TESTIMONY OF
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BEFORE THE STATE WATER RESOURCES CONTROL BOARD

Phase II – Public Trust Fisheries

The Bay Institute

PREPARED FOR:

NATURAL RESOURCES DEFENSE COUNCIL

TROUT UNLIMITED

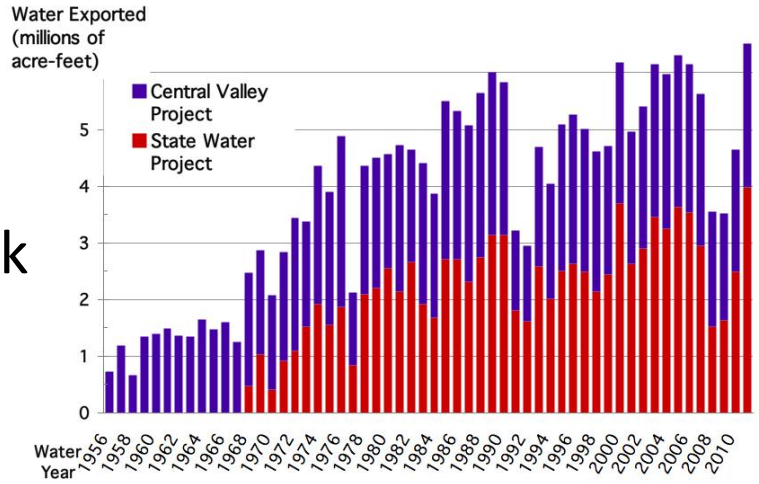
Outline

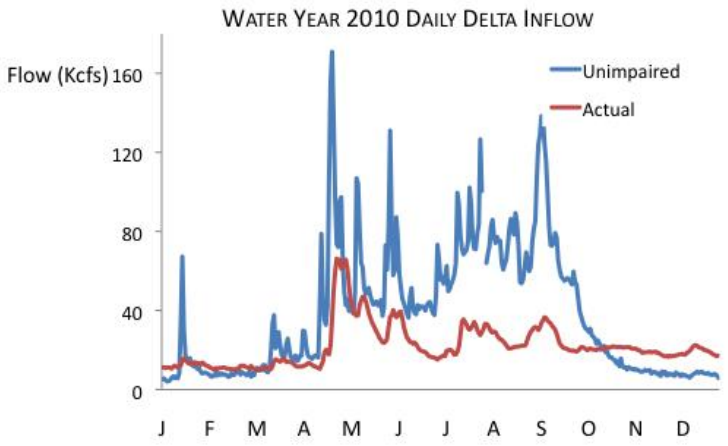
A) Winter-Spring Delta Outflow
B) Delta Hydrodynamics
C) Making Decisions in the Face of Uncertainty

A) Delta Outflows

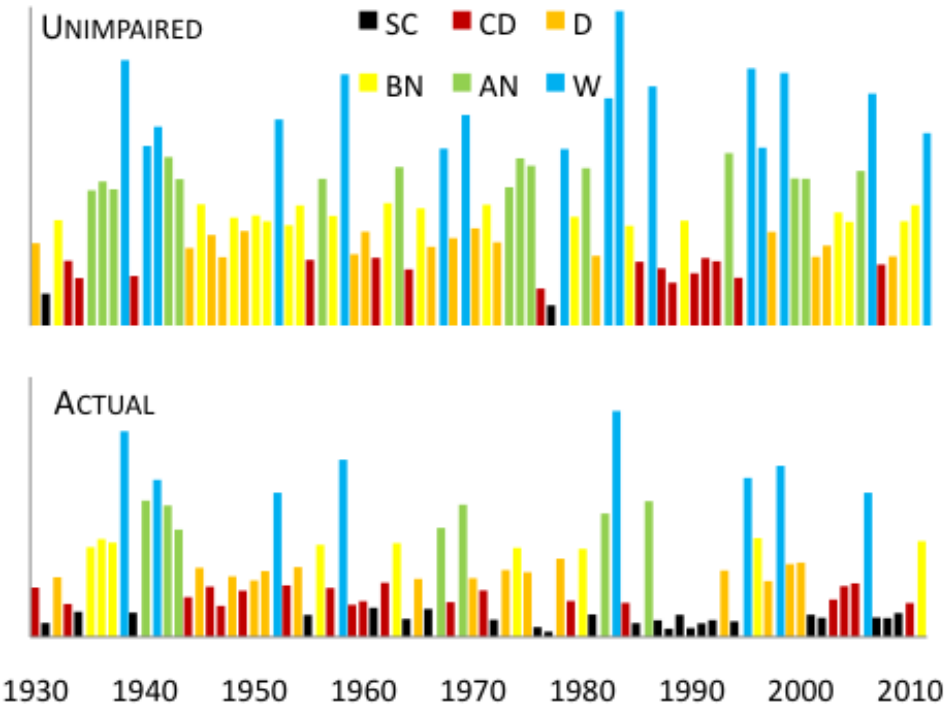
The Board has a Very Strong Scientific Basis for Significantly Increasing Winter-Spring Delta Outflows

- Central Valley water diversions have increased substantially through time
- The magnitude, timing, duration of peak flows has been radically altered
- Populations of numerous fish and invertebrate species have declined precipitously
- Connections between timing, magnitude, frequency, and duration of flow and viability of native fish species are numerous and strong





Increasing Outflow is Critical Because The Bay-Delta Estuary is Experiencing a Man-Made Permanent Drought



Hydrology Since 1967		
Yr Type	**Unimpaired**	**Actual**
Wet	11	4
Super-Critical	1	17

Water Year Type Classifications

- ~20% exceedence categories
- "Super Critical" (SC) = 97.5% exceedence

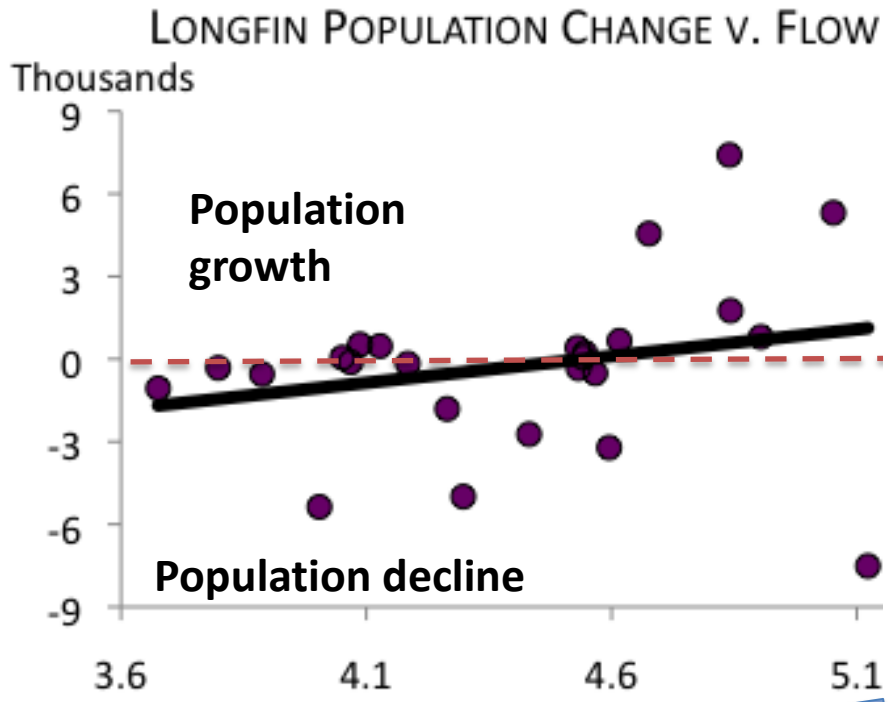
Delta Freshwater Flow Criteria are Closely Linked to Attributes of Viability for Numerous Species

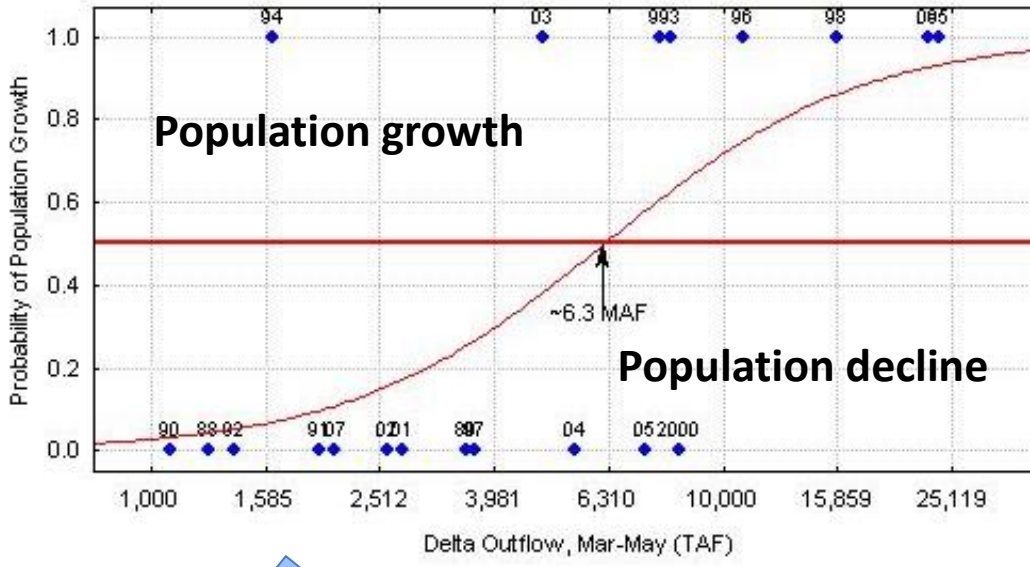
Viability Attribute	Flow Criteria: Delta outflows	San Joaquin River Delta Inflows	Sacramento River Delta Inflows	Delta Hydrodynamics
Abundance	**longfin smelt** **bay shrimp** **delta smelt** starry flounder Sacramento splittail striped bass American shad Eurytemora affinis (spring) *habitat abundance for estuarine species*	**fall run Chinook salmon** spring run Chinook salmon *Abundance of and transport to accessible cold-water riverine habitats and communities*		**SJR Chinook salmon** **Sacramento River Chinook salmon** **Delta smelt** *abundance of habitat for smelt species in the south Delta*
Spatial Extent	**longfin smelt** **Delta smelt** **striped bass YOY** starry flounder bay shrimp *transport both seaward and landward (e.g. gravitational circulation)*	**fall run Chinook salmon** **spring run Chinook salmon** steelhead white sturgeon green sturgeon Sacramento splittail longfin smelt Delta smelt *Distribution of productive cold-water riverine habitats and communities*	**fall run Chinook salmon** **Sacramento splittail** **spring run Chinook salmon** **winter run Chinook salmon** **late-fall run Chinook salmon** white sturgeon green sturgeon American Shad striped bass *increased distribution of floodplain*	longfin smelt Delta smelt fall run Chinook salmon (SJR) spring run Chinook salmon (SJR) *Spatial distribution of spawning and rearing habitats in the South Delta*
Diversity	*increased occurrence of juveniles seaward for freshwater spawners and landwards for marine spawners*	**fall run Chinook salmon** spring run Chinook salmon white sturgeon steelhead *Diversity of riverine hydrographs and habitats in the Central Valley*	fall run Chinook salmon spring run Chinook salmon winter run Chinook salmon late fall run Chinook salmon *increased availability of floodplain habitats*	**Delta smelt**
Productivity/ Stability	**longfin smelt** **bay shrimp**	**fall run Chinook salmon**	**fall run Chinook salmon** **Sacramento splittail** spring run Chinook salmon winter run Chinook salmon late-fall run Chinook salmon white sturgeon green sturgeon American Shad striped bass *increased production and transport of materials off of floodplains to river and tidal habitats*	**longfin smelt** **Delta smelt** **SJR Chinook salmon**

Reprinted from TBI et al. (2010)

Well-supported flow objectives to protect the Public Trust have been identified

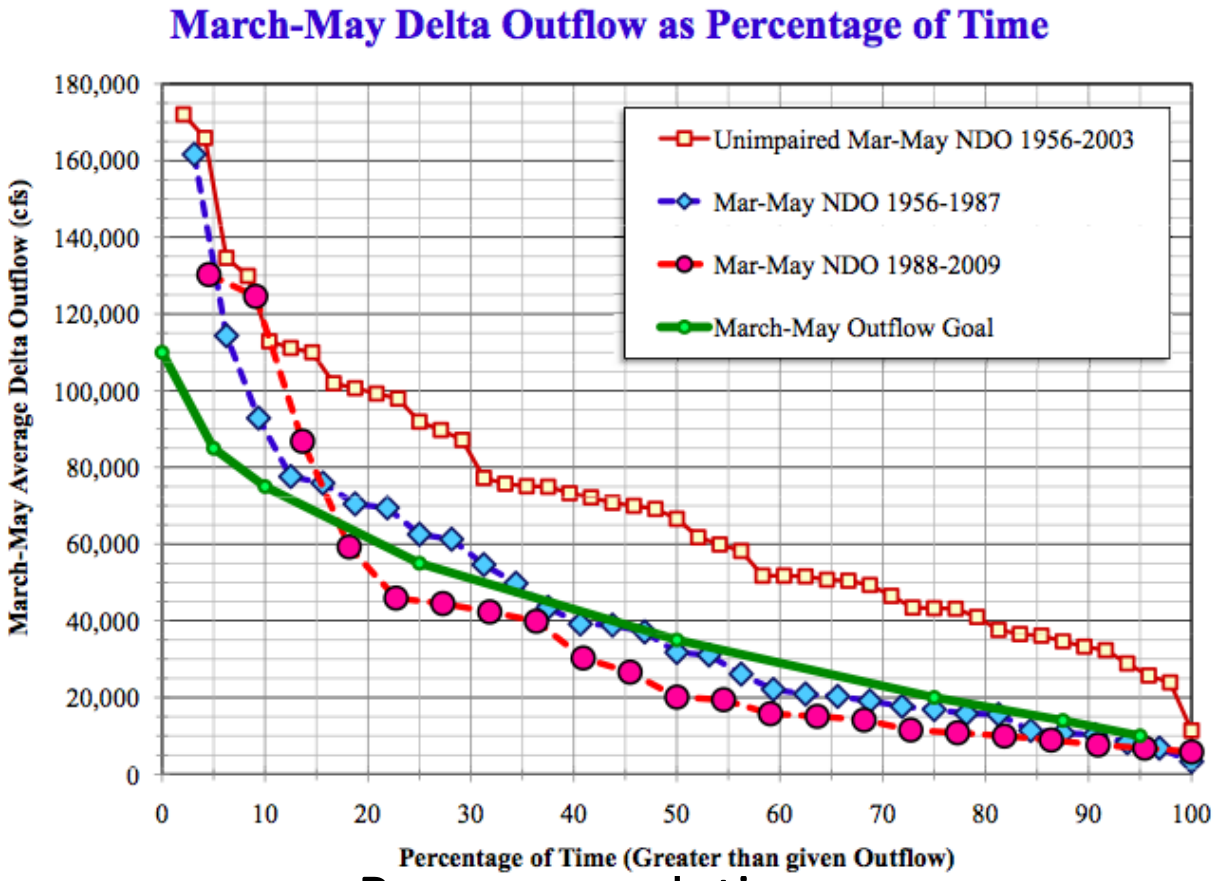
Ex. 1 -- Outflow and Longfin Abundance (2010)





Finding:

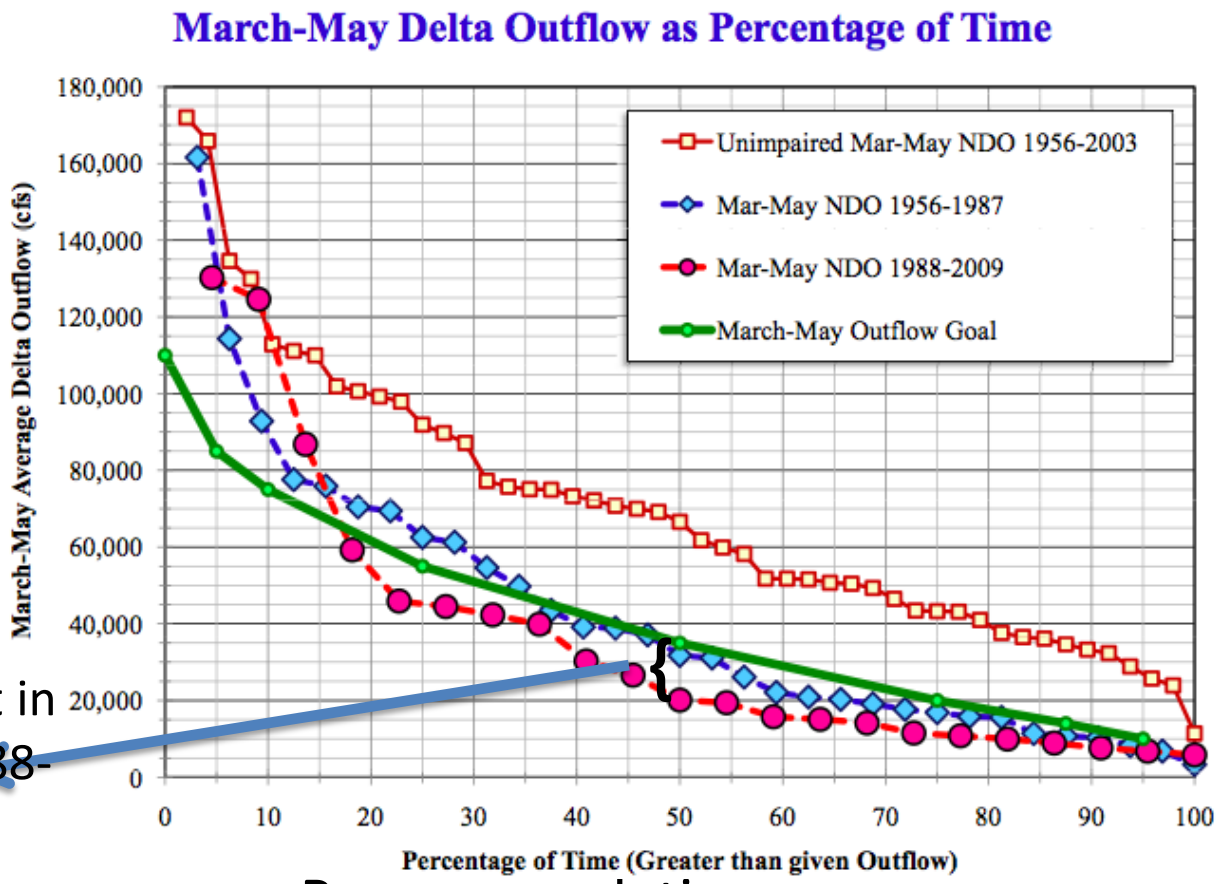
Flows that allow longfin population to grow in ~50% of years are attainable and consistent with those of the 1956-1987 period



Recommendations

(2010) ~6.3MAF spring NDO (>50% likelihood of population growth in 50% of years) and that %UIF throughout most of the frequency distribution

Flow Necessary to Support Restoration of Pelagic Fish Species Far Exceed Flows of the Recent Past



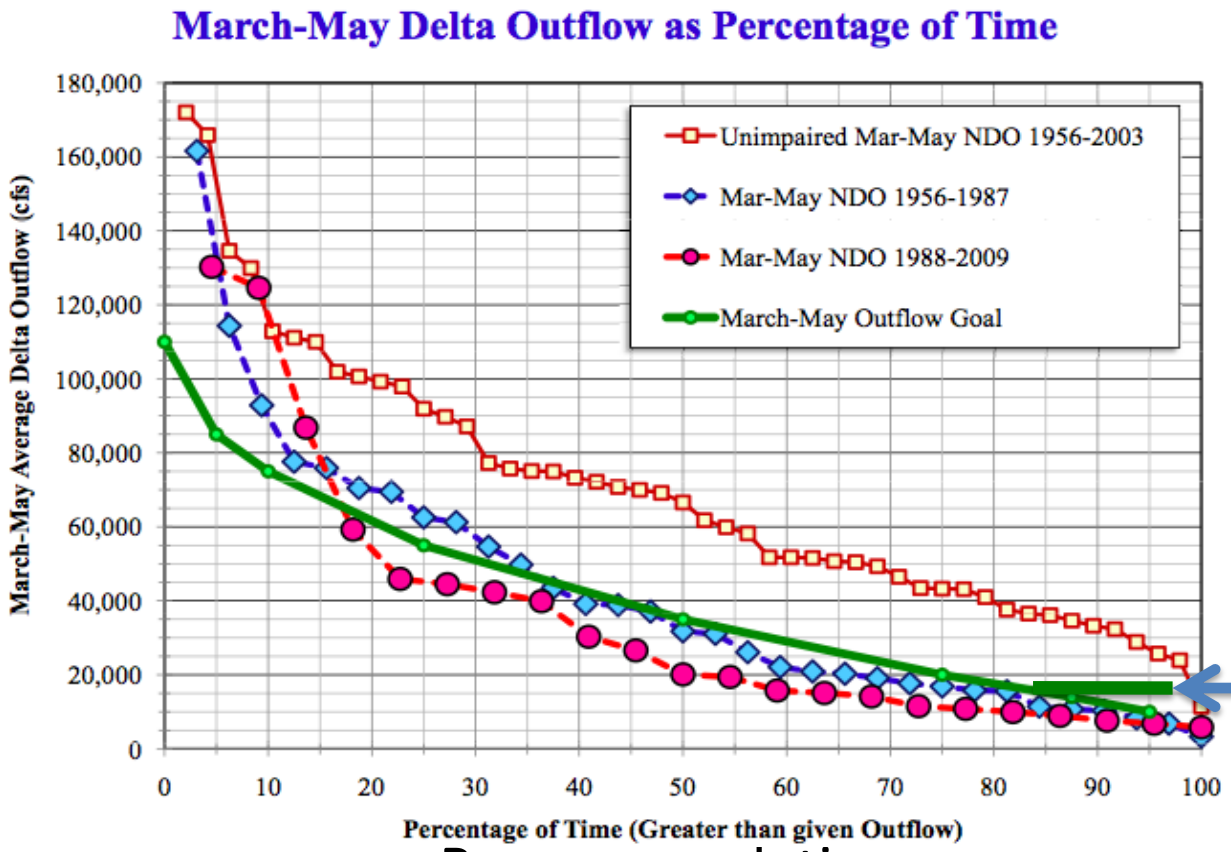
~75% improvement in median flows v. 1988-2009 period

Recommendations

(2010) ~6.3MAF spring NDO (>50% likelihood of population growth in 50% of years) and that %UIF throughout most of the frequency distribution

Preliminary Findings of New Research:

Given current flow patterns, Longfin populations will not stabilize until they are virtually (or actually) extinct



New Minimum Flow Criteria (specific recommendation forthcoming)

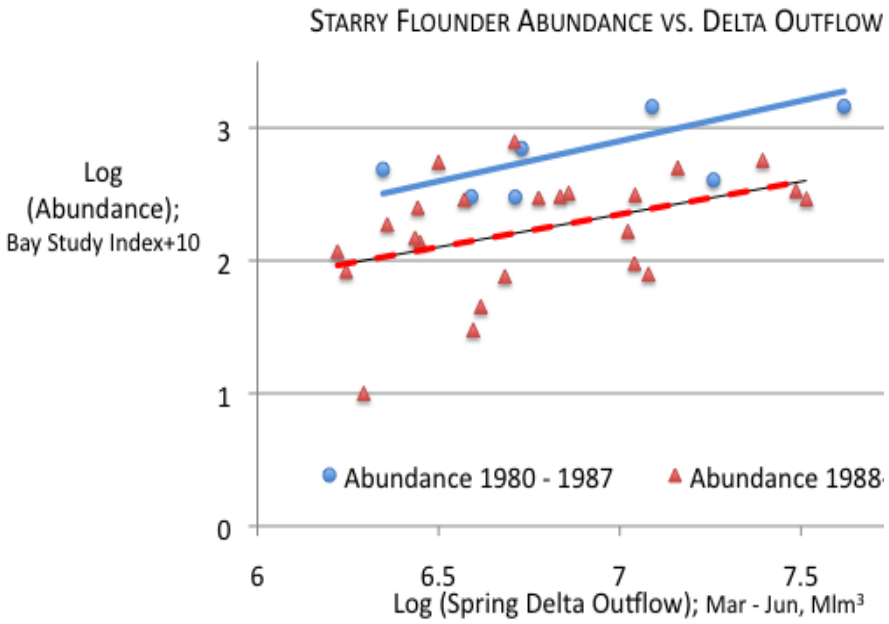
Recommendations

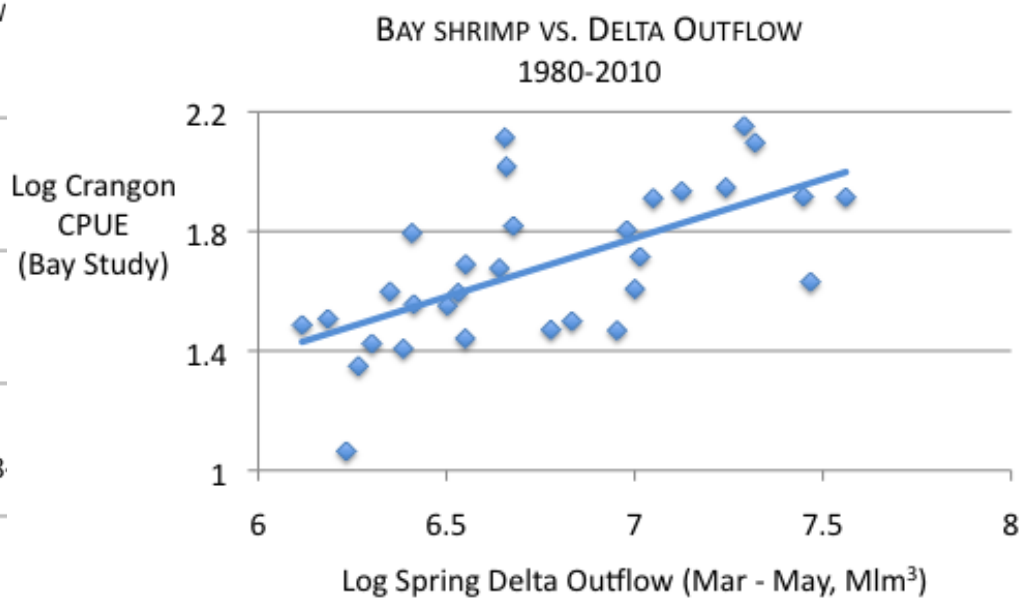
(2010)~6.3MAF spring NDO (>50% likelihood of population growth in 50% of years)

AND

(2012) ~3+MAF Min. spring NDO (necessary to maintain viable population in driest ~15% of years)

Strong and widespread connections between spring Delta outflow & viability of numerous species





Flows necessary for longfin smelt population growth are consistent with improved abundance of other pelagic species and food web productivity

B) Delta Hydrodynamics

The Board has a Very Strong Scientific Basis for Limiting Net Negative (Reverse) Flows in the South Delta

- On average, every year, 10,000,000's – 100,000,000's of fish are entrained by South Delta exports
- A substantial fraction of Delta primary productivity (not to mention production at higher trophic levels) is exported from the Delta via the South Delta exports

Selected Fish Species	1993-2011 Annual Salvage	
	Average	Maximum
American shad	1,022,700	2,510,184
Bluegill	127,133	394,952
Channel catfish	45,799	131,484
Chinook salmon (winter run) Chinook salmon (spring run) Chinook salmon (fall run) Chinook salmon (late-fall run)	51,955	183,890
Delta smelt	29,918	154,820
Green sturgeon	58	363
Inland silverside	62,838	142,652
Largemouth bass	54,180	234,198
Longfin	6,228	97,686
Prickly sculpin	76,403	274,691
Steelhead (Rainbow trout)	5,278	18,580
Redear sunfish	1,609	5,611
Riffle sculpin	155	798
Sacramento sucker	3,443	27,362
Sacramento splittail	1,201,585	8,989,639
Striped bass	1,773,079	13,451,203
Threadfin shad	3,823,099	9,046,050
White catfish	296,543	941,972
White sturgeon	151	873
Yellowfin goby	193,399	1,189,962

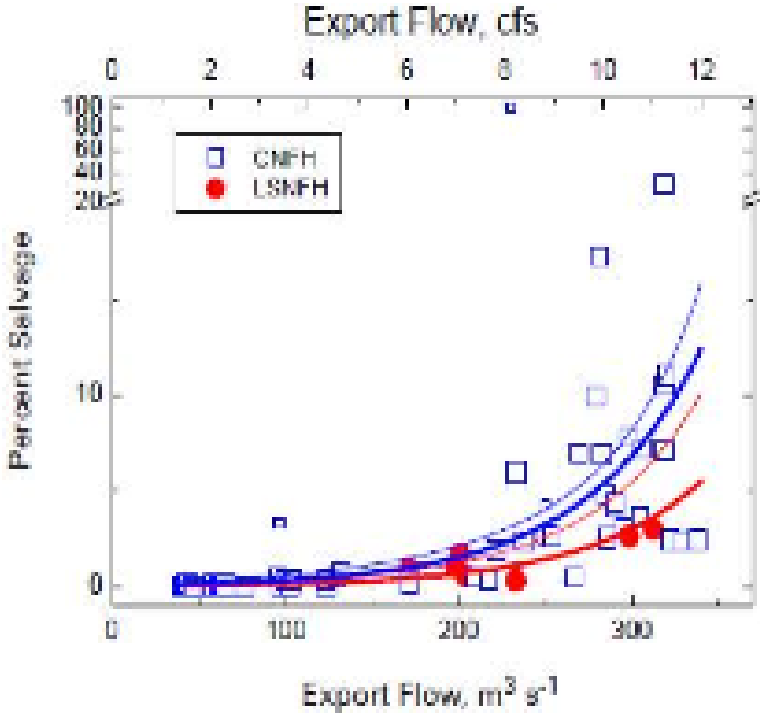
Average yearly salvage total: 9,237,444

Entrainment as a Multi-faceted Problem
(with strong mechanistic underpinnings)

- Abundance Effects

  For some species, entrainment mortality is an episodic and substantial impact to the population

  (e.g. Bennett 2005; Kimmerer 2008; NMFS 2008; CDFG 2009; USFWS 2008, 2012)



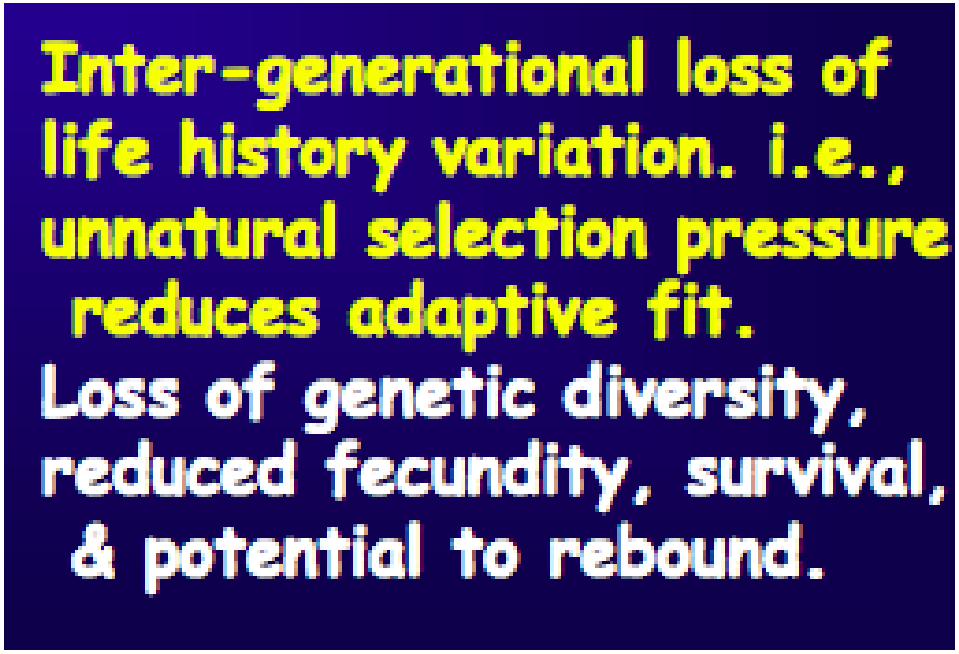
Reprinted from Kimmerer 2008

"...a loss [of Delta smelt] *to export pumping on the order reported by Kimmerer (2008) can be simultaneously nearly undetectable in regression analysis, and devastating to the population. This also illustrates how inappropriate statistical significance is in deciding whether an effect is biologically relevant."* [Kimmerer 2011]

The Many Faces of Entrainment

- Abundance Effects
- Life History Diversity Erosion

Similar life history impacts would be expected for many native species including longfin smelt and Chinook salmon



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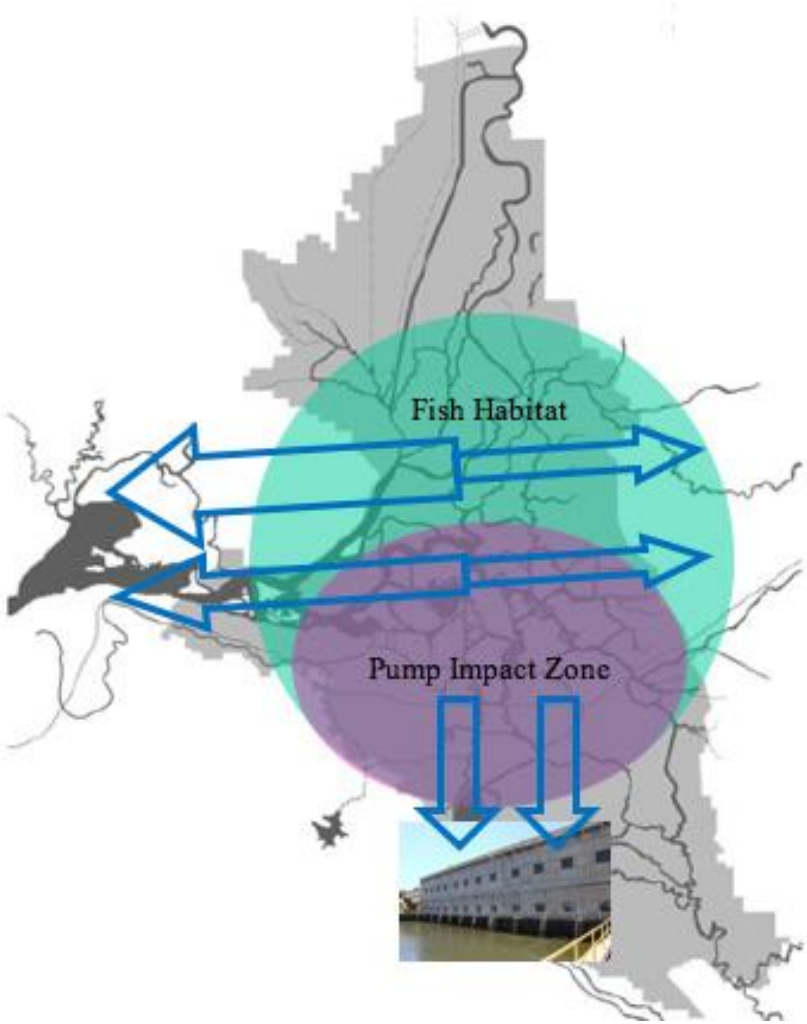
The Many Faces of Entrainment

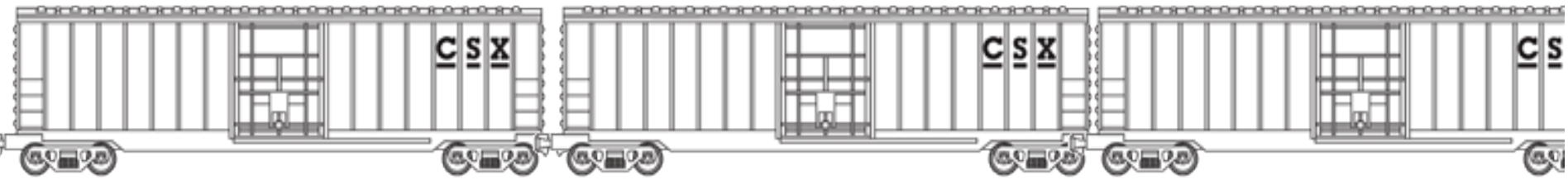
- Abundance Effects
- Life History Diversity Erosion
- Range Constriction
  - Consistent mortality + poor South Delta conditions restrict range of fishes including Delta smelt; longfin smelt (Rosenfield 2010); and San Joaquin Salmon
  - Range restriction increases susceptibility to catastrophic events (Rosenfield 2002)



The Many Faces of Entrainment

- Abundance Effects
- Life History Diversity Erosion
- Range Constriction
- Loss of Productivity (population and system-wide)

"Water export from the Sacramento-San Joaquin Delta is a direct source of mortality to fish… and export plus within-Delta depletion alters system energetics of an already low-productivity ecosystem by removing phytoplankton biomass equivalent to 30% of Delta primary production." [Cloern and Jassby, *in press*].



~three 50' boxcars worth of water (& food) exported every second

Specific Levels of in-Delta Flows that are Consistent with Maintaining Public Trust Resources Remain Undetermined

But, there is zero compelling scientific evidence supporting maintenance of quasi-permanent net negative flow conditions, particularly in drier years

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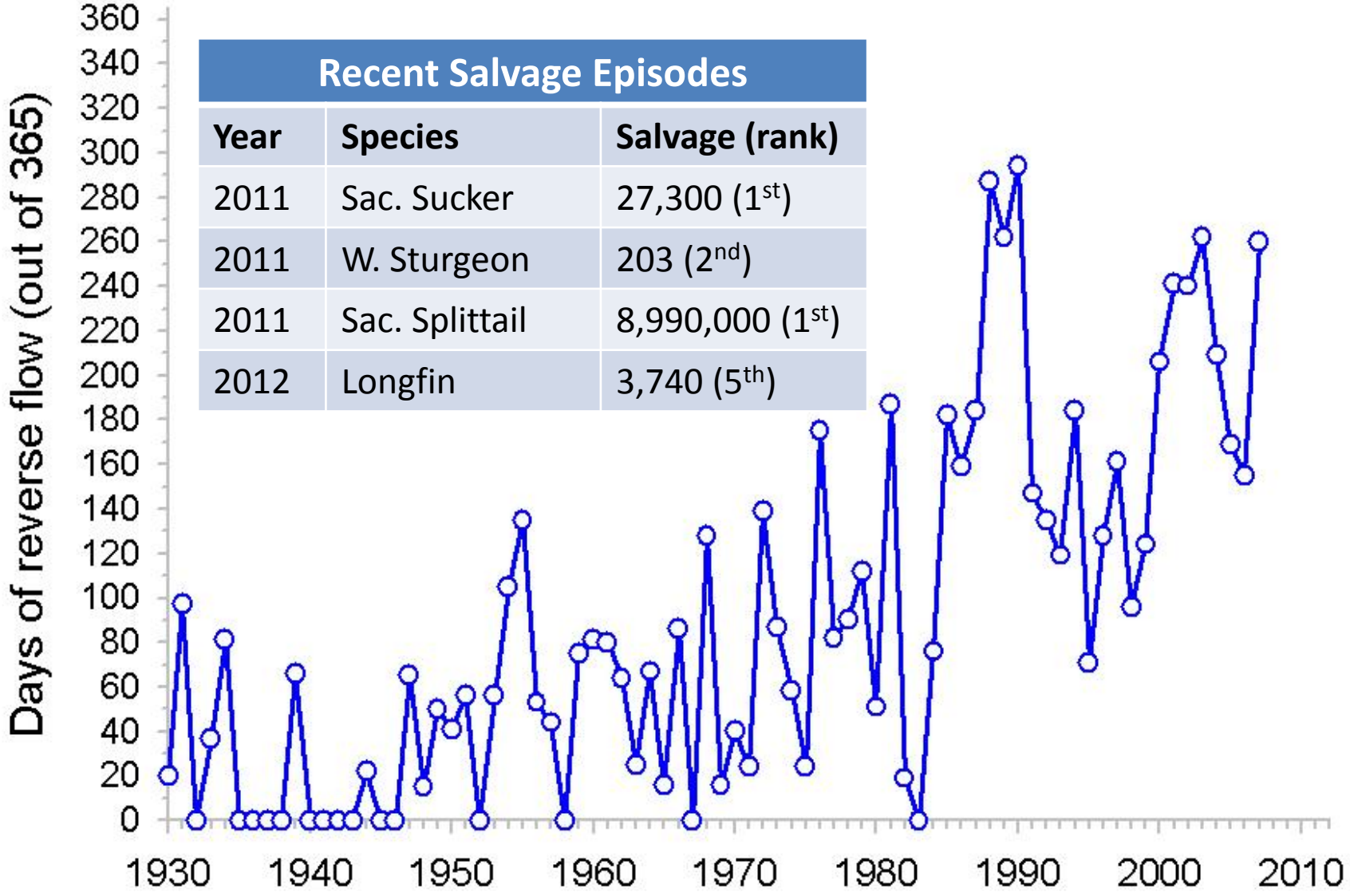
Flows Required to Prevent Extinction of Endangered Species may not Adequately Protect Other Species

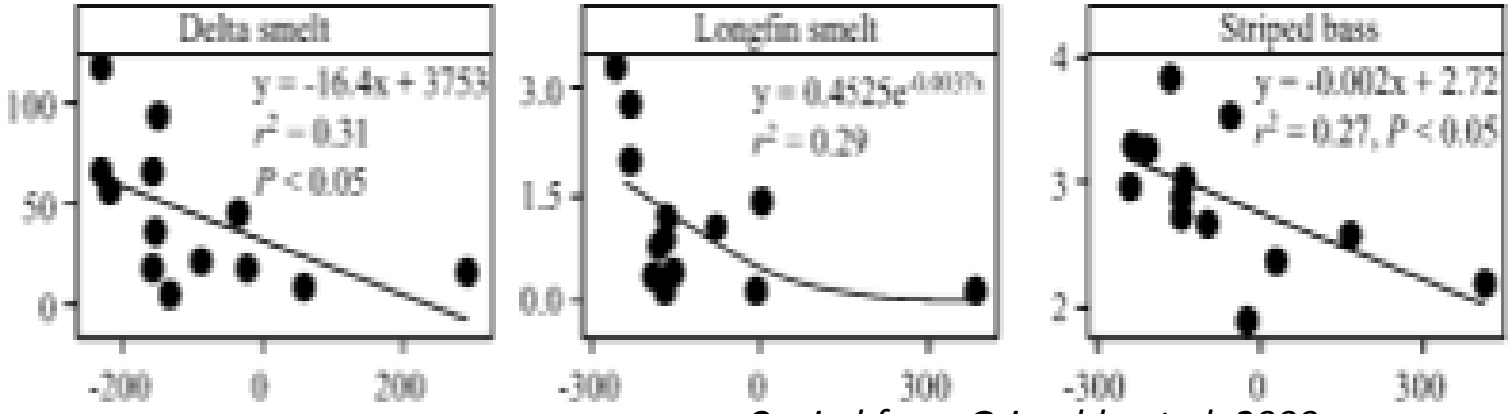
Recent Salvage Episodes		
Year	**Species**	**Salvage (rank)**
2011	Sac. Sucker	27,300 (1st)
2011	W. Sturgeon	203 (2nd)
2011	Sac. Splittail	8,990,000 (1st)
2012	Longfin	3,740 (5th)



Well-supported Delta Hydrodynamic Objectives to Protect Public Trust Resources Can Be Identified

Ex. 2 – Entrainment and Net OMR Flows

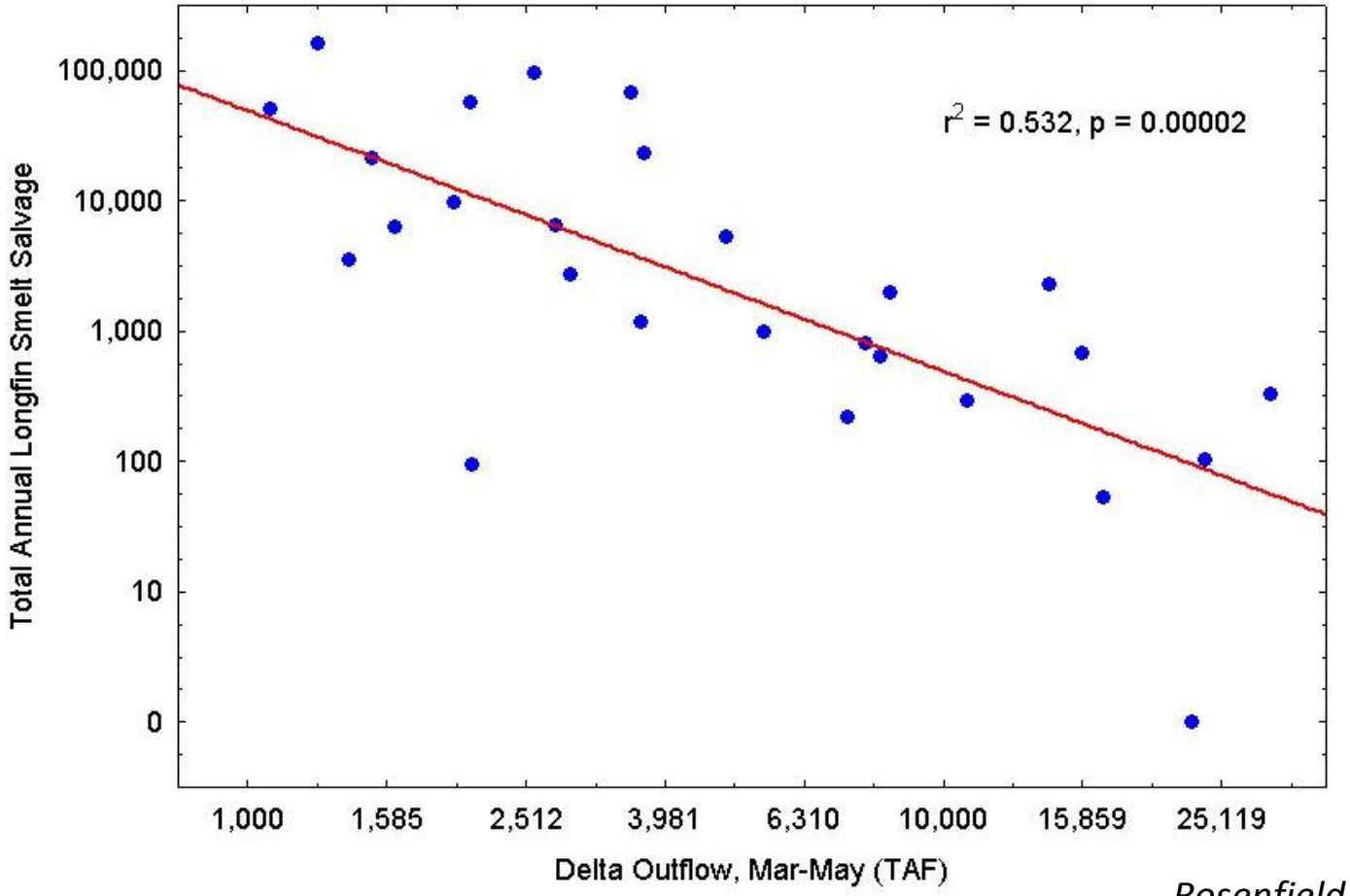
OMR indexes entrainment risk for some species



Copied from Grimaldo et al. 2009

Entrainment risks increase substantially when OMR flows < 0cfs

Entrainment of Many Pelagic Fishes Increases When Outflow is Low (i.e. When it is Dry)



Rosenfield 2010

This is consistent with our understanding of spawning and early rearing ecological requirements for these fish

Public Trust Flow Objectives For Delta Hydrodynamics Must Do More Than "Avoid Extinction"

- May be managed adaptively (in real time and across WQCP Triennial review periods) to learn what works
- Requirements of the Biological Opinions to avoid jeopardy must be the floor (lower limit) of the adaptive range
- OMR > 0cfs during ecologically sensitive seasons will be necessary during drier years and/or when abundance falls below critical threshholds
- Upper end of the adaptive range should include net positive flows with duration increasing as hydrology permits

C) Addressing Uncertainty in a Planning Framework

- What specific, measureable ecological outcomes represent adequate protection of the Public Trust? By when will these be attained?
- What stressors prevent the attainment of those goals and targets currently?
- How much change (specifically) in those stressors is necessary to contribute to the Biological Targets? By when will this stressor reduction occur?
- What actions will the Board implement in order to affect stressor reduction targets within the specified time frame?
- How much is each of these actions expected to contribute to stressor reduction?

Biological Outcomes – Goals and Targets

Guide All Actions in Conservation Planning

Salmonids and Sturgeon

- Doubling from 1967-1991 average (by when?)
  - –CVPIA/State Law
- San Joaquin Restoration Settlement Act
- Recovery Plans

Pelagics

- Draft USFWS Recovery Plan (1995)
  - –Attain population dynamics ≅ 1967-1984 (by when?)

Red Herring #1

We cannot go back to the ecosystem of the past
(a.k.a. “Regime Change”)

≠

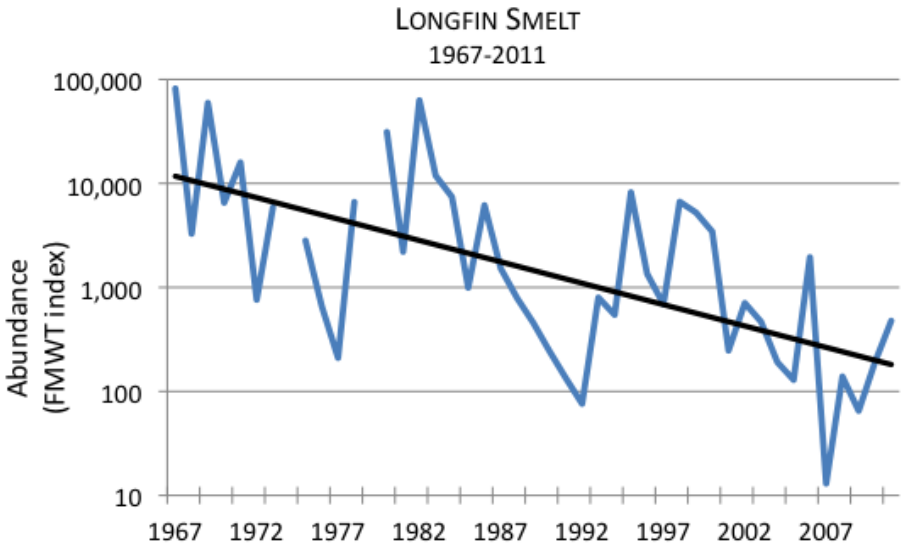
…we must settle for less; or
near extinction is the best we can do; or
scarcity is our future

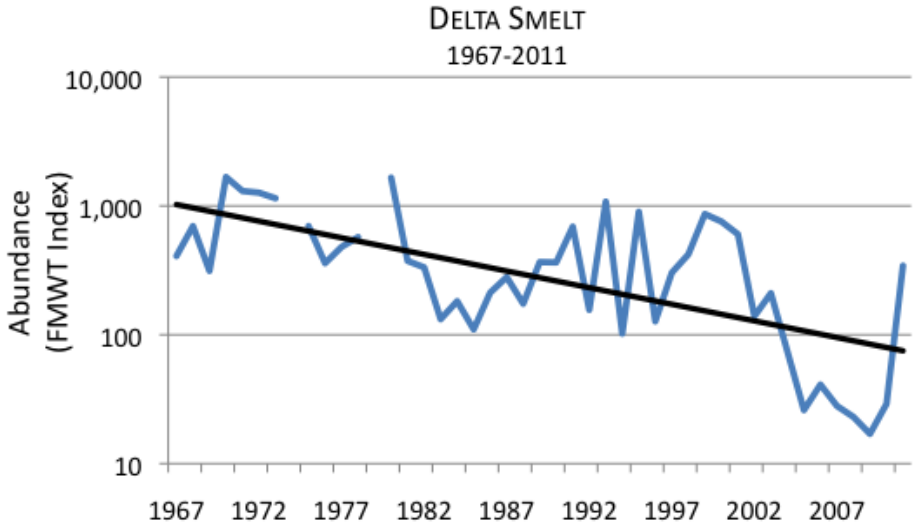
With flow *and* habitat improvements necessary for some species (e.g. smelt), other species (e.g. splittail, salmon) could do substantially better than we’ve witnessed since sampling began

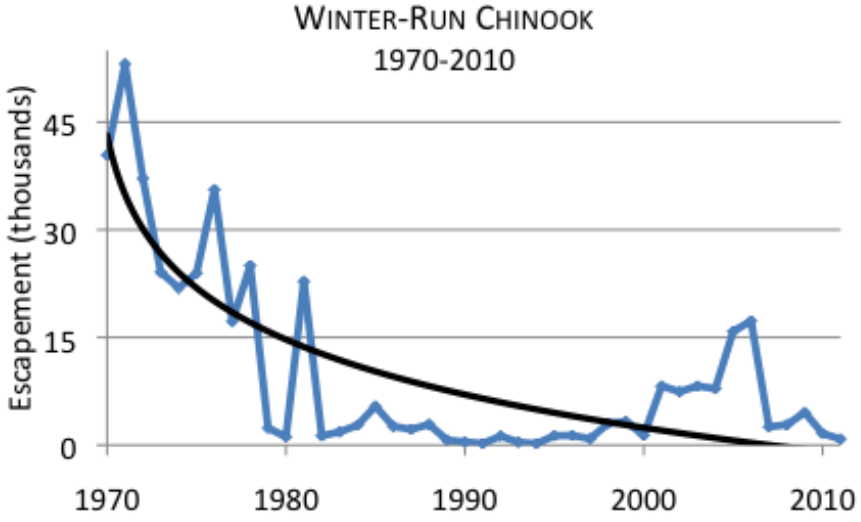
Red Herring #2

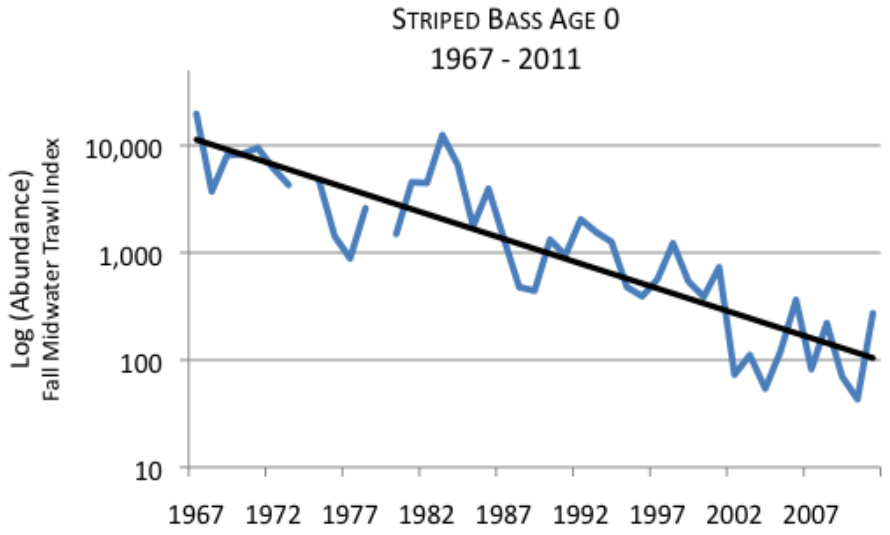
The 2010 Flow Criteria Report is too aggressive; the Board should tweak flow criteria and use “Adaptive Management” to better understand the problem and evaluate potential solutions

Precarious Nature of the Bay-Delta's Public Trust Resources Provides Little Scope for a Tepid or Incremental Approach









Summary

Improvements in Delta outflow and hydrodynamic conditions are absolutely necessary, if not alone sufficient, to protect and restore native fishes and invertebrates

Scientifically supported flow recommendations necessary to support various elements of the Public Trust are contained in our earlier submissions to the Board

Adaptive management is appropriate to address uncertainty regarding specific parameters, but it cannot be a rationale for inadequate protections of imperiled resources

The Bay Institute