



Napa Sonoma Salt Pond Fish Monitoring

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Purpose

To better understand fishery resources inhabiting Napa-Sonoma salt ponds.

Objectives

- Document fish species & selected environmental variables in salt ponds.
- Determine if restoration activities (levee breaching) affected fish species composition.
- Identify environmental variables that explain fish assemblage changes.

Study Area



Sampling Methods and Statistical Analysis

- Fish surveyed either bimonthly (Jul 1999-Dec 2000) or semiannually (Jan 2004-Jul 2006).
 - Gears included variable-mesh gill nets, bag seines, & minnow traps (minnow trap data not used in analysis).
 - Identify & count fish, then release.
- Measure water quality (temp, DO, pH, & salinity) & water depth.
- Use of Bray-Curtis Ordination to identify groups of fish assemblages & their relation to environmental variables.

Sampling Methods



Setting a gill net

Pond 2



Gill net

Minnow trap

Pond 4



Hauling a seine

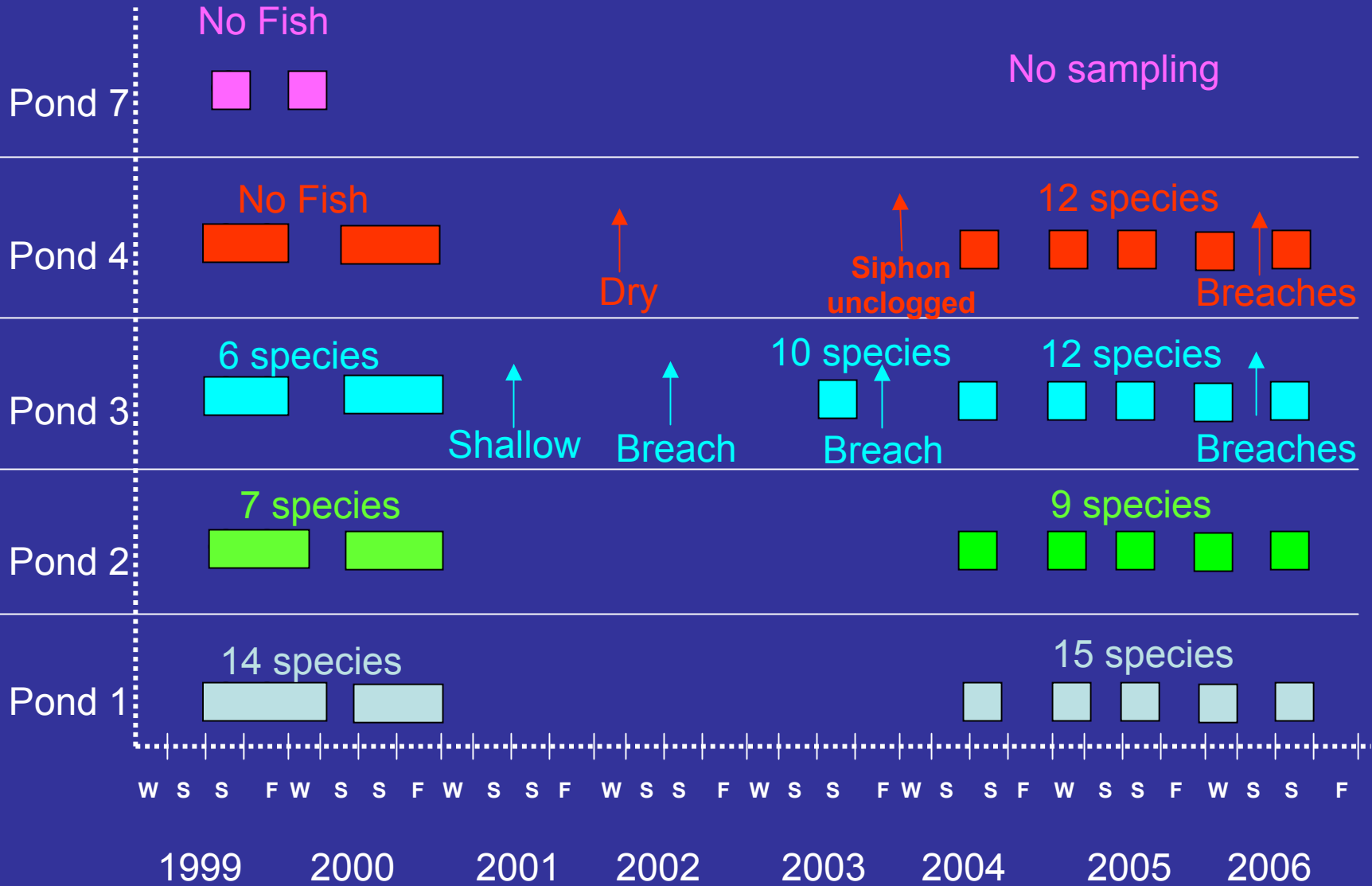
Pond 3



Minnow trap

Pond 2

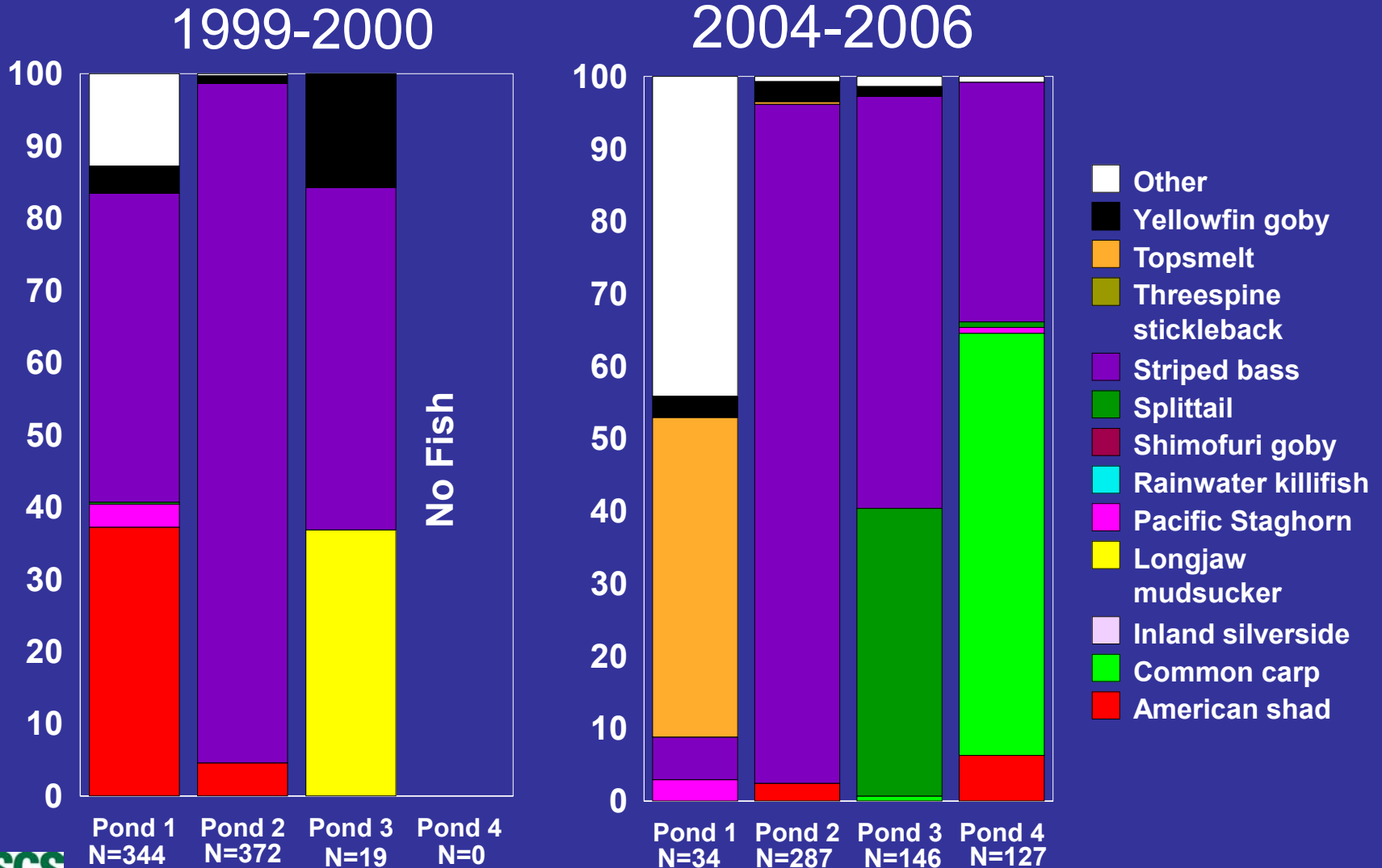
Timeline Overview



Occurrence of Fish Species (1999-2000 vs. 2004-2006)

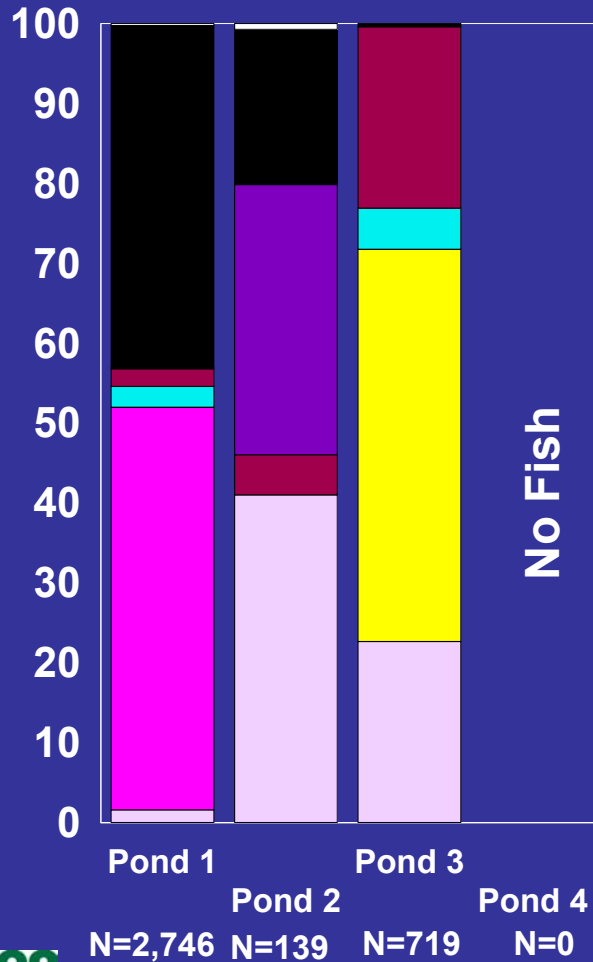
Fish Species	1999-2000				2004-2006			
	1	2	3	4	1	2	3	4
American shad	+	+	-	-	-	+	-	+
Chinook salmon	-	-	-	-	+	-	-	-
Common carp	-	-	-	-	+	-	+	+
Delta smelt	-	+	-	-	-	-	-	-
Inland silverside	+	+	+	-	+	+	+	+
Longjaw mudsucker	-	-	+	-	+	-	+	+
Northern anchovy	+	-	-	-	+	-	-	-
Pacific Staghorn	+	-	-	-	+	-	+	+
Prickly sculpin	-	-	-	-	-	+	+	+
Rainwater killifish	+	-	+	-	+	+	+	+
Shimofuri goby	+	+	+	-	+	-	+	-
Splittail	+	-	-	-	-	-	+	+
Starry flounder	+	-	-	-	+	-	-	-
Striped bass	+	+	+	-	+	+	+	+
Striped mullet	+	-	-	-	+	-	-	-
Threadfin shad	+	-	-	-	+	+	+	+
Threespine stickleback	+	-	-	-	+	+	-	+
Topsmelt	-	-	-	-	+	+	-	-
Tule perch	+	+	-	-	-	-	-	-
White catfish	-	-	-	-	-	-	+	-
Yellowfin goby	+	+	+	-	+	+	+	+
Number of Species	14	7	6	0	15	9	12	12

Comparison of Fishes Captured with Gill Nets (1999-2000 vs. 2004-2006)

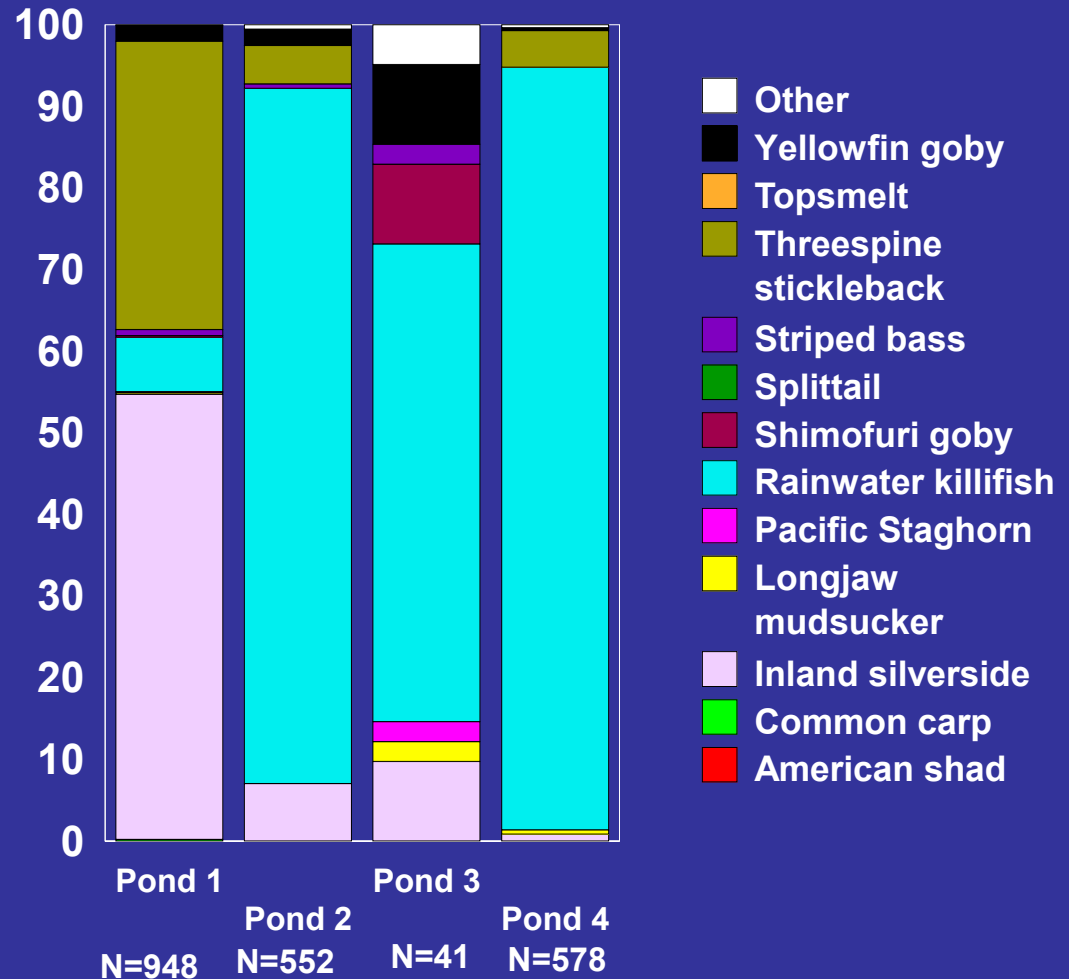


Comparison of Fishes Captured with Bag Seines (1999-2000 vs. 2004-2006)

1999-2000



2004-2006



Water Quality*

1999-2000

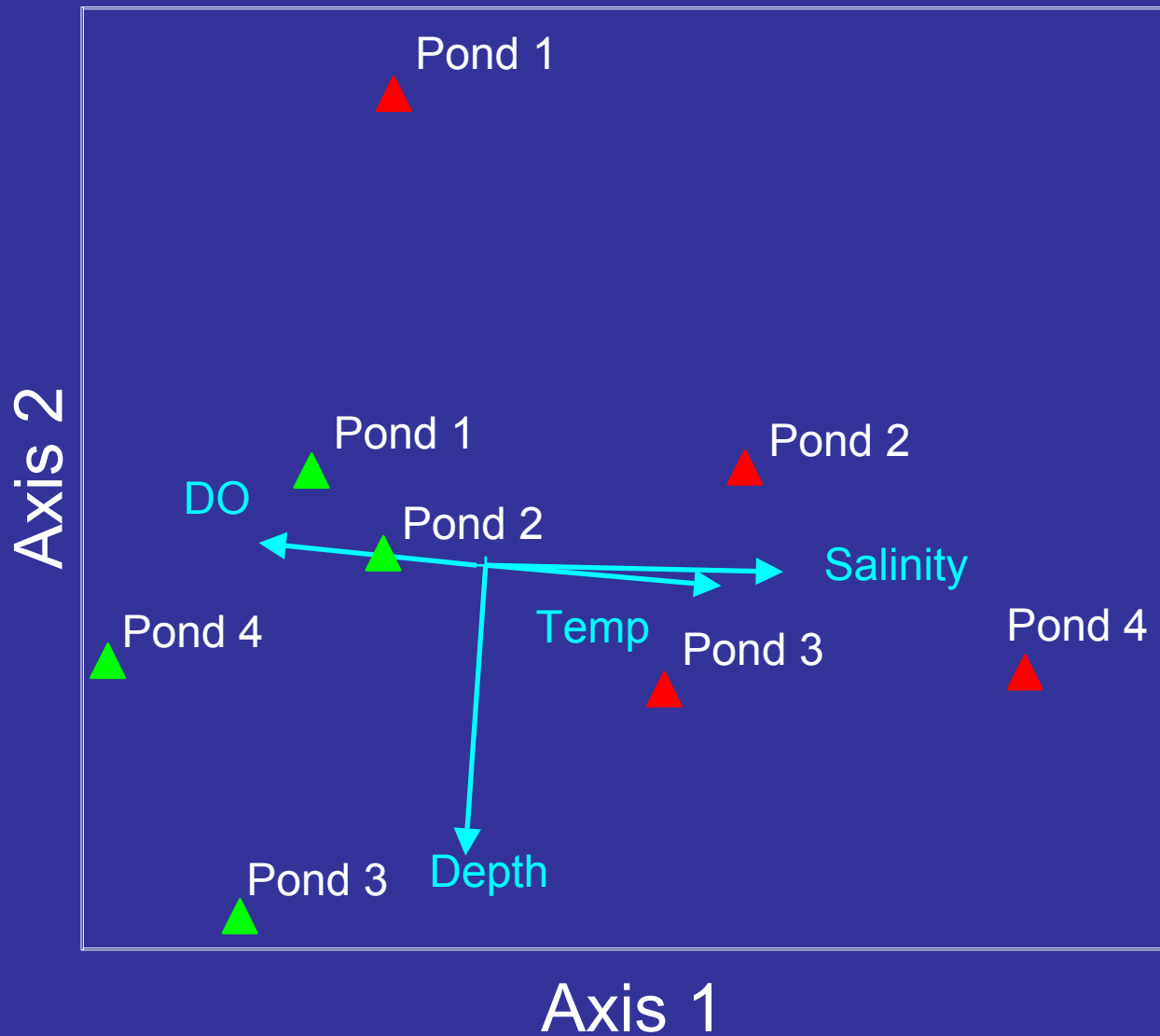
Pond	Temp (°C)	DO (mg/L)	pH	Salinity (‰)	Depth (m)
Pond 1	14.4	7.9	7.9	22.8	0.3
Pond 2	16.0	8.1	8.6	25.1	0.9
Pond 3	16.6	6.6	8.3	44.3	0.7
Pond 4	18.6	0.9	7.5	164.8	0.6

2004-2006

Pond	Temp (°C)	DO (mg/L)	pH	Salinity (‰)	Depth (m)
Pond 1	16.1	8.7	8.2	21.1	0.5
Pond 2	16.6	10.0	8.7	16.8	0.8
Pond 3	14.4	8.0	7.6	8.5	1.1
Pond 4	15.8	7.0	8.3	15.8	0.9

* Mean values

Bray-Curtis Ordination Plot



Group: ▲ 1999-2000 ▲ 2004-2006

Conclusions

- Salinity was the most important environmental variable influencing species distribution, particularly for Ponds 3 & 4 where levees were breached. Temp, DO and depth were also important, pH was not important.
- Levee breaching at Ponds 3 & 4 allowed new fish species from adjacent sloughs and river to colonize the ponds. New species were able to use ponds because of improved water quality conditions.

Conclusions (cont'd)

- Ponds 1 & 2 fish assemblages remained relatively similar (presence-absence). This is an expected result since no major restoration activities took place before or during the study & CADFG stocks striped bass in Pond 2.
- Fast-reproducing, invasive fish species such as inland silverside and rainwater killifish are colonizing new available areas where connectivity with the system was restored and salinity reduced.

Conclusions (cont'd)

- Most species expanded range. Threadfin shad, longjaw mudsucker, Pacific staghorn sculpin, splittail, rainwater killifish, threespine stickleback formerly used one or two ponds, now use all ponds.
- Ponds 3 & 4 provide new habitat for splittail.

Management Implications

- Salt ponds provide habitat for several small-bodied fish species that, when abundant, can provide important forage for piscivorous wildlife (e.g., fish-eating birds).
- Ponds 3 & 4 can provide new available areas to native species such as splittail. However, same areas are being populated by predators such as striped bass.

Some Information Needs

- Need to understand how splittail are utilizing Ponds 3 & 4, whether spawning is taking place in the ponds and how important the risk of predation by striped bass is to the population.
- Need to understand use of salt ponds by larval and juvenile native fishes and how this use can enhance their population status.