## Project Objectives

* Determine the extent to which long-term IEP sampling reflects conditions in nearby shallow-water and wetland habitats.
* Determine whether gear efficiency evaluations are feasible using new sampling technology (i.e., ARIS sonar).
* Determine the level of spatial and temporal replication necessary to make sampling design recommendations for long-term monitoring.
* Begin developing a baseline of biomass, community composition, and fish condition for fish and invertebrates near planned tidal restoration and comparison sites. This will allow us to make pre-and-post-restoration comparisons for evaluating restoration progress.

Blitz Study questions:

1. How do invertebrate and phytoplankton communities change from year to year?
   1. How does water year type affect invertebrates?
   2. ~~How do invertebrate communities change post-restoration?~~
2. Are there significant differences in invertebrates and phytoplankton between channel habitat, managed wetlands (pre-restoration), and tidal wetlands (remnant and/or post-restoration)?
3. What food is available for listed fish species throughout the year?
   1. How do fall food resources compare to spring food resources?
   2. When during the spring is most important to sample?

Channel/Littoral Study Questions

1. How does the fish community in littoral habitat compare to open water habitat?
2. How do mesozooplankton and macrozooplankton communities in the littoral and wetland habitat compare to open water habitat?
   1. How do these communities change over the course of the year?
   2. How do these communities change along the salinity gradient?
3. Are there differences in nutrients, chlorophyll, and organic carbon concentrations between the wetland and the exterior channel?

Nutrients/Phytoplankton questions:

1. Are nutrients limiting phytoplankton production?
2. Are excess nutrients a causal factor for harmful algal blooms on our sites?
3. Are there major changes in phytoplankton community composition over the course of the spring?

ARIS Study Questions:

1. Can the ARIS sonar be used as a tool to determine gill net and electrofishing efficiency?
2. Can ARIS sonar be used to monitor fish use of wetlands with decreased take of listed species?

SAV Questions:

1. **What is the natural variability in SAV cover, composition, and turnover at intertidal wetland sites around the delta (site-level)?**
2. **~~Are SAV cover, composition, and turnover related to delta outflows?~~**
3. **~~How do SAV cover, composition, and turnover respond to restoration of intertidal wetland sites?~~**
4. **How do SAV cover, composition, and turnover affect invertebrate abundance and composition at tidal wetlands?**

2018 Report Analyses Meeting

**2/21/2019**

**Dan:**

* Nutrient analyses
  + For each nutrient type (NO2+NO3, NH4, Phosphorus, etc), make a box plot of concentration broken out by site type, with individual points overlayed.
    - Stacy – Make sure the points are broken out by reference/restoration pairs.
  + Run a GLM comparing concentration of each nutrient type to various environmental variables: Month, site type, water quality, etc.
    - Rosie – Be sure your variables are not autocorrelated (e.g., month and temperature will likely be related).
  + Line graphs of concentration over time.
    - Dan – Should I just plot the inside point?
    - Rosie and Stacy – No, plot them all so you can explain why we are moving to just the inside point in the future. Explain that we want to get further inside.
    - Relabel the “EMP” point “Far Outside”
  + Try using a CCA to relate environmental factors to nutrients
    - Maybe try relating nutrients to phytoplankton community, but we might not have enough data for that.
* SAV analyses
  + BIOBASE versus rake samples. Put two maps side-by-side
    - Rosie – the map with the pie charts for the rake samples is better for your data than the interpolated map
    - Stacy – Be sure to have a thorough discussion of all the issues with BIOBASE and why you don’t want to use it.
  + Stacked bars of SAV biomass and relative percent composition, similar to BDSC presentation
  + Comparing community composition of SAV to invertebrate community composition
    - Might not have enough data. Rosie can help Dan pull the relative bits out of the database
  + Regression of sweep net catch verses SAV biomass
    - Stacy – This is probably a better place to start than the community composition stuff.
  + Some measure of variation between the two replicate rakes to show that we don’t need two rakes. Maybe something like coefficient of variation.
* Phytoplankton Analyses
  + NMDS and/or CCA for environmental parameters, nutrient suite, and phytoplankton.
  + Box plot of phytoplankton concentration by site type, with 10 ug/L line
    - Rosie – the 10 ug/L is for chlorophyll, not phytoplankton. That was how we would know to take extra samples during blooms, but it didn’t happen last year. We’ll work harder to make it happen this year.
    - Rosie also things chlorophyll is a better measure of overall biomass than the counts, but that’s more a gut instinct than anything else
    - Rosie’s gut instinct makes Stacy sad.
  + In future, we’ll work on ways to standardize our sonde depth and phytoplankton sampling methods.

**Dave:**

* Fish Analyses
  + For each pair of sites and each season:
  + Kruskal-Wallace test on total CPUE
    - Stacy and Rosie – Try a GLM instead, then you can add more predictor parameters
  + NMDS
    - Some of these are very pretty.
    - Dan – If you remove samples that are all 0’s, is that a problem?
    - Stacy and Rosie – No.
  + Permanova
    - Rosie: Add “Year” to the permanova
  + Plots of total catch by species
    - Stacy – Zoom in on the bottom end of the bar graphs so you can see the species with low catch and have something showing the higher catches for silversides, etc.
  + Rosie – Make sure to be clear that “Prospect” and “Tule Red” are actually “Miner Slough” and “Grizzly Bay”
  + The lack of sampling at Stacy’s Island isn’t ideal, but there wasn’t a real good way to sample there. Dave will look to see if there is any comparable USFWS beach seine data nearby.

Rosie

* Invertebrate analyses
  + Did an overall CPUE GLM on all the sites together, bar plot with mean total CPUE of all sites together \
    - Stacy – be sure to specify that you are presenting means, since Dave just presented totals
  + Multivariate analyses with stacked bar plots by site
    - Stacy – present them by site, not site type
  + PerMANOVA showed Region and Year were significant for community composition even though they weren’t significant for CPUE.
  + Dan – Change “vegetation” to “sweep net”
  + Indicator analyses
    - Use the Common Name analysis for the report, but maybe present the larger groups for IEP
    - Be careful that people don’t think the large number of Diked wetland indicators means diked wetlands are better
    - Add the CPUE to the table
  + Pairwise comparisons
    - Try putting Liberty, Flyway, and Prospect together for now, though they will have to be broken out for the individual reports.
  + Clams are still in draft mode
    - Stacy – break out corbicula and potamocorbula
    - Dan – put sites in order of the salinity gradient
  + How do I expand the lengths from the critters I measured to the plus-counted critters for biomass calculations?
    - Stacy likes just expanding the frequency of the measurements, but the normal distribution method sounds OK too.
    - Rosie will look at the literature.