


The Enigmatic Salton Sea: All Water Is Not Created Equal

A photograph of a sunset over a body of water, likely the Salton Sea. The sun is low on the horizon, creating a bright orange glow. In the foreground, the dark silhouettes of several trees with bare branches are visible against the bright sky. The water in the background is calm and reflects the light from the sun.

Douglas Barnum, PhD
Salton Sea Scientist Retired

Salton Sea Summit
UC Riverside Palm Desert
Oct 17, 2019

Why is the Salton Sea in trouble ?

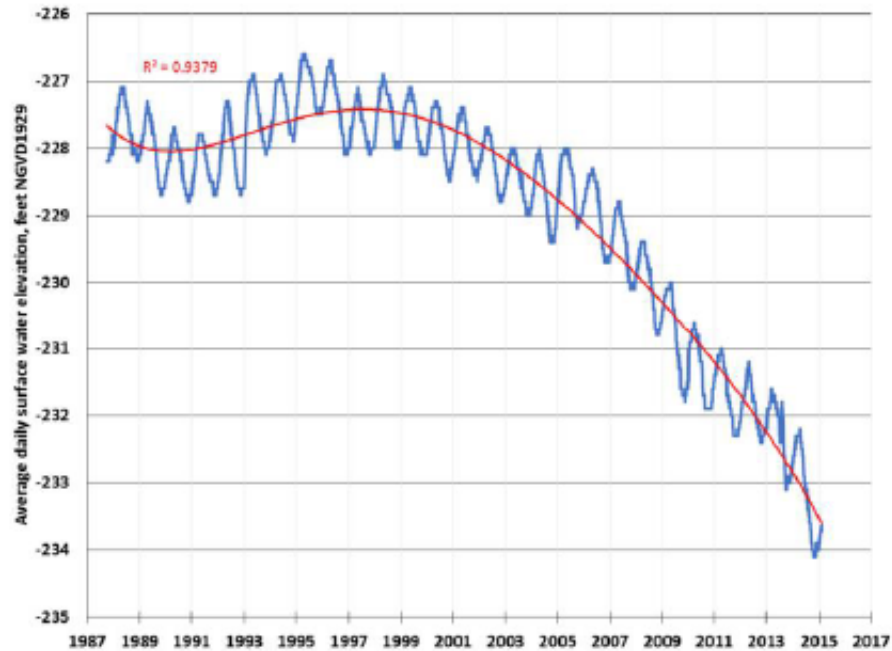
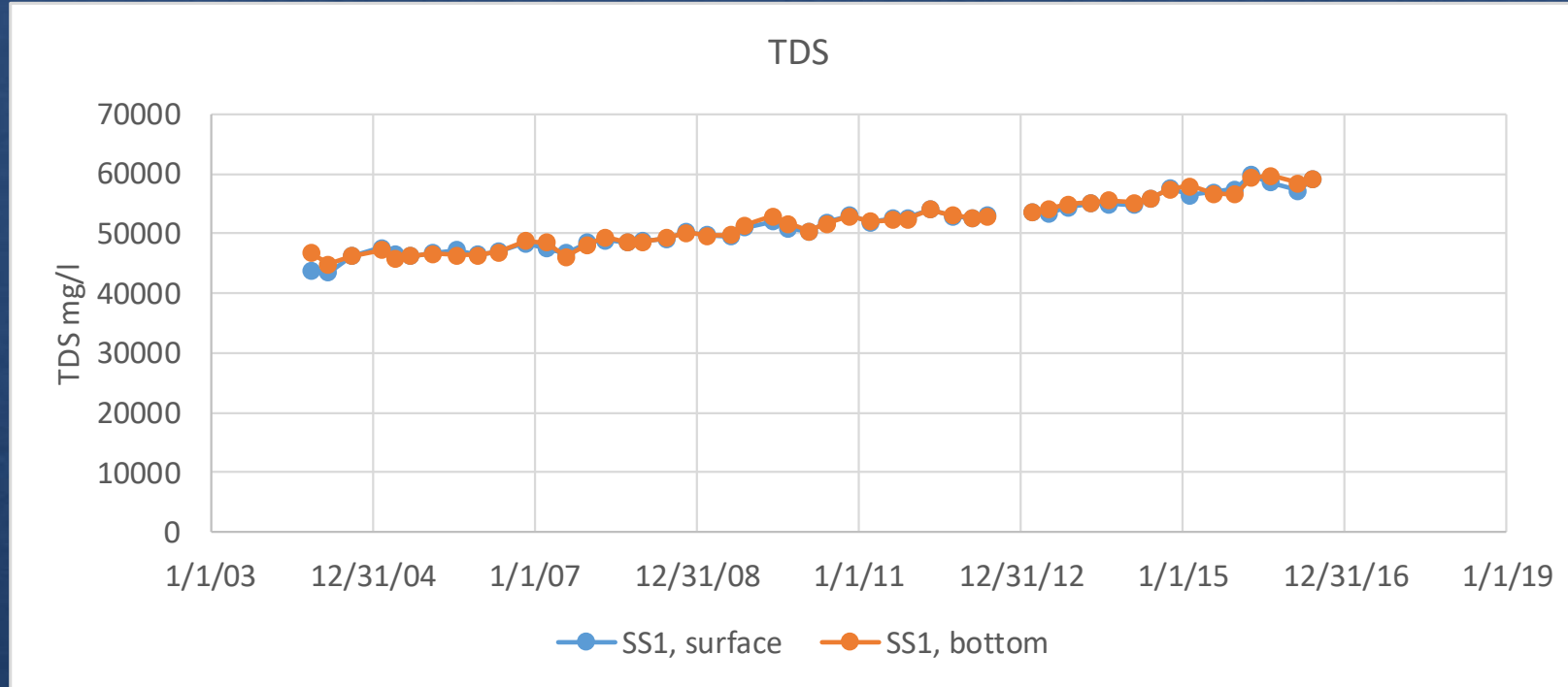


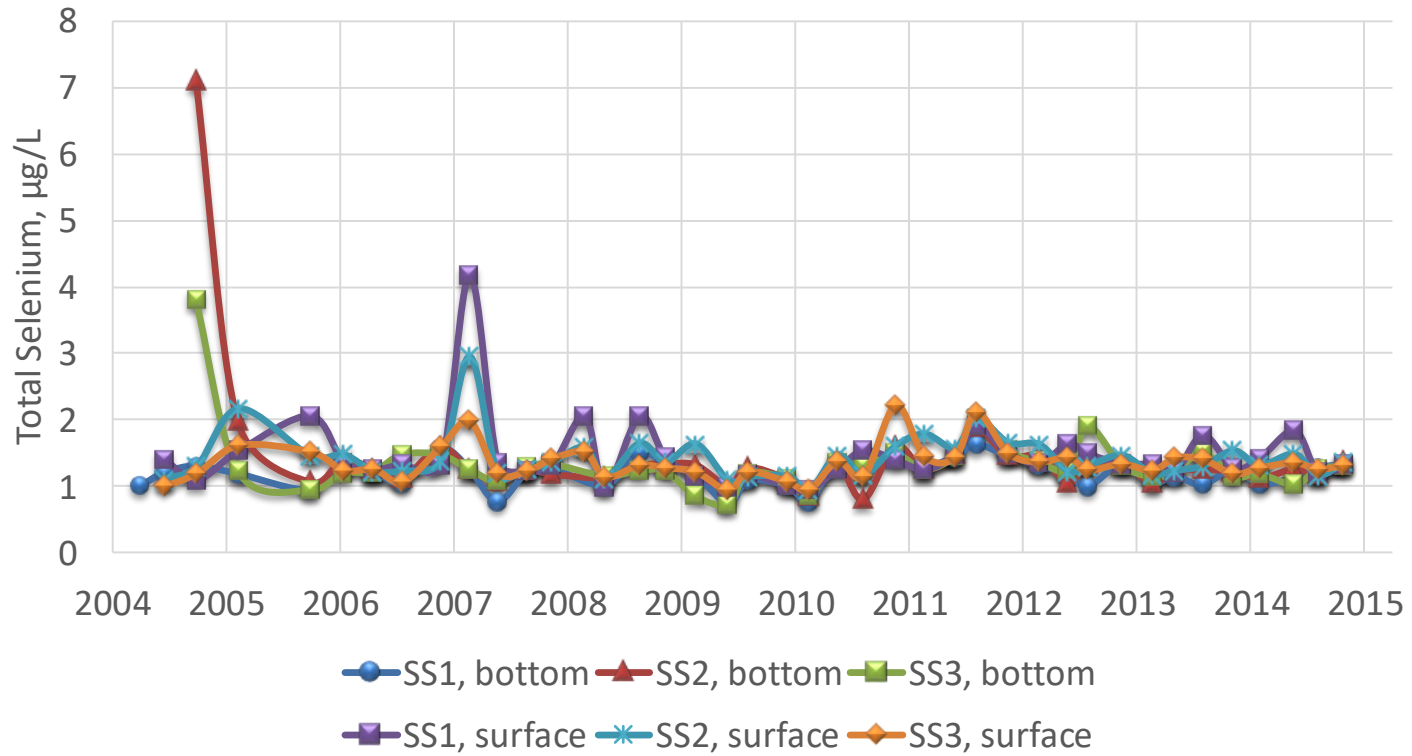
Figure 8 Daily surface water elevation above NGVD 29 for Station 10254005 located along Salton Sea near Westmorland, CA from October 1987 to February 28, 2015 (USGS). Trend line (5th order polynomial) with R^2 shown in red.

Scientific and management question is this – how do we manage for all the qualities of the Salton Sea, e.g. birds, fish, and societal values, all while receiving less water. Do more with less?

Total Dissolved Solids



Total Selenium



Blended water strategy

TARGETS

Blends low salinity river water with high salinity Salton Sea water – target is 15-25 mg/l TDS

Blends river water with elevated selenium with Salton Sea water of low selenium – target is <5 µg/l

Blended Water uses Salt for Habitat Management

- Minimizes Selenium exposure
- Uses salinity as a tool to suppress most plant growth thus interrupting a major selenium bioaccumulation pathway
- By suppressing higher aquatic plant growth this allows for continuous wave action, thus avoiding the creation of habitat conditions for mosquito larvae
- Anecdotal observations by Wildlife Health Officials indicate the incidence of wildlife diseases is lower at salinities exceeding 20 mg/l
- Furthermore, it does all this and provides coverage with water to suppress fugitive dust



Selenium uptake/toxicity is a food-mediated pathway. Selenium Cycling typical of saltwater wetlands (e.g. TDS >20,000 mg/l)

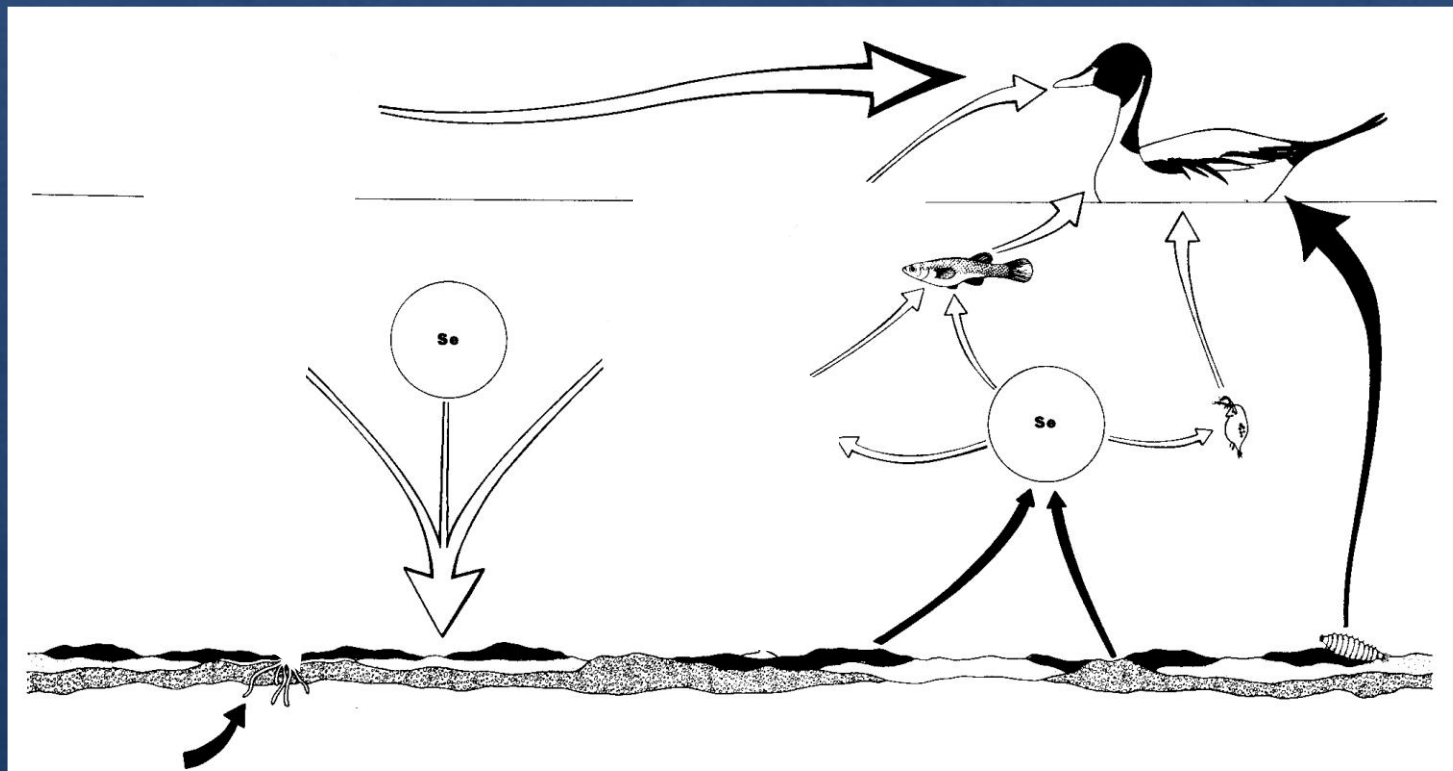


Fig. 1. A highly dynamic system: Biological, chemical, and physical processes cycle selenium into and out of the water, sediments, and biota. (In this and later figures, solid arrows indicate pathways by which selenium is remobilized from sediments into the food chain.)

Selenium Cycling typical of saltwater brine sink (e.g. TDS >100,000 mg/l)

Good for selenium risk management, bad for biodiversity

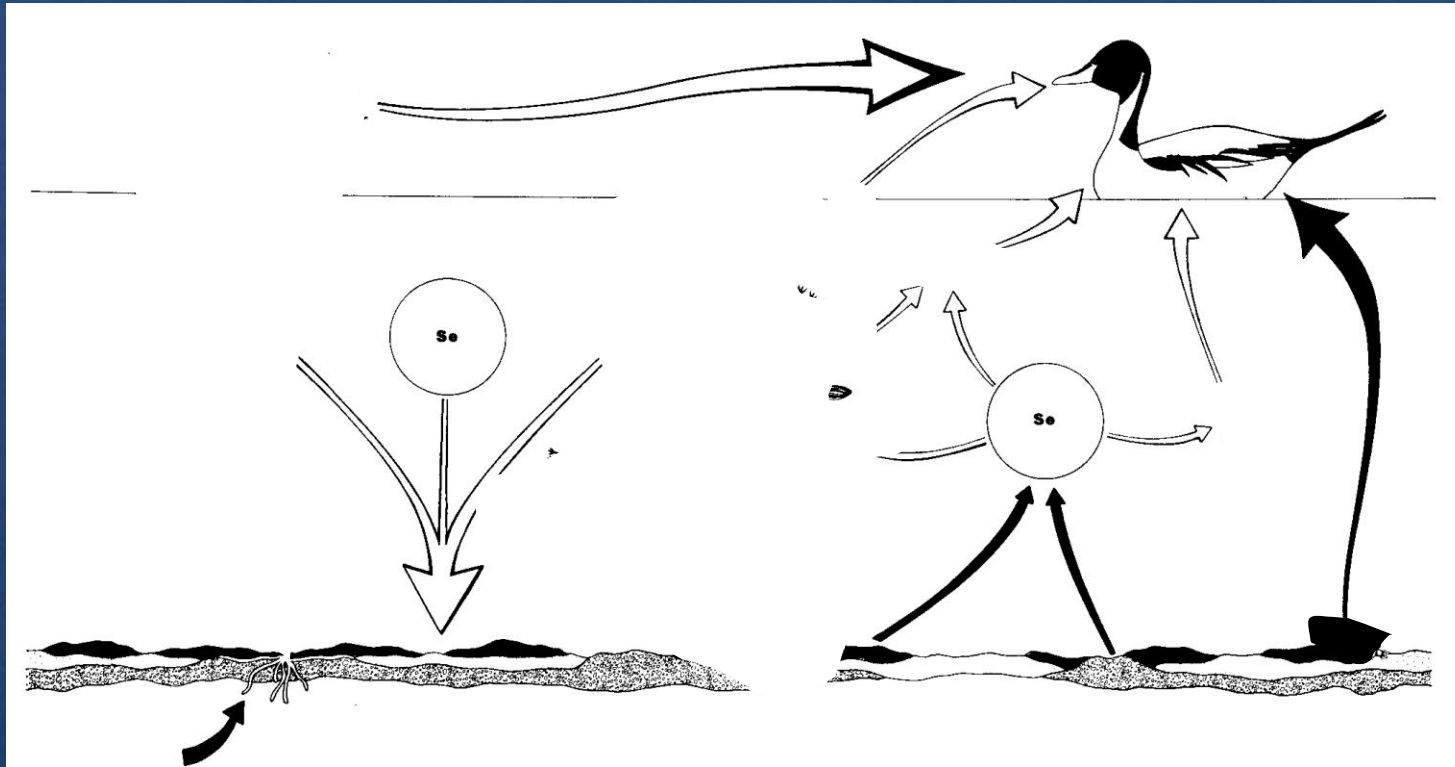


Fig. 1. A highly dynamic system: Biological, chemical, and physical processes cycle selenium into and out of the water, sediments, and biota. (In this and later figures, solid arrows indicate pathways by which selenium is remobilized from sediments into the food chain.)

Selenium uptake/toxicity is a food-mediated pathway

Direct discharge of river water or drain water into shallow habitats will result in excessive algae growth, and selenium problems.



Green water trail is algae growth due to high nutrient loading

Whitewater River, eutrophication and plant growth similar to the North Lake concept plan



Science for a solution - a blended water experiment

- ◇ Conduct an ecological risk assessment – particularly for selenium
- ◇ Evaluate avian:
 - ◇ Numerical abundance
 - ◇ Species diversity
 - ◇ Nesting success
 - ◇ Recruitment
 - ◇ Use patterns
- ◇ Evaluate water, sediments, and aquatic invertebrate response to blended water
- ◇ Evaluate construction techniques and the durability of levees and islands

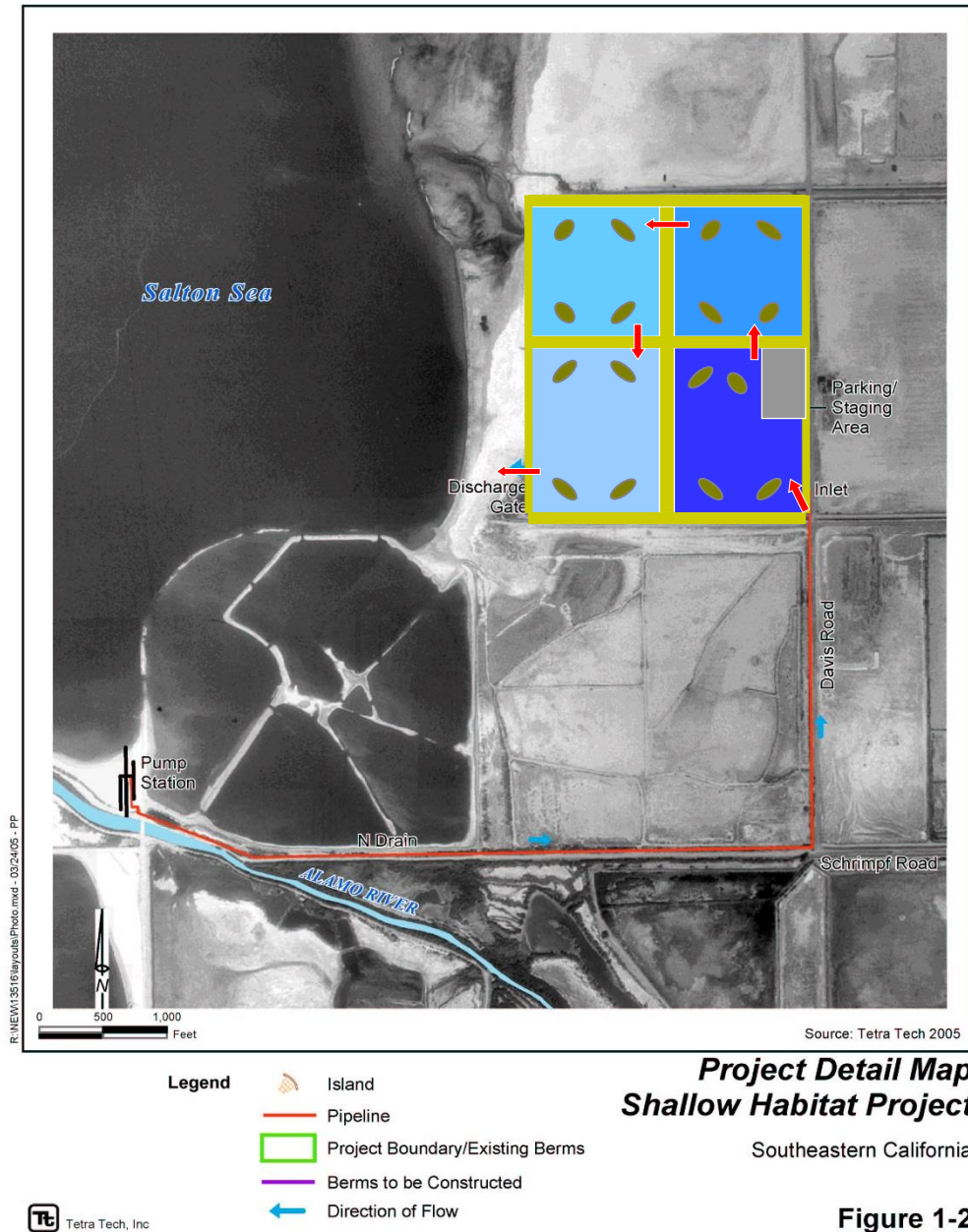
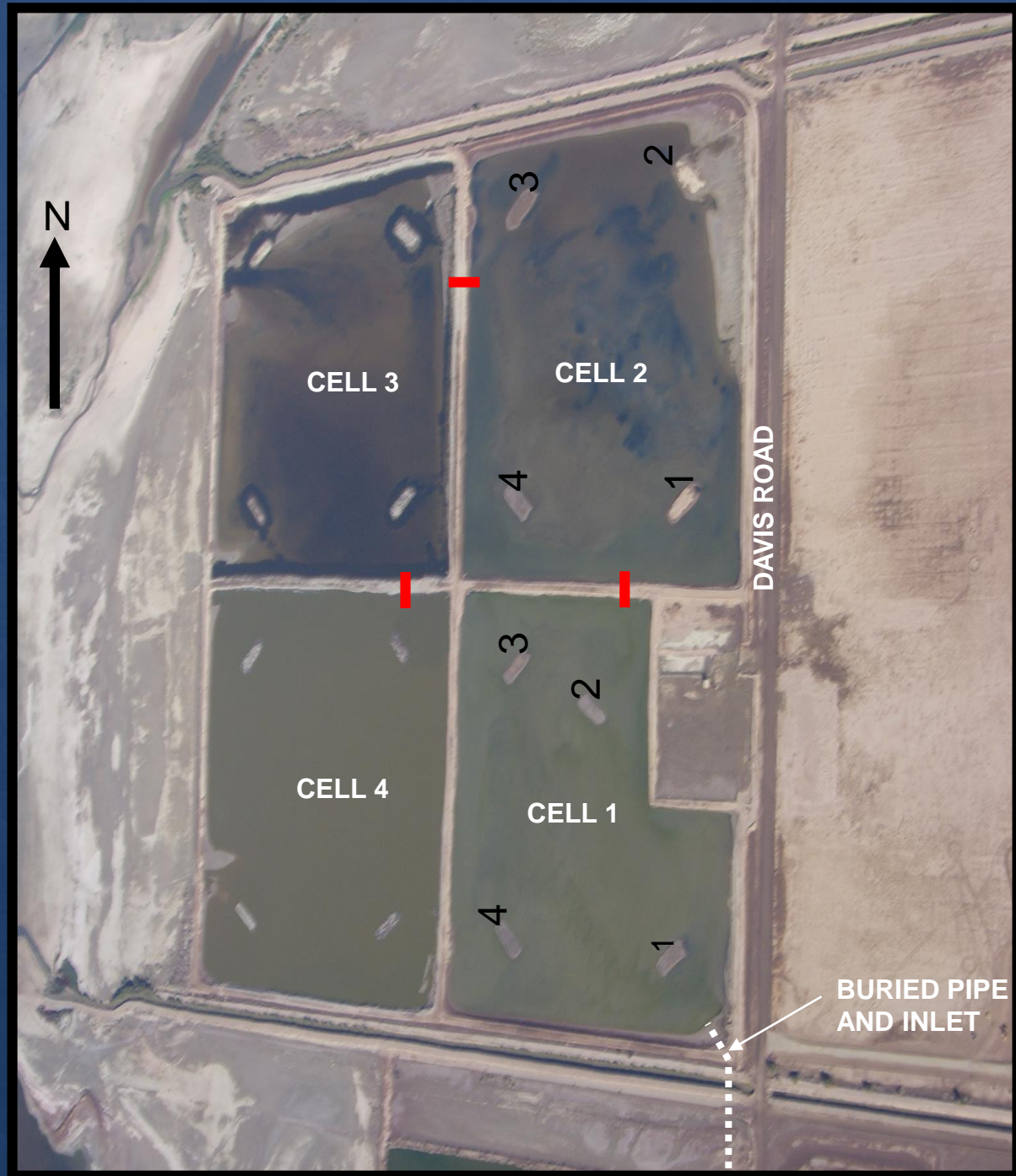


Figure 1-2

- USGS/Reclamation Shallow habitat project site. Aerial photo November 2007



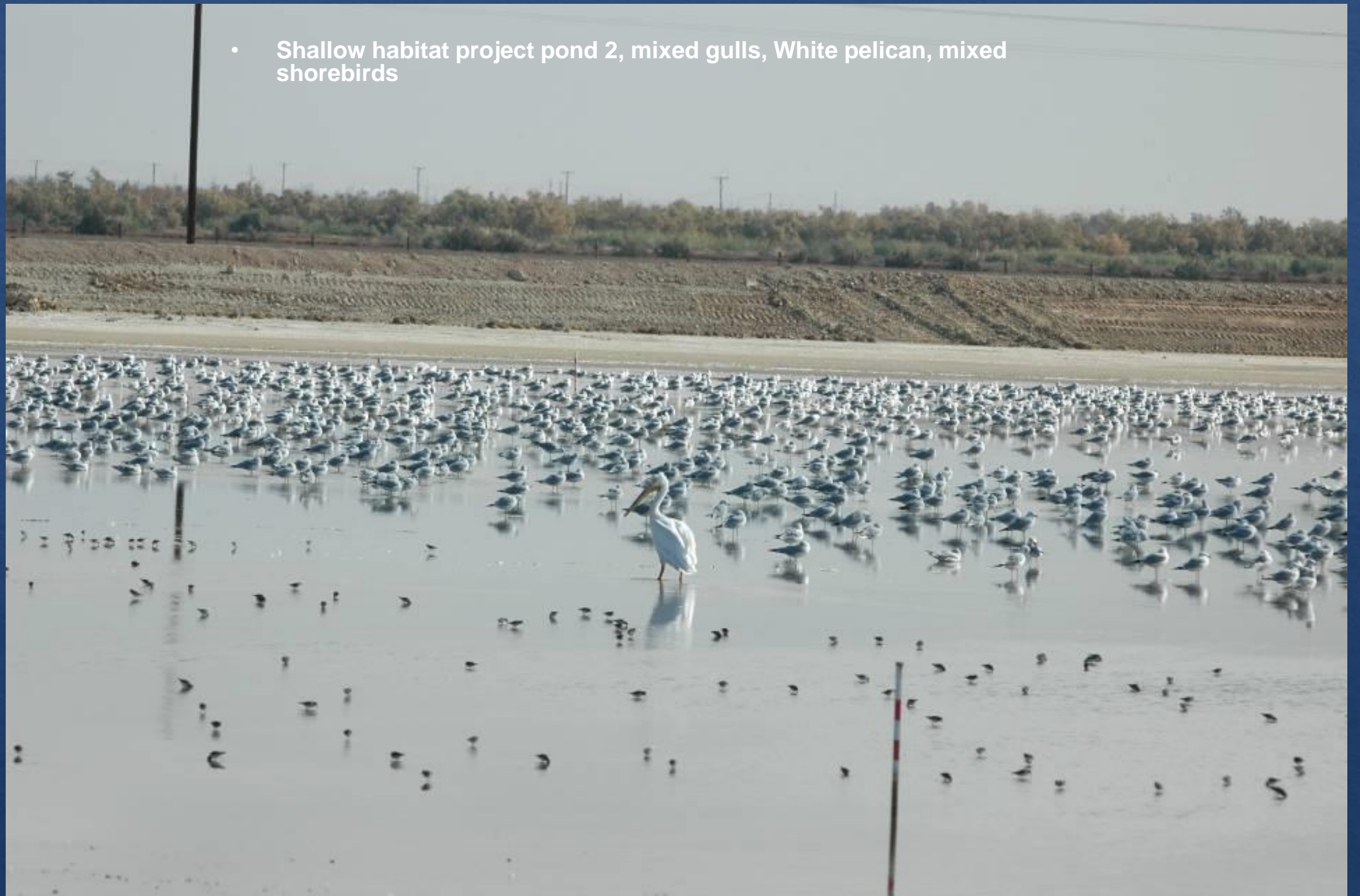
Invertebrate productivity



Waterboatmen (Corixidae)
Single figure 8 sweep



- Shallow habitat project pond 2, mixed gulls, White pelican, mixed shorebirds





- , American White pelicans



- , California Brown pelicans



Black Skimmers nesting island
– avoiding native soil



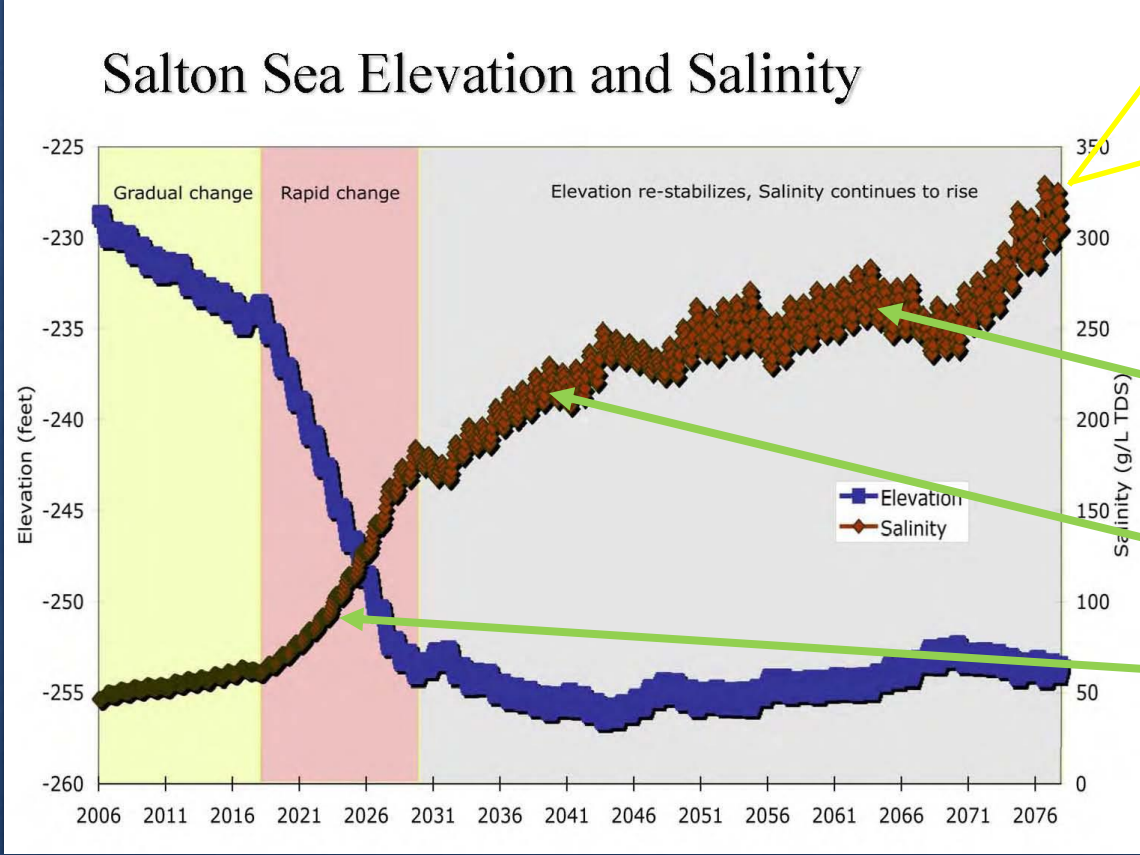
- Shallow habitat project pond 2, Great egret eating Desert pupfish

Desert pupfish



Upon Project closure an estimated 1 million desert pupfish were captured and relocated

GREAT SALT LAKE



- Loss of brine shrimp
- Loss of brine flies
- Loss of fish

CATASTROPHIC TIPPING POINTS ARE NOT FUTURISTIC, THEY ARE NOW

Effect of No- Action on Salinity and Lake Elevation. From Cohen and Hyun, 2006. Hazard: The Future of the Salton Sea with No Restoration Project

Accomplishments

- Avian biodiversity equal or greater than Salton Sea
- Fish, particularly Desert Pupfish in abundance
- Minimal aquatic plant growth (interrupted selenium pathway and no mosquitos)
- Low to moderate concentrations of selenium
- Risk of selenium effects among birds is managed to acceptable levels
- Byproduct of fugitive dust suppression

All Water Is Not Created Equal

- ◇ The notion of simply adding more water, either from the Colorado River, wells, or importing from the Gulf of California are all problematic
- ◇ There is no more available water from the Colorado River
- ◇ Water from shallow wells is of insufficient quantity to contribute meaningfully
- ◇ Import from the Gulf of California must overcome engineering, political and scientific challenges, not the least of which is importing salt into the Salton Sea in excess of current levels by a factor of 7

Thanks

- ◇ USGS
- ◇ US Fish and Wildlife Service
- ◇ US Bureau of Reclamation
- ◇ US Department of the Interior
- ◇ California Department of Fish and Wildlife Service
- ◇ California Department of Water Resources
- ◇ California Regional Water Quality Control Board
- ◇ California EPA
- ◇ California Natural Resources Agency