**iTeams Research Cruise**

October 1, 2015

*Participant Agenda*

**Research Questions:**

1a. Are the properties of the water in the San Francisco Estuary the same in different locations (i.e. at the Richmond Bridge, near Romberg Tiburon Center, and at the Golden Gate Bridge)?

1b. Are there differences in plankton and larger animals in the three locations? If so, how do you think the water properties play a role?

2. Is there evidence of a bloom of toxic phytoplankton inside the estuary?

**Agenda:**

8:30 am Meet at Angel Island Ferry Dock in downtown Tiburon

8:30 – 9:00 Introductions, assignments, and context

9:00 – 12:30 On board the Derek M. Baylis

Rotate through 3, 30 minute stations at three locations: water-quality sampling at different depths using different instruments, plankton collection and observation, and large animal and surface water surveying

12:30 Arrive back at Angel Island Ferry Dock, travel to Romberg Tiburon Center at 3152 Paradise Dr (the second entrance to RTC). Park in the same parking lot where we met in August.

**Lunch**

1:30 – 2:45 Work in 3 groups, with each group analyzing water-quality, plankton, or surface observation data. Within the group, teachers will analyze and interpret all data from the cruise about “their” topic, collect additional evidence online, if needed, and share results and conclusions with the larger group.

2:45 – 3:30 Discussion of bringing these types of science practices back to classroom.

3:30 End of official day; optional tour with Dr. Bill Cochlan, expert in harmful algal blooms

**NGSS Connections:**

Science and Engineering Practices:

Today’s experience is intended to be an example of the power of engaging students directly in the practices of science. In particular, we will be using these practices: #3 Planning and Carrying out Investigations, #4 Analyzing and Interpreting Data, #5 Using mathematics and computational thinking, # 6 Constructing explanations, #7 Engaging in argument from evidence, # 8 Obtaining, evaluating, and communicating information

Although today’s experience is meant to focus on Practices, it supports the other NGSS strands, too.

Crosscutting Concepts:

1. Patterns. The estuary is a great place to see and study patterns. In the data from today, for example, we should see the influence of tidal patterns in water-quality and species observed. Over longer term, the estuary has clear tidal, seasonal, and annual patterns. Weather and creeks show these patterns, too, and connect tightly to the changes in the estuary.

2. Cause and effect: In the estuary, water salinity and temperature drive a lot of other factors, so they can be an accessible way to show cause and effect in nature. The oyster data we looked at in August is a good example of changes in salinity causing a die-off of oysters. The same idea could be extended by looking at plankton in different salinities of water.

6. Structure and function. Plankton have very unique and often beautiful structures for specific functional reasons. A great activity to bring in engineering design, plankton, and this crosscutting theme is “build a drifter” or “plankton races”.

7. Stability and change. The estuary is a very dynamic place! One aspect that connects easily to this concept is studying the change in the San Francisco Estuary over time. For example, although the coastline used to be out at the Farallones, the essential habitats within the estuary (marshes, tide pools, etc.) still existed, but they were in different places than they are now.

Disciplinary Core Ideas:

Third grade life science has good connections with estuary/marine science, especially:

 3-LS1-1 (diverse life cycles, with common birth, growth, etc.) has strong connections to zooplankton, some of which are larval (baby) forms of more familiar animals

3 – LS4-3 (arguments and evidence for habitats) has strong connections with the estuary because subtle changes in the habitat (the salinity of the water, for example), determine which animals survive in a particular location

Fourth grade has some connections with estuary/marine science, in particular with:

4- LS1-2 (animal senses) could be experienced first-hand with plankton or fish responding to salinity or light, or studied in the context of seabirds

4- ES S2-2 (maps of Earth’s features) could be taught using local topographic maps and maps of the bay floor to teach about rivers, sea level changes, erosion, and watershed-ocean connections. There is an old flooded river on the floor of the estuary – we will sail over it in Raccoon Straight.