Marine Science Discovery Program

Doreen Gurrola
gurrolad@tmmc.org
415.289.8620

Molly Russell
russellm@tmmc.org
415.289.0216

Fall 2006 - Spring 2007
Meaningful Watershed Educational Experiences for Students
Partners: Bay Model, Seamen's Training Institute, Cordell Bank National Marine Sanctuary, Farallones Marine Sanctuary Association

Goals and Objectives

The Marine Mammal Center's (TMMC) Marine Science Discovery Program (MSDP) is a two-month long course offered to underserved Bay Area high schools. Since 1999, we have taught over 13,000 students through this program. It is designed to introduce students to careers in marine science and the marine environment through experiencing techniques used by marine scientists. During the course students:

- Learn about TMMC including husbandry and veterinary research
- Study marine mammal biology and identification of local species
- Explore various marine careers and opportunities available
- Experience techniques used by scientists (in the lab and in the field)
- Conduct coastal and at-sea field work
- Foster an appreciation for the ocean and marine life
- Present what they learned to their peers

Project Overview

1. **Marine Careers:** During the first classroom visit, our instructor introduces students to the vast opportunities in marine science and the work of TMMC. Students are provided with handouts on colleges with marine science programs and guidelines on pursuing environmental careers.
2. **Marine Mammal Exploration:** During the second classroom visit, students review marine mammal biology and ecology. Students study marine mammals in a cooperative interactive style by comparing furs and skulls, exploring different adaptations, and discovering environmental threat.
3. **Marine Mammal Feeding Ecology Lab:** During the next two classroom visits, students study marine mammal diets by extracting "hard parts" (bones and scales) from dried scat, and comparing them to similar parts of fish they dissect. They examine fish ear bones (otoliths), to determine fish species and age.
4. **Research Discovery Day:** Students visit behind the scenes at The Center's hospital, observing how we care for seal and sea lion patients. In our classroom, students see video clips of animal care and veterinary procedures. Students participate in three hands-on labs, selected by the teacher to correlate with their curriculum. Lab Options:
   - **Cetacean Photo Identification:** Match photos of various cetacean species and discuss statistics used to estimate their populations.
   - **Comparative Anatomy:** Examine marine mammal bones, including skulls, jaws and baculum. Compare homologous structures and differences used in species identification.
   - **Dentition:** Compare tooth samples among marine mammals to determine diet. Determine age in sea lions based on dental growth rings.
   - **Hematology**: Study prepared blood slides to determine illnesses in seal and sea lion patients. Learn about diagnosis and treatment of diseases.
   - **Marine Mammal Tracking:** Discuss tagging techniques including radio and satellite telemetry. Use data to track previously released patients.
   - **Parasitology:** Examine various marine mammal parasites, discuss their life cycles, and learn about resulting problems.
   - **Radiology:** Study pinniped x-rays and diagnose their problems, such as broken bones, lung congestion, and ingestion of foreign objects.
5. **Marin Headlands Exploration and Monitoring:** Students return to the Marin Headlands for an in-depth exploration of its natural resources and scientific monitoring including: harbor seal census and behavior observations, sand crab monitoring, beach debris survey, and water quality testing.
6. **Marine Science Discovery Cruise and tour of the Bay Model:** Students tour the Bay Model to learn about the SF Bay watershed, then board the R/V *White Holly* for a research cruise on San Francisco Bay. Students collect data and learn research techniques including: seabird and marine mammal transects, plankton tows and species identification, water quality testing, submersible research and video transects. Additionally, students tour the vessel to learn about life aboard and crew watch procedures.
7. **Student Projects:** Students present final projects that convey what they have learned or gained from the program. Projects take many forms, such as poster, poem, song, video or Power point presentation. All assignments and projects are part of the students' final grade.

Target Audience

Low-income SF Bay Area High Schools, 204 students total:

- Oakland High (Katy Noonan/Kevin Jordan) 11-12th grade AP Environ. Sci.
- Oakland Tech (Shawn Raeke) 9th grade Biology
- DeAnza High (Athena Kraus) 11-12th grade AP Biology
- Pittsburg High (Tom Arbuckle) 11-12th grade AP Biology
- Elsie Allen High (Annette Bustamante) 9th grade Honors Biology

School	# Students	Free or reduced lunch	Caucasian	Hispanic/ Latino	African American	Asian American
Oakland High	51	34	0	5	5	41
Oakland Tech	45	21	9	9	13	14
DeAnza	52	20	10	14	6	22
Elsie Allen	33	17	16	12	1	3
Pittsburg	23	11	1	11	1	10
Totals	**204**	**103 50%**	**36 18%**	**51 25%**	**26 13%**	**90 44%**

Program Evaluation:

Before the start of the program, students are given a pre-questionnaire to assess their knowledge of TMMC, marine mammals, marine careers, NMS, and their views on the environment and their field experiences. After the program, they are given a post questionnaire that helps us assess the knowledge they have gained and the effectiveness of the program. Additionally, students and teachers fill out a qualitative program evaluation form that provides us feedback on the programs successes and potential improvements.

Pre-Post Questionnaire Results	Before the program	After the program
• Had heard of The Marine Mammal Center	82%	n/a
• Knew that The Center was a hospital and research facility	63%	82%
• Could identify different marine mammals	70%	84%
• Could identify local marine mammals	65%	76%
• Could identify different marine careers	61%	83%
• Had considered a career in marine science	45%	59%
• Knew what makes a National Marine Sanctuary	86%	75%
• Knew that Cordell Bank, Gulf of the Farallones, and Monterey Bay were local National Marine Sanctuaries	38%	58%
• Had been on a boat	91%	n/a
• Had been on a boat on San Francisco Bay	59%	n/a
• Had been to a beach	100%	n/a
• Had volunteered for an environmental organization	27%	n/a
• Recycled at home or school	91%	95%
• Would devote their time and energy to protect San Francisco Bay and ocean	77%	82%
• Felt their actions could impact San Francisco Bay	100%	100%
• Felt their actions could impact the Pacific Ocean	100%	100%
• Cared about the environment	95%	100%
• This program gave them a better understanding of the marine environment	n/a	100%
• This program gave them new experiences	n/a	95%
• This program changed their view on the marine environment.	n/a	100%

New for 2006-2007

- **Sand Crab Monitoring**: In 2006, we incorporated the **Sand Crab Monitoring** project into our Headlands Exploration and Monitoring day. We chose to sample at Rodeo Beach because its proximity for transporting gear and the presence of sand crabs. We were able to share the data with the Farallones Marine Sanctuary Association. In the student evaluations, the majority said their favorite part of the Headlands Exploration was "looking for sand crabs."
- **Exploring the Ocean with Sanctuary Scientists:** In collaboration with the Cordell Bank National Marine Sanctuary, we designed a day that allowed students to work side by side with Sanctuary researchers. Eight students and two teachers were chosen. While onshore, they conducted intertidal quadrant and shorebird surveys. On the R/V *C. Magister*, students worked with Sanctuary staff to collect physical and chemical oceanography parameters and survey seabirds and marine mammals. After summarizing our findings and providing them with resources, they were asked to give a presentation to their classmates. Although the day was well coordinated and students gained a tremendous amount of knowledge and experience, their presentations lacked the content we were hoping for in this program. Therefore next year, we intend to offer a similar experience to MSDP teachers onboard the R/V *Fulmar,* as their experience will reach more students. .

Changes in 2007-2008

- **Grading Rubric:** In order to make the program more academic and have students more accountable for their participation, we began to track student attendance and homework assignments in 2006-2007. Then in 2007-2008, we introduced a grading rubric in which students are given points for attendance, homework, and final projects. Teachers incorporate these points into the student's class grade. Students now have a clear understanding of the programs expectations.
- **Pre-Post Questionnaire:** In 2007-2008 we were able to simplified both questionnaires to yield more quantitative results.
- **Student and Teacher Evaluation**: In 2007-2008 we began working with an evaluator to assess our student and teacher evaluation forms. The new forms yield both qualitative and quantitative results with more with defined fields. Additionally, instead of individual student evaluations forms for each field trip, the teacher uses a group form to survey the results from the whole class. These improvements have streamlined our analysis of the program.
- **Field Data Sheets:** In 2007-2008 students worked in groups for both the Headlands Exploration and Monitoring day and the Marine Science Discovery Cruise. Each group was responsible for completing their data sheet. Eventually, we intend to create a website for posting students' data.