Delta Smelt-
Fall Habitat and Entrainment

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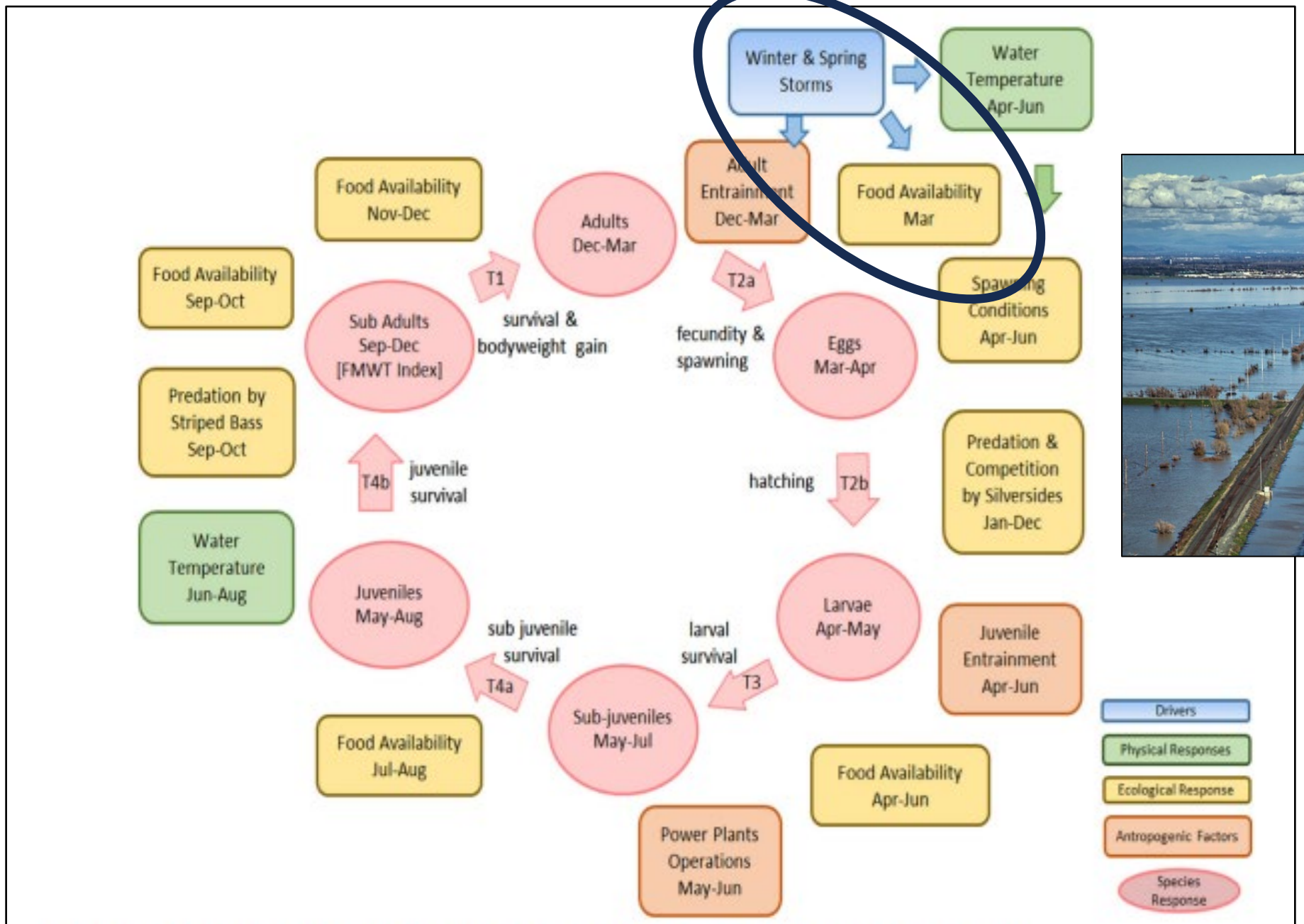
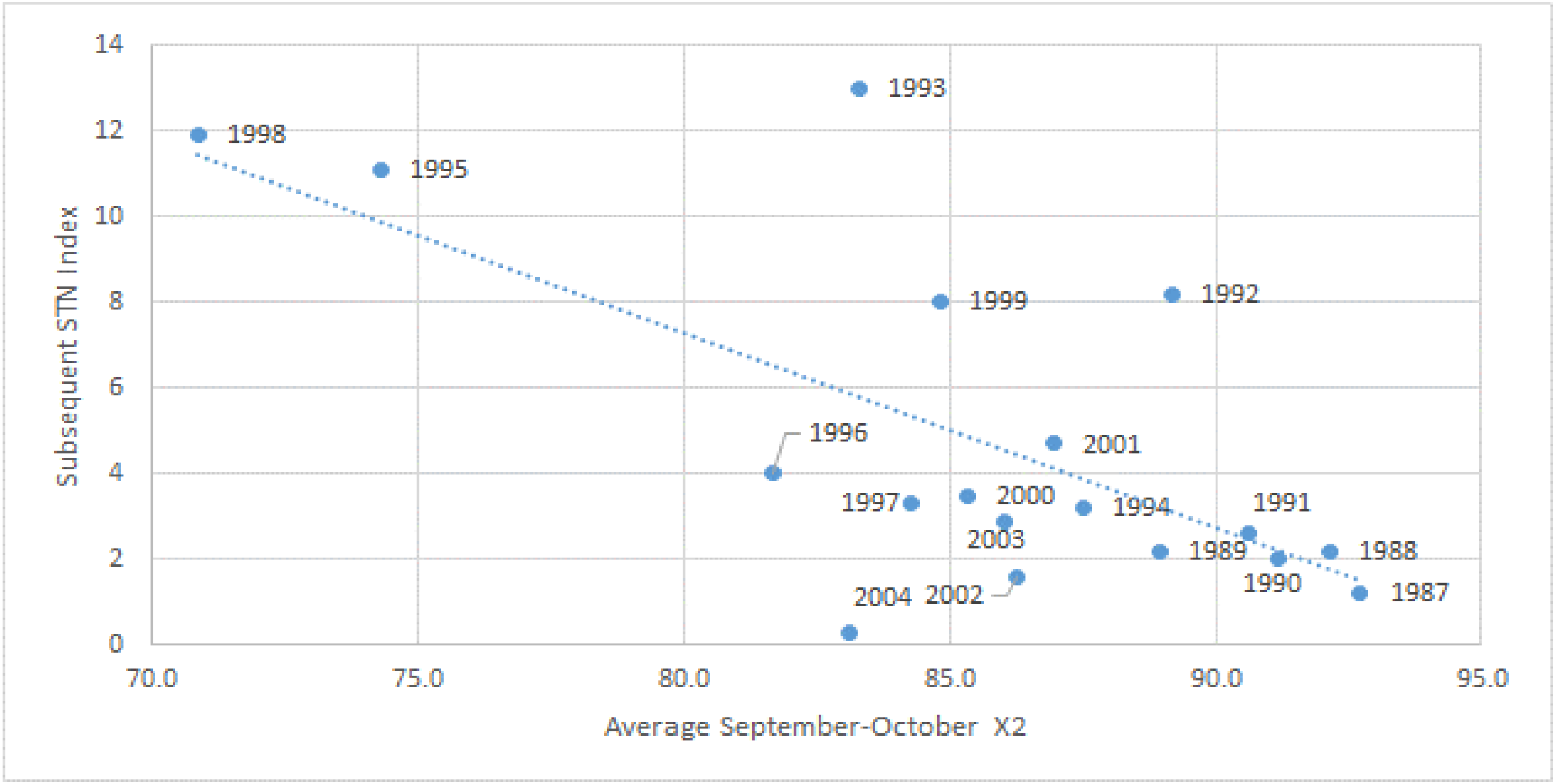


Fig. 2 Conceptual ecological model of the life stages of delta smelt and the ecological influences on them

Hamilton and Murphy (2018), Figure 2.

Original Analysis

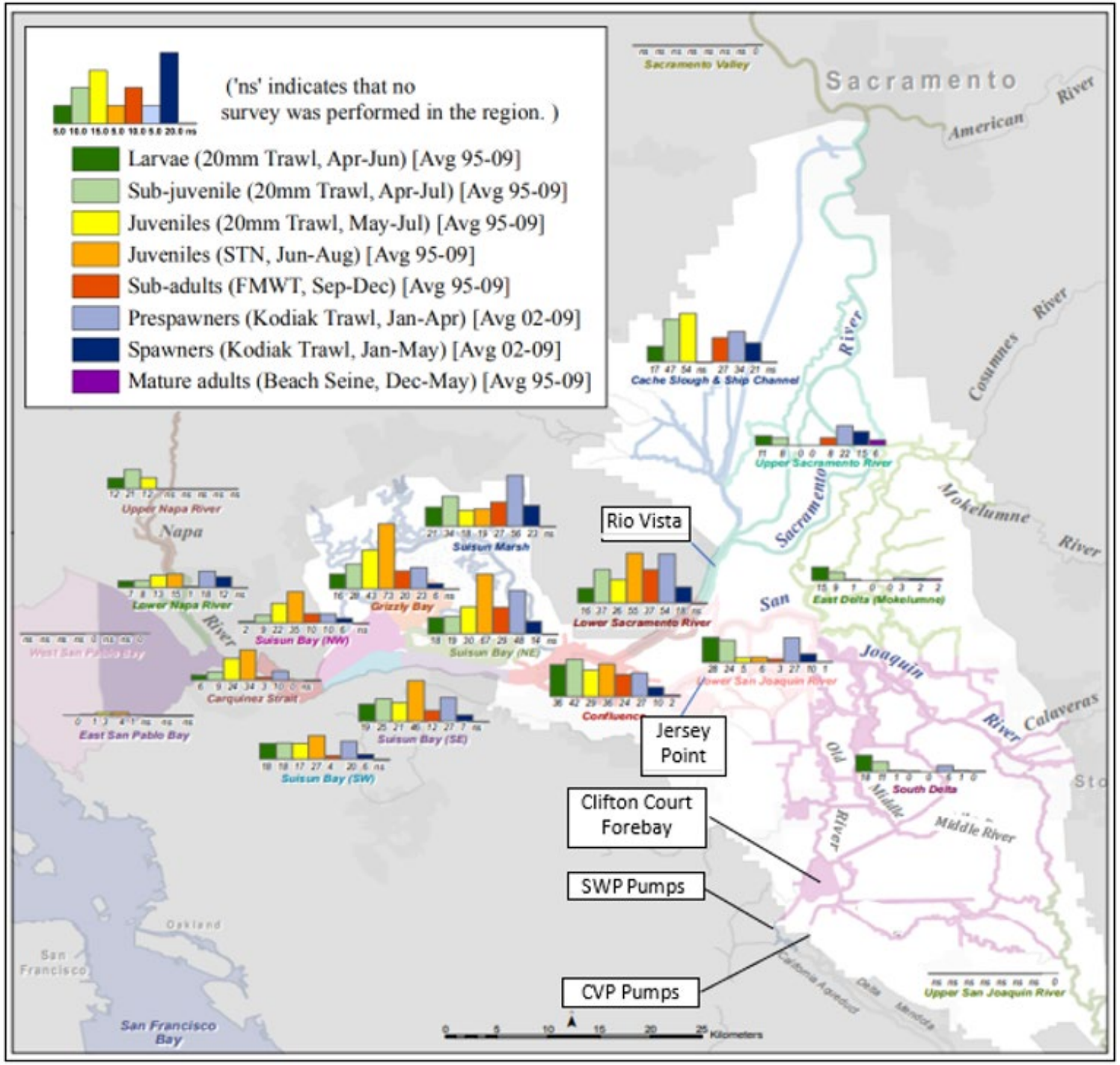


Studies and Papers Related to Fall Habitat

Feyrer et al. (2011)	Found a relationship between Fall X2 and fall abundance but when only post-clam data were used, the relationship no longer existed.
Mac Nally et al. (2010)	Conducted a multivariate study but did not find that Fall X2 was a factor responsible for the decline in abundance of delta smelt.
Thompson et al. (2010)	Used Bayesian model selection to identify covariates with the strongest associations with abundances. Fall X2 was not associated with the FMWT-derived autumn abundance of delta smelt.
Maunder and Deriso (2011)	Their state-space model did not include Fall X2 as a candidate covariate
Miller et al. (2012)	Including Fall X2 did not add explanatory power to their empirical multivariate model.
Mount et al. (2013)	Like Feyrer et al. (2007), did not consider spring X2 and incorrectly attributed an influence to autumn X2.
Brown et al. (2014)	Their fall low-salinity habitat investigation was "largely inconclusive" as to the benefits of a fall outflow action to delta smelt. Their prediction of higher recruitment in the next year due to higher outflow was not supported by the findings presented.
Castillo (2019)	Like Feyrer et al. (2007), did not consider spring X2 and incorrectly attributed an influence to X2 in the autumn.
IEP MAST (2015)	Cited to the 2008 Biological Opinion, (which cited to Feyrer et al. (2007) and Mount (2013) to support a relationship between summer abundance and prior fall X2. The conclusions in those studies become invalid when more relevant covariates are considered. The report asserted that there was support for a fall X2-fall abundance relationship, but it depended on 4 data points. When a longer time period is used, no relationship can be demonstrated.
Hamilton and Murphy (2018)	Their limiting factor model largely explained variation in abundance of delta smelt without including Fall X2 as a candidate covariate.
IEP FLOAT-MAST (2020)	All of their predictions regarding benefits of higher fall outflow to delta smelt and food availability were either not supported by the data or the data were insufficient to draw a conclusion.
Polansky et al. (2021)	Their LCM found a relationship between X2 in the autumn and subsequent recruitment.
Lewis et al (2021)	Decreasing salinity had no effect on growth rates of delta smelt in the western Delta and decreased growth rates in the Confluence, lower Sacramento and lower San Joaquin rivers.
Hammock et al (2022)	Their study of the condition of 1600 delta smelt from multiple years concluded that seasonal and interannual variation in body condition corresponded strongest with pelagic productivity and water temperature, with little correlation to freshwater outflow.
Hamilton and Murphy (2022)	Their limiting factor model considered Fall X2 but found it not to be a factor limiting the performance of delta smelt.
Lee et al. (2023)	Their study found greater prey availability for delta smelt in two wet years than in two dry years. They concluded that was due to flow augmentation in the fall of the wet years without recognizing that prey availability was already high in wet years prior to the fall action (see Figure 3 in Smith and Nobriga 2023).
Smith and Nobriga (2023)	Simulated habitat augmentation of prey and turbidity revealed that the effects of potential restoration actions could vary regionally as the factors limiting delta smelt foraging varied along longitudinal and seasonal gradients. Their Figure 3 showed inadequate levels of food in north Suisun Bay for delta smelt after July in most years, despite X2 being at target levels in the two wet years,

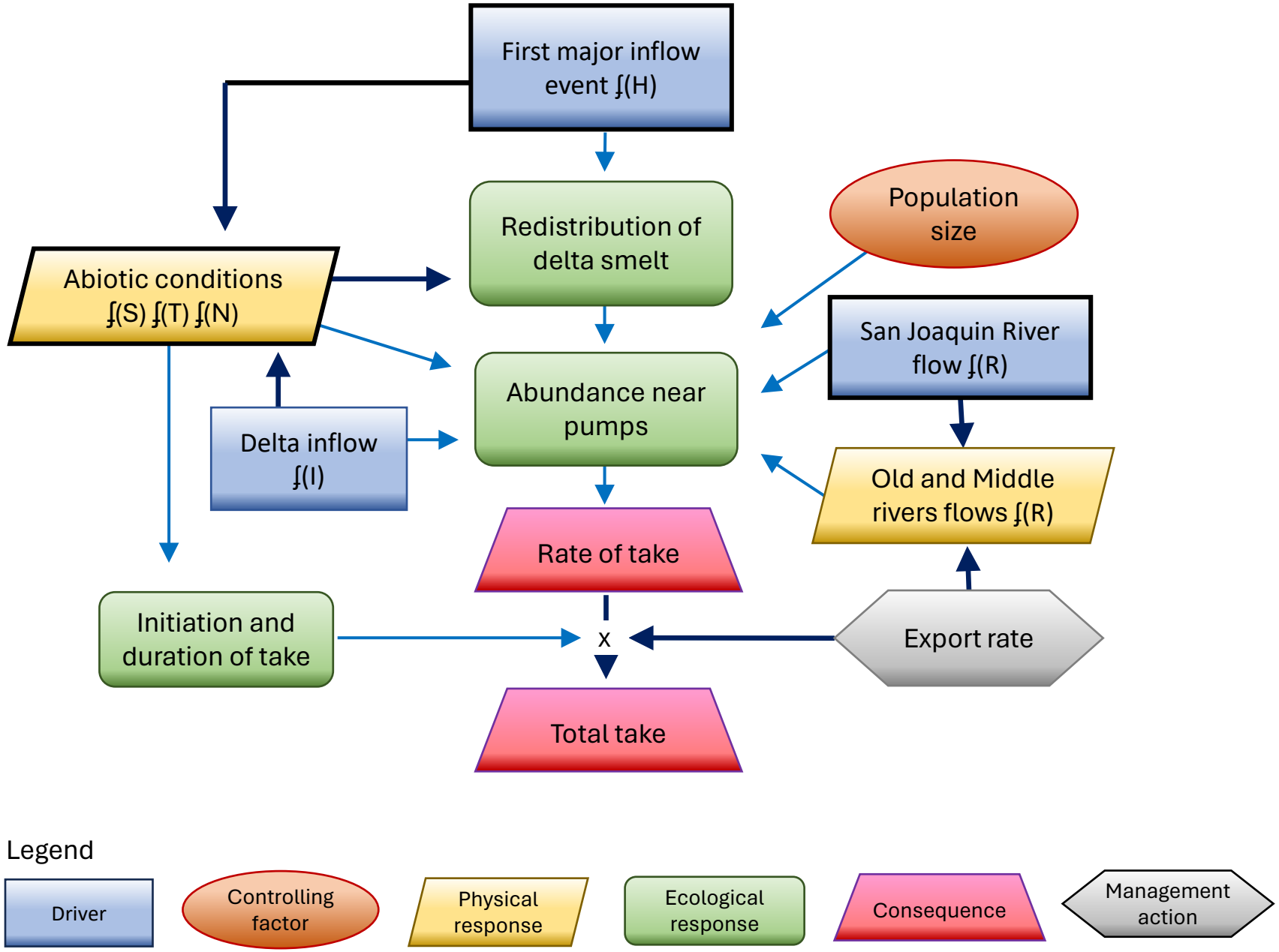
Delta smelt are observed infrequently in the south Delta

Average annual frequency of delta smelt observations (percentage of observations where delta smelt were observed) by life stage and region in IEP Surveys



Merz et al. (2011) Figure 6.

Conceptual Ecological Model for Entrainment of Delta Smelt



Blue arrows reflect biological relationships that vary by life stage. Thick black outlines indicate source of potential precedent conditions.

PRELIMINARY DATA
SUBJECT TO REVISION WITHOUT NOTICE

EXECUTIVE OPERATIONS SUMMARY ON 2/29/2024

This summary, State Water Project informational data, and data for previous 30 days can also be found at:
https://water.ca.gov/Programs/State-Water-Project/Operations-and-Maintenance/Operations-and-Delta-Status

SCHEDULED EXPORTS FOR TODAY

Clifton Court Inflow	=	2,500 cfs
Jones Pumping Plant	=	4,200 cfs

ESTIMATED DELTA HYDROLOGY

Total Delta Inflow	~	119,306 cfs
Sacramento River	=	66,662 cfs
San Joaquin River	=	8,311 cfs

DELTA OPERATIONS

Delta Conditions	=	Excess with Restrictions for Old and Middle River Flow
Delta x-channel Gates (% of day is open)	=	0%
Outflow Index	=	111,600 cfs
% Inflow Diverted	=	6.3 (14-day avg)
X2 Position (yesterday)	<	56 km
Controlling Factor(s)	=	OMR(-2500)
OMR Index Daily Value	=	-2,400 cfs

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RESERVOIR STORAGES (AS OF MIDNIGHT)

Shasta Reservoir	=	3,761 TAF
Folsom Reservoir	=	606 TAF
Oroville Reservoir	=	2,962 TAF
San Luis Res. Total	=	1,395 TAF
SWP Share	=	474 TAF

- ¼ million acre-feet/day flowing to the ocean
- SWP share of San Luis <1/2 full
- 7% of inflow being pumped.
- Is there a need to protect delta smelt during these high outflows?


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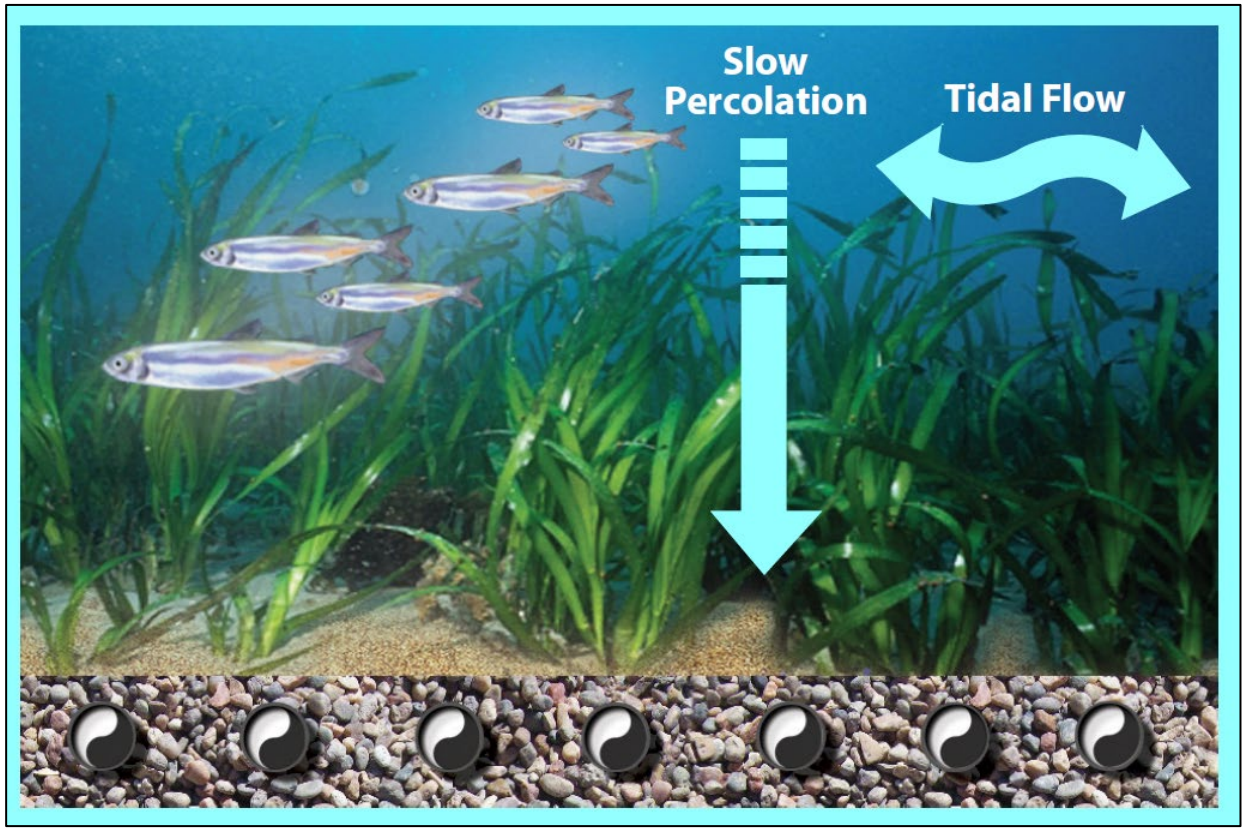
“With the correct water engineering, entrainment effects might be eliminated”

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

2012

Infiltration Galleries

Concept



Installation,
Tuolumne River California

Two findings:

1. The Fall X2 action was based on a faulty analysis and more than a dozen studies since have either repeated similar errors or not supported the action.

2. As tool to manage entrainment, OMR is a blunt instrument for advancing the co-equal goals. There is a need to pursue better short-term and long -term alternatives.