Overview of the Biology of Delta Smelt and Longfin Smelt in the San Francisco Estuary

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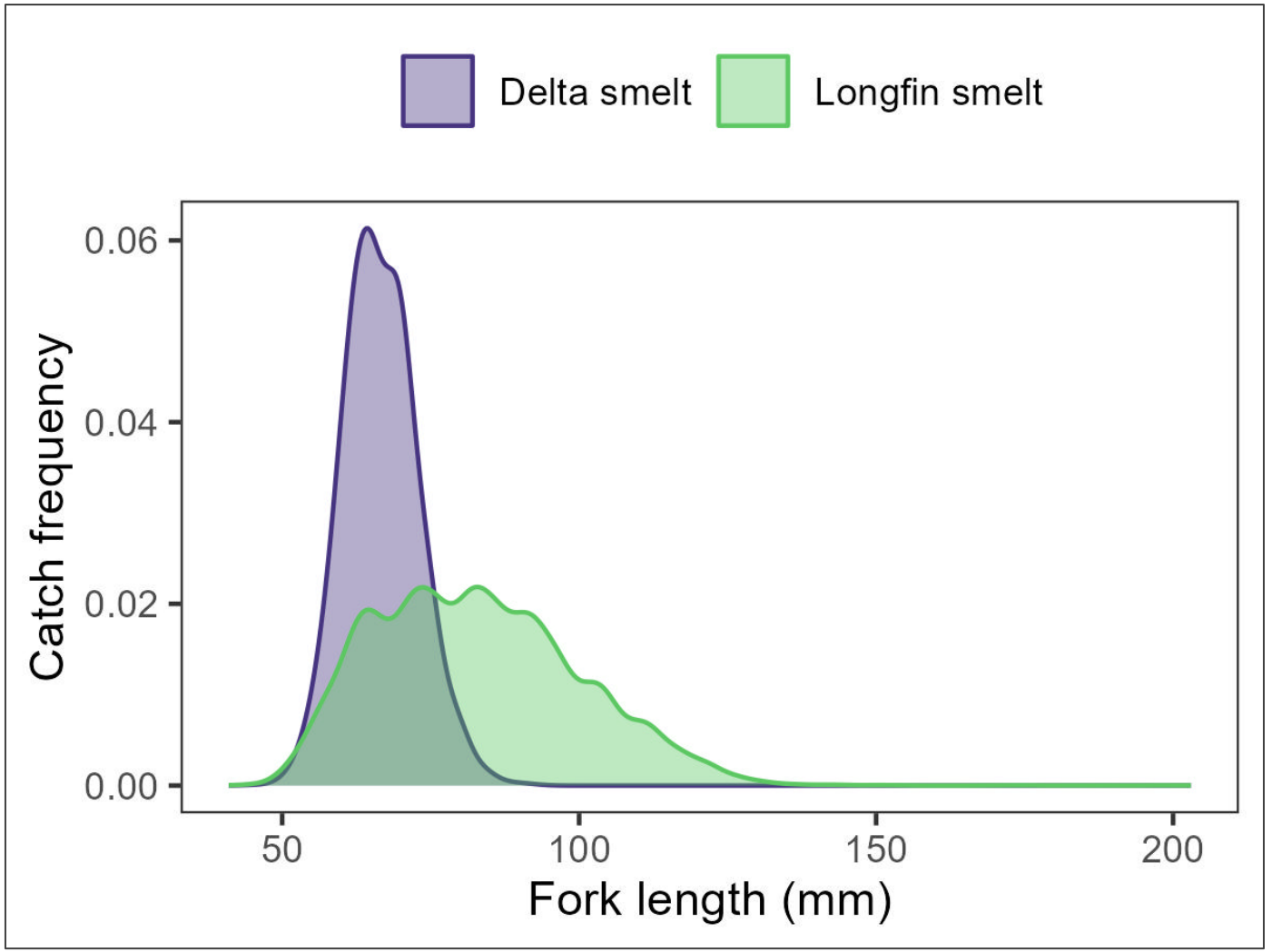
National Academy of Sciences Panel on Long-Term Water Project Operations

Some smelt biology basics…

	Longfin Smelt	Delta Smelt
		
Historical status	Native	Endemic
Current status	Proposed Endangered	Threatened: Conservation-reliant
Size	Bigger	Smaller
Fecundity	Higher	Lower
Spawning phenology	Earlier	Later
	Seaward	Landward
Prey size	Larger	Smaller
Salt tolerance	Higher	Lower
Temperature tolerance	Lower	Higher

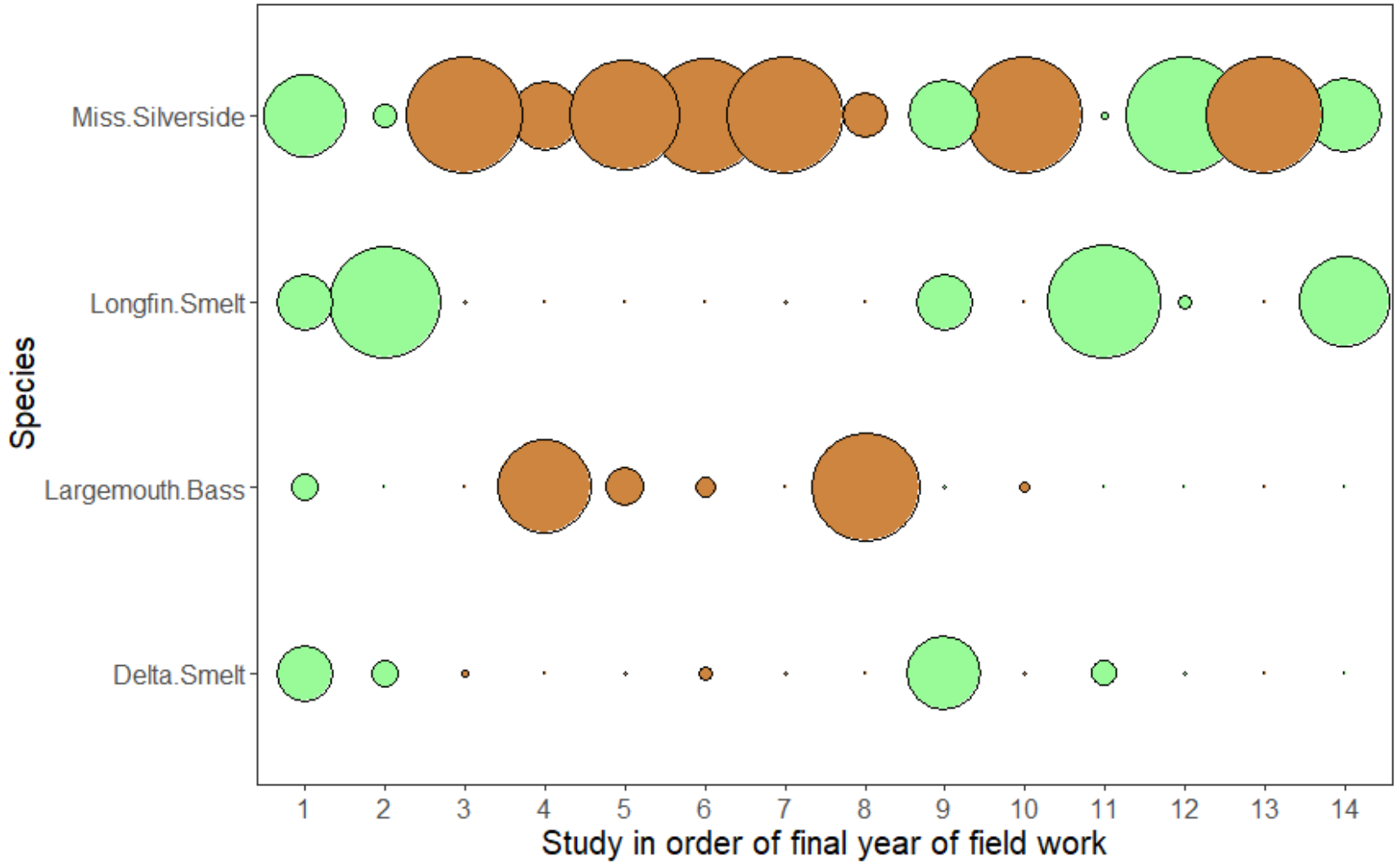
Both species are small, predominantly pelagic forage fishes

(graphic courtesy of Leo Polansky, BDFWO and Lara Mitchell, LFWO)



Both smelts are predominantly pelagic fishes

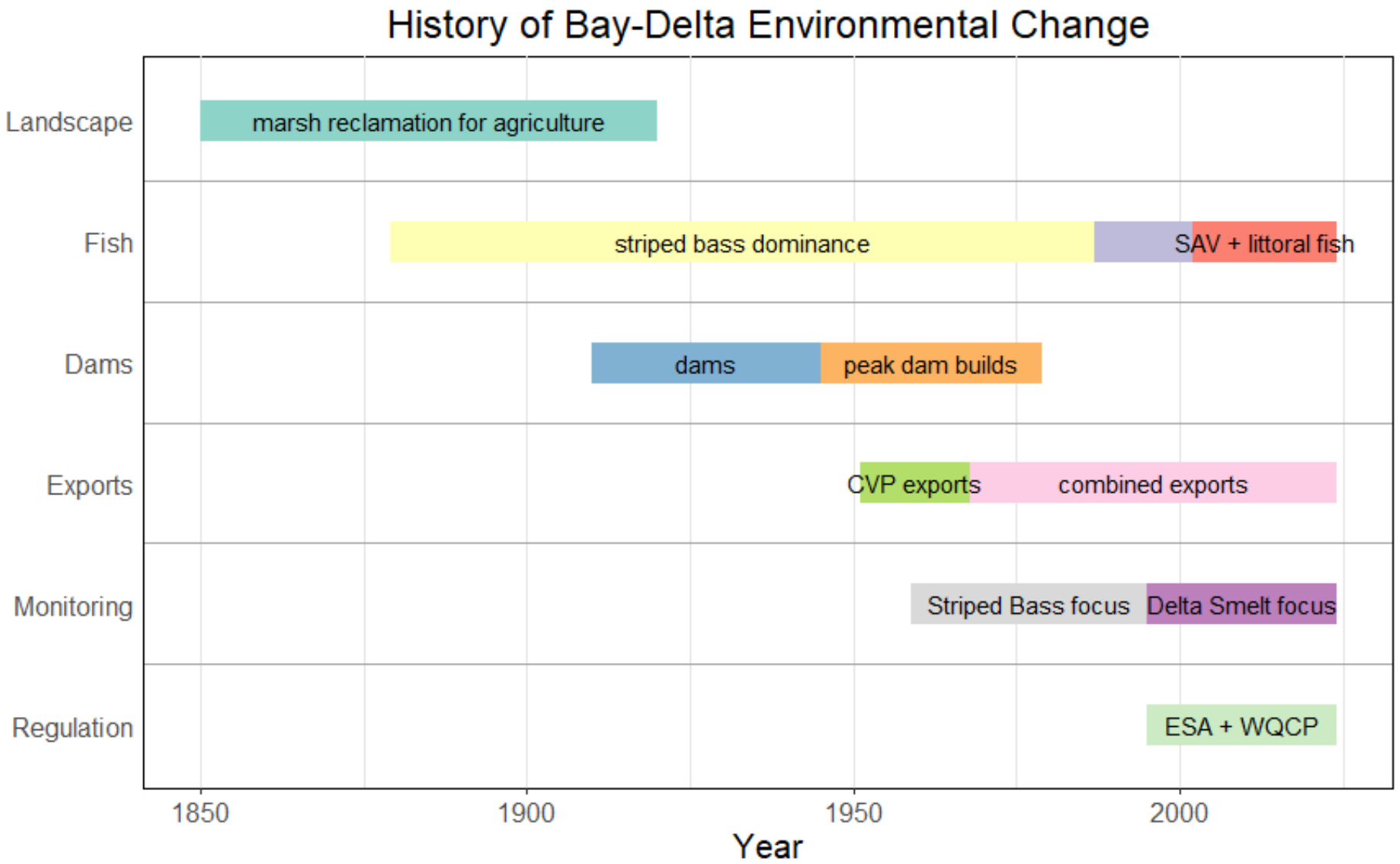
(green = offshore sampling; brown = nearshore sampling)



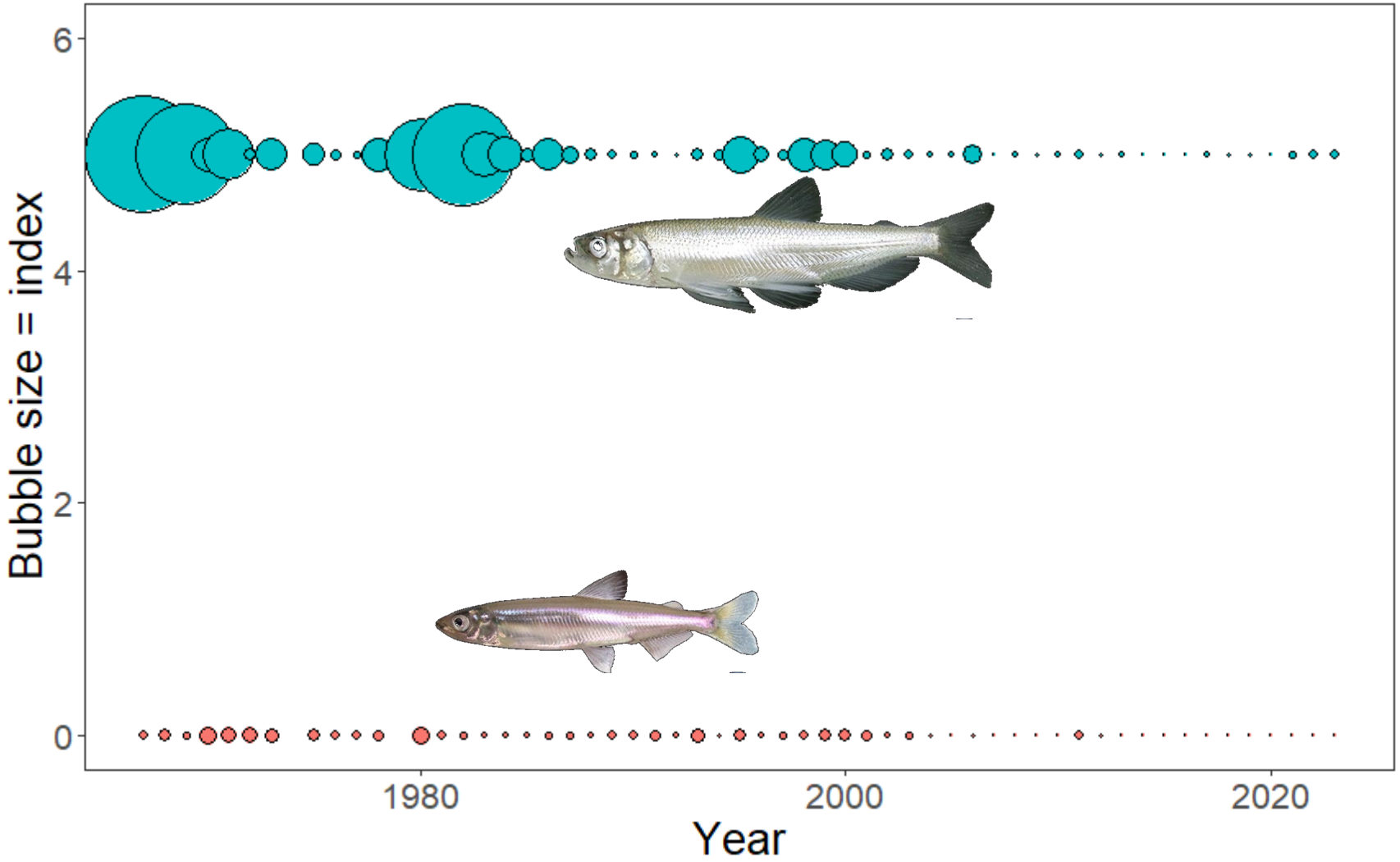
Some smelt life cycle basics…

	Longfin Smelt	Delta Smelt
		
Meaningful max age	2 yr	1 yr
Spawning	Winter to early spring; ≤ 15°C	Late winter thru spring; ≤ 20°C
	Assumed demersal eggs on sandy substrate	Same
Larvae	Pelagic [mostly] in low-salinity zone (LSZ)	Pelagic [mostly] landward of LSZ
Juveniles	Move seaward in late spring/early summer to avoid warming LSZ water	Most individuals move into LSZ
Fall	Age-0 and older fish begin to move back into the estuary and LSZ	Mostly remain in LSZ; move into freshwater when it starts to rain

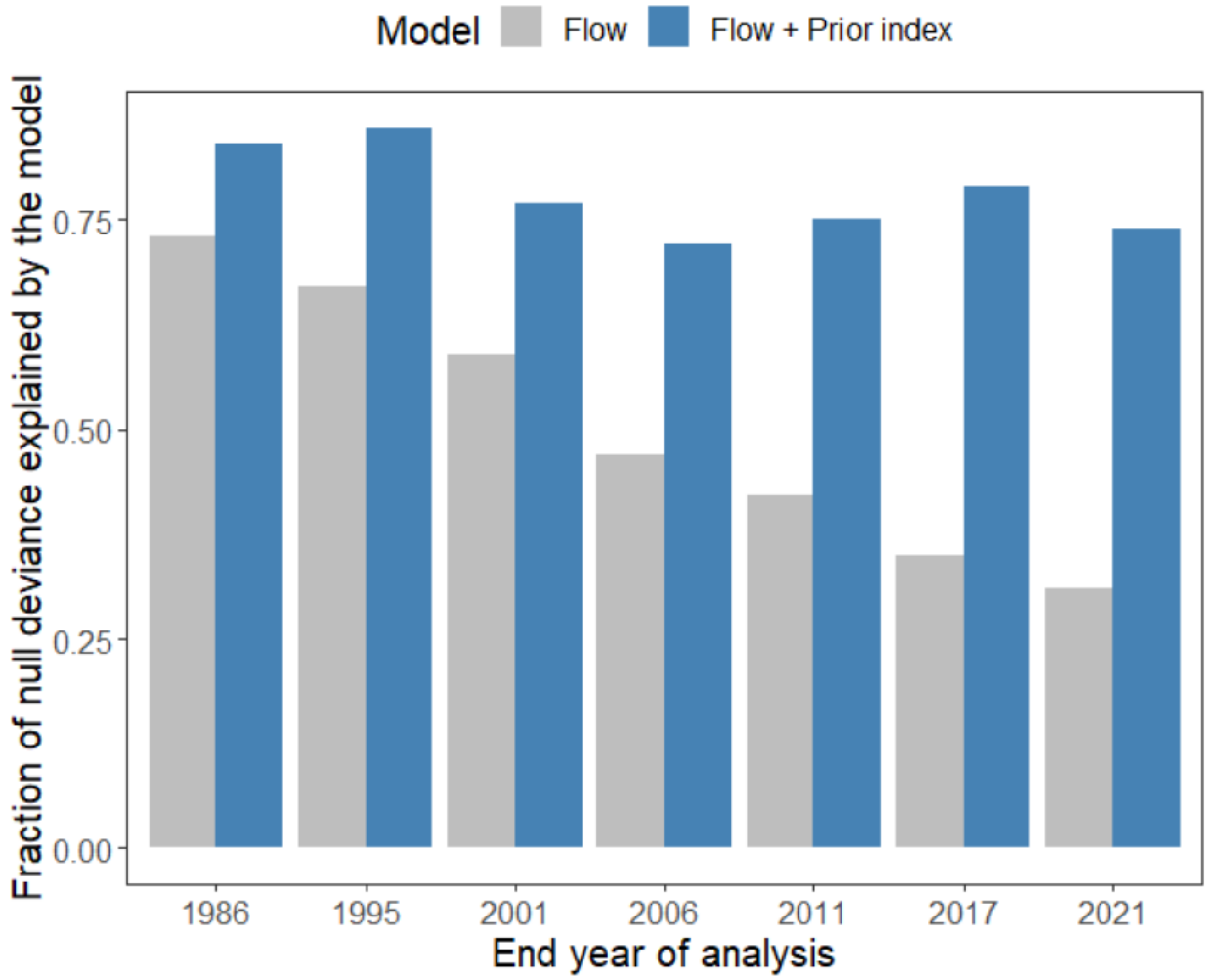
Context


History of Bay-Delta Environmental Change
Landscape
Fish
Dams
Exports
Monitoring
Regulation
marsh reclamation for agriculture
striped bass dominance
SAV + littoral fish
dams
peak dam builds
CVP exports
combined exports
Striped Bass focus
Delta Smelt focus
ESA + WQCP
1850
1900
1950
2000
Year

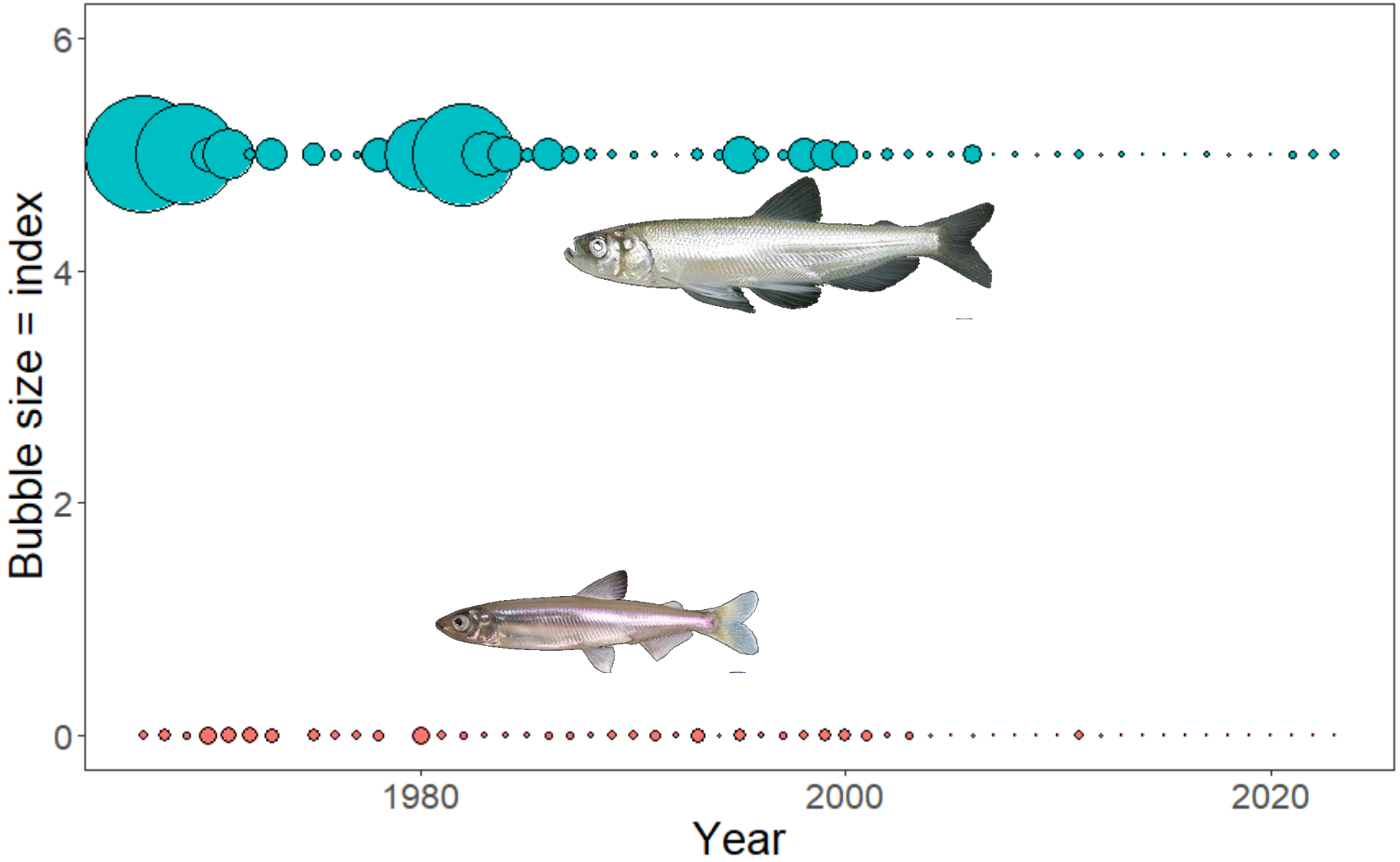
Relative abundance since 1967
(Fall Midwater Trawl)



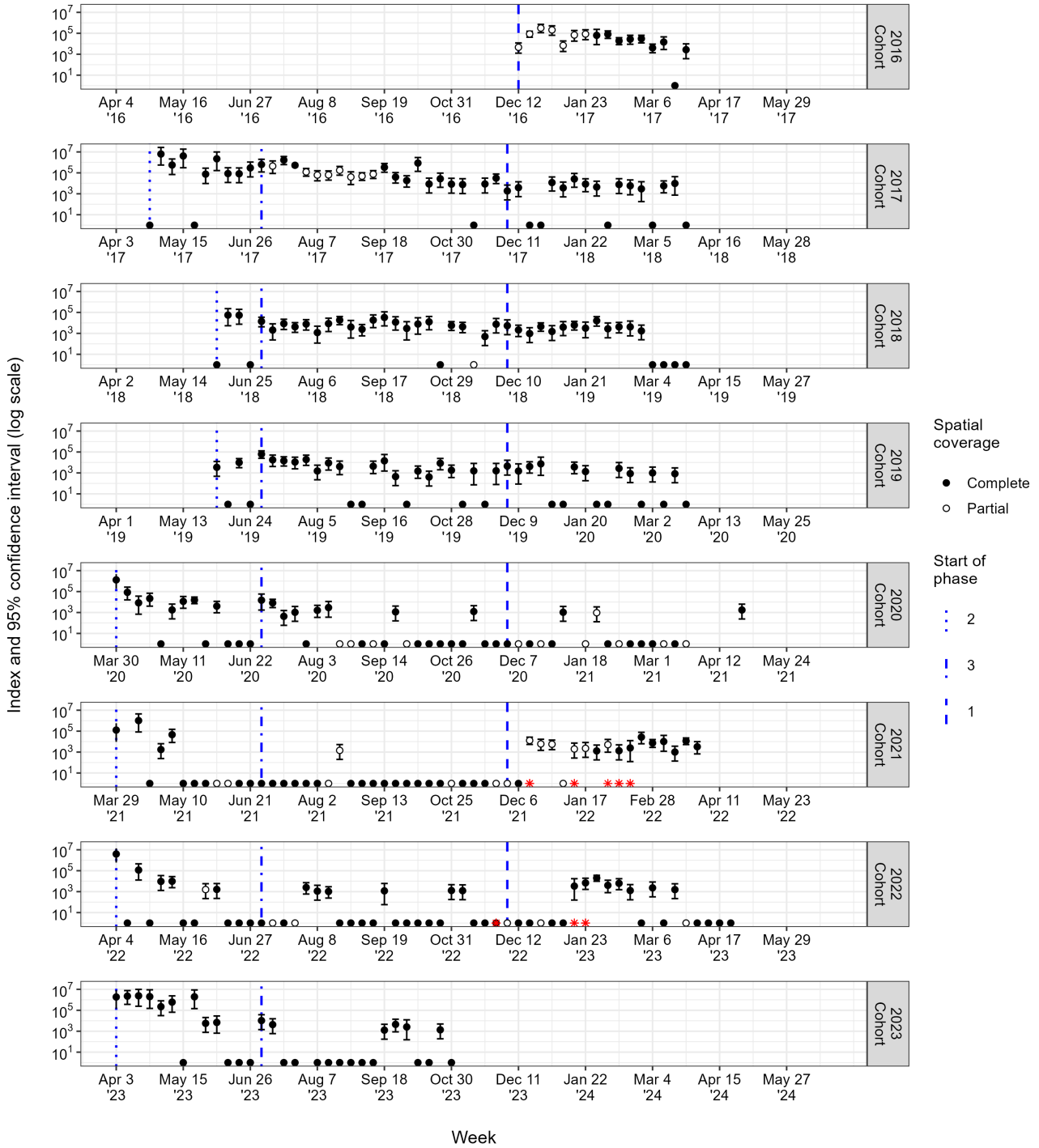
Population dynamics 101

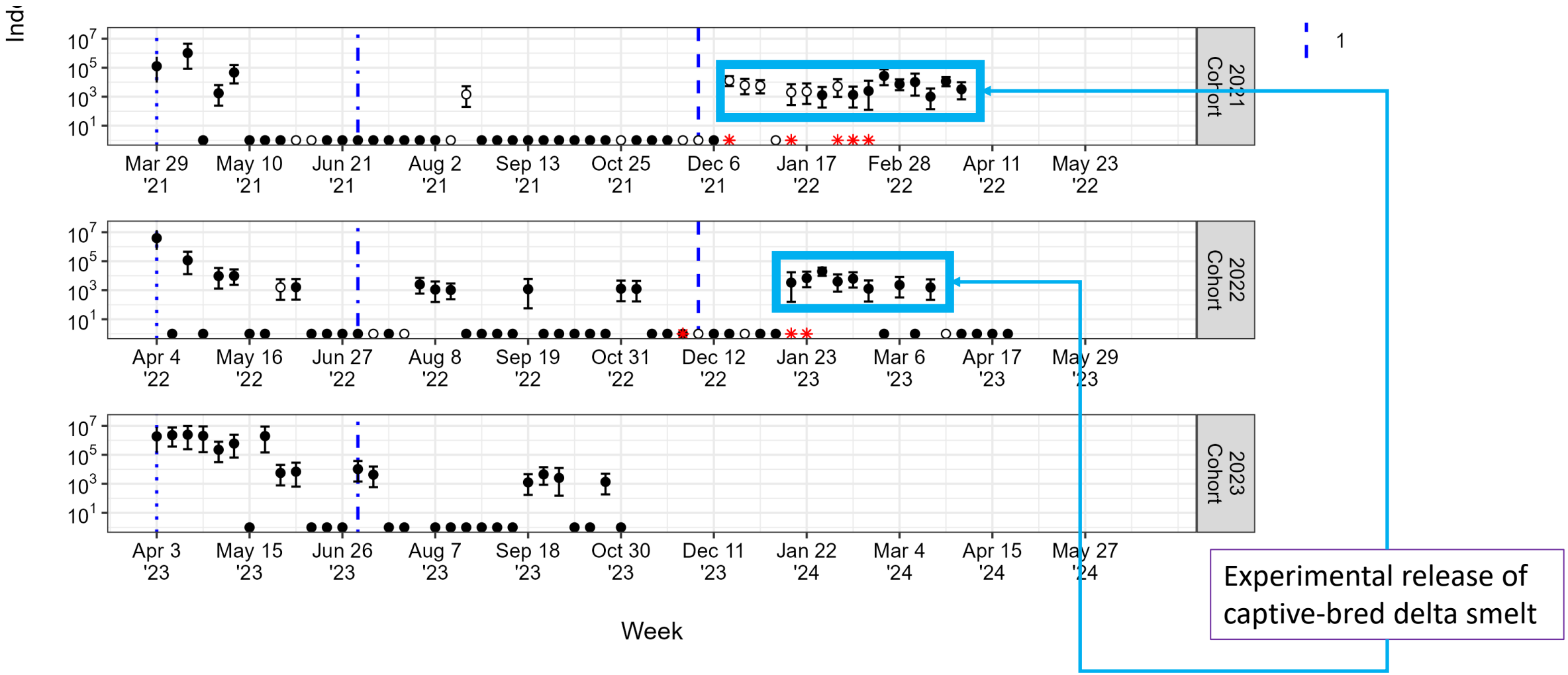


Relative abundance since 1967
(Fall Midwater Trawl)

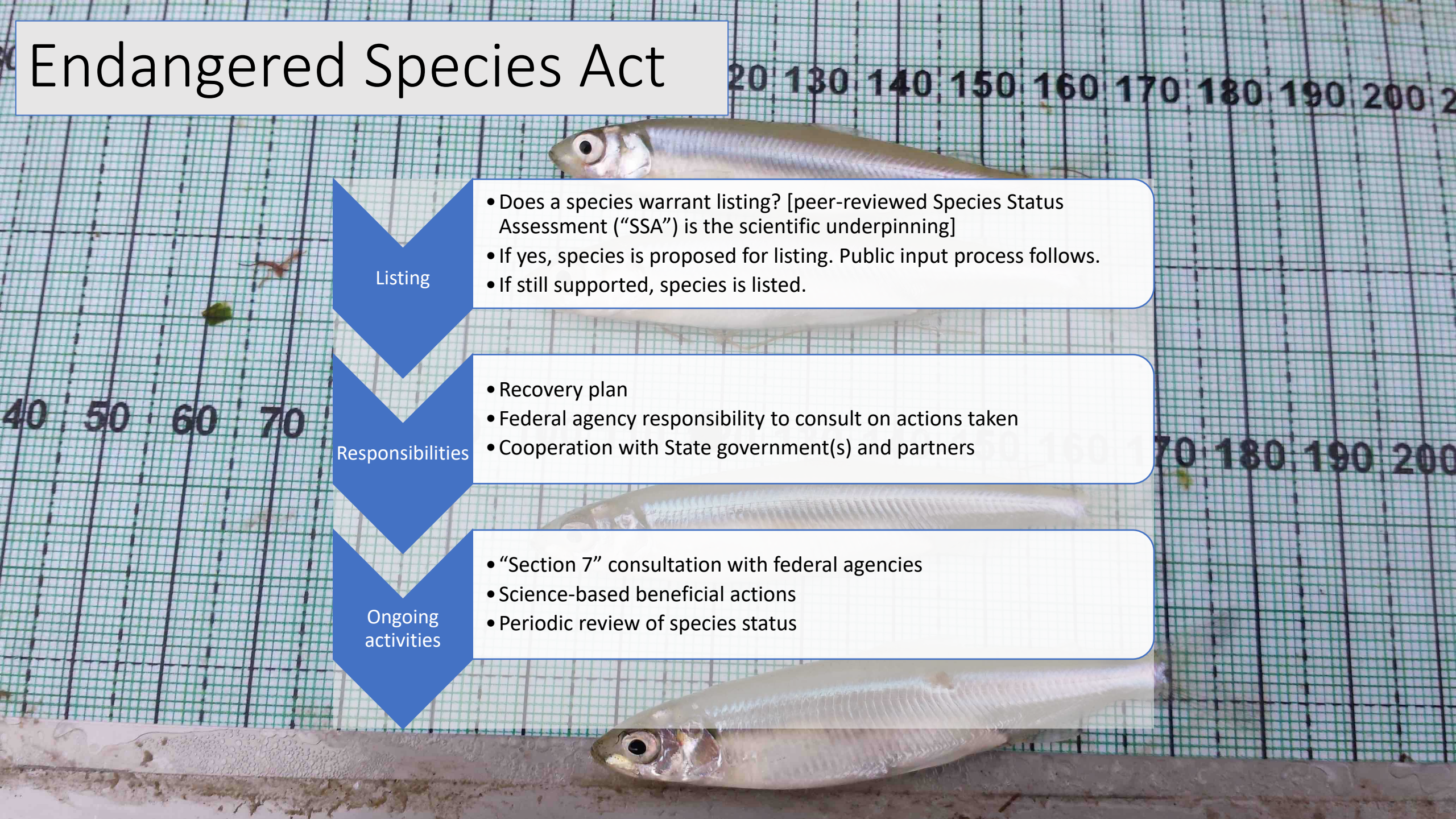


Enhanced Delta Smelt Monitoring Program (EDSM)




Ind
10^7
10^5
10^3
10^1
Mar 29 '21
May 10 '21
Jun 21 '21
Aug 2 '21
Sep 13 '21
Oct 25 '21
Dec 6 '21
Jan 17 '22
Feb 28 '22
Apr 11 '22
May 23 '22
2021 Cohort
1
Apr 4 '22
May 16 '22
Jun 27 '22
Aug 8 '22
Sep 19 '22
Oct 31 '22
Dec 12 '22
Jan 23 '23
Mar 6 '23
Apr 17 '23
May 29 '23
2022 Cohort
Apr 3 '23
May 15 '23
Jun 26 '23
Aug 7 '23
Sep 18 '23
Oct 30 '23
Dec 11 '23
Jan 22 '24
Mar 4 '24
Apr 15 '24
May 27 '24
2023 Cohort
Week
Experimental release of captive-bred delta smelt

Endangered Species Act



Listing

- Does a species warrant listing? [peer-reviewed Species Status Assessment ("SSA") is the scientific underpinning]
- If yes, species is proposed for listing. Public input process follows.
- If still supported, species is listed.

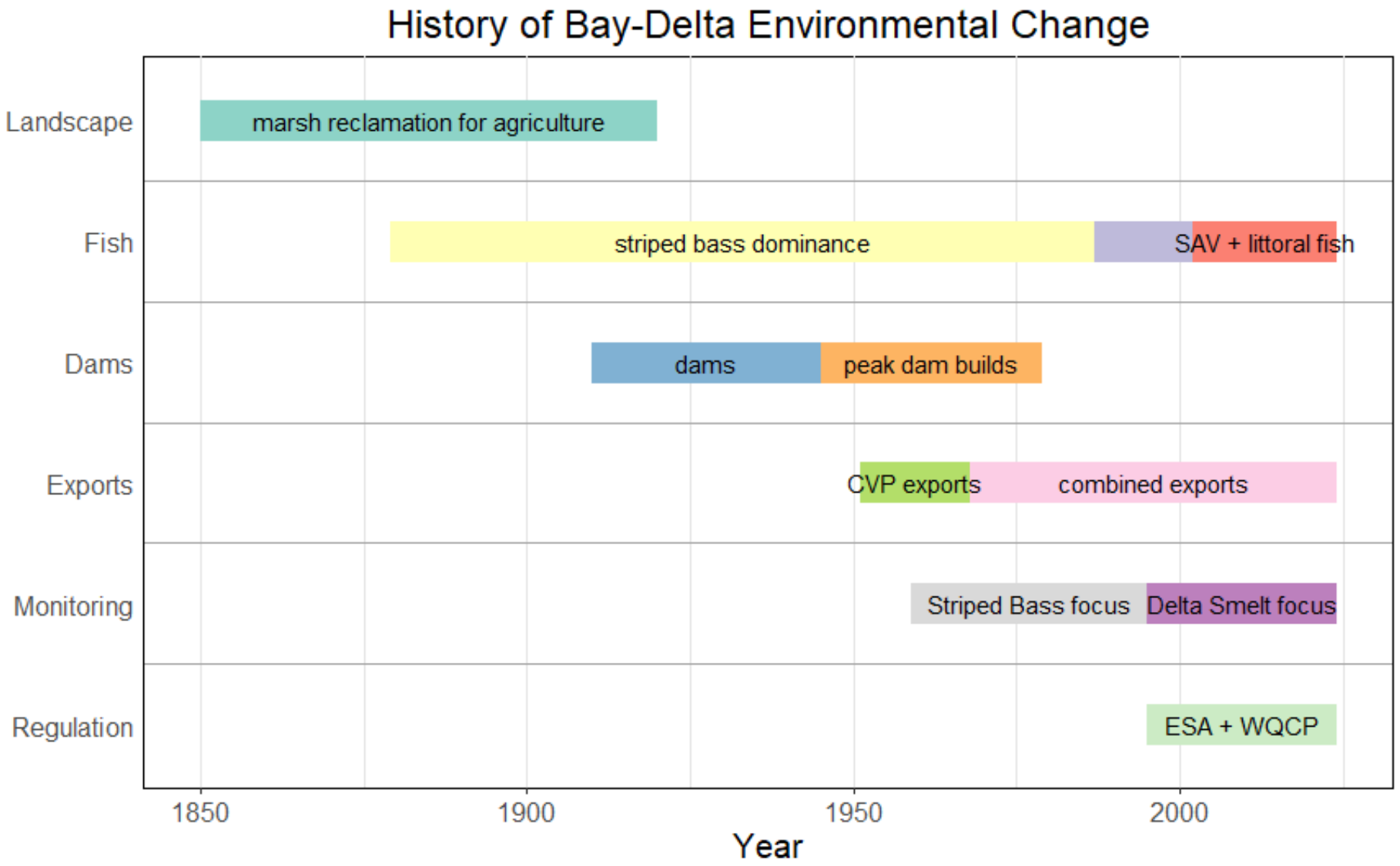
Responsibilities

- Recovery plan
- Federal agency responsibility to consult on actions taken
- Cooperation with State government(s) and partners

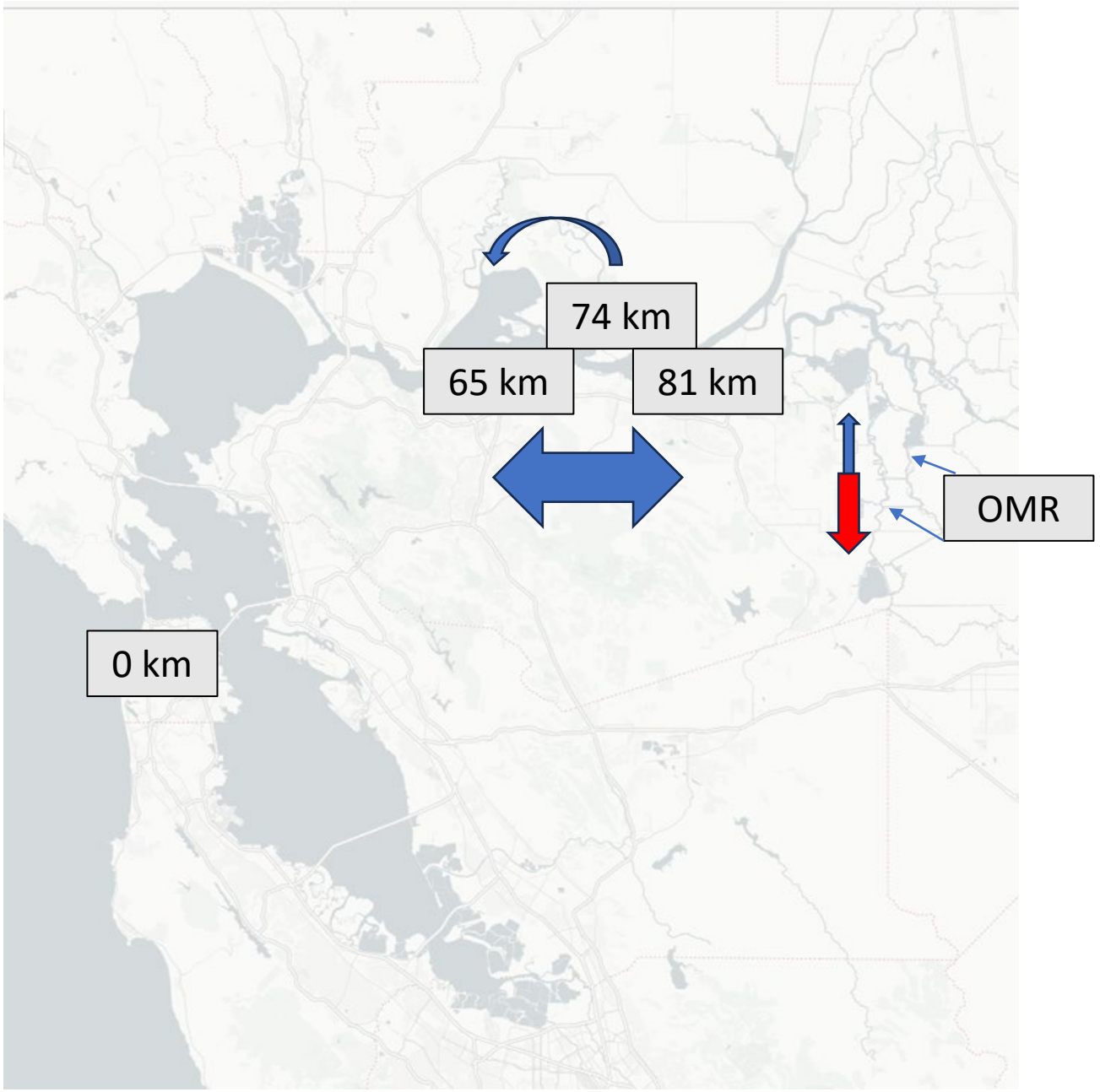
Ongoing activities

- "Section 7" consultation with federal agencies
- Science-based beneficial actions
- Periodic review of species status

Context = ESA “baseline”



Flows within and out of the Delta are the primary way the smelts interact with the water projects



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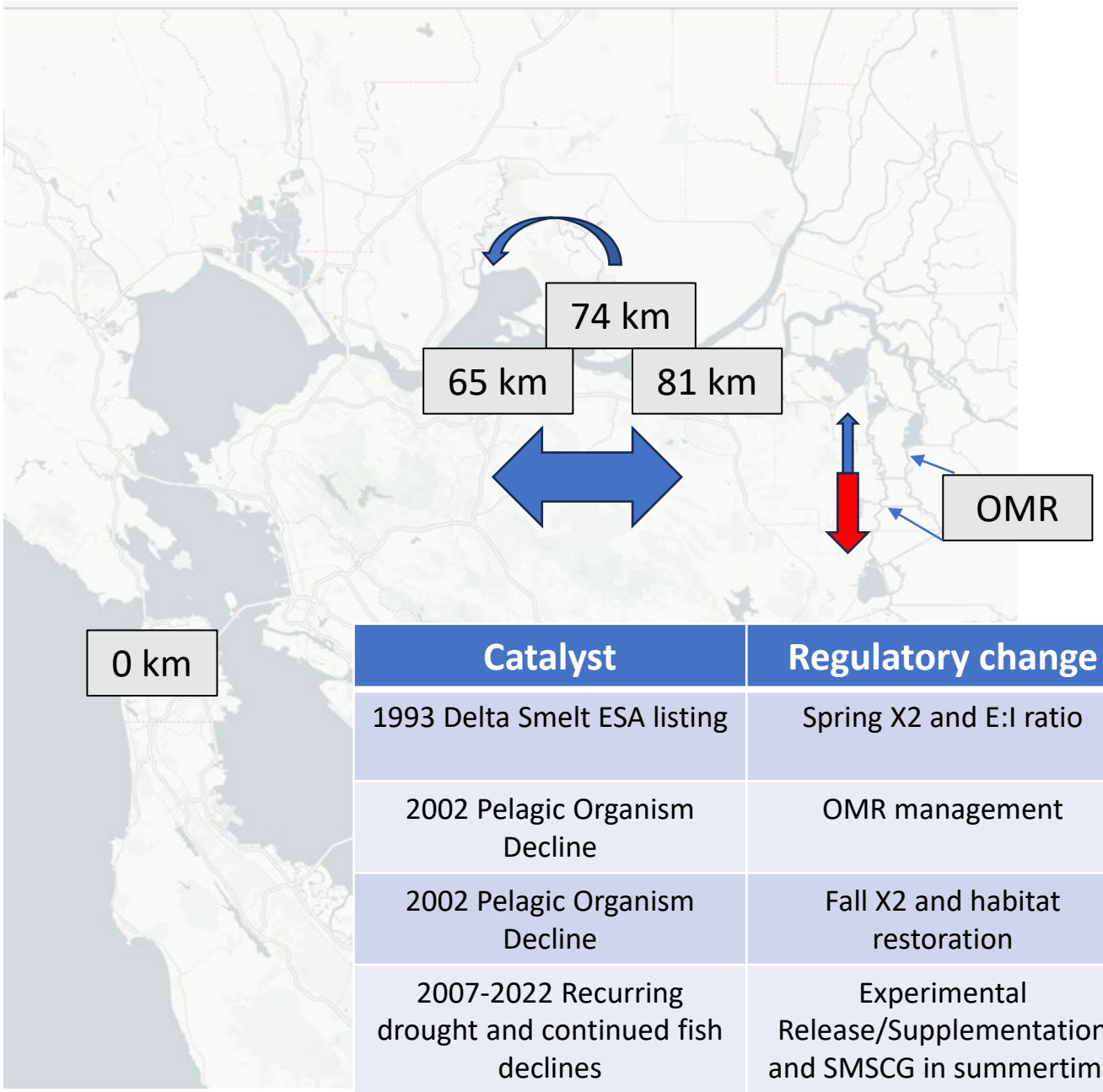

Catalyst	Regulatory change	ESA/CESA document
1993 Delta Smelt ESA listing	Spring X2 and E:I ratio	1995 smelt biop → 2000 WQCP
2002 Pelagic Organism Decline	OMR management	2007 Court Order → 2008-2009 biops and ITP
2002 Pelagic Organism Decline	Fall X2 and habitat restoration	2008-2009 biops and ITP
2007-2022 Recurring drought and continued fish declines	Experimental Release/Supplementation and SMSCG in summertime	2019-2020 biops and ITP

Acknowledgements

U.S. Bureau of Reclamation and National Academies
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