Office of National Marine Sanctuaries/National Centers for Coastal Ocean Science Long-term Agreement (ONMS/NCCOS LTA)

2005 Annual Liaison Report on Existing and Potential ONMS/NCCOS Collaborative Studies at the Monterey Bay National Marine Sanctuary (MBNMS)

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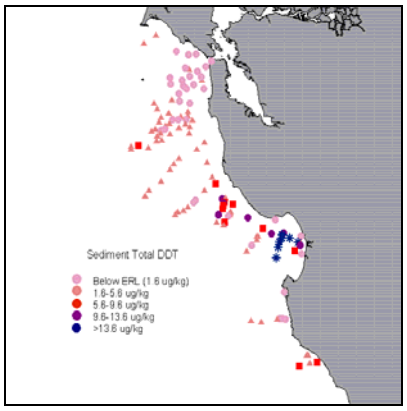
1. Regional Environmental Characterization – Sediment Contamination and Benthic Faunal Assemblages (S. I. Hartwell, Ian.Hartwell@noaa.gov)

This research is designed to describe the levels and distribution of a suite of toxic chemicals in surficial sediments, document the soft bottom benthic infauna community in the central California region, and delineate habitats as defined by the resident biological communities. These habitats will then be characterized to determine how bathymetry, disturbance, and sediment characteristics influence the distribution of the communities.

Data on toxic chemicals, based on samples collected in 2002 and 2004, indicate a very inhomogeneous distribution of trace contaminants on the continental shelf and between the canyon heads in central California (Fig 1). A research paper describing the distribution of DDT in the study area was published recently (Hartwell, 2004). It is unknown to what extent contaminant loads moving down the canyons may be impacting benthic communities. In 2004, relatively stable, depositional areas of six canyons were sampled for benthic community and contaminant concentrations. Five transects across the shelf and slope outside of canyon areas were also sampled to characterize the communities present on the stable shelf and slope.

Sampling in 2005 primarily targeted active canyon axes in those same canyons (Fig 2). In addition, based on the distribution of contaminant concentrations observed in 2004, both depositional and axis habitats were sampled in Bodega Canyon, north of the Gulf of the Farallone Islands, and in Lucia Canyon south of Monterey Bay. The latter was also sampled to assess the benthic community in what is believed to be located in a distinct biogeographical zone than that north of Monterey Bay. Two slope transects, one in the south and one in the northern portion of the study area, were also sampled to provide an inter-annual comparison between 2004 and 2005. Subsamples were also collected for analysis of the Foraminifera community by the USGS. A total of 93 sites were successfully sampled for chemical contaminants (e.g. PAHs, chlorinated pesticides, etc.) and a variety of biological communities. An additional 6 samples were taken in Monterey Bay later in the summer to address seasonal accumulation of contaminants. Samples from 12 selected stations were also collected for toxicity bioassays to be conducted at NCCOS Center for Coastal Environmental Health and Biomolecular Research (CCEHBR). Toxicity increased with depth in most locations. Benthic community samples have been transferred to Moss Landing Marine Lab. The CTD casts were used to measure water quality parameters, and to assess what, if any, differences there were between the canyon axes and the canyon rims at comparable depths, especially with regard to dissolved oxygen. Within the Soquel/Monterey Canyon complex, USGS deployed two moorings at a water depth of 250 m. The moorings included sediment traps, CTDs and ADCP sensors to monitor turbidity flows for the coming year.



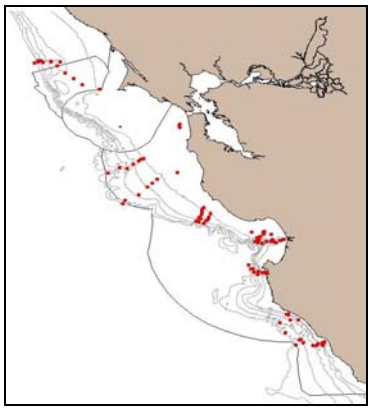


Figure 1 (left). Distribution of total DDT in sediments in the Gulf of Farallones and Monterey Bay National Marine Sanctuaries from samples taken in 2002 and 2004.

Figure 2. Locations of sediment samples obtained in eight canyons and two slope transects in and around Cordell Bank and Monterey Bay National Marine Sanctuaries May 9-20, and July, 2005.

The research project was also designed to assess what the physical and ecological processes are that enable these highly diverse communities to exist in a seemingly simple habitat that is stable over long periods of time. In contrast, Monterey Canyon experiences periodic sediment sloughing that opens up new habitat space by removing the existing benthic community. The frequency of these natural disturbances is partially dependent on storm activity and sedimentation rate, and resident communities are expected to be evolutionarily adapted for periodic disturbance. Earthquake activity is also a periodic cause of turbidity flows throughout the region. The similarity or dissimilarity of the faunal assemblages present in different canyon habitats in this region have only begun to be explored.

2. Biogeographic Assessment off Central and Northern California National Marine Sanctuaries: Phase II - Marine Birds and Mammals. (Tracy Gill and Mark Monaco, Tracy.Gill@noaa.gov; Mark.Monaco@noaa.gov)

Completed collection of additional mammal and bird survey data that was needed; data includes both at-sea data and colony haulout data. Also, developed GIS maps of selected physiographic features off central CA. Mapping, analysis and development of the Phase 2 central CA report is ongoing. Also adding selected environmental setting maps (e.g., chlorophyll, SST) to include in the report. Final report, maps, data and webpage to be completed in spring, 2006.

A marine biogeographic assessment was conducted from 2001-2004 in the coastal ocean off North/Central California that encompasses the following three sanctuaries: Cordell Bank (CBNMS), Gulf of the Farallones (GFNMS), & Monterey Bay (MBNMS). Phase 1

of the project (FY01-04) was completed with four major products: 1) a literature-based ecological linkage report of the marine and estuarine ecosystems of central and northern California; 2) a biogeographic assessment using a GIS to identify important biological areas and time periods; 3) a summary folio of the overall assessment (in paper, web & PDF format), which includes highlights from the ecological report, the biogeographic assessment, and the integration of data to identify important biological areas; 4) a website of all final files and products. Phase 2 (FY04-05) was necessary to complete and update the bird and mammal assessments, which were not part of the initial assessment plan. Phase 2 focuses on updates to bird colonies and pinniped haulouts and rookeries, and an improved summary for mammals.

Phase 2 of this project will build on Phase 1 products; Phase 2 will include: updates to the bird and mammal data; updates to analyses and maps for selected bird and pinniped colonies; revisions to the at-sea mammal maps; and updates to the overall mammal and bird assessments and summaries. Separate reports will be developed for birds and mammals, and an updated website is planned for Phase 2 of this assessment. Phase 1 products (described above) are already being used by sanctuary staff in the development of their management plans and in their management activities, and some of these products are displayed on the individual sanctuary web sites. Planned 2005 annual accomplishments for this project are bird and mammal reports and an updated website. Major planned activities and products to accomplish this include: 1) data acquisition on bird and mammal colonies; 2) updated bird and pinniped colony maps; 3) revised at-sea maps for mammals; 4) revised summary analyses for colony and at-sea data for mammals; and 5) revised bird colony maps. http://ccma.nos.noaa.gov/ecosystems/sanctuaries/ca_nms2.html

3. Characterization and Monitoring of Temperature, Chlorophyll and Light Availability Patterns in National Marine Sanctuaries: Monterey Bay, Gulf of the Farallones, and Cordell Bank (Richard Stumpf, Richard.Stumpf@noaa.gov)

The project utilized satellite data that is produced by the NCCOS Center for Coastal Monitoring and Assessment, Remote Sensing Team (CCMA-RST) for coastal U.S. waters. Significant patterns in the temperature, chlorophyll and water quality fields and their variability were characterized, and trends were determined at various time-scales for each Sanctuary studied. An associated objective was to coordinate with Sanctuary staff to optimize the information content in products derived from the satellite data and to minimize additional data processing requirements for Sanctuary staff.

The ocean color data set from NASA's Sea-Viewing Wide Field-of-View Sensor (SeaWiFS) provides a nearly seven year (1997 to present) time series of chlorophyll and light attenuation data. The CCMA-RST has developed algorithms, implemented by NASA for standard processing, to improve the generation of ocean color data and estimation of chlorophyll from SeaWiFS in the coastal zone (Stumpf et al., 2003). The CCMA-RST has reprocessed the entire SeaWiFS data set, applying the improved algorithms and obtaining georeferenced chlorophyll and light availability data at 1-km spatial resolution for all continental U.S. coastal regions. The primary source of sea surface temperature (SST) data

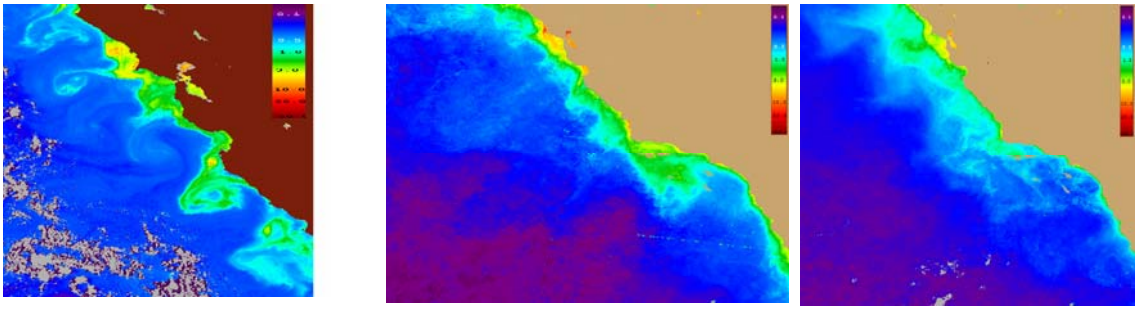
is NASA's Pathfinder SST data set, derived from Advanced Very High Resolution Radiometer (AVHRR) data. The Pathfinder data set consists of nineteen years (1985 to 2004) of daily (excepting clouds) and monthly mean, climatological-grade, georeferenced SST data for coastal U.S. waters. Pathfinder was calibrated for inter-comparison of the temperature data across the entire period, facilitating climate and other studies. Spatial resolution of the Pathfinder data varies slightly with latitude, with a horizontal resolution of about 7 km at 35 degrees of latitude. Data for the waters of the central California Sanctuaries was extracted from these data sets and analyzed in conjunction with the information on physical forcing conditions.

Discussions with sanctuary research coordinators at a June, 2004 coordination meeting confirmed interest in characterizing upwelling patterns and variability, as well as linking physical patterns and trends seen in chlorophyll, SST and wind fields to biological distributions. Zoning and fishing/harvest effects were identified as priority management issues by all three of the central California sanctuaries, based on a recent evaluation of information needs for the NMS program (Gittings et al. 2003). In addition, water quality issues, particularly non-point source pollution and harmful algal blooms (HABs), were identified as critical management issues by CBNMS and GFNMS. This study specifically addresses water quality issues, and knowledge of spatial and temporal oceanographic patterns can contribute substantially to understanding fishing/harvest effects. Characterizations of phytoplankton and water quality patterns from satellite data can also easily be incorporated into ongoing biogeographic assessments of sanctuaries by CCMA, which play a role in zoning.

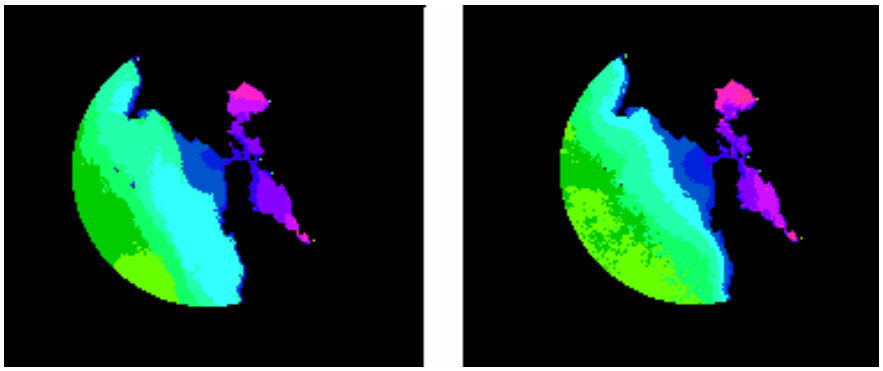
Image processing of satellite data for the region that encompasses the central California sanctuaries has been completed, to include generating regional subsets from SeaWiFS ocean color and chlorophyll data, as well as Pathfinder SST data. Both satellite data sets were reprojected to common geographic bounds and spatial resolution (1 km), in order to facilitate cross-correlations between the datasets and extraction of consistent time series information. Processing of monthly, 5 day, and 8 day Pathfinder SST data was completed for data from 1985-2004. Time series data was extracted from the available SST data for all three sanctuaries (Gulf of the Farallones, Cordell Bank, and Monterey Bay). Chlorophyll and turbidity imagery (SeaWiFS) was processed. Characterization of the sanctuaries physically was completed with the application of remote sensing techniques trying to identify patterns in the data. Completed data sets and final report were delivered to Gulf of the Farallones, Cordell Bank and Monterey Bay NMS. The report (Stumpf et al., 2005) is referenced as NOAA Technical Memorandum # 13.

A presentation on project data and methods, as well as potential satellite data-derived products was provided at the GFNMS offices on 2 Jun 2004. The following set of graphics provides chlorophyll features in the region. The leftmost image provides an example of chlorophyll features along the central California coast (San Francisco Bay in center of coast) from a daily SeaWiFS image (17 May 1998). The two images on the right illustrate variability in 60-day mean chlorophyll distributions along the entire California coast, for Apr-May 1998 (center) and Aug-Sep 1998 (rightmost). Higher chlorophyll values are

indicated by yellow and red (highest) colors and lower values are represented by blue colors.



An estimation of the San Francisco Bay plume was completed by analyzing chlorophyll and turbidity imagery. The following graphics depict the average location of the plume. Dark blue shows the average zone of influence of the inner plume. Medium blues shows the average zone of influence of the outer plume, although areas south of Santa Cruz should be disregarded. The plume boundary during May-Sept (leftmost) is strongly influenced by turbidity. Chlorophyll is typically lower inside the plume than outside. During winter (rightmost), the plume boundary is influenced by chlorophyll and turbidity. Although it is identified best by turbidity, chlorophyll is higher inside the plume than outside.



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