

Bugs, Fish, Eagles

*How Wastewater Treatment Saved
Lower South San Francisco Bay for Critters*



Serving 1.4 million residents

+ 17,000 commercial & industrial facilities in Silicon Valley

Wastewater from San Jose

From Milpitas

From Santa Clara,
Cupertino, & West Valley

Treated Effluent



San Francisco Bay



San José-Santa Clara
Regional
Wastewater
Facility

Coyote Creek

Pond A17

Artesian Slough

Pond A16

Pond A18

Where the water goes...

Lower South Bay



Three wastewater treatment plants discharge to LSB

Lower South Bay

Dumbarton Bridge

Some may say ...



Palo Alto
229K ●

Sunnyvale
145K ●

●
San Jose
1.4 M

Google

Treatment Train

- Primary
- Secondary - BNR
- Tertiary - Advanced



Wastewater Treatment 101

Headworks

screens out big chunks



Bar Screens

Primary
*physical settling
separates floaters &
sinker*



Primary Clarifier Notch Weirs

Secondary

*biological treatment
– a living, breathing
'bug factory'*



Secondary Aeration Tanks

Tertiary / Advanced

passes through a 10 micron filter!



Disinfection



Beneficial Uses of Artesian Slough & Lower Coyote Creek

San Jose-Santa Clara RWF

Pond A18

Pond A16

Artesian Slough

Pond A17

Coyote Creek





Beneficial Uses of Artesian Slough & Lower Coyote Creek

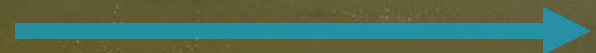
1. Wildlife Habitat (WILD)
2. Fish Spawning (SPWN)
3. Warm Freshwater Habitat (WARM)
4. Cold Freshwater Habitat (COLD)
5. Fish Migration (MIGR)
6. Non-Contact Recreation (REC-1)
7. Contact Recreation (REC-2)
8. Commercial & Sport Fishing (COMM)
9. Rare & Endangered Species (RARE)

Pond A18

Pond A16

Pond A17

Coyote Creek



Results at Outfall Weir



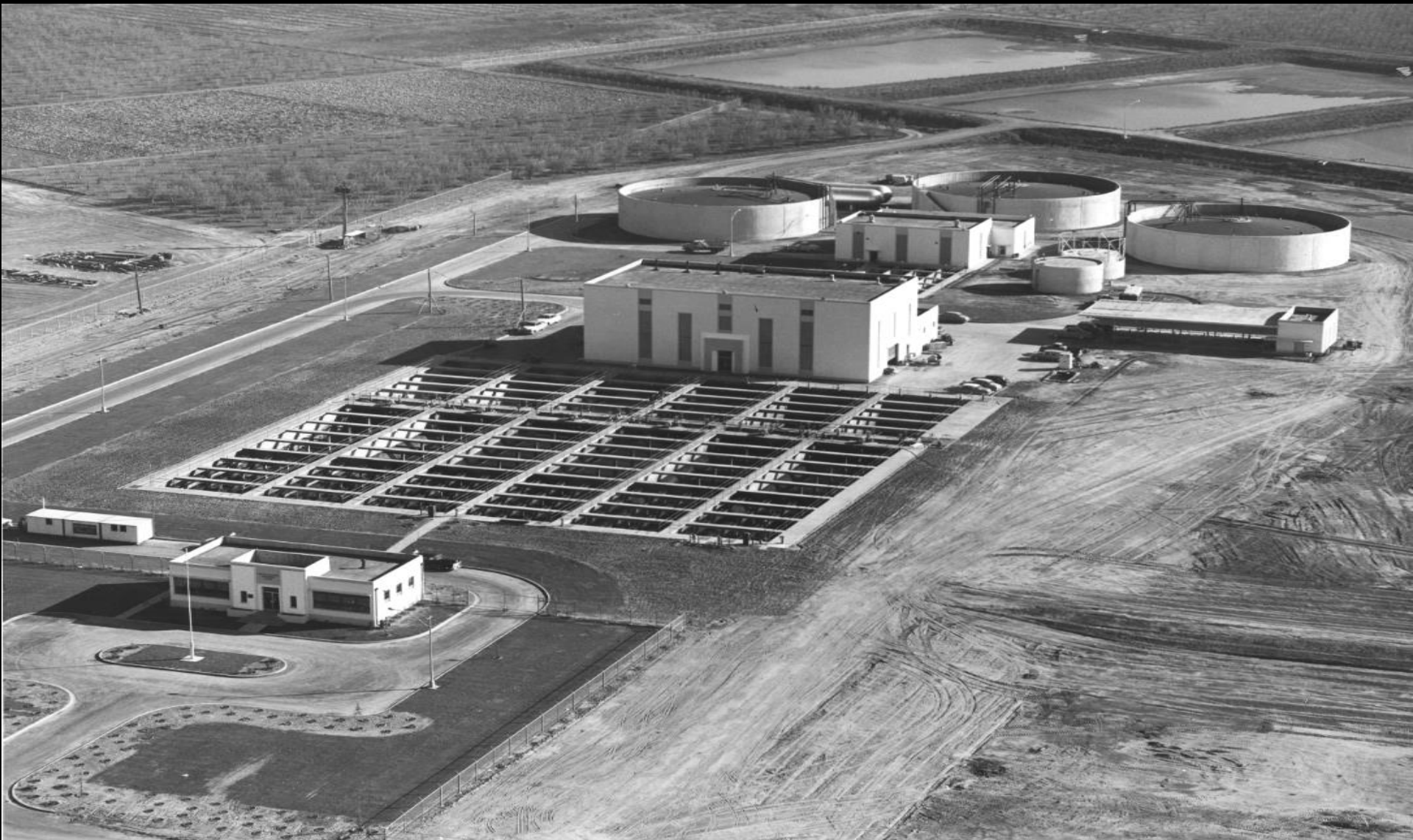
San José-
Santa Clara
Regional
Wastewater
Facility

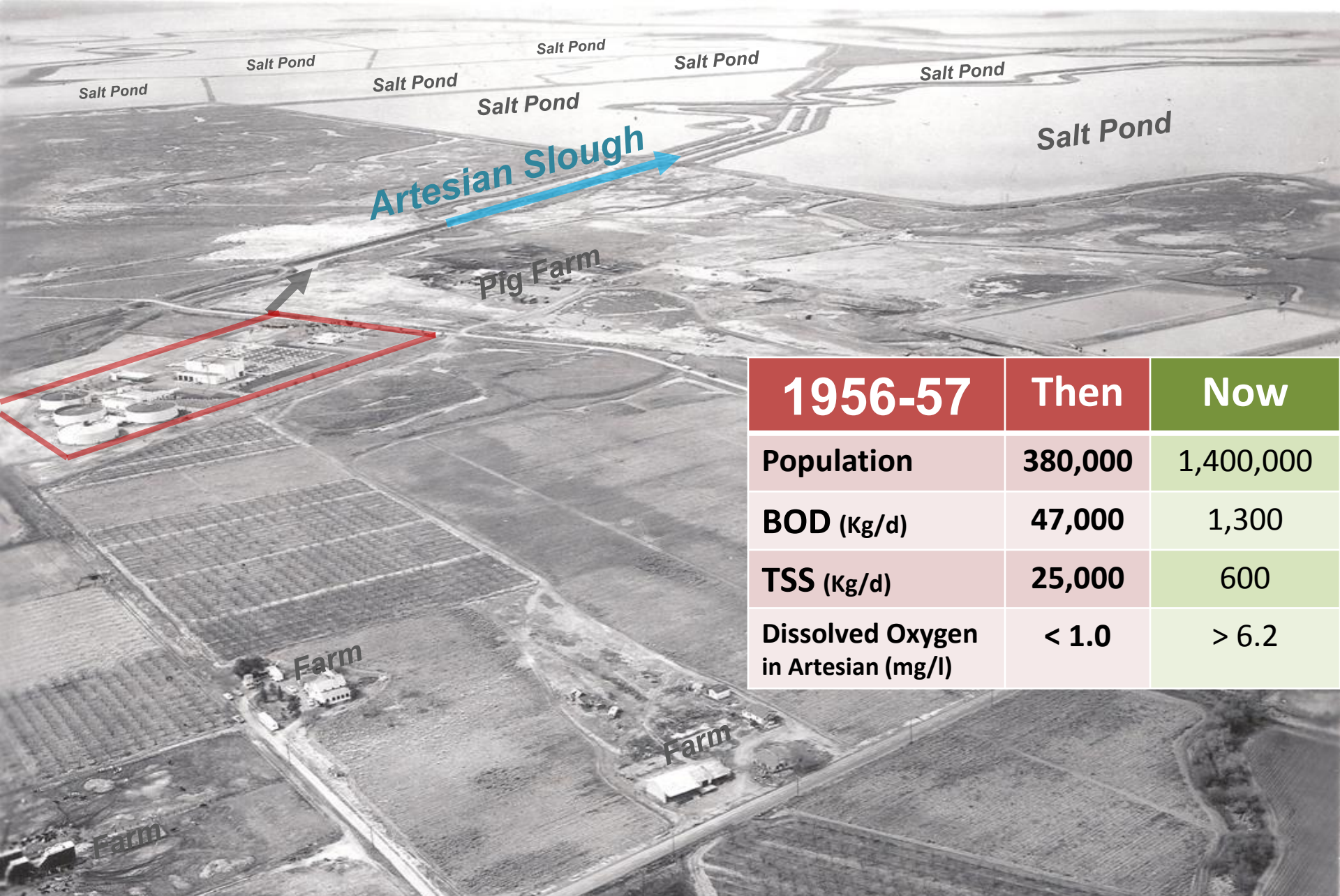




Once upon a time ...

A Sleepy Little Sewer Plant born in 1956





1956-57	Then	Now
Population	380,000	1,400,000
BOD (Kg/d)	47,000	1,300
TSS (Kg/d)	25,000	600
Dissolved Oxygen in Artesian (mg/l)	< 1.0	> 6.2

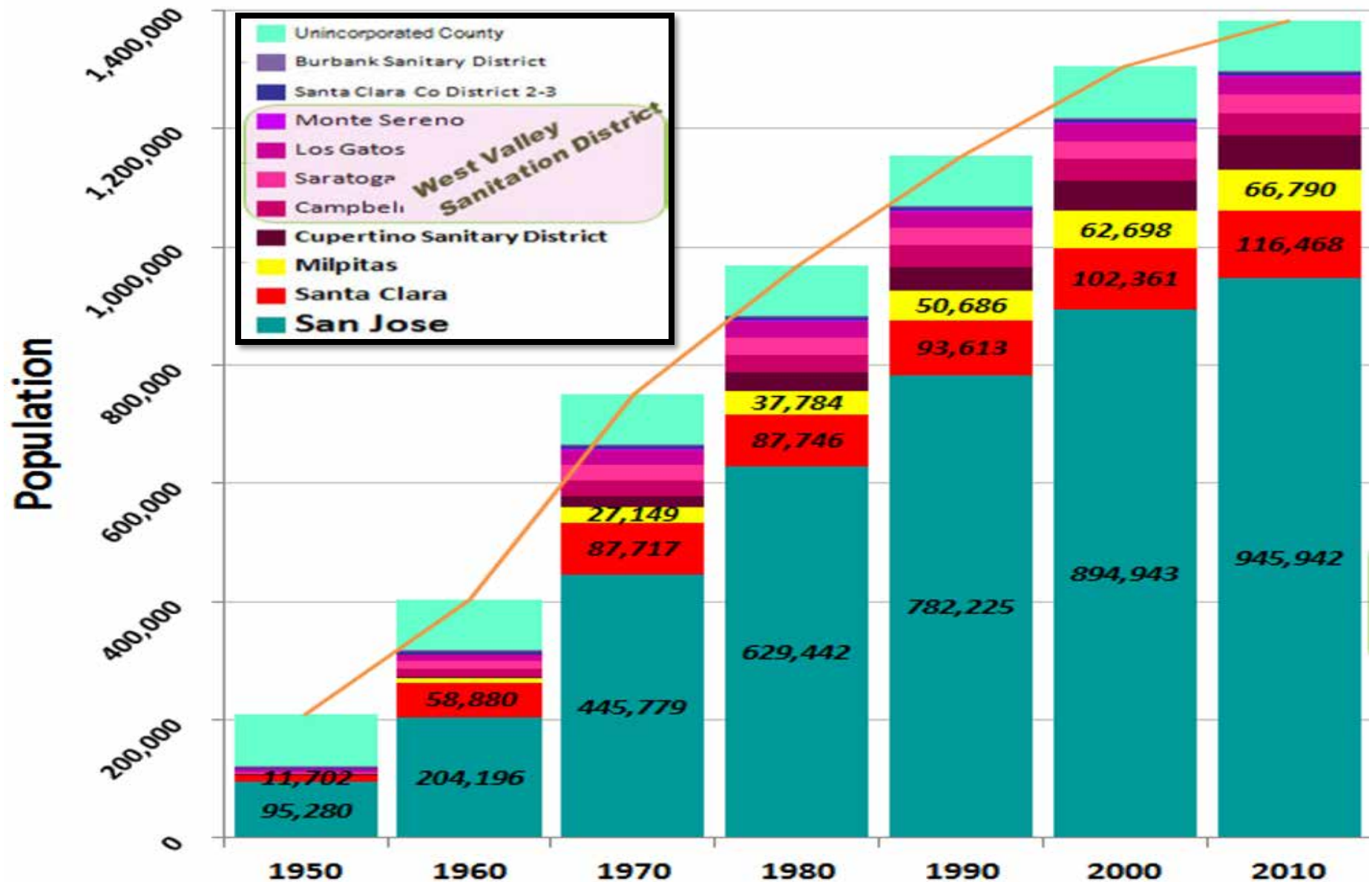
Good old days?



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Wastewater
Facility

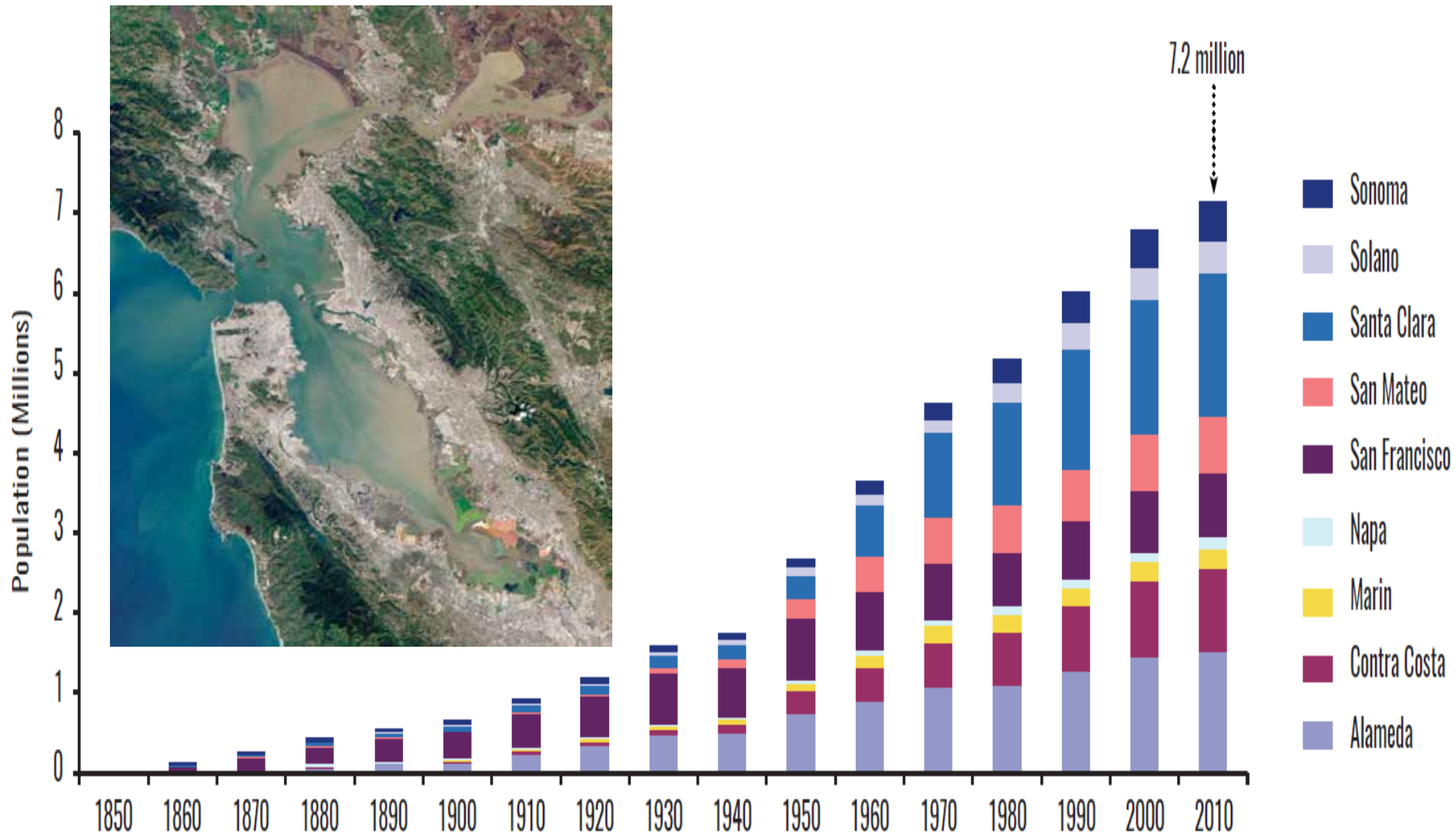
SJ-SC RWF Resident Population Served

Census data from <http://www.bayareacensus.ca.gov/>



Bay Area Population Growth

1850-2010



Earth Day 1970

Things were looking grim.

“In a decade, urban dwellers will have to wear **gas masks** to survive air pollution... by 1985 **air pollution** will have reduced the amount of **sunlight** reaching earth by **one half.**”

— Life magazine, 1970



Happy Earth Day!



ARNARD GOTFRYD/ARCHIVE PHOTOS



Treatment Improvement

- 1957-1964: primary treatment
- 1964-1979: secondary treatment
- 1979-1997: tertiary/advanced treatment
- 1997-2013: Biological Nutrient Removal (BNR)

1956

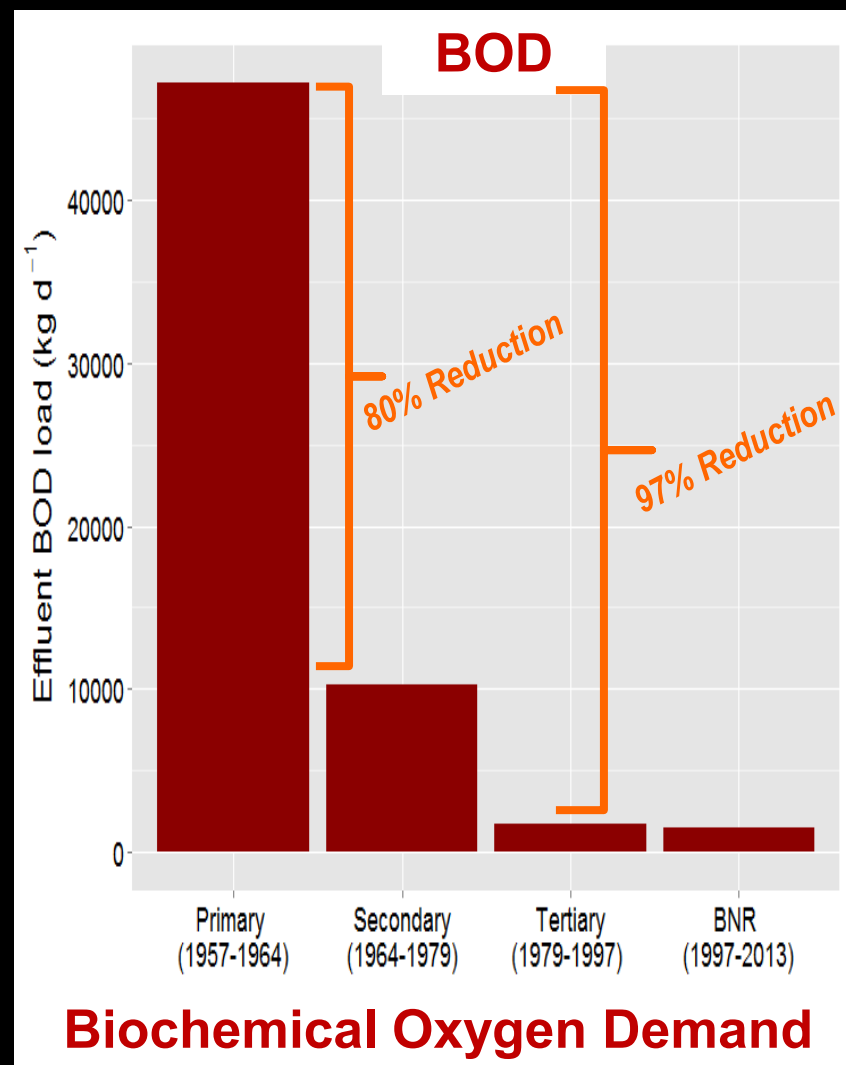
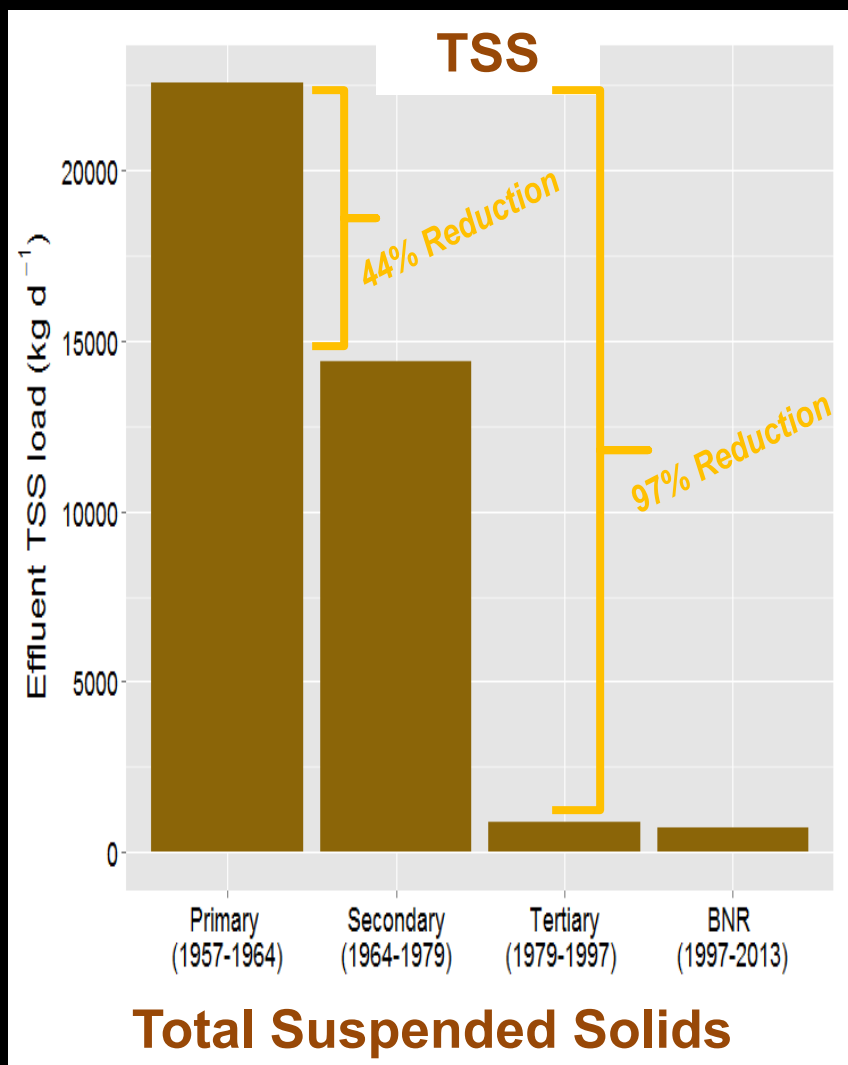
1964

1979

1997



Facility Improvement = better effluent



1956

Primary

1964

Secondary

1979

Tertiary/Advanced

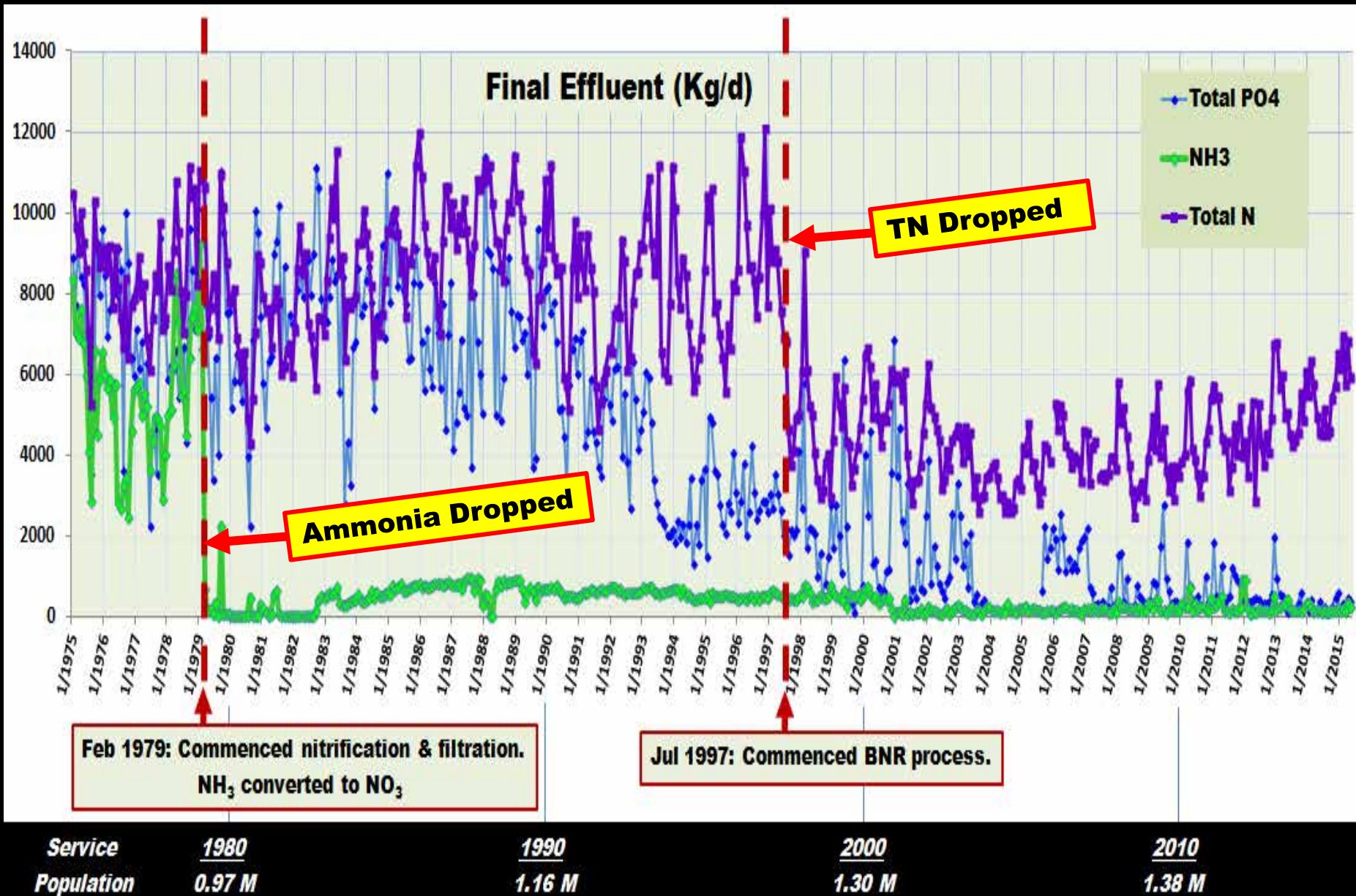
1997

BNR

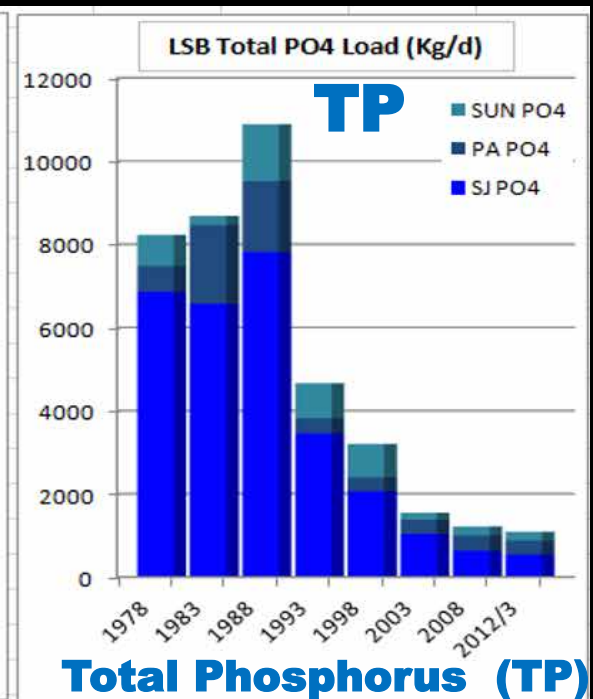
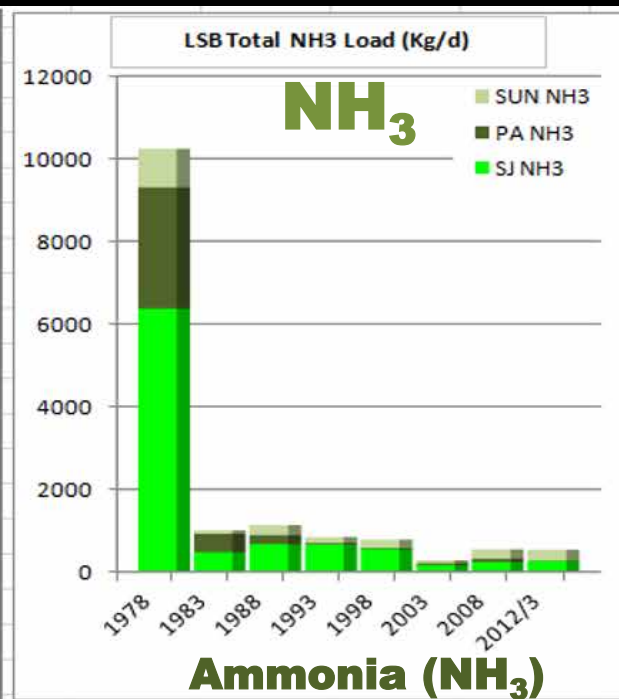
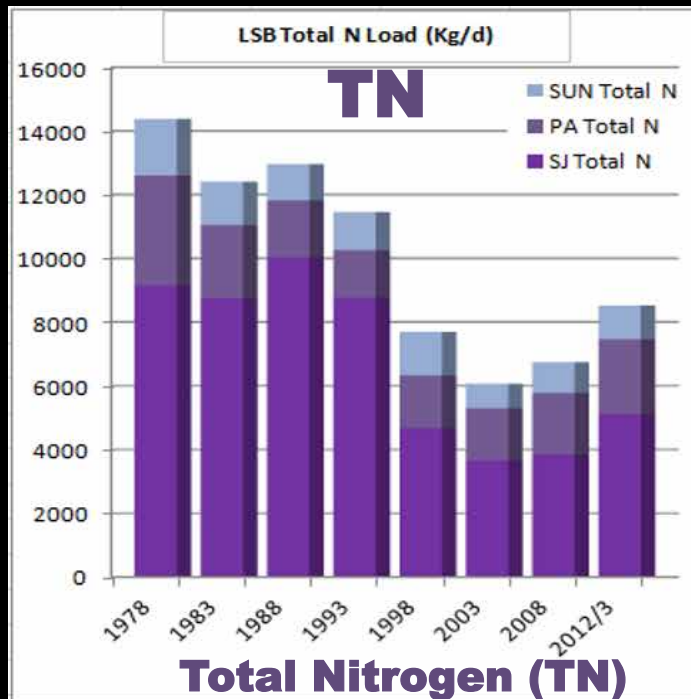
San Jose Nutrient Loads (Kg/d)



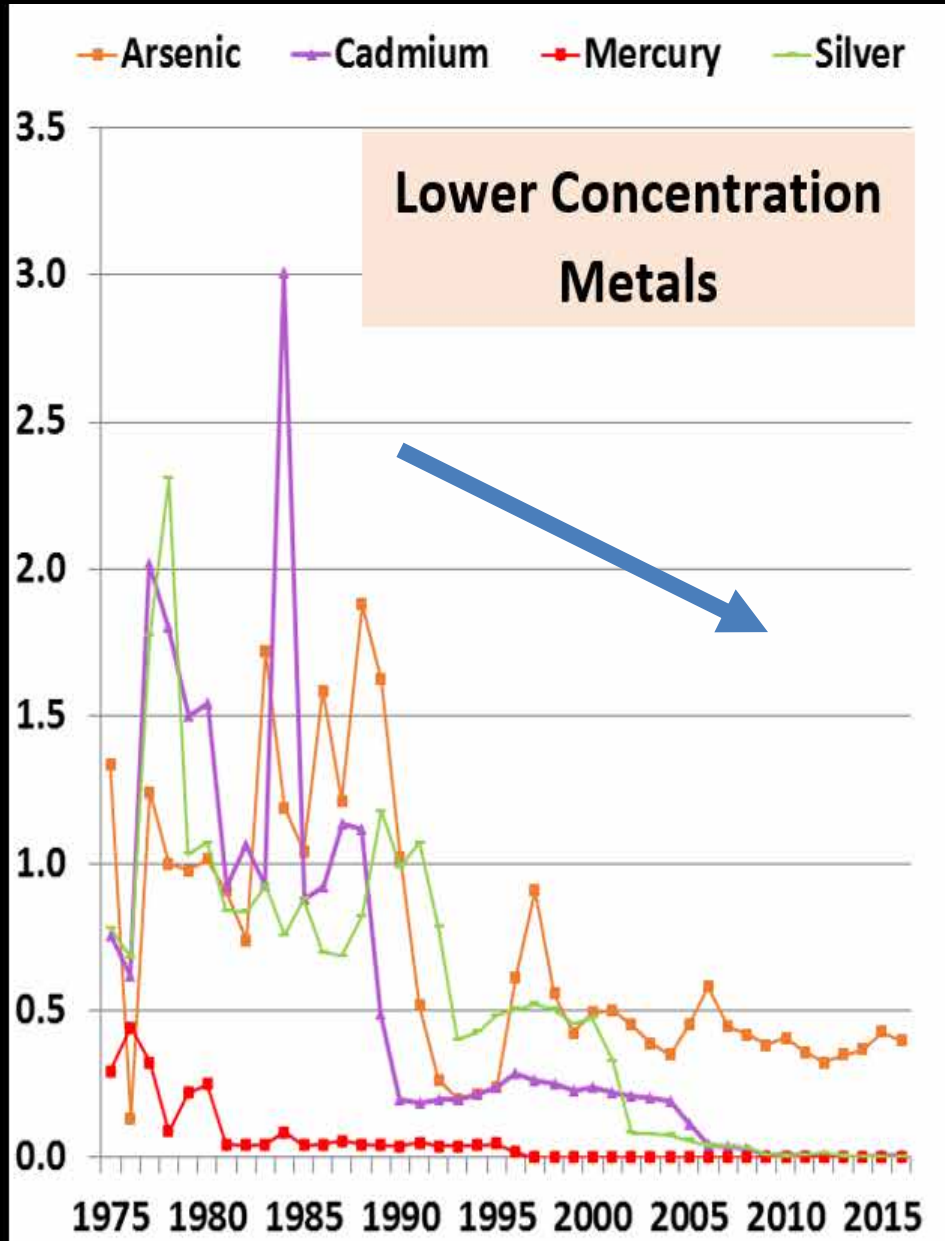
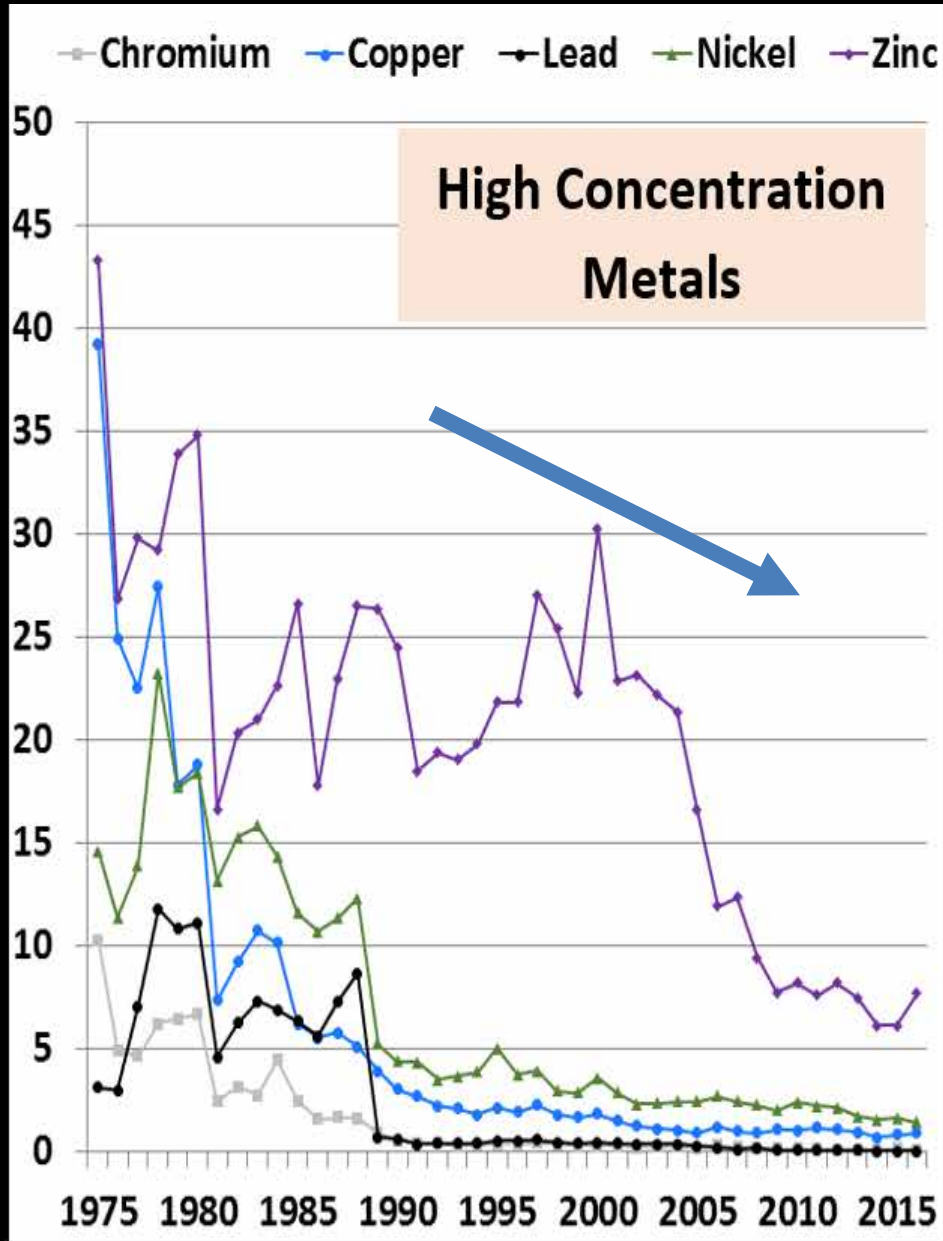
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LSB Nutrient Loads (Kg/d)



Metals Loads (Kg/d)



Industrial & Commercial Improvement = better effluent



Andrew Luong checking a flammable storage locker.



Jack Dickinson at a metal finishing facility.



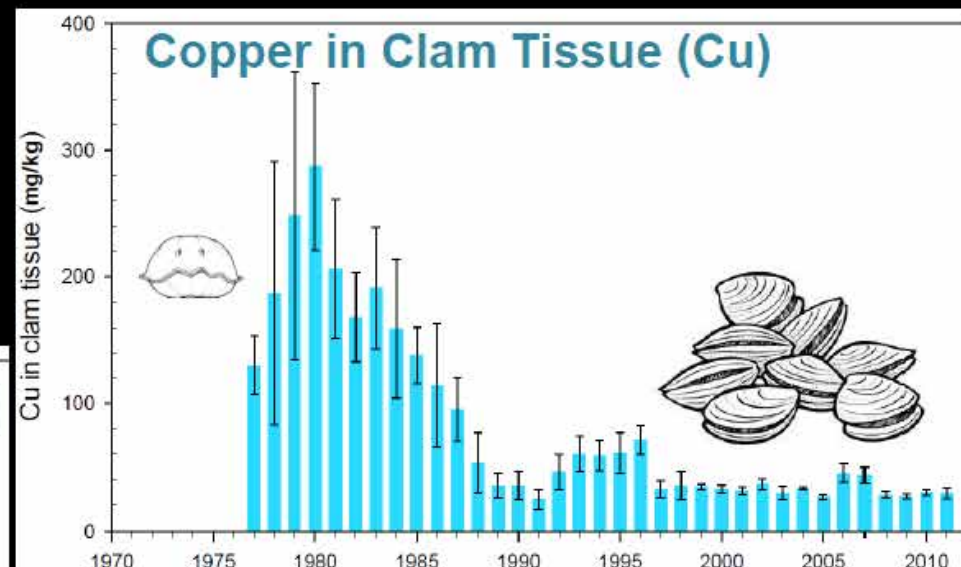
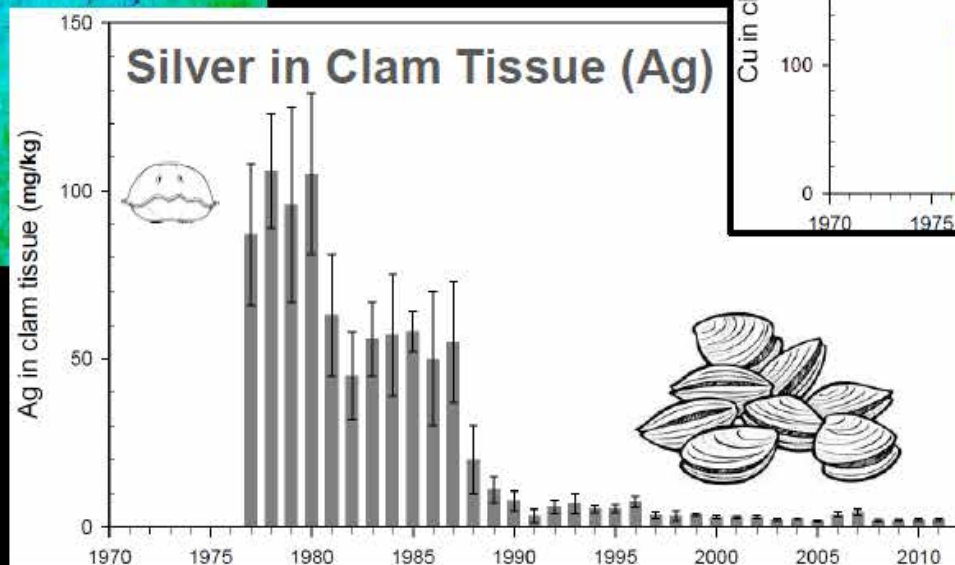
Chris Fivecoat measuring pH at an industrial site.



Brian Fontes inspecting a dental amalgam separator.

The USGS–Palo Alto Study (1974 – present):

Metals in treated sewage → Metals in Bay mud → Metals in clams



By 1991 metals concentrations in clams stabilized at around 40 $\mu\text{g/g}$ Cu & 4 $\mu\text{g/g}$ Ag.

By 2001 sediment copper & zinc were lowest detected since study began.

South Bay Salt Pond Restoration in vicinity of SJ-SC RWF



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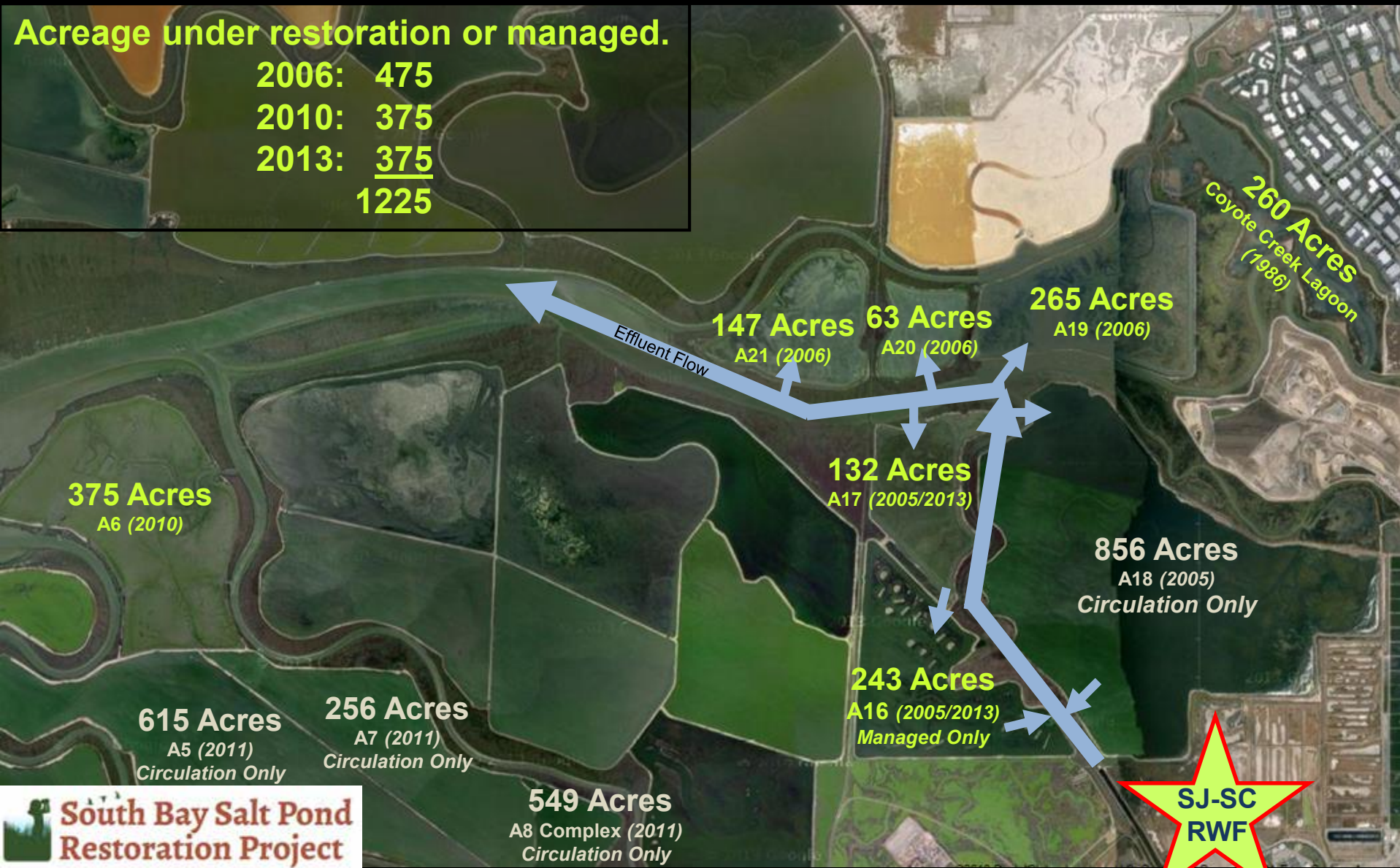
Acreage under restoration or managed.

2006: 475

2010: 375

2013: 375

1225



South Bay Salt Pond Restoration in vicinity of SJ-SC RWF



San José-Santa Clara
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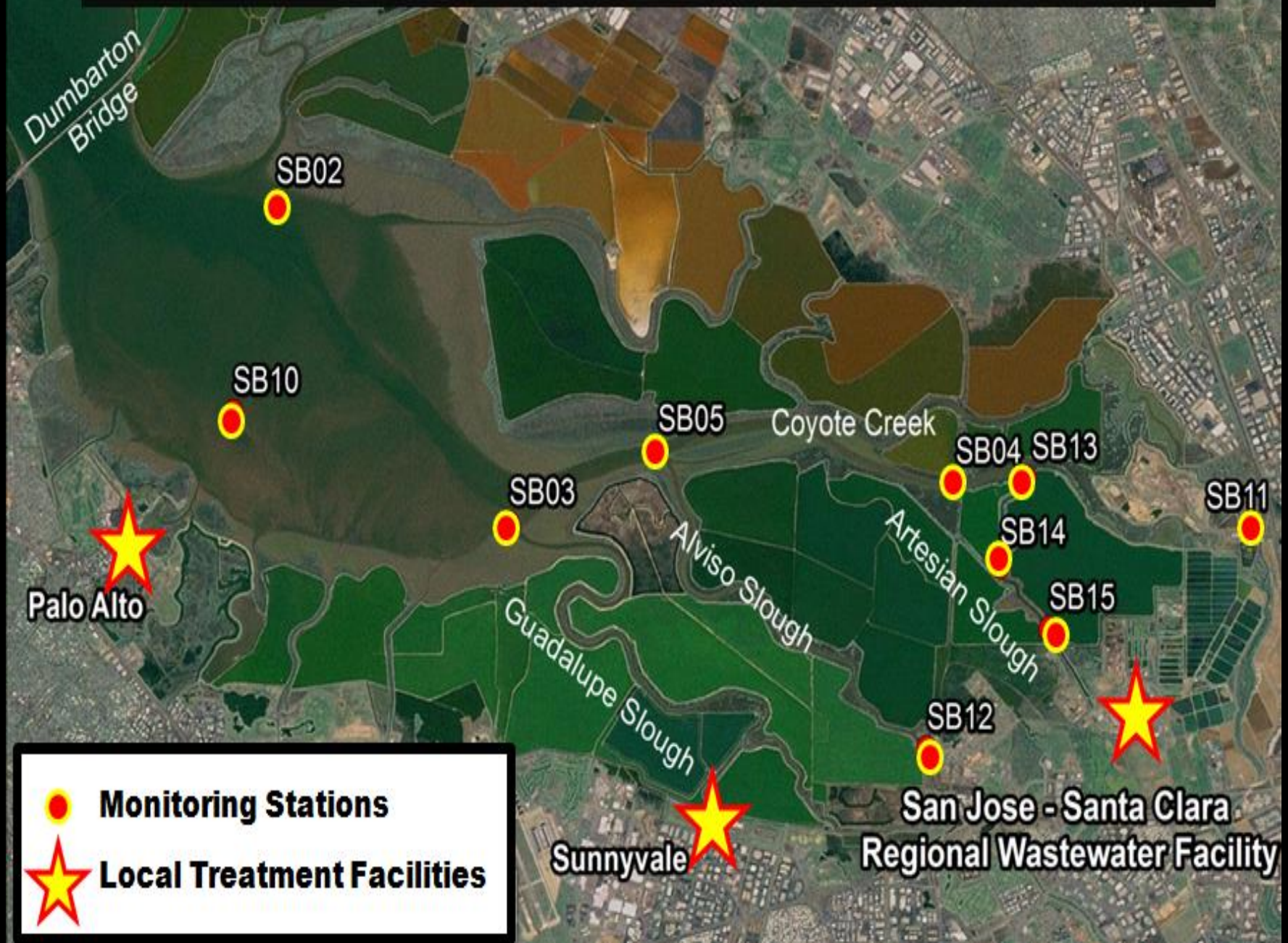
Fishing at the Weir

Up to 39 bass caught per hour!

100% Effluent



Lower South Bay Monitoring Stations



Monitoring the Bay since the 1960s



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**SJ-SC RWF crew
August 1968**

Water Quality Monitoring 2017



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**Ryan
Mayfield**

Things we monitor:

pH, DO, Cond
Temp, TSS
Cu, Ni, Se
NH₃, NO₃
TKN, PO₄



**Bryan
Frueh**



**Jessica
Donald**

More Things: Fish, Benthos, Phytos

Ongoing Studies

Water Quality Monitoring

- **San Jose:** Phytoplankton species composition monitoring.
- **USGS:** Phytoplankton, chlorophyll, nutrients.
- **RMP/SFEI:** Nutrient fluxes and cycling.

Benthic studies

- **USGS:** Clam & Benthic Bug abundance and diversity in Artesian Slough.

Wildlife

- **UC Davis:** Fish abundance and diversity.
- **SFBBO:** Avian Disease monitoring & general bird occurrence observations.





Measuring Beneficial Uses in Artesian

Otter Trawls



Measuring Beneficial Uses in Artesian

Beach Seines

100% Effluent →

6/28/2014: Results: **7,633** tiny fish



Lots of Fish



“Lower Coyote Creek & Artesian Slough harbor some of the densest fish populations seen in SF Bay.” - J. Hobbs

Searching for BUGS!!





Tiny Bugs

Copepods, Cladocerans



Bigger Bugs in Artesian Slough



Synidotea



Corophium



Mysids

Three species of native Crangon



C. franciscorum



C. nigricauda
(Blacktail Bay Shrimp)



C. nigromaculata
(Blackspotted Bay Shrimp)

Non-native shrimp



Exopaleamon



Paleamon





Musculista senhousia



Macoma petalum



Potamocorbula



Venerupis philippinarum
(Japanese Littleneck)

Fish Food!

Fish eat bugs



Mysids, Crangon, Isopods



Baby Fish & Eggs



Shiner Surfperch



Inland Silversides with eggs



2015-12-12



In A19 5/17/15

Bay Pipefish

Striped Bass

**Pelagic Fishes
in Artesian Slough**

Longfin Smelt



Threadfin Shad



American Shad



Fish Diversity - winter



Bat Ray



White Sturgeon



Longfin Smelt



Staghorn Sculpin



American Shad



California Halibut



Striped Bass

✓ Cold Freshwater Habitat (COLD)

✓ Rare & Endangered Species (RARE)

Fish Diversity - summer



Bat Ray



Plainfin Midshipman



Striped Bass



Starry Flounder



Gobies – Various Types



Sanddab



Pipefish



Northern Anchovy



Warm Freshwater Habitat (WARM)

Bird Food!

Birds eat fish



Sculpin & Gobies

Silversides
Killifish
Gobies
Shrimp
Larval Bass





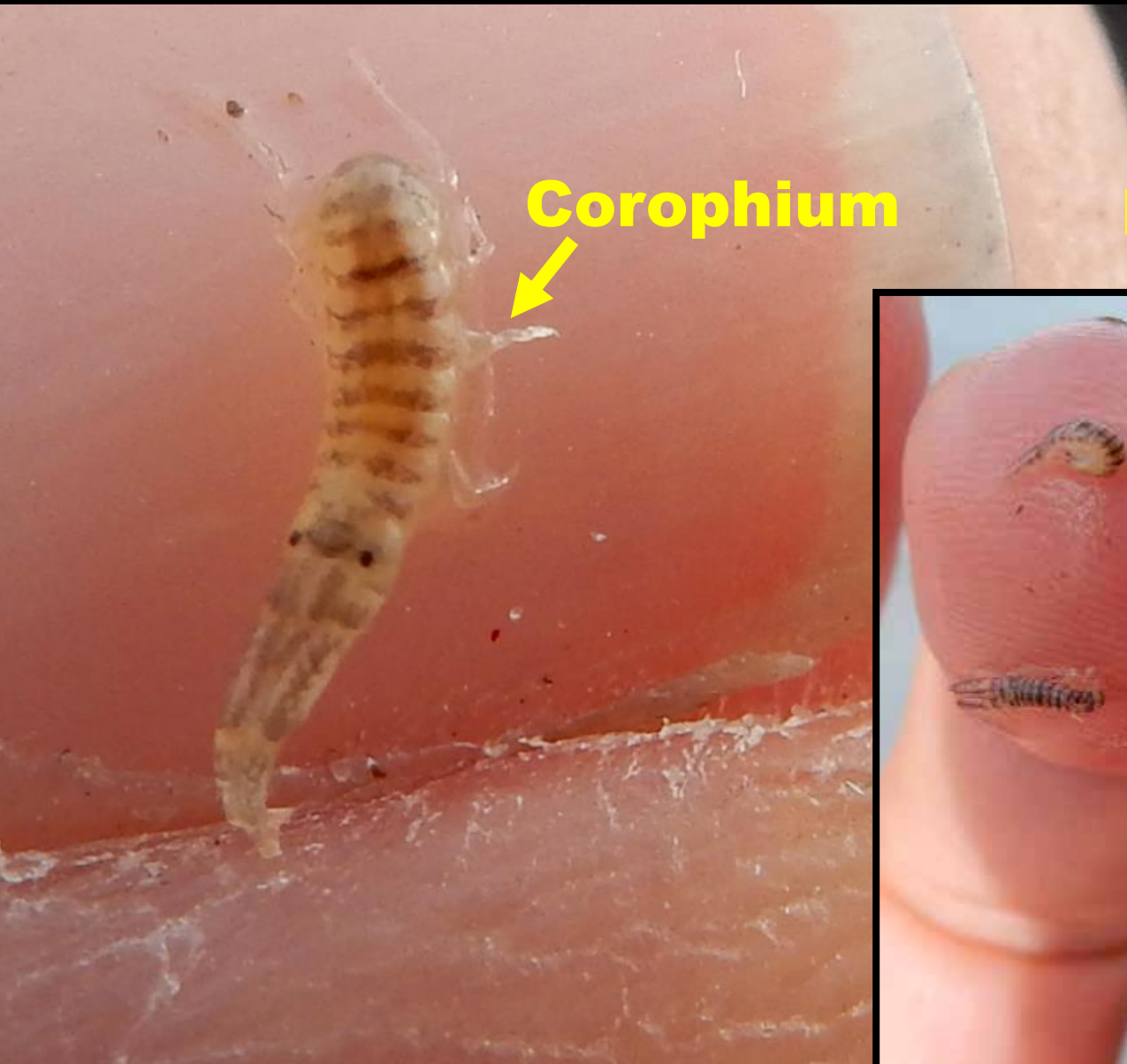
Lots of Birds



Wildlife Habitat (WILD)

Bugs! (Corophium) in Artesian Slough

Very desirable food for fish & birds





Anchovies
Artesian Slough
- Nov 2016

Corophium in anchovy stomachs



Spawning Anchovies!



**8 anchovies post spawn
– or too young to spawn**

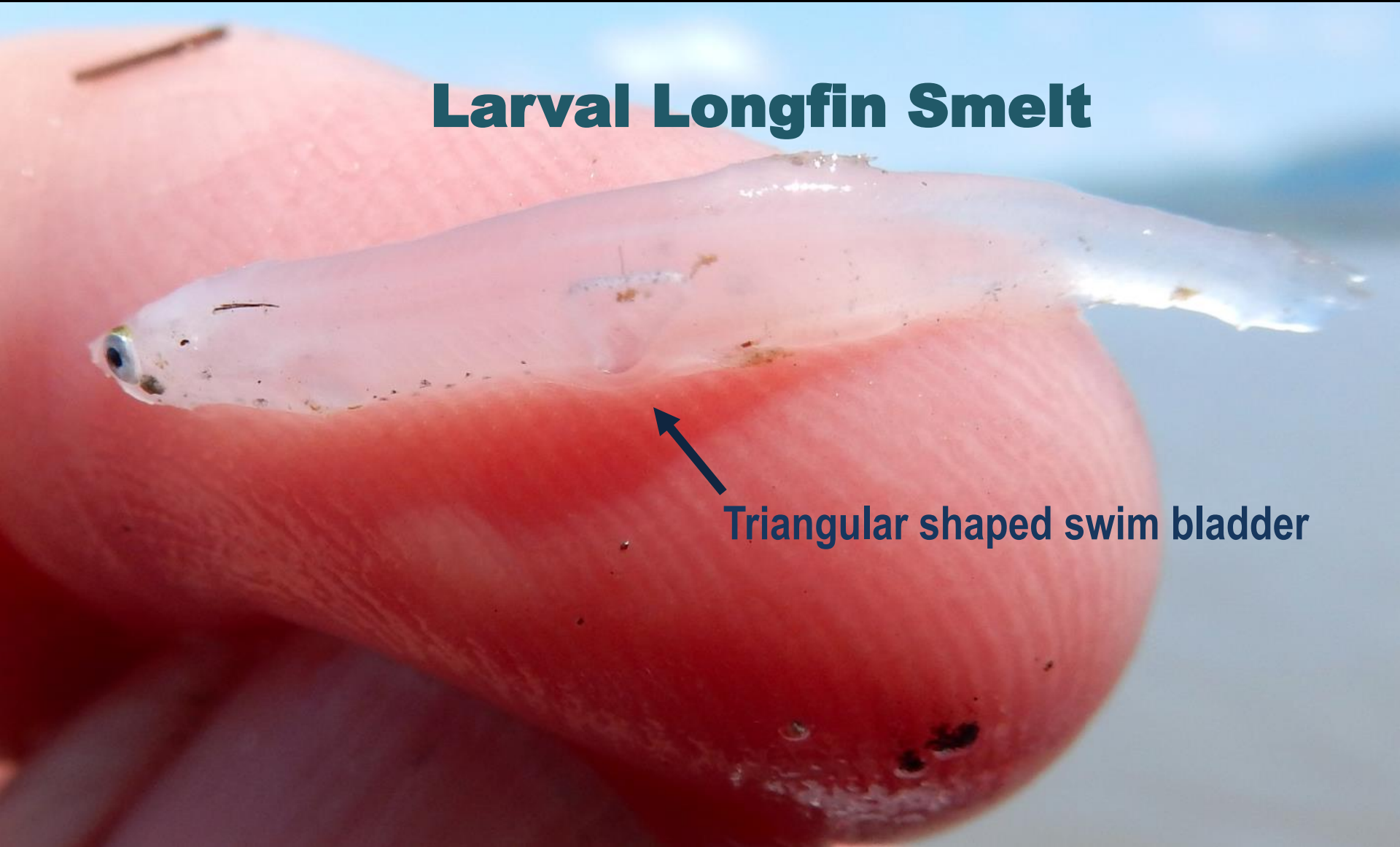
Who would have thought?

Mysids

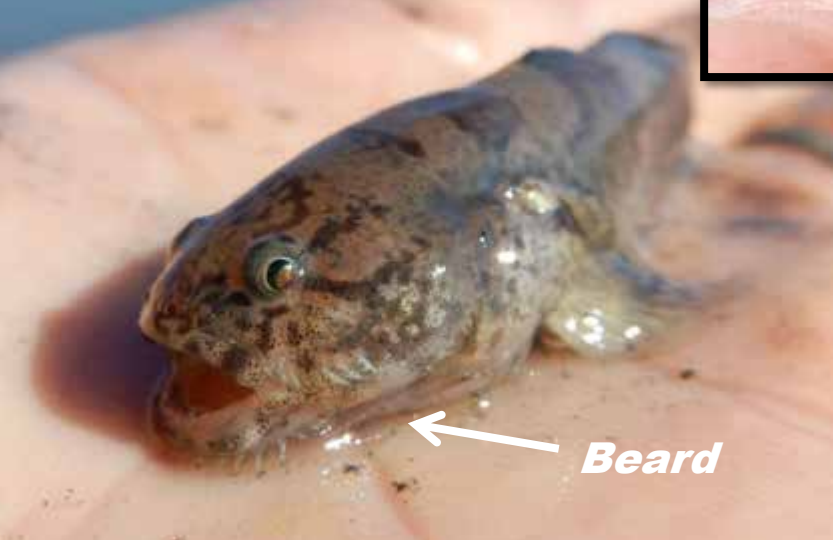


Larval Longfin Smelt

Triangular shaped swim bladder



Shokihaze Goby *(AKA Bearded Goby)*



Beard



*Slender, snake-like body for
burrowing in mud bottom*

Arrow Goby



*Shokihazes have a two-toned
snake-skin pattern*

Yellowfin Goby





Longjaw Mudsucker

***Sentinel of healthy
pickleweed marsh nearby***



Babies



Young of year

**California
Halibut
Nursery -
2016**

Wet 2017: good year for Starry flounder & Prickly Sculpin



Sharks & Rays ***October 2016***



Brown Smoothhound



Leopard Shark



Bat Rays



Shovelnose Guitarfish



River Monsters from the Outfall Channel

June 2015

***Striped Bass
~ 3-6 years***

***Largemouth
Bass
~ 3-6 years***

***Common Carp
~ 8-10 years***



White Sturgeon



The El Nino Fish!

Striped Mullet are Back – not seen in SFB since 2002.

5/22/2015



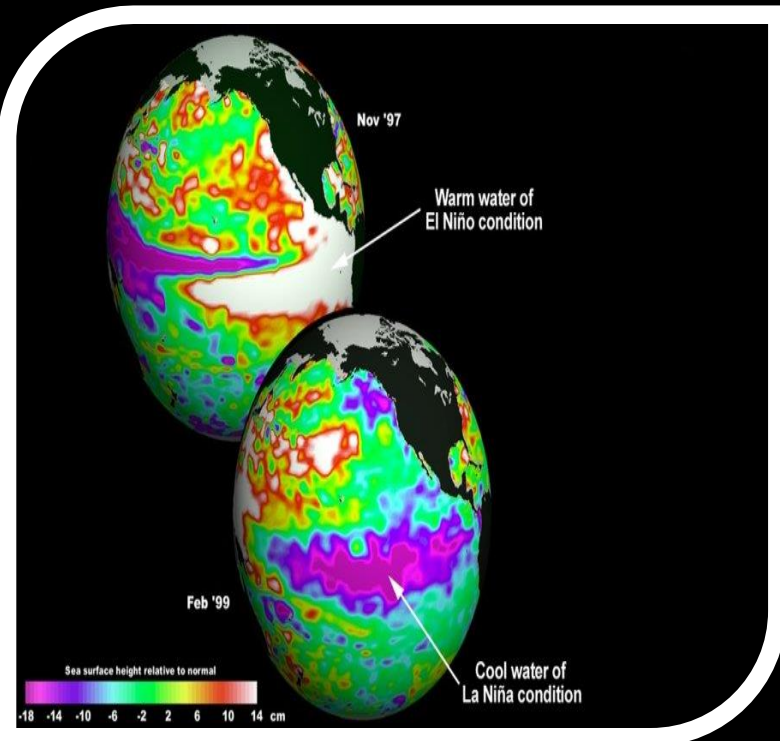
5/20/2015



6/14/2015



Artesian Slough catch



12 July 2017





Ducks on A16, looking west



Cinnamon Teal

Ruddy Duck



Scaup (hens)



Redheads

Ducks!



Shovelers



Gadwalls



Goldeneye



Ducks on A18, looking east

Fishing & Hunting



- ✓ REC-1: Water Contact Recreation
- ✓ Commercial & Sport Fishing (COMM)

Hiking & Sightseeing



REC-2: Noncontact Water Recreation

Observations on RWF Property





**North-west corner of Lagoon 53,
0726 AM**



***Ruddy
Duck***



Ducks!

**Six species spotted in RWF lagoons
11/6/2016**



***Northern
Shoveler***



***Green-
winged Teal***



Northern Pintail



Gadwall



Mallard

Lagoon 36 on 26 May 2017



Eggs!!!





Canada Geese

**Other migratory
birds seen**



***American Coots
(mud hens)***

And then? ...

Predators arrived: Falcons, Coyotes, Eagles



2015

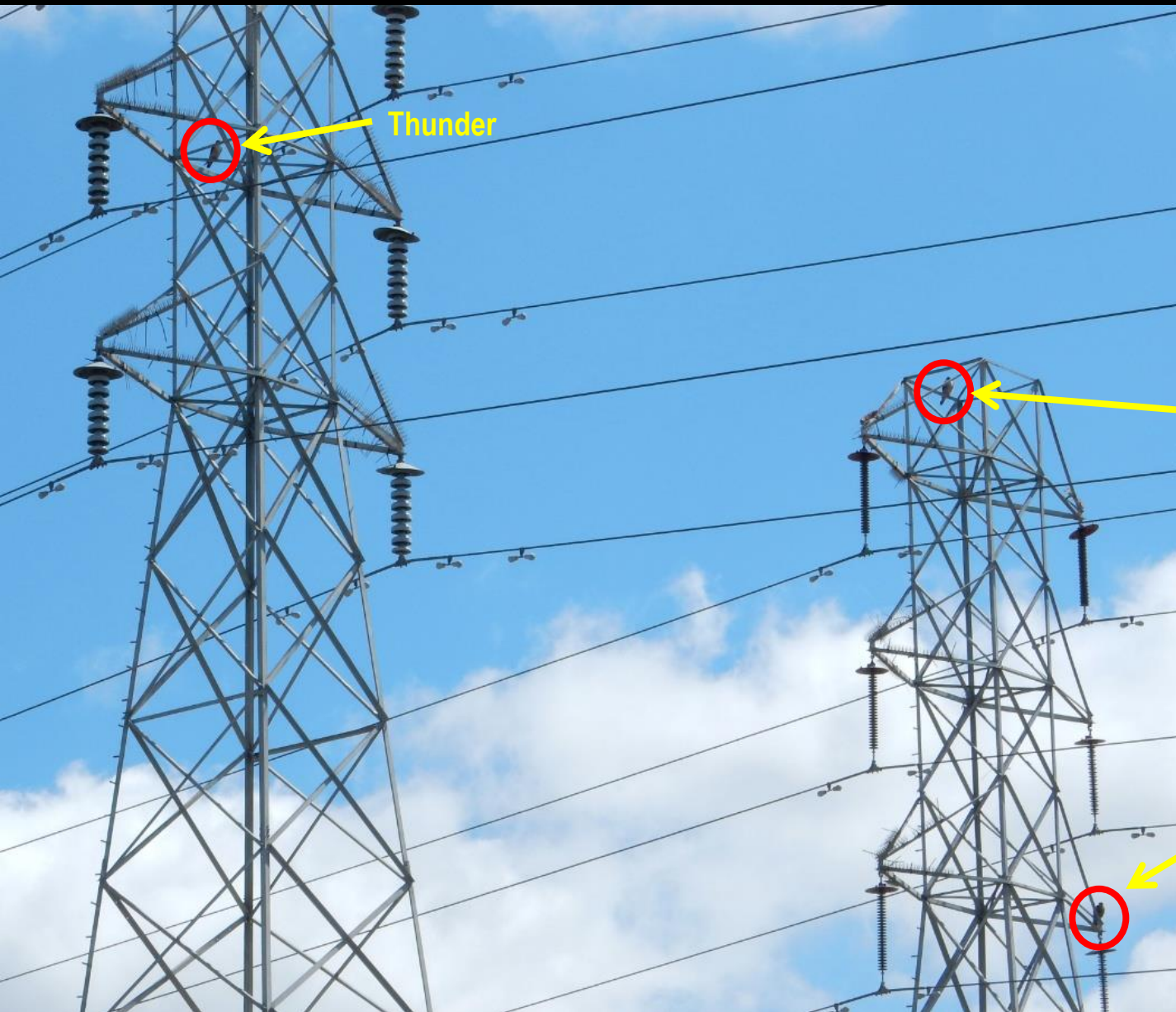


2016



2017

Peregrine Falcons



Peregrine Falcons



Hawks





November 2016
Trouble arrived at
Cootville





Bald Eagle Honeymoon

Bald Eagles nest where food is available



Mom Eagle with Fish!

(photo by Ron Lam)



Did it really happen here?

(photo by Ron Lam)



D500 April 29_09
by Ronhc Lam



Meet Junior

(photo by Ron Lam, one of many fans of our Milpitas Eagles)



D500 June 18_04

by Ronhc Lam

Artesian Slough Today What Next?



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2008



2016



2008

2016

