

Salton Sea CDFW Monitoring Effort

California Department of Fish & Wildlife

Salton Sea Program: Region 6

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Human-Impacted Salton Sea

- Agricultural runoff (nutrients and pesticides)
- Playa aerosols
- Sea aerosols
- Water deoxygenation
- Reduction in water flux to the sea due to the Quantification Settlement Agreement



OUTLINE

- Origins of the Salton Sea
- Water Quality
- Pupfish Monitoring
- Tilapia Monitoring
- Bird Monitoring
- Fate of the Salton Sea & its Food Web
- Concluding Remarks

Origins of the Current Salton Sea

- Prehistoric Lake Cahuilla covered an area of 5700 km² ~ 2200 mi²
- Current Salton Sea is largest lake within California (980 km² ~ 378 mi²)
- Salton Sea was formed in 1905-07 as flooding allowed Colorado River water to inundate the Salton Basin.
- Desert conditions has led to continuous evaporation of Salton Sea

Salton Sea Major Nutrients



Phosphorus to Chlorophyll a relationship in aquatic systems

- 0-12 $\mu\text{g/L}$ TP – Oligotrophic
- 12-24 $\mu\text{g/L}$ TP – Mesotrophic
- 25- 95 $\mu\text{g/L}$ TP – Eutrophic
- 96 + $\mu\text{g/L}$ TP - Hypereutrophic

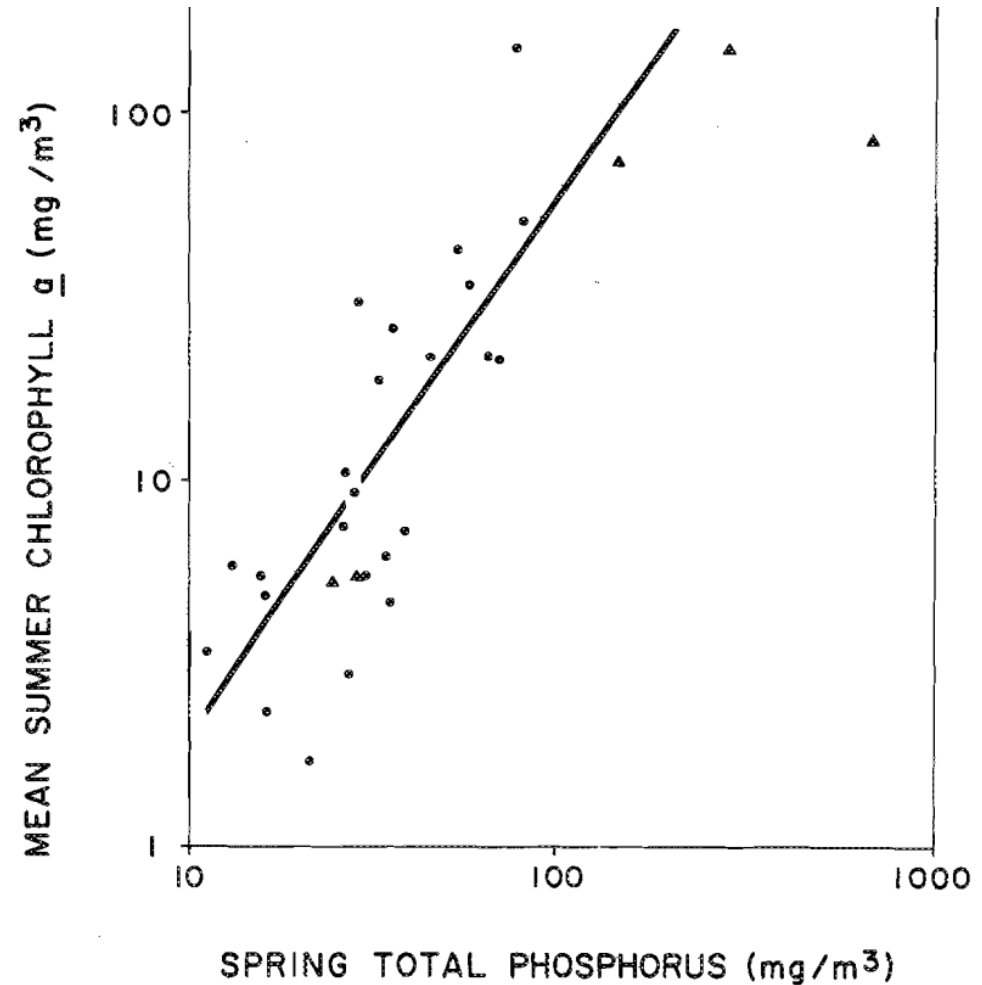
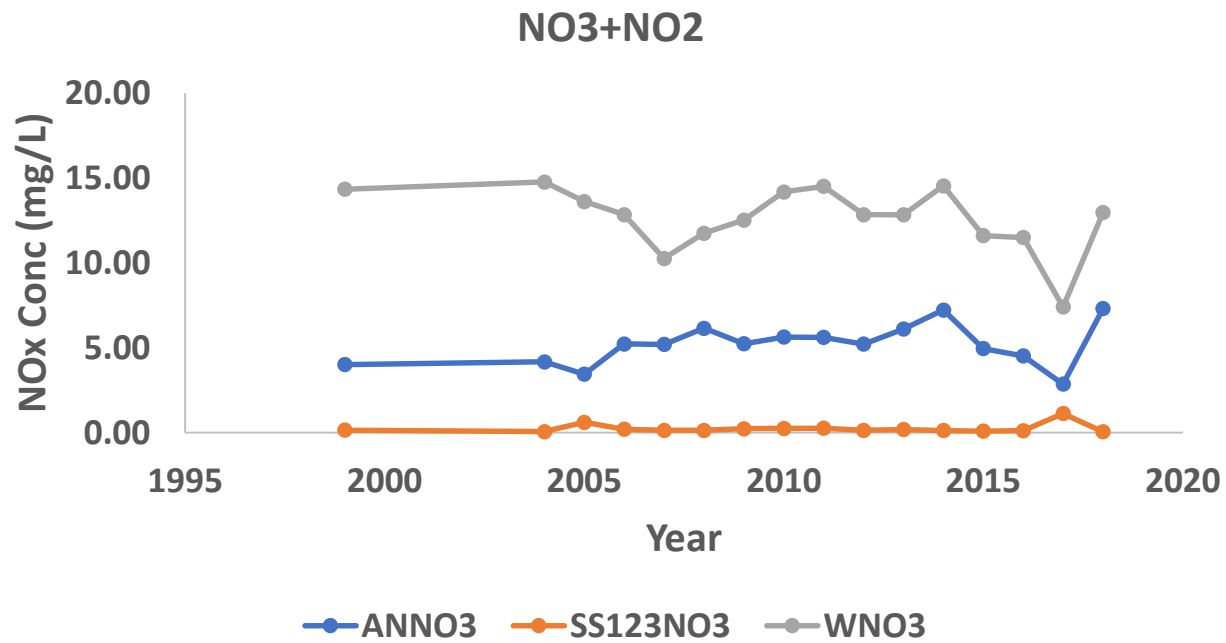
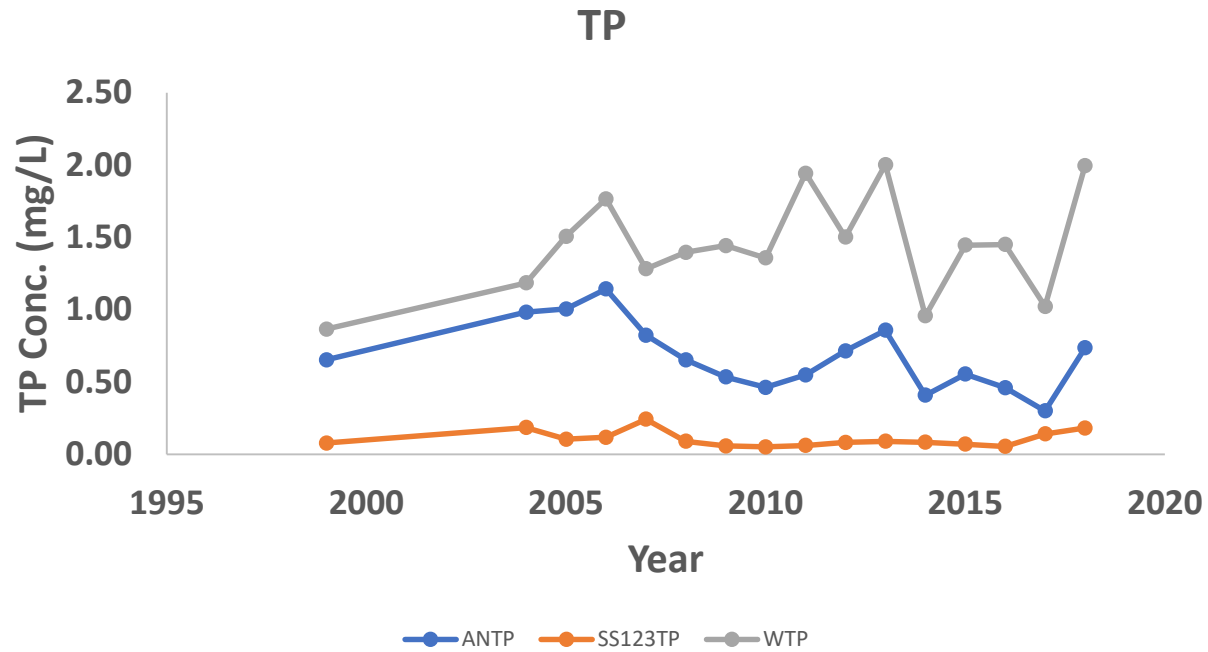


FIG. 3. Relationship between mean summer chlorophyll and total phosphorus at spring overturn in lakes in central Alberta. Triangles (\blacktriangle), saline lakes. The line is from Dillon and Rigler (1974).

Salton Sea Total Phosphorus (TP) and Nitrate (NO₃) + Nitrite (NO₂) for the Alamo + New Rivers, Salton Sea stations 1 (north), 2 mid-lake, & 3 (south), and Whitewater (Coachella Valley Stormwater Canal).

Bureau of Reclamation Data collected for the Salton Sea 1999 + 2004-2018.





SALTON SEA
DESERT
PUPFISH

CDFW Desert Pupfish Surveys

Trapping surveys conducted in selected tributaries, irrigation drains, refuges (artificial habitat), shoreline pools/ponds, Sea proper (primarily embayments)

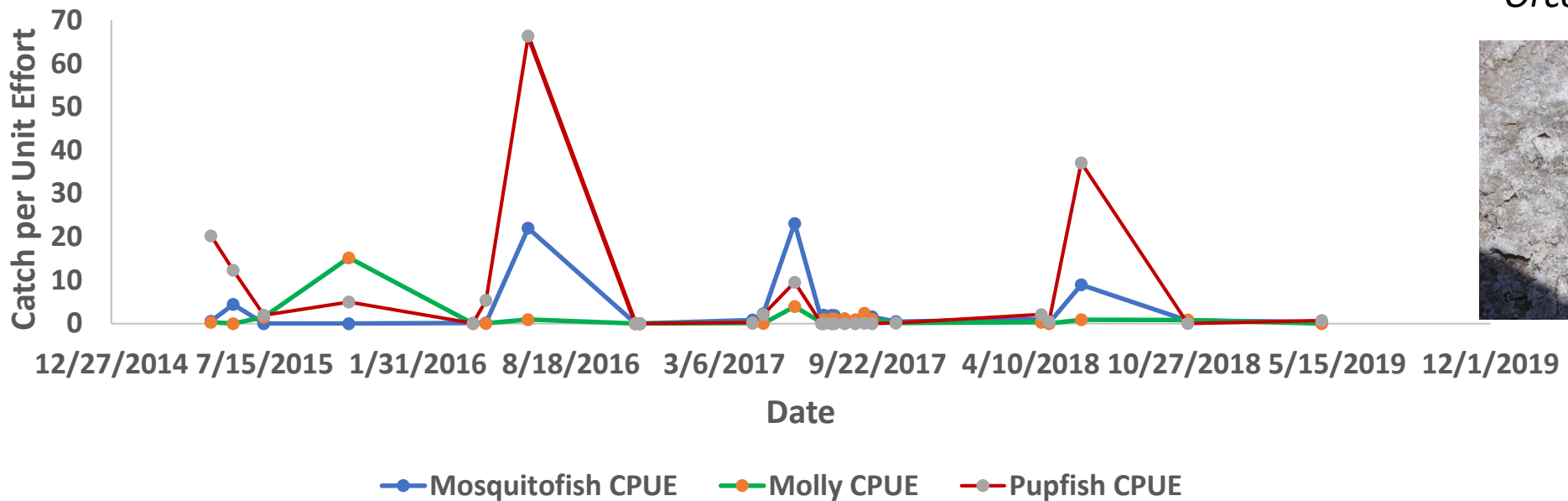
Surveys generally conducted from late March through October or early November, when the species is active

Frequency of surveys ranges from quarterly to every 5-10 years

San Felipe Creek: 2018 survey showed pupfish still present

South end drains are currently being surveyed for the 2019 season

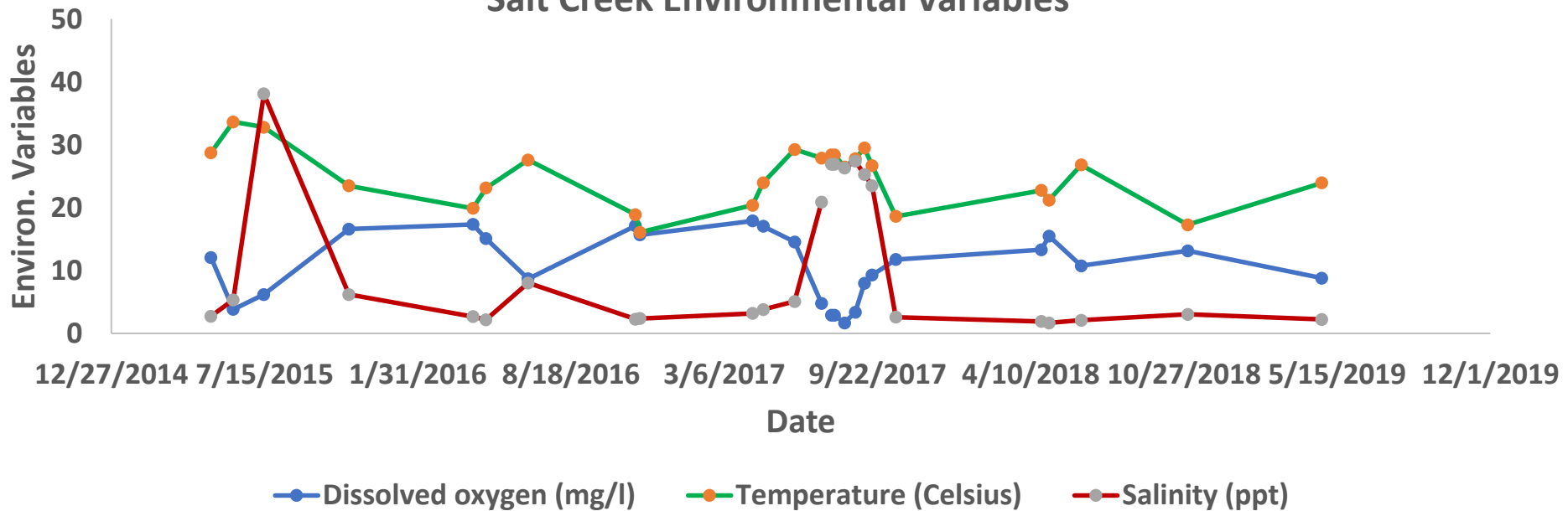
Salt Creek CPUE



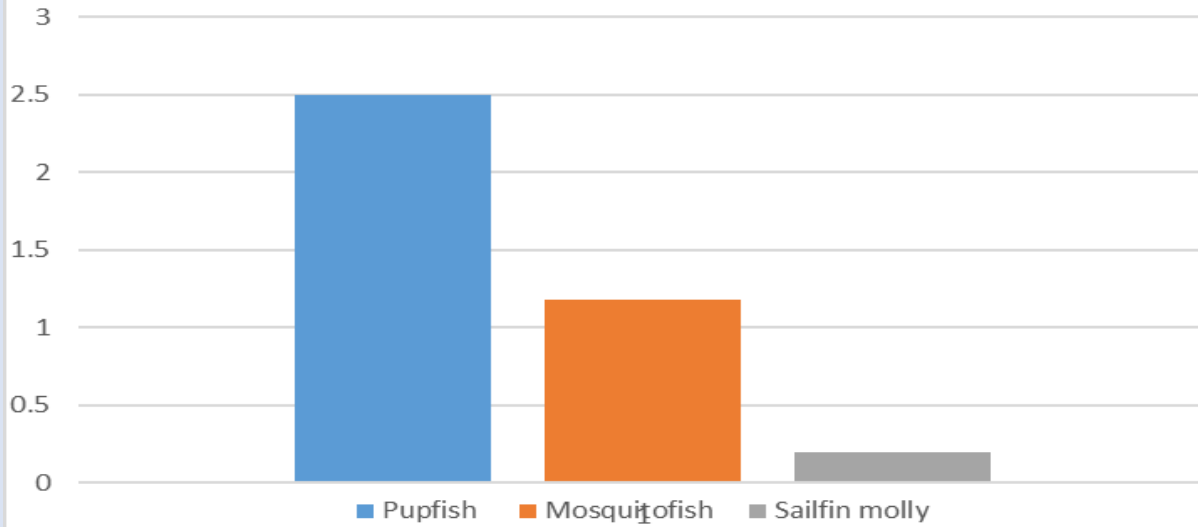
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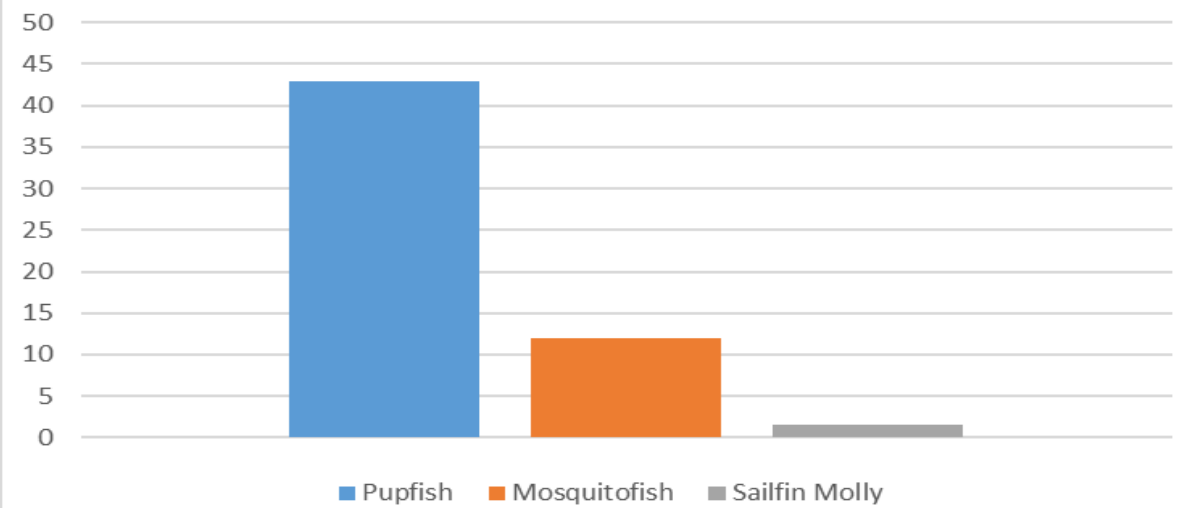
Salt Creek Environmental Variables



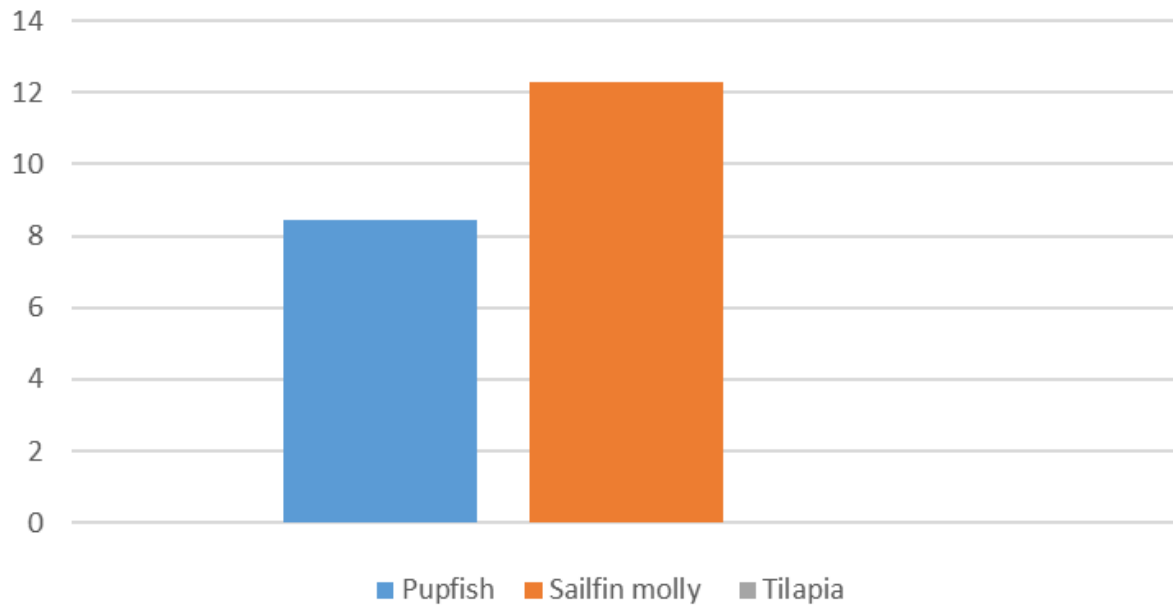
April 2018 CPUE Upper Salt Creek



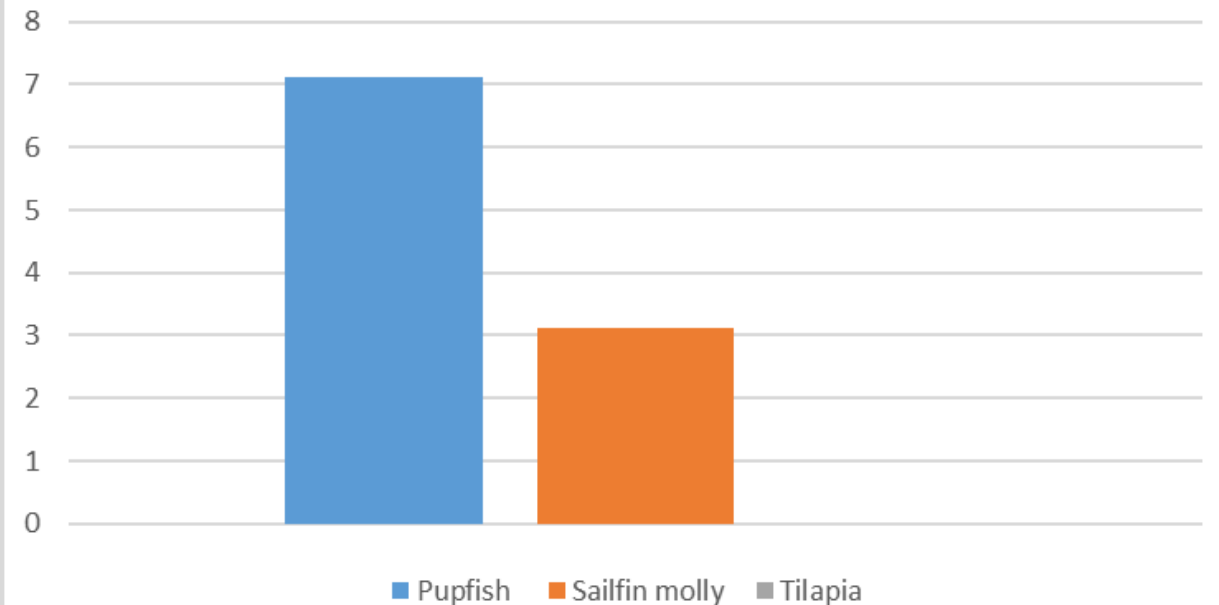
June 2018 CPUE Upper Salt Creek (three sites)



April 2018 CPUE Varner Harbor



October 2018 CPUE Varner Harbor





Gambusia affinis



Poecilia latipinna

Physiological tolerance: upper temperature/salinity acclimation, which species is best positioned to acclimate to abrupt changes?

Cyprinodon macularius



Salton Sea Tilapia

Oreochromis mossambicus x *O. urolepis hornorum*



Salton Sea Tilapia Gill- Netting Sites

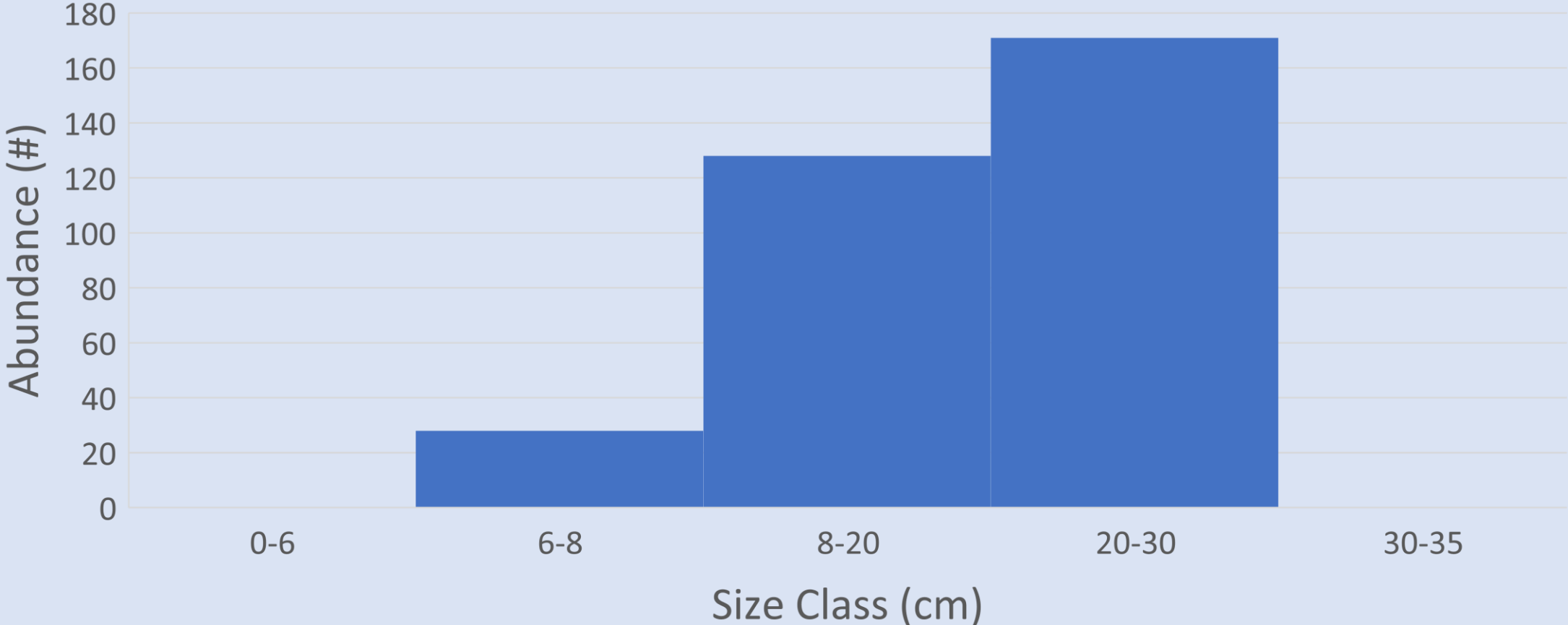


Salton Sea Tilapia

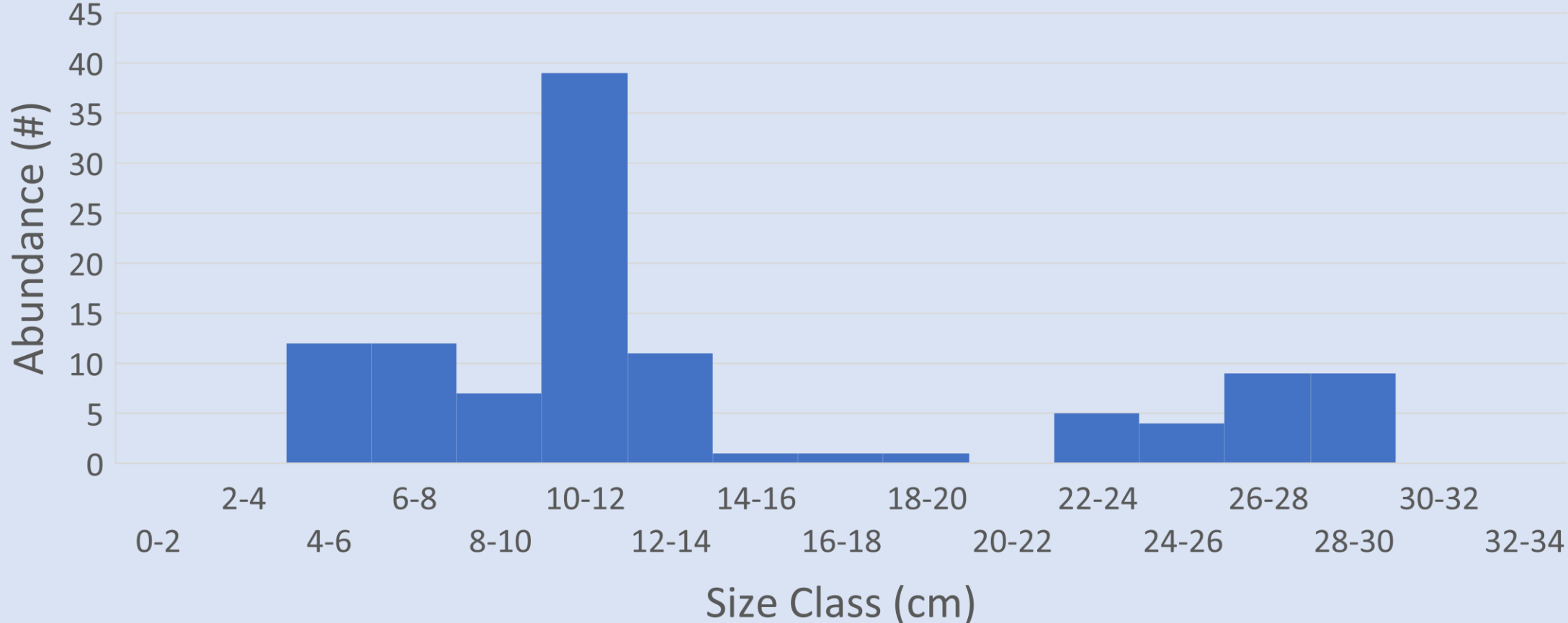
Catch per Unit Effort 2003-08, 2017&18

Year	Tilapia CPUE
2003	1.14
2004	7.23
2005	10.85
2006	10.05
2007	14.63
2008	27.01
2017	1.12
2018	0.45

Salton Sea Tilapia Size Structure for 2017



Salton Sea Tilapia Size Structure for 2018



SALTON SEA AVIAN MONITORING

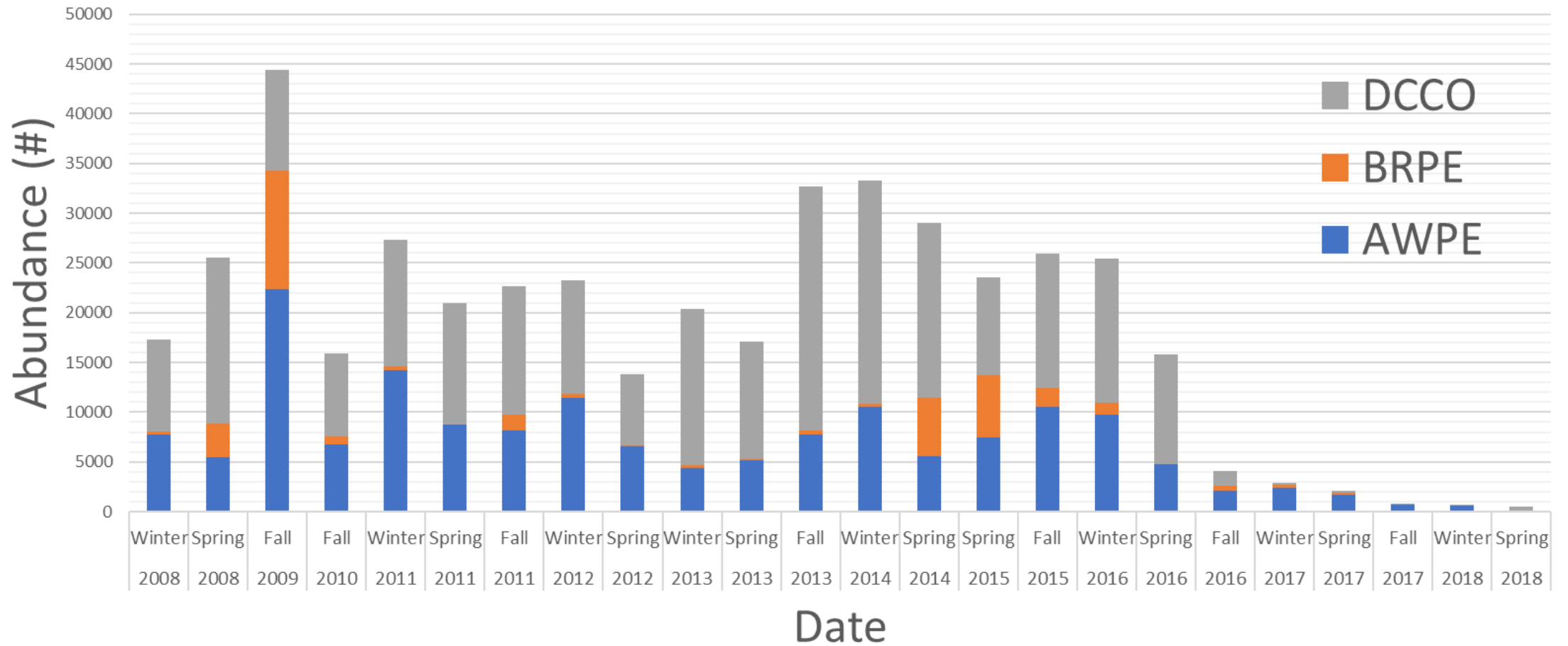


SALTON SEA AVIAN MONITORING

- **Aerial Surveys of piscivorous birds**
 - Double-Crested Cormorants (DCCO), Brown Pelicans (BRPE), American White Pelicans (AWPE).
 - Six surveys are completed from Nov-May by fixed wing aircraft.
 - Aircraft travels in a counter-clockwise direction around the perimeter of the Salton Sea
 - Aircraft also flies over the wildlife areas at the south end of the Salton Sea at an altitude of 60 m (200 ft).
- **Other Surveys: Pacific Flyway Nesting Birds; Shorebird; Marsh bird; Dead & Sick Birds**

Piscivorous Birds by Season and Year

Winter 2008- Spring 2018





Fate of the Salton Sea and its Food Web

Imperial Irrigation
District/CH2M Hill:
Salton Sea
Modeling Salt
Content

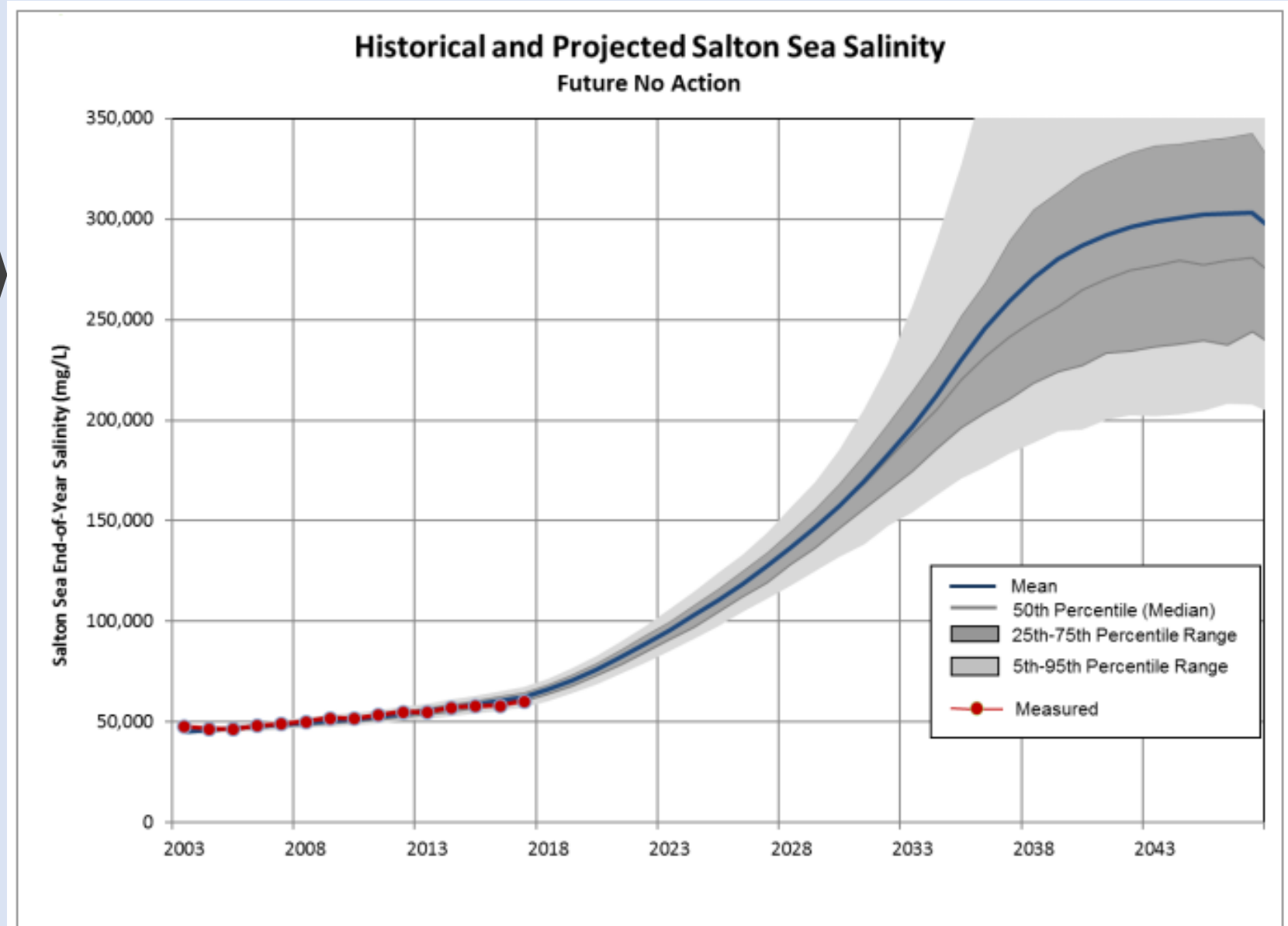
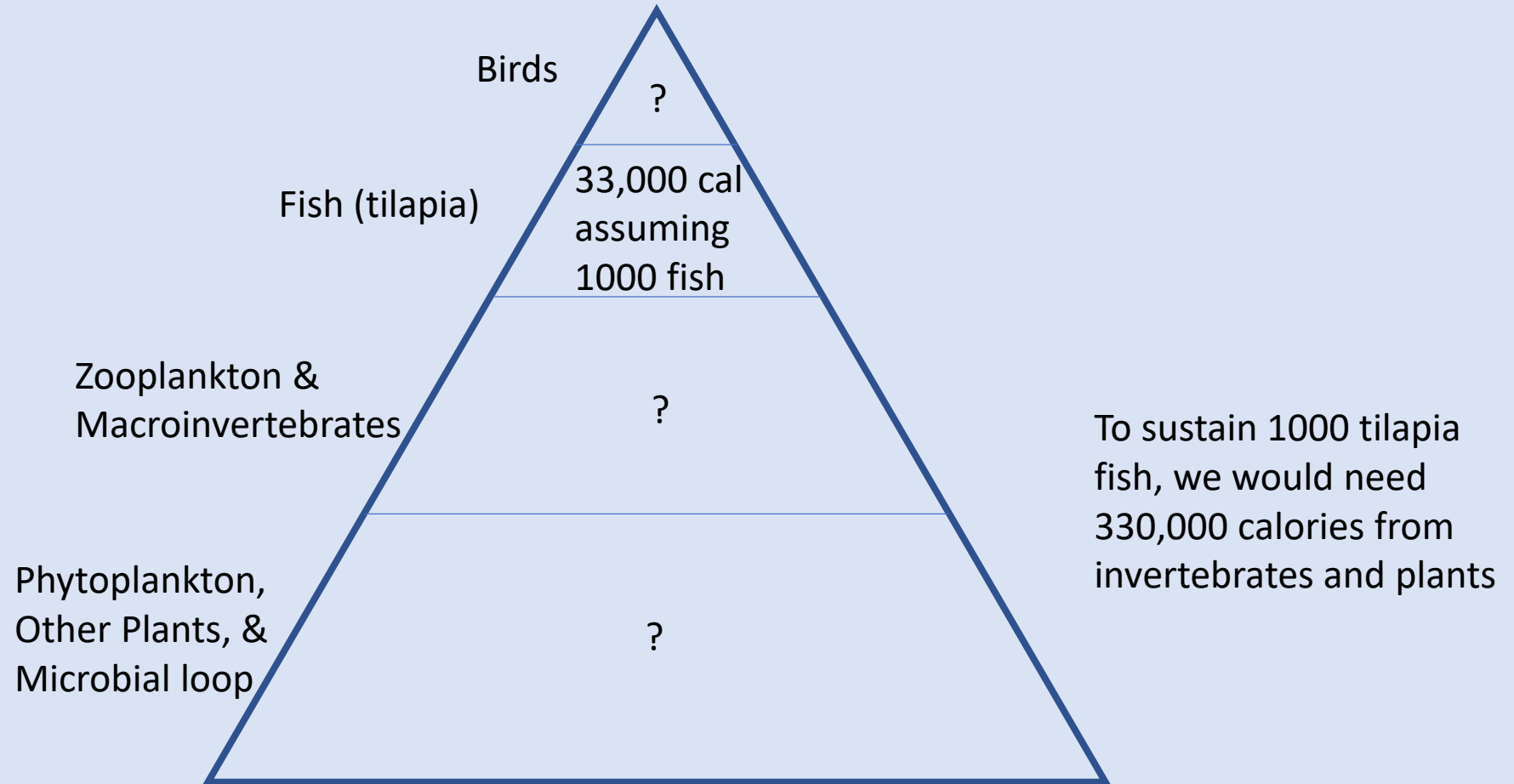


Figure 10. Simulated and Measured Salton Sea Salinity, 2003–2047 (Validation)

Salton Sea Food (Pyramid) Web 2018



Changing Climate

- Increase in temperature?
- Increase in variable weather patterns?
- Increase in frequency and intensity of El Nino Events?
- Or increase in frequency and intensity of La Nina Events?

CONCLUDING REMARKS

Salton Sea nutrients are tending towards favoring nitrogen-fixing cyanobacteria, salt content is currently >60 g/L as Total Dissolved Solids, average seawater is 35 PSU. There is also a difference in the types of salts in the Salton Sea v Seawater.

Even though desert pupfish appear to be doing relatively well, their natural habitats are diminishing.

In 2019 we plan on surveying pupfish in the south drains, continue the aerial bird surveys and gill-netting surveys as we did in 2018.

Increase in salinity and reduction in freshwater flow into the Salton Sea may be responsible for the current reduction in the fish community and birds present at the Sea.

Salton Sea food web is in decline, if tilapia feed proportionally more on plants, then bioaccumulation up the trophic ladder will be less.

How will climate change impact the Salton Sea and its fish and wildlife?



QUESTIONS??