



Coastal Science Review

Issue 1, Fall 2003

Tomales Bay Biodiversity Partnership

The Tomales Bay Biodiversity Partnership (TBBP) is a community-based research, education and public policy initiative to help ensure a sustainable Tomales Bay ecosystem. While in far better condition than most neighboring California estuaries, Tomales Bay's habitats and species are still threatened by pollution, habitat loss, invasive species, human disturbance, and habitat fragmentation.

Contents

Tomales Bay Biodiversity Projects	2
Marine Biodiversity Database	3
Involving Students in Biodiversity	4
Tomales Bay Species Composition	5
Partnerships	5
Pacific Coast Science and Learning Center	6

The first stage of this project is one of the most comprehensive biodiversity surveys of any marine system in the world. The results will help develop an invasive species early warning and removal system; implement

This project will enhance community capacity to reach consensus on actions to address threats.



Hands-on science opportunities for students on Tomales Bay.

preservation plans for species and habitats in need of protection; identify, restore and protect critical habitats; and improve guidelines for sustainable human use. Students, adults, teachers, and other



Sonoma State University students assist with Algae BioQuest.

groups will also experience the scientific process first-hand and contribute to this local conservation effort. This issue of the Pacific Coast Science and Learning Center's "Coastal Science Review" will highlight the TBBP and related projects.



High school students assist with nearshore Fish BioQuest.

Tomales Bay Biodiversity Projects



Casting nets into Tomales Bay to search for life below the surface.

The Pacific Coast Science and Learning Center and the Point Reyes National Seashore Association have raised over \$140,000 to support research and education projects associated with the Tomales Bay Biodiversity Partnership (TBBP). These funds support data management, graduate student internships, field research and educational activities. Following are descriptions of some of the many projects that are being coordinated and funded this year.

Algae Inventory

Sonoma State University (SSU) professor Dr. Chris Kjeldsen and his aquatic botany students spent several days this past spring collecting algae from the rocky intertidal areas of Tomales Bay. Additional collecting trips are planned in the fall. Algal experts will identify specimens collected in the field to identify invasive species and shifts in community structure due to climate change, disturbance, or pollution. In addition, two SSU students are also beginning long-term studies of algal biodiversity dynamics in the bay.

Fish Inventory

San Francisco State University professor Dr. Mike McGowan and graduate student Jim Pettigrew are cataloging the fishes of

Tomales Bay. Mike is focusing on all species in the bay while Jim is focusing on nearshore species with the aid of high school students and volunteers. Results from both studies will be incorporated into the TBBP database. Over 100 species of fish have been found in the bay.



Algae experts collected specimens to be taken back to the lab and identified.



Many species of fish were identified and released through the Fish BioQuest.

Ascidian Workshop

Dr. Ted Grosholz and Dr. Jay Stachowicz of Bodega Marine Lab held an Ascidian ("sea squirt") inventory and taxonomic workshop on Tomales and Bodega Bays in May, 2003. International experts Dr. Charlie Lambert and Dr. Gretchen Lambert came to help with collection, taxonomy and to teach a group of 15 graduate students and faculty the intricacies of ascidian biology, ecology and taxonomy. The workshop discovered a clonal invasive ascidian new to Tomales Bay that has harmed commercial oyster production in other estuaries. The discovery of this new threat will lead to more informed management and increased awareness of detrimental invasive species. Ted also coordinated an intertidal invertebrate inventory in September of 2003.



Didemnum vexillum, a nonnative clonal ascidian discovered in Tomales Bay.

Bird Inventory

Dr. John Kelly of Cypress Grove Preserve has been studying and documenting the birds of Tomales Bay for over a decade and has contributed his exceptional data to the TBBP database. His report indicated that 163 bird species have been documented in the Bay, with 122 regularly occurring species and 41 species that are known from less than five sightings. John's data allows long-term natural and anthropogenic changes to be easily detected.

Lichen Inventory

In mid-April, the California Lichen Society took part in a rapid assessment of lichens in the spray zone of the Tomales Bay shore. Participants investigated the rocky beaches, cliffs and large driftwood of White Gulch, Avalis Beach, and one



Preparing to sample lichens on the bay's western shore.

unnamed beach on the bay's western shore. Their objective was to sample species of lichen living in

areas with direct salt-water influence. These species require microscope and chemical analysis for identification and the collection continues to be reviewed. Over 40 species have been documented.

Environmental History of Tomales Bay

The bay's ecology has changed dramatically over the past century, affecting species, ecological communities, and the ways humans interact with this environment. The Tomales Bay Environmental History and Historic Resource Study is examining and documenting the changing relationship between people and nature to help managers evaluate the significance of the bay's resources.

2003 TOMALES BAY BIODIVERSITY GRANTS

San Francisco State University
Inventory and summer habitat associations of nearshore fishes in Tomales Bay

Humboldt State University
Inventory of intertidal benthic diatoms from Tomales Bay

Bodega Marine Laboratory
Tomales Bay phytoplankton community and nutrient take-up

Variables influencing the distribution of native oyster populations in Tomales Bay

San Diego State University
Epiphytic and planktonic diatoms of Tomales Bay

Duke University
Impact of European Green Crab on San Francisco Bay area shellfisheries

Sonoma State University
Algae inventory and monitoring in Tomales Bay

Marine Biodiversity Database

Tomales Bay All Taxa Biodiversity Inventory

Generate a Checklist of Organisms in Tomales Bay

Choose the conditions you would like to apply to your list.

Presence in Tomales Bay
 Documented
 Predicted

Boundary
 Avalis Beach - Sand Point
 Tomales Pt. - Dillon Beach

Choose the taxonomic group you would like to review.
 (For all organisms, choose "All" for Kingdom.)

Kingdom: **Animalia**
 Phylum: **Brachiopoda**
 Division: **Phaeophycophyta**
 Class: **Trematoda**
 Order: **Laminariales**
 Family: **Accipitridae**
 Genus: **Odontaspis**

Other genera listed: Blepharipoda, Bolidia, Boccardia, Bolivina, Bolaria, Boeselia, Botaurus, Botrogonus.

Checklists of birds, invertebrates, fish, algae, and wetland plants that occur within Tomales Bay have been gathered into a Microsoft Access database. This data structure allows users to generate checklists based on any taxonomic level. The database has been developed to allow continued accumulation of observation, voucher, and natural history information for any species or taxonomic group of organisms. Future plans include a spatial database containing maps of species and habitat distributions that will be available via the web.

Tomales Bay All Taxa Biodiversity Database

Review Data For: **Cancer magister** | **Burgess Cobb**

Fields: Species Name, Date, Location, etc.

Observations | Vouchers | Bibliography | Status | Nativity | Natural History

Observer: **Dr. Hugh G. Johnson**
 Date: **1/1/01**
 Location: **Avalis Beach - Sand Point**
 UTM East: **100000** | UTM North: **4000000**

Involving Students in Biodiversity

Environmental Marine Science Magnet School

Tomales High School, in partnership with the Pacific Coast Science and Learning Center and Bodega Marine Lab has secured a \$300,000, 4-year grant from the State of California to establish a magnet school for Marine Sciences that will draw students from throughout Marin and Sonoma Counties. The curriculum will be focused on marine research in Tomales Bay and the local coast, including the Tomales Bay Biodiversity Partnership (TBBP). Students will work with researchers to develop their own monitoring programs focused on taxonomy, ecology, scientific methodology, data analysis, writing and presentation.

Science Immersion for High School Students

Twelve high school students from San Francisco became assistant researchers for the "Tomales Bay Biodiversity Inventory." Each student spent one week at Point Reyes National Seashore participating in a

variety of projects including studying nearshore fishes, removing nonnative plants, and interacting directly with researchers. Students were provided food and lodging at the Point Reyes National Seashore's Historic Lifeboat Station in return for their long hours of fieldwork.

This summer seminar was created to provide science education to groups of students who may never otherwise visit Point Reyes National Seashore, even though most of them live only an hour away. At the beginning of the week some students were hesitant to even get in the water. By the end of the week these same students were fully immersed in the bay as they hauled in 100-meter nets full of fish.

Biological Science Aids

Every summer up to ten high school students are hired to assist researchers in their fieldwork throughout National Parks in the Bay Area. Some of these students are hired as federal employees



Students experience Tomales Bay first-hand.

and commit to a regular schedule with a variety of researchers. Other interns work intermittently over the life of a single project. This summer our interns have worked on a variety of projects, including:

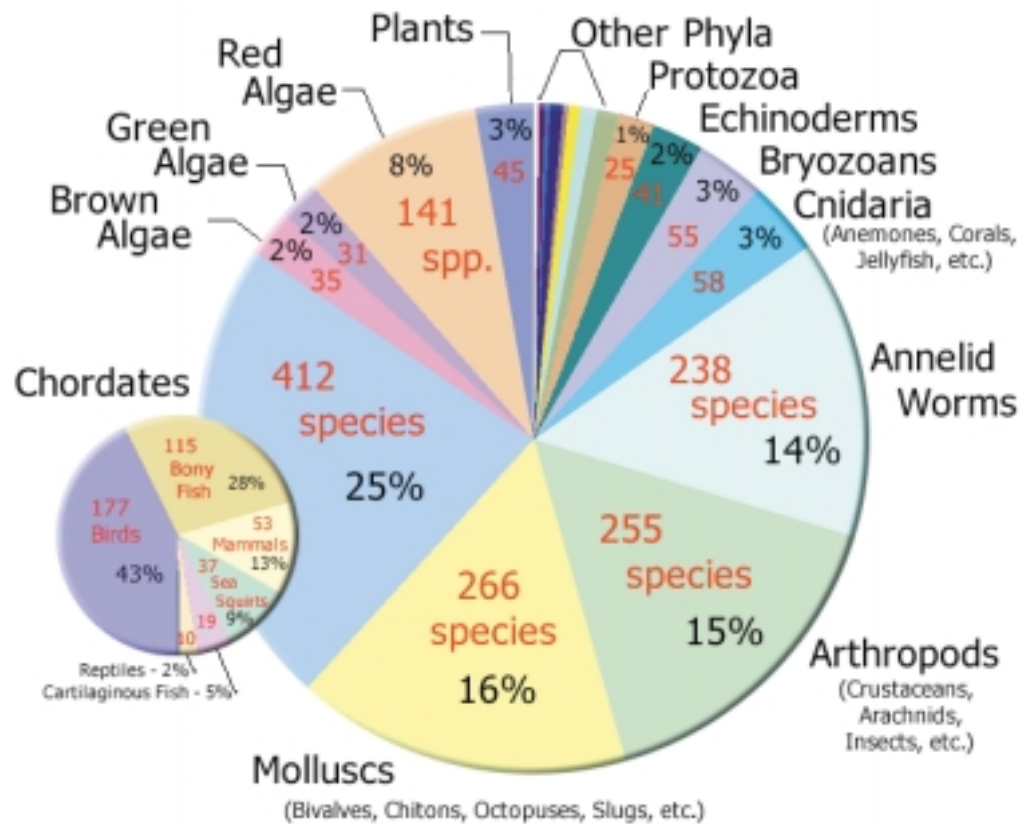
- *Tomales Bay phytoplankton community and nutrient up-take*
- *Investigation of variables influencing the current distribution of native oyster populations in Tomales Bay*
- *Summer habitat associations of benthic fish species in northern and southern Tomales Bay*
- *Coastal Inventory Mapping*



Students were invaluable to the nearshore fish inventory by sorting specimens, attending to nets, and recording findings.

Tomales Bay Species Composition

Ten thousand species are believed to be in the Tomales Bay Area. To date, 1,623 species have been documented. Larger and more complex organisms such as birds and mammals have had the most historical study and are easier to observe and identify. Simpler and smaller organisms such as flatworms, internal parasites and bacteria are more difficult to study and have had less historical observation. Therefore, it is expected that as further investigation and discovery of microscopic or otherwise obscure organisms takes place, the percentages of less well represented phyla will grow and the “slice of the pie” for larger groups will shrink.



Partnerships

- | | |
|--|--|
| Bodega Marine Laboratory | Gulf of the Farallones National Marine Sanctuary |
| University of California, Davis | Tomales Bay Watershed Council |
| University of California, Berkeley | Marin Community Foundation |
| San Francisco State University | Giles W. and Elise G. Mead Foundation |
| Sonoma State University | Cox Family Fund |
| Duke University | Commonweal |
| Humboldt State University | Tomales Bay State Park |
| San Diego State University | Tomales High School |
| Moss Landing Marine Laboratories | Point Reyes National Seashore |
| Audubon Canyon Ranch- Cypress Grove Preserve | Golden Gate National Recreation Area |
| Point Reyes Bird Observatory | Point Reyes National Seashore Association |
| Environmental Action Committee of West Marin | Stanford University |
| | Mead Foundation |

Pacific Coast Science and Learning Center

The Pacific Coast Science and Learning Center (PCSLC) is currently facilitating a range of marine and coastal research projects to aid park management, conservation and science education.

One project involves the University of California Davis and Moss Landing Marine Laboratories to create subtidal habitat maps of the nearshore areas of Point Reyes National Seashore and Golden Gate National Recreation Area. High resolution sonar is gathering undersea habitat data which will be used to assess potential sites for Marine Protected Areas. Criteria to select these proposed areas will be based on habitat type, larval dispersal ranges and distance between reserves.



The historic Hagmaier Ranch has been adapted for use as the Pacific Coast Science and Learning Center.

In addition, the PCSLC has also granted 7 researchers funds to initiate research projects that will help inform local and potentially global management of protected areas. Many of these projects integrate high school interns into the research, benefiting both the student and the researcher.

The Pacific Coast Science and Learning Center seeks to increase the scope and effectiveness of research toward science-based management and preservation of our coastal resources.

2003 COASTAL RESEARCH GRANTS

University of California, Berkeley

Interactions between the soil microbial community and the performance of invasive grasses

A comparison of carbon cycling and material exchange in landscapes dominated by native and exotic grasses at Golden Gate National Recreation Area

Stability and loss of buried soil organic carbon on a coastal watershed in Tennessee Valley, CA, Golden Gate National Recreation Area

University of California, Davis

Ecological impacts of green macroalgal mats in Drakes Estero

Age structure and population dynamics of Bishop pine stands

A multi-disciplinary approach to assess Coast Miwok influences on genetic diversity of native grasses

Chemical defenses in marine algae

Coastal Science Review is published twice a year by the Pacific Coast Science and Learning Center to share research supporting science-based management and preservation of our coastal resources. The Pacific Coast Science and Learning Center is a part of the National Park Service at Point Reyes National Seashore.

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For more information visit:
www.nps.gov/pore/science.htm

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