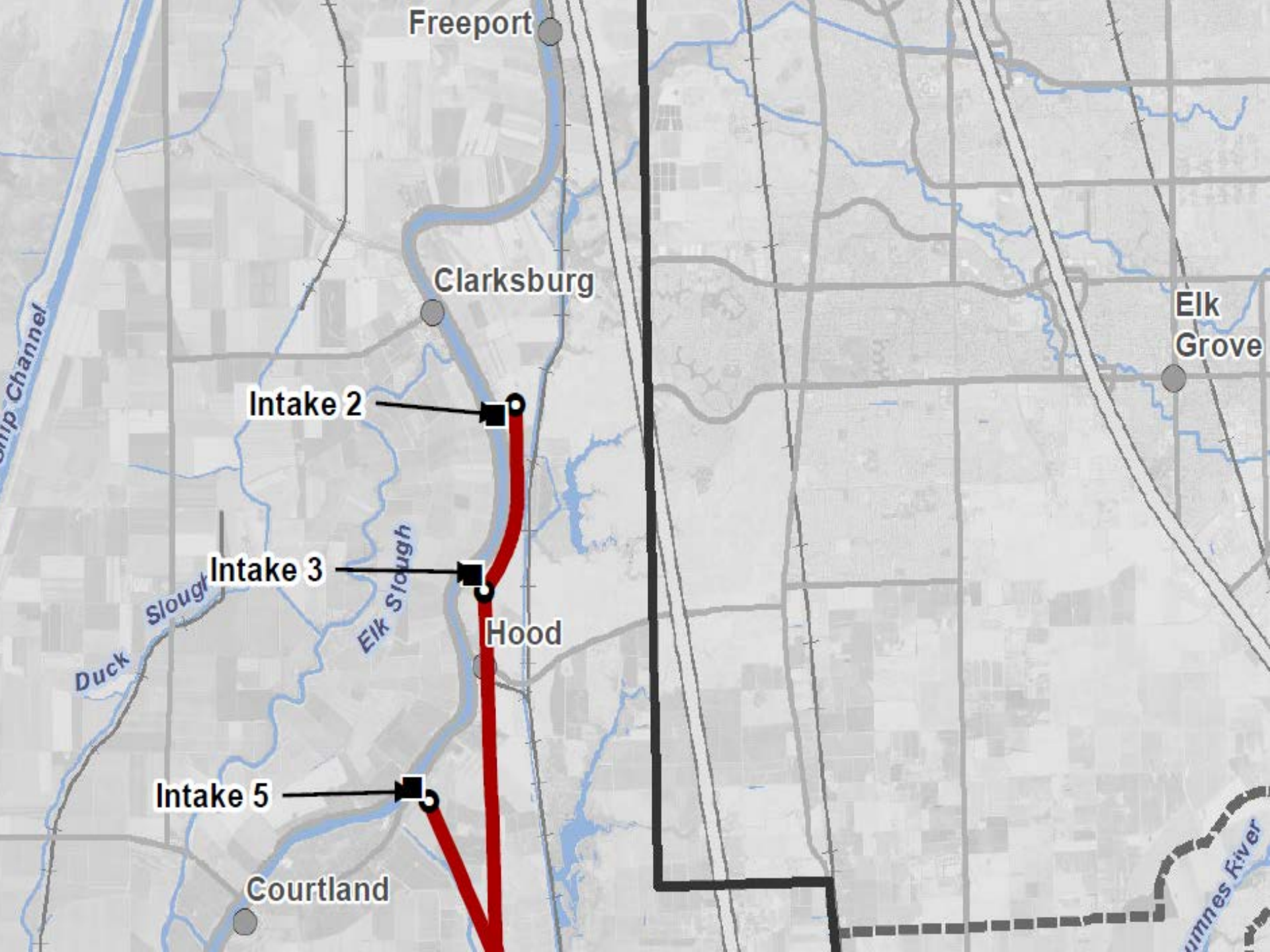


With NDD



Meandering Stream Channel

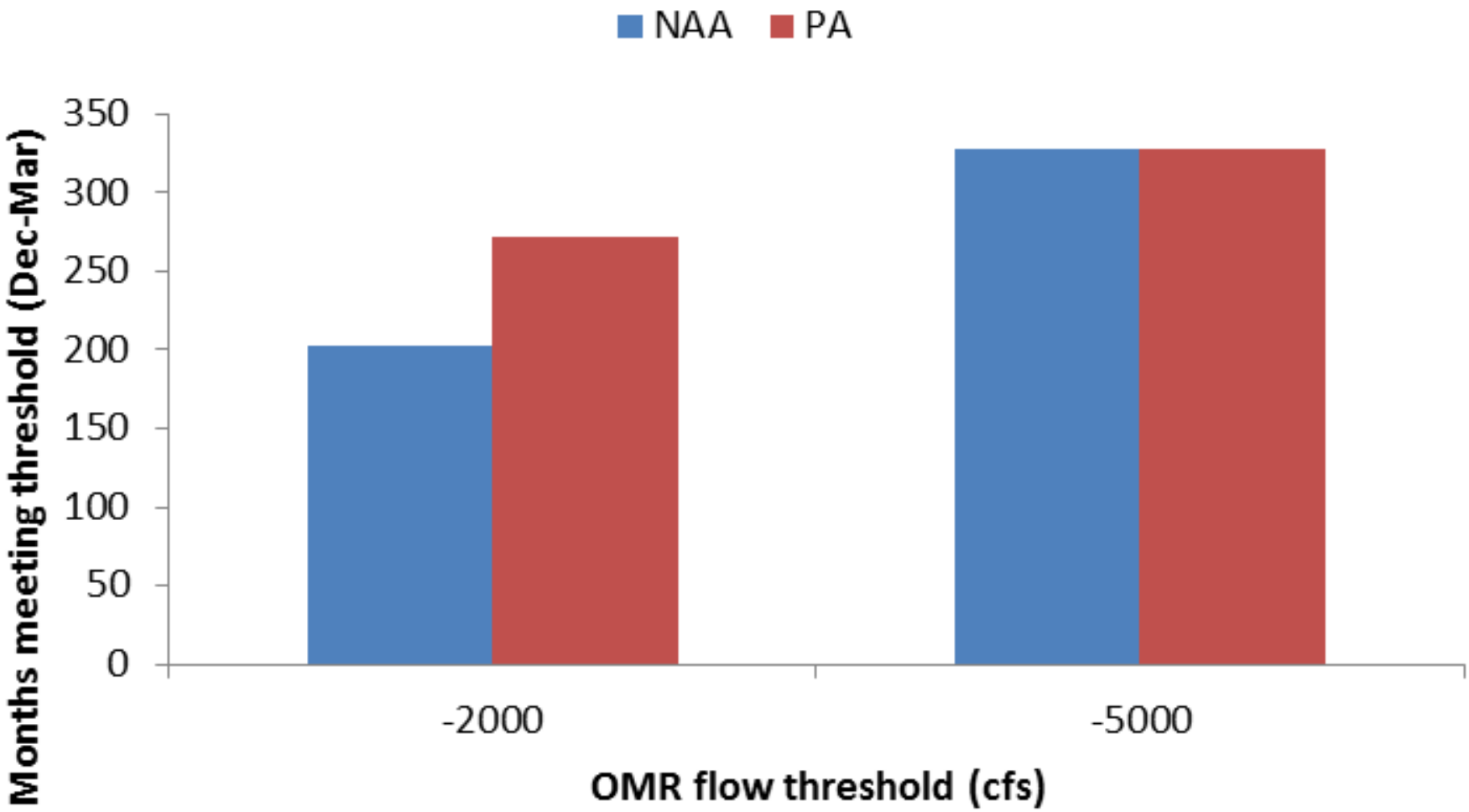



Freeport
Clarksburg
Elk Grove
Intake 2
Intake 3
Hood
Intake 5
Courtland
Elk Slough
Duck Slough
Channel

Spawning habitat
February-June

* Method- Quantify acres of spawning habitat lost to construction
* Findings-
  * 5.6 acres loss due to footprint
  * 245 acres of shallow water habitat is inaccessible due to NDD migration barrier
  * PCEs still present upstream of NDD but inaccessible

Larval and juvenile transport March-June

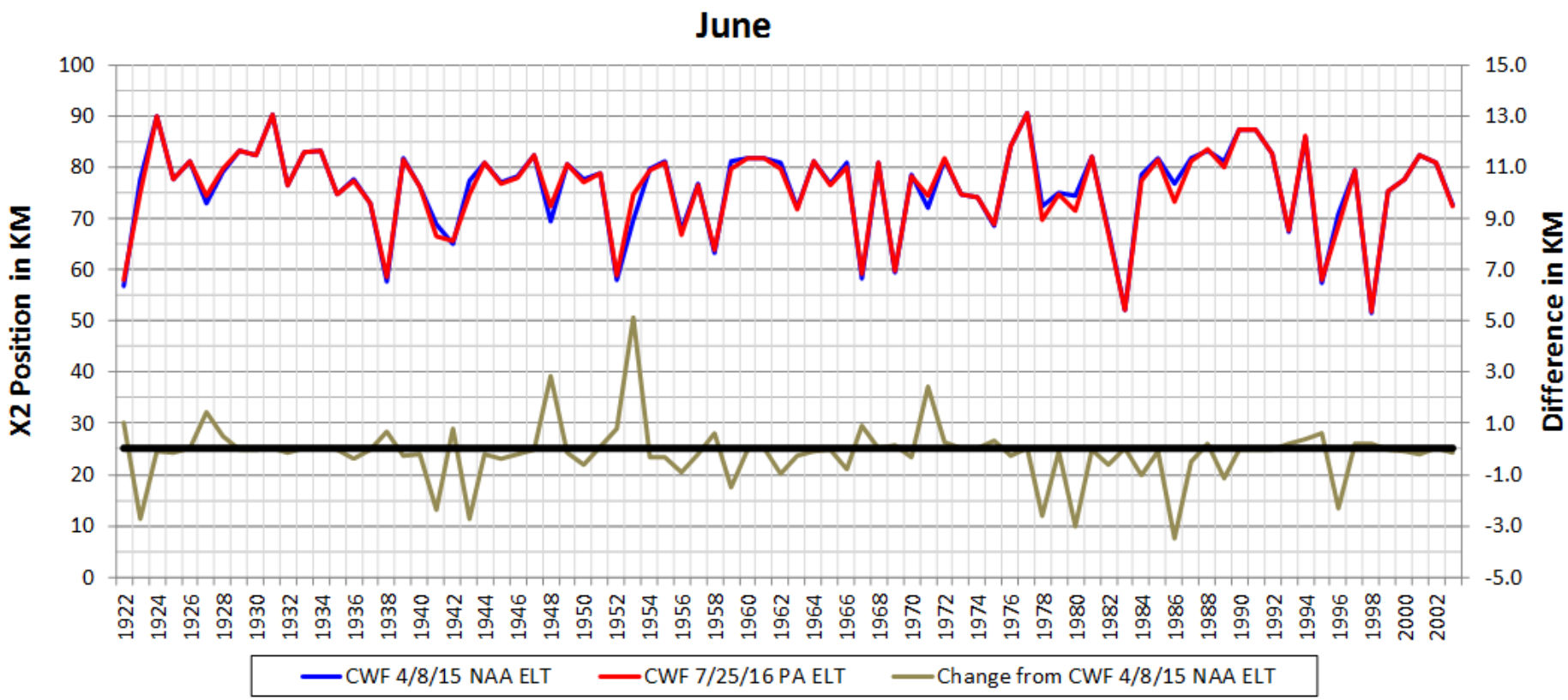


March-June

Rearing habitat
July-December

Salinity

* Method-
  * DSM2-QUAL estimates of X2 position in km
  * Disaggregated data from BA to 82 years of monthly outputs
* Findings- Under the PA, the location of the X2 is consistently eastward of current conditions during July-September


June
X2 Position in KM
Difference in KM
100
90
80
70
60
50
40
30
20
10
0
15.0
13.0
11.0
9.0
7.0
5.0
3.0
1.0
-1.0
-3.0
-5.0
1922
1924
1926
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1930
1932
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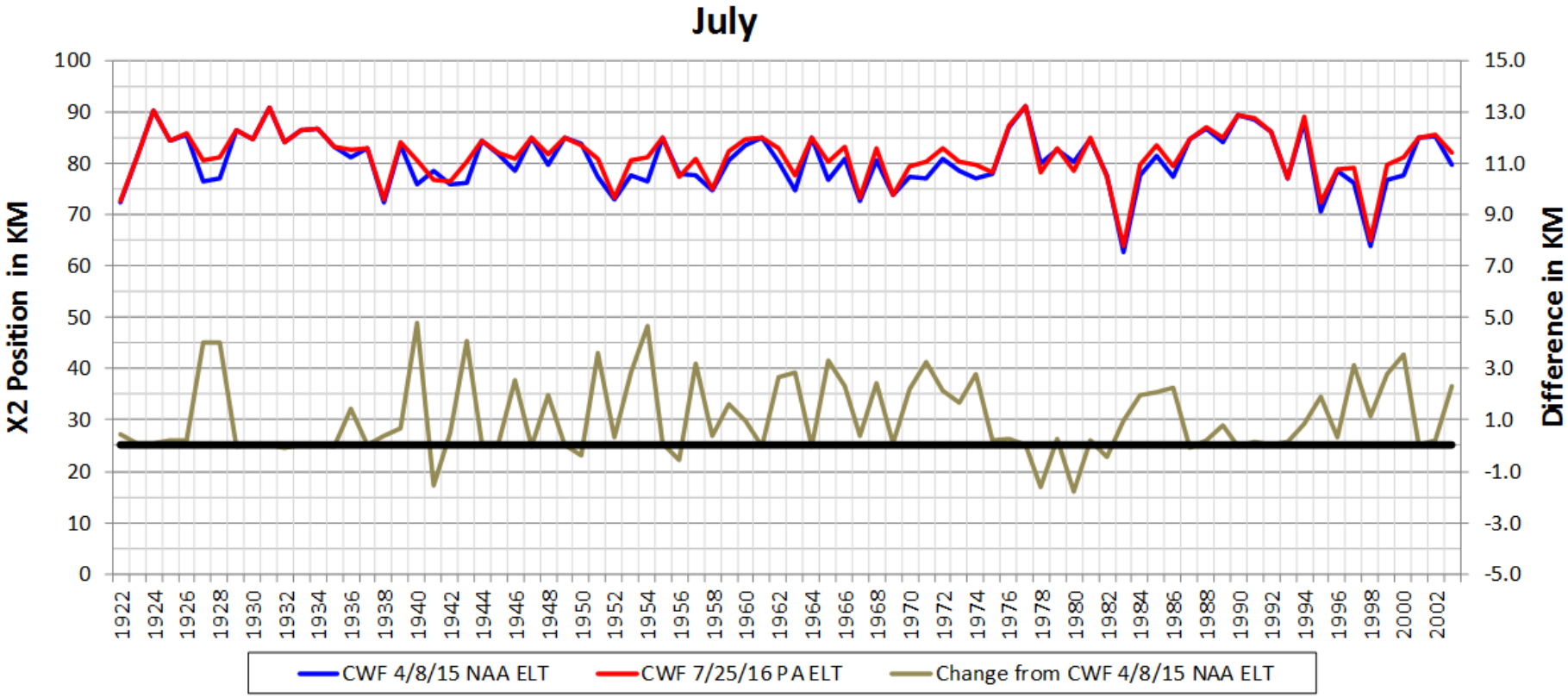
1994
1996
1998
2000
2002
CWF 4/8/15 NAA ELT
CWF 7/25/16 PA ELT
Change from CWF 4/8/15 NAA ELT


July
X2 Position in KM
Difference in KM
100
90
80
70
60
50
40
30
20
10
0
15.0
13.0
11.0
9.0
7.0
5.0
3.0
1.0
-1.0
-3.0
-5.0
1922
1924
1926
1928
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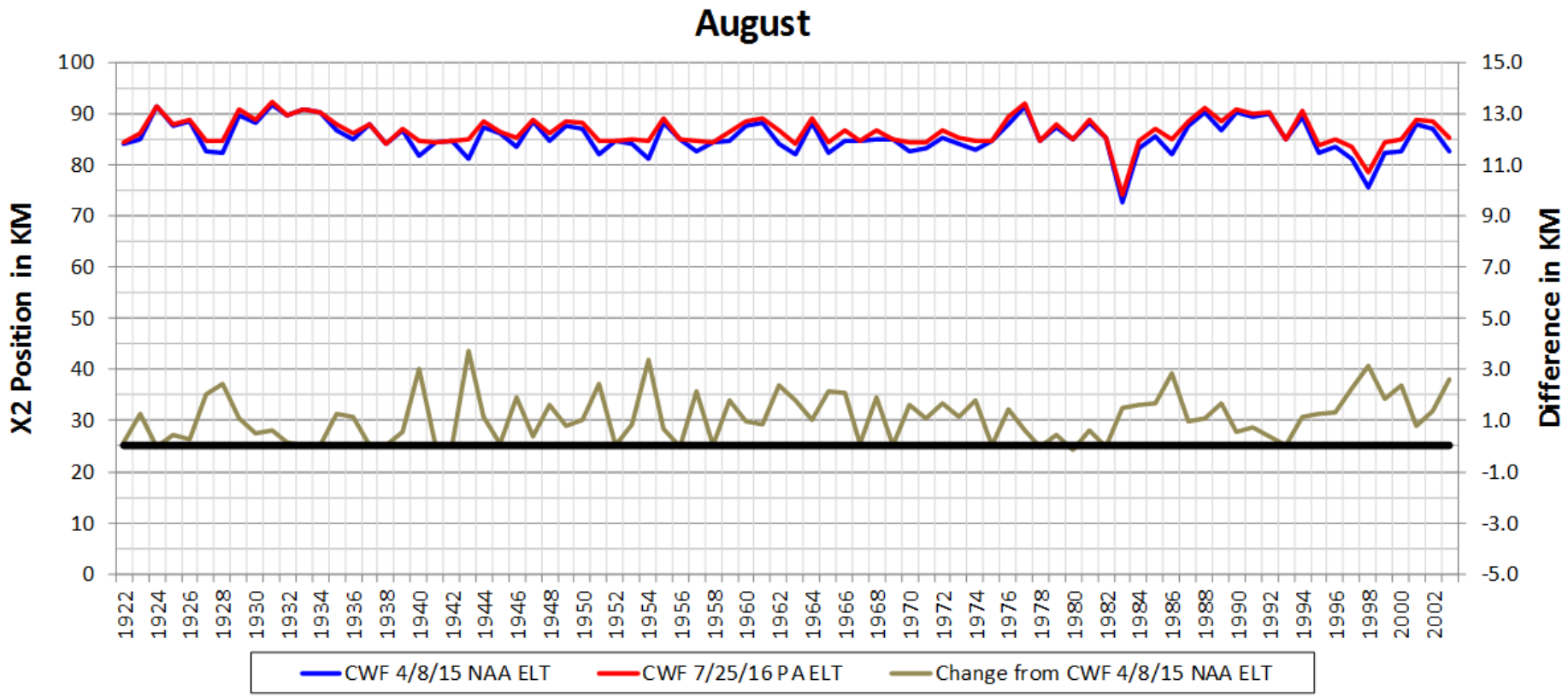
1996
1998
2000
2002
CWF 4/8/15 NAA ELT
CWF 7/25/16 P A ELT
Change from CWF 4/8/15 NAA ELT


August
X2 Position in KM
Difference in KM
100
90
80
70
60
50
40
30
20
10
0
15.0
13.0
11.0
9.0
7.0
5.0
3.0
1.0
-1.0
-3.0
-5.0
1922
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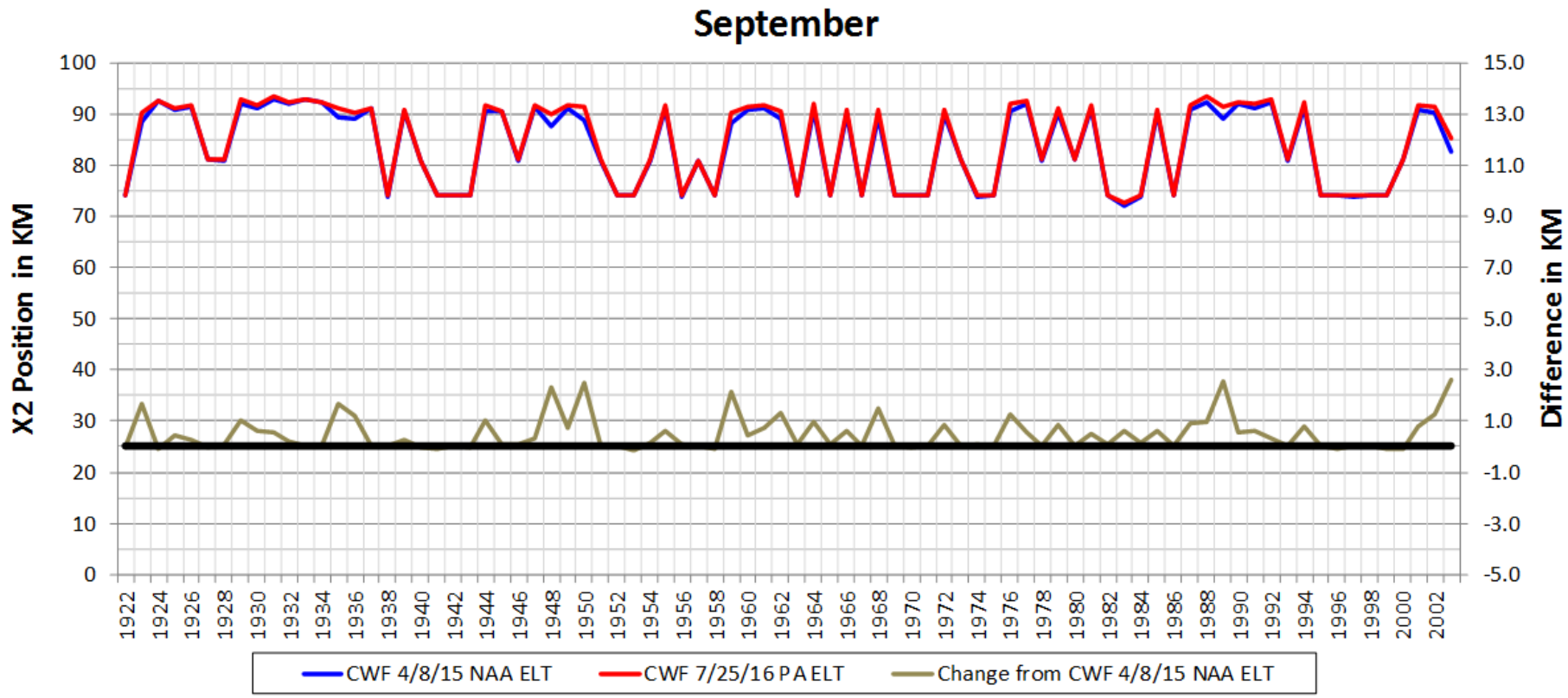
1996
1998
2000
2002
CWF 4/8/15 NAA ELT
CWF 7/25/16 P A ELT
Change from CWF 4/8/15 NAA ELT


September
X2 Position in KM
Difference in KM
100
90
80
70
60
50
40
30
20
10
0
15.0
13.0
11.0
9.0
7.0
5.0
3.0
1.0
-1.0
-3.0
-5.0
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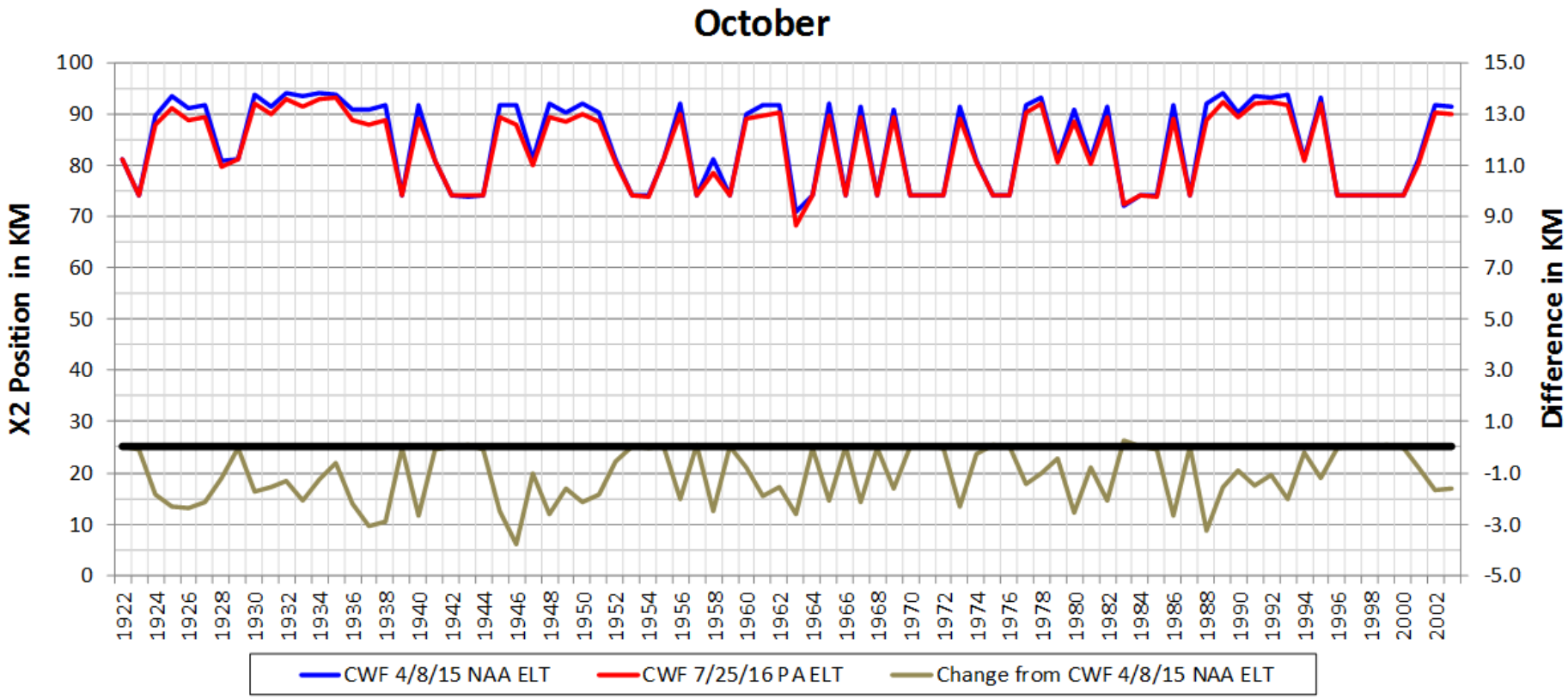
1996
1998
2000
2002
CWF 4/8/15 NAA ELT
CWF 7/25/16 P A ELT
Change from CWF 4/8/15 NAA ELT


October
X2 Position in KM
Difference in KM
100
90
80
70
60
50
40
30
20
10
0
15.0
13.0
11.0
9.0
7.0
5.0
3.0
1.0
-1.0
-3.0
-5.0
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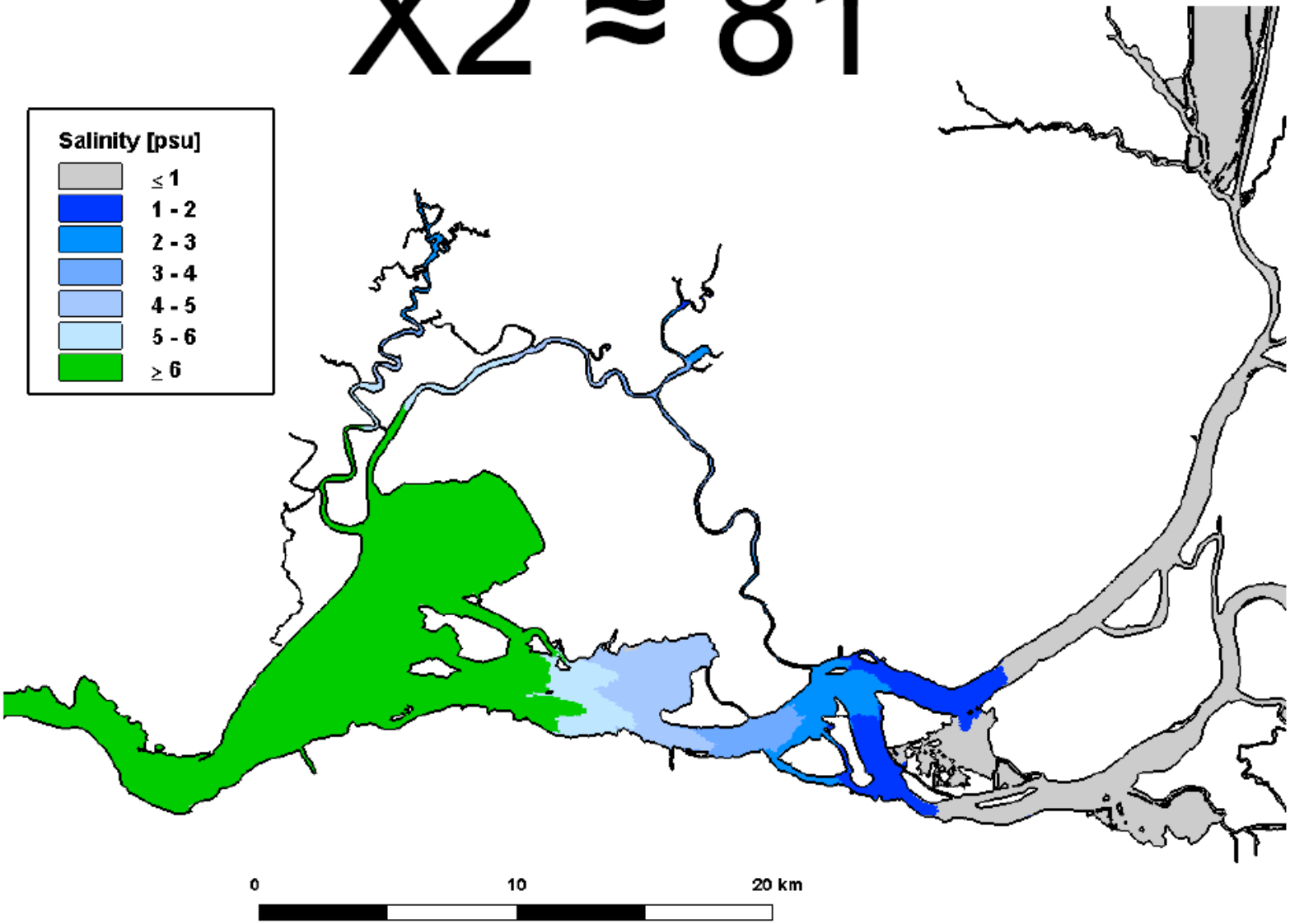
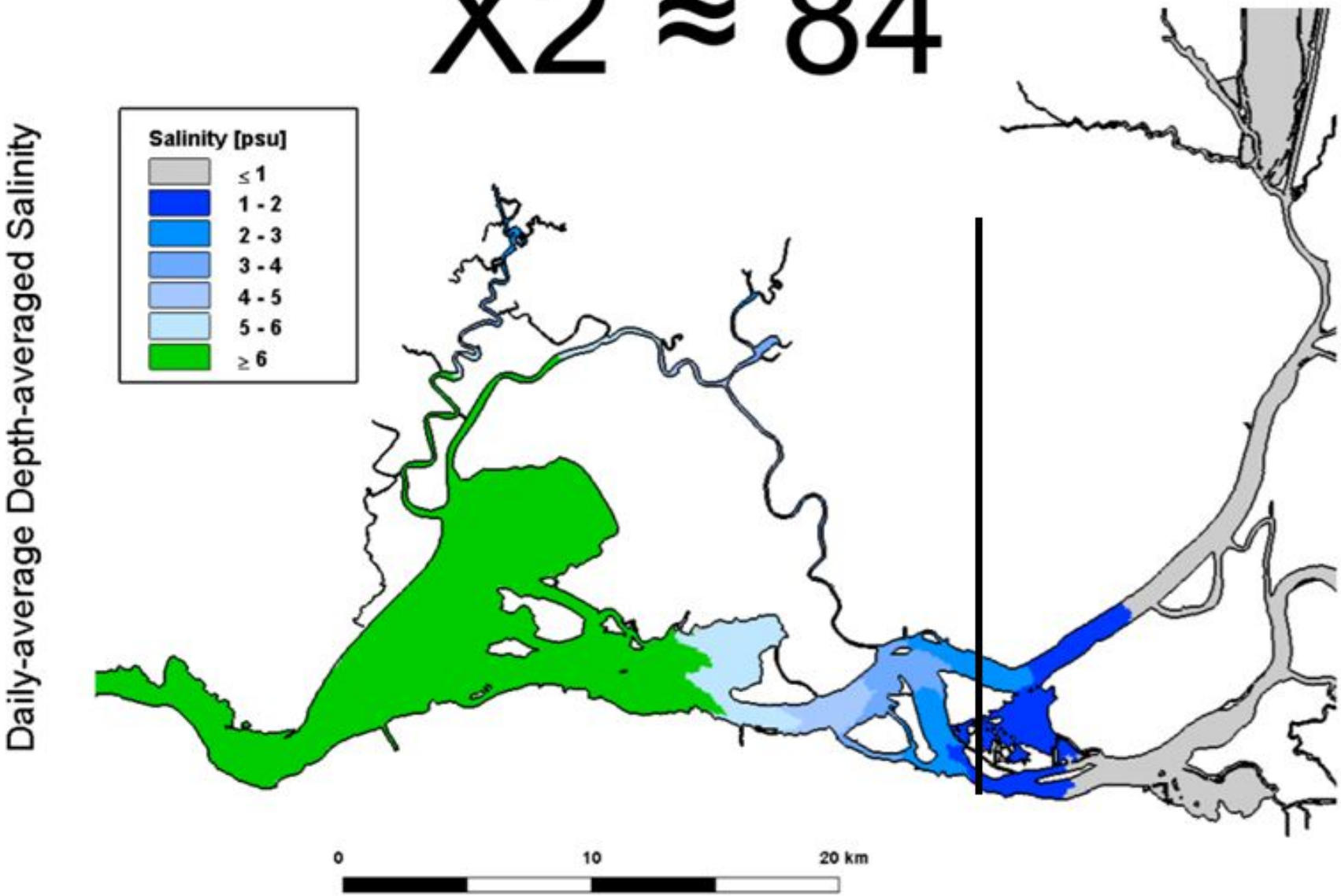
1992
1994
1996
1998
2000
2002
CWF 4/8/15 NAA ELT
CWF 7/25/16 P A ELT
Change from CWF 4/8/15 NAA ELT

X2 ≈ 81

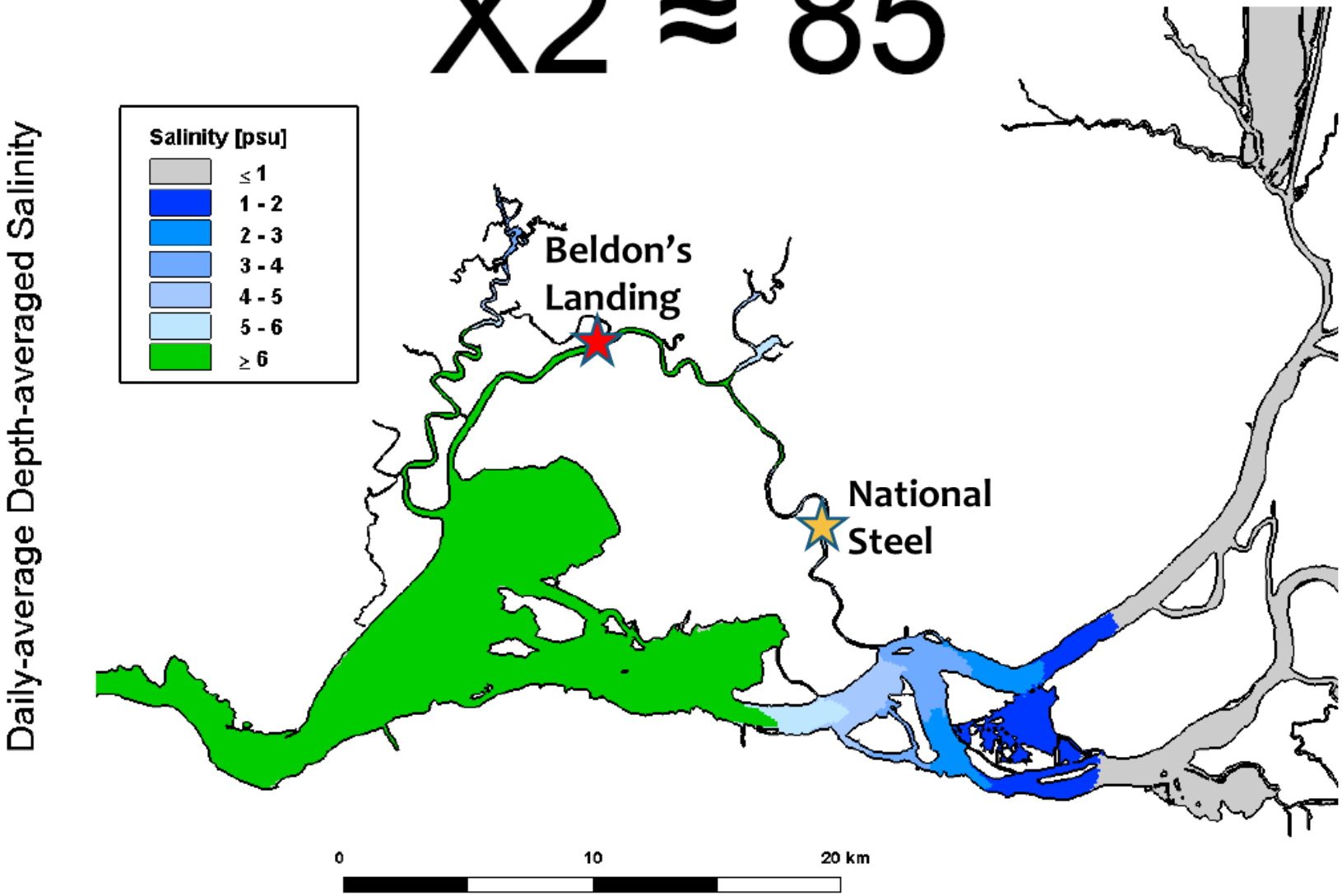
Daily-average Depth-averaged Salinity

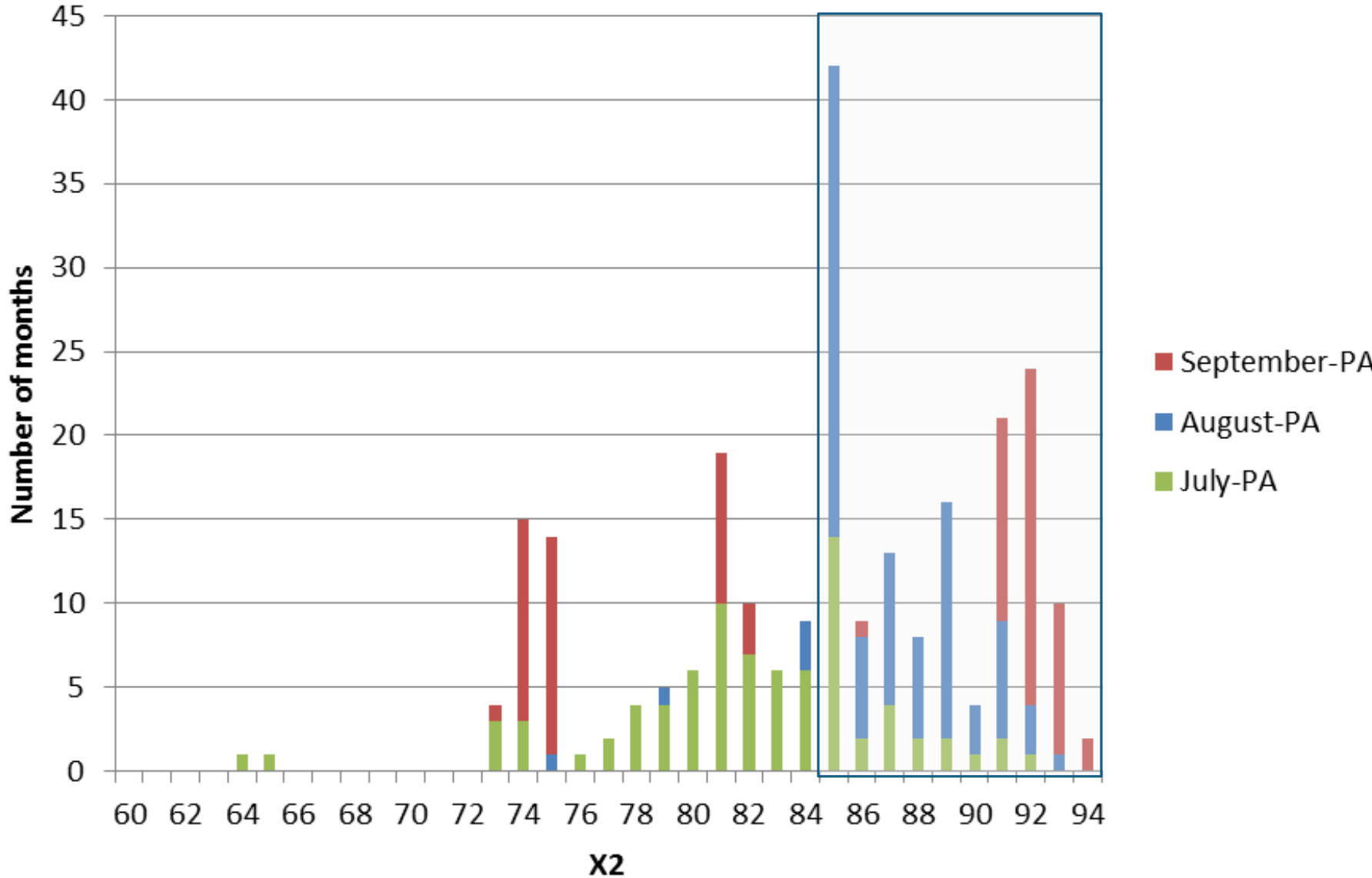


X2 ≈ 84


Daily-average Depth-averaged Salinity
Salinity [psu]
≤ 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
≥ 6
0
10
20 km

X2 ≈ 85


Daily-average Depth-averaged Salinity
Salinity [psu]
≤ 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
≥ 6
Beldon's Landing
National Steel
0
10
20 km



Distribution of predicted X2 values for the Proposed Action for the month of July-September as predicted by CalSim II modeling (N=82)

Summary of the Effects to Critical Habitat

* Improved OMR flows for adult migration and larval and juvenile transport
* Loss of access of shallow water habitat above NDD
* Further eastward salinity intrusion during juvenile rearing

Operations

* Reclamation and DWR have reinitiated consultation on the long term operation of the CVP and SWP
* Also, the State Water Resources Control Board's Water Quality Control Plan will be updated
* Both of these processes will likely result in changes to CWF operations
* These changes are not reflected in the PA because the operational standards are not yet known
* CWF operations will be addressed in the reinitiated consultation
* The operational scenario that is described in the CWF BA will almost certainly change between now and when the dual conveyance system goes online

Reinitiation Triggers

When does reinitiation apply?

* Some project elements and their effects on delta smelt or its critical habitat will change as DWR continues to develop the PA
* May require reinitiation at a project-level if effects rise above those analyzed in the standard consultation part of the CWF BiOp

Delta smelt and critical habitat

* Corps Phase 1 activities
  * Overwater geotechnical explorations
  * Barge landings
  * Clifton Court Forebay
  * Compensatory mitigation, monitoring, and adaptive management associated with Corps Phase 1 activities

Questions?