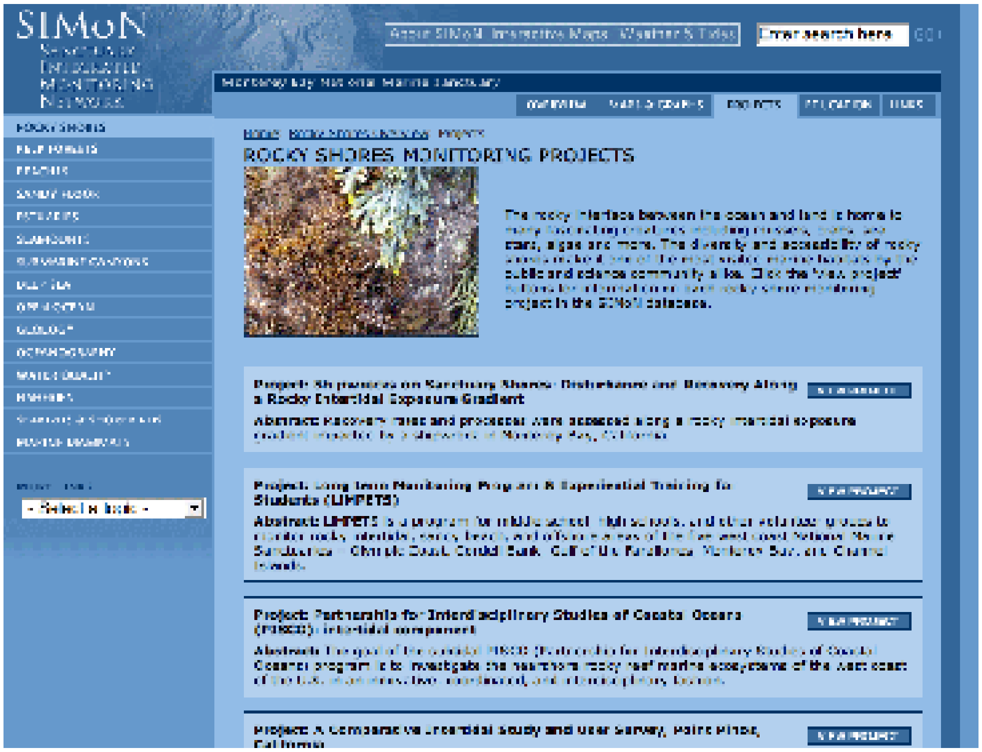


Rocky shores monitoring projects page. This page lists all of the projects stored in the SIMoN database and provides links to information on each.

Individual monitoring project page. Each project in the SIMoN database has a page showcasing the project abstract, findings, trends and supporting materials.

National Marine Sanctuaries

Outreach

As an outreach tool, the SIMoN web site provides information on habitats, issues, and events of the Monterey Bay National Marine Sanctuary. Supplied through the effective navigational structure of the web site, this information is delivered by concise textual content, high resolution imagery, and a comprehensive list of links to other sources.

The SIMoN web site is broken up into fifteen sections that represent the major habitats and issues of the Monterey Bay National Marine Sanctuary. Each of these sections have the following:

- Overview information (what it is, important issues and trends, etc)
- Static maps and graphs of interesting data
- List of relevant monitoring projects
  - Link to individual project information (containing textual and visual summary information)
- Educational material and links to educational web sites
- List of links to relevant web sites for further information on the topic

The SIMoN web site also offers an internet mapping application, SIMoN Interactive Maps, that allows users to dynamically create maps using Sanctuary GIS data. This high powered feature of the SIMoN web site allows users to take a virtual tour of the Monterey Bay National Marine Sanctuary by creating maps with the scale, location, and data layers of their choosing. User documentation and tutorials are provided for reference and effective use of this outreach tool.

Integration

The SIMoN web site serves to integrate the various monitoring programs in the Monterey Bay National Marine Sanctuary, including those implemented by SIMoN staff. By providing a single platform where summary information of these programs is presented, the web site provides a comprehensive overview of resource monitoring in the Sanctuary. This integration allows visitors of the SIMoN web site to accomplish various goals, depending on what user group they are part of. Each of these user groups and their goals for monitoring program information are described below:

- General public and educators
  - Find out what is being done to monitor the health of particular habitats and the Sanctuary in general
  - Gain new knowledge that allows them to judge the health and status of the Sanctuary
- Resource managers
  - Find up-to-date results of specific monitoring efforts helpful to management decisions
  - Find new programs working in the managers area of interest

- Marine scientists
  - Find relevant monitoring efforts unknown to them, which may lead to unanticipated partnerships
  - Find answers to questions being addressed by other monitoring efforts
  - Showcase their own monitoring project on the SIMoN web site

The SIMoN database stores information on over 50 monitoring projects and the web site makes them accessible. Projects are primarily grouped according to the web site section (habitat and issue) that they are most relevant to. They are secondarily grouped by institution(s) responsible for the project. Users may use either of these options for finding projects on the web site or take advantage of the user defined keyword search function to locate a project.

<u>Statistiscs</u>

Various statistics to-date of the SIMoN web site include:

- Released October 29, 2003
- > 220,000 hits
- > 1,400 unique visitors
- 50 monitoring projects presented
- 60 contributing institutions/organizations
- 98 contributing principal investigators

Other Reports and Presentations

Scientific information will only be applied to resource management issues if it is shared with potential users. The Sanctuary research team uses a variety of venues to present our research findings. Below are abstracts developed by memebers of the research team for professional conferences, technical reports, book chapters, and scientific publications in 2003.

Andrews, A.H.[1], G.M. Cailliet[1], L.A. Kerr[1], K.H. Coale[1], C. Lundstrom[2], and A.P. DeVoglaere[3]. [1]Moss Landing Marine Laboratories, [2]University of Illinois - Urbana Champaign, [3]Monterey Bay National Marine Sanctuary.
<u>INVESTIGATIONS OF AGE AND GROWTH FOR THREE DEEP-SEA CORALS FROM THE DAVIDSON SEAMOUNT OFF CENTRAL CALIFORNIA.</u> *Chapter submitted for the Proceedings of the Deep Sea Coral Symposium, Erlangen, Germany.*

Recent investigations of the Davidson Seamount off central California using a remotely operated vehicle have revealed communities rich with deep-sea corals. During these observations several corals were collected and three colonies were made available for an age and growth study. The colonies examined were identified as bubblegum coral (*Paragorgia sp.*), bamboo coral (*Keratoisis sp.*), and precious coral (*Corallium sp.*). Age was estimated from growth zone counts made in skeletal cross sections. These age estimates were used to estimate growth rates and colony age. Estimated growth rates determined for each species were quite different. The bubblegum coral had a relatively high estimated growth rate, with the precious and bamboo coral being slow growing. These age and growth observations were evaluated relative to other studies on similar species and an attempt was made to validate the age and growth estimates with an independent radiometric ageing technique (e.g. lead-210 dating). This approach was not successful for the bubblegum coral and was successful for the bamboo and precious corals to differing degrees. For the bamboo coral a minimum colony age of about 200 yr was determined. For the precious coral a linear growth rate of approximately 0.25 cm/yr led to a colony age of about 115 yr; however, based on the radial growth rate an age of up to 200 yr is applicable.

Andrews, A.H.[1], L.A. Kerr[1], G.M. Cailliet[1], K.H. Coale[1], and A.P. DeVogelaere[2]. [1]Moss Landing Marine Laboratories, [2]Monterey Bay National Marine Sanctuary. **DETERMINING THE AGE AND GROWTH OF THREE SPECIES OF DEEP-SEA CORAL FROM THE DAVIDSON SEAMOUNT OFF CENTRAL CALIFORNIA.** *Oral presentation at the Deep Sea Coral Symposium, Erlangen, Germany.*

Recent investigations of the Davidson Seamount off central California using a remotely operated vehicle have revealed communities rich with deep-sea corals. During these observations several corals were collected and three colonies were made available for an age and growth study. The colonies examined in this study were identified as bubblegum coral (*Paragorgia sp.*), precious pink coral (*Corallium sp.*), and bamboo coral (*Keratoisis sp.*). Age was estimated from growth zone counts made in skeletal cross sections. These age estimates were used to estimate growth rates, and ultimately colony age and perhaps longevity. To validate the growth rate estimates from growth zone counts a radiometric

Bamboo coral (*Keratoisis sp.*) on the Davidson Seamount. Photo: NOAA/MBARI.

method called lead-210 dating was used to determine an independent growth rate for each colony. Agreement of growth rates derived from growth zone counts and lead-210 dating were used as an indicator of age estimate accuracy. Growth rates determined for each species were quite different. The bubblegum coral had a relatively high growth rate, with the precious pink coral being somewhat intermediate and the bamboo coral being the slowest growing.

Bizzarro, J.J.[1], J.M. Field[1], H.G. Greene[1], R.N. Lea[2] and J. de Marignac[3]. [1]Center for Habitat Studies, Moss Landing Marine Laboratories, [2]California Department of Fish and Game, [3]Sanctuary Integrated Monitoring Network (SIMoN), Monterey Bay National Marine Sanctuary.
HABITAT ASSOCIATIONS OF UPPER SLOPE ROCKFISHES (SEBASTES SPP.) AND CO-OCCURRING DEMERSAL FISHES IN THE HEADWARD PART OF ASCENSION CANYON, CA. *Poster presentation at the Sanctuary Currents Symposium, Seaside, CA.*

Due to their typical life history patterns (slow growth, late age at maturity, and extreme longevity) deep-water rockfishes (Sebastes spp.) are especially susceptible to overfishing, as evidenced by recent declines in most commercially targeted stocks. To establish effective Marine Protected Areas (MPAs), the interaction between fishes and their available habitats must be determined. Our objectives were to describe habitat associations for rockfishes and co-occurring fish species within the headward part of Ascension Canyon at large (100s of meters to kilometers) and small (10s of meters) scales. Geologic structure and lithology were investigated using high-resolution multibeam bathymetric and backscatter data. These data were interpreted to produce habitat maps of the study area. Seafloor features and fish assemblages were then surveyed using the Delta submersible along 50-meter depth contours, between 200 and 350 meters. Thirty-two ten minute transects were completed between two distinct large-scale habitat types. At 200 and 250 m, stripetail (Sebastes saxicola) and greenstripe (S. elongatus) rockfishes were the dominant fish species. At 300 and 350 m, splitnose (S. diploproa) and shortspine thornyhead (Sebastolobus alascanus) were the most abundant rockfishes. Large and small-scale habitat associations of these and several other commercially important demersal fishes were also determined.

Burton, E.J.[1], A.P. Devogelaere[1], R.E. Kochevar[2], G.M. Cailliet[3], T. Trejo[3], S.R. Benson[4], D.A. Clague[5], M.N. Tamburri[6], and W.J. Douros[1]. [1]Monterey Bay National Marine Sanctuary, [2]Monterey Bay Aquarium, [3]Moss Landing Marine Laboratories, [4]NOAA Fisheries, [5]Monterey Bay Aquarium Research Institute, [6]Alliance for Coastal Technologies.
EXPLORING DAVIDSON SEAMOUNT: BIOLOGICAL CHARACTERIZATION AND PROTECTION. *Poster presentation at the Deep Sea Biology Symposium, Coos Bay, OR.*

The Davidson Seamount is an impressive geologic feature located 120 km southwest of Monterey, California. This inactive volcano is roughly 2,300 m tall and 40 km long, yet its summit is far below the ocean surface (1,300 m). In May 2002, a diverse group of scientists led by the Monterey Bay National Marine Sanctuary embarked on an exploration to more fully characterize the Davidson Seamount. Using the research vessel *Western Flyer* and ROV *Tiburon*, we completed 6 full-day dives and recorded 90 hours of video from all depths of the seamount. Meanwhile, at the surface, a team counted seabirds and marine mammals. We collected 104 rock samples, 21 sediment cores, 123 biological samples, and 3 trash items. The crest of Davidson Seamount had the highest diversity of species, including large gorgonian corals and sponges. While detailed analyses are still in progress, it is clear that these assemblages of species are arranged in previously undiscovered large, contiguous patches, and are susceptible to physical disturbance. The number of new species is unknown, but with the samples collected and associated digital video, there is a potential to describe several. At least 4 rare fishes were observed and many invertebrates have yet to be identified. Our work is helping resource managers make a decision regarding inclusion of the Davidson Seamount into the Monterey Bay National Marine Sanctuary boundary to conserve and protect the species and habitats there.

Burton, E.J.[1], A.P. DeVogelaere[1], R.E. Kochevar[2], G.M. Cailliet[3], T.Trejo3, S.R. Benson[4], D.A. Clague[5], M.N. Tamburri[6], and W.J. Douros[1]. [1]Monterey Bay National Marine Sanctuary, [2]Monterey Bay Aquarium, [3]Moss Landing Marine Laboratories, [4]NOAA Fisheries, [5]Monterey Bay Aquarium Research Institute, [6]Alliance for Coastal Technologies.
EXPLORING DAVIDSON SEAMOUNT: BIOLOGICAL CHARACTERIZATION AND PROTECTION. *Poster presentation at the Western Society of Naturalists Meeting, Long Beach, CA.*

The Davidson Seamount is an impressive geologic feature located 120 km southwest of Monterey, California. This inactive volcano is roughly 2,300 m tall and 40 km long, yet its summit is far below the ocean surface (1,250 m). In May 2002, a diverse group of scientists led by the Monterey Bay National Marine Sanctuary embarked on an exploration to more fully characterize the Davidson Seamount. Using the research vessel *Western Flyer* and ROV *Tiburon*, we completed 6 full-day dives and recorded 90 hours of video from all depths of the seamount. Meanwhile, at the surface, a team counted seabirds and marine mammals. We collected 104 rock samples, 21 sediment cores, 123 biological samples, and 3 trash items. The crest of Davidson Seamount had the highest diversity of species, including large gorgonian corals and sponges. While detailed analyses are still in progress, it is clear that these assemblages of species are arranged in previously undiscovered large, contiguous patches, and are susceptible to physical disturbance. The number of new species is unknown, but with the samples collected and associated digital video, there is a potential to describe several. At least 4 rare fishes were observed and many invertebrates have yet to be identified. Our work is helping resource managers make a decision regarding inclusion of the Davidson Seamount into the

Monterey Bay National Marine Sanctuary boundary to conserve and protect the species and habitats there.

DeVogelaere, A.[1], R. Kochevar[2], M. Tamburri[3], G. Cailliet[4], E. Burton[1], S. Benson[5], W. Douros[1]. [1]Monterey Bay National Marine Sanctuary, [2]Monterey Bay Aquarium, [3]Alliance for Coastal Technologies, [4]Moss Landing Marine Laboratories, [5]NOAA Fisheries.
EXPLORING THE DAVIDSON SEAMOUNT: COMBINING SCIENCE, PUBLIC OUTREACH, AND RESOURCE MANAGEMENT. *Chapter Submitted for the Proceedings of the California and the World Oceans Conference, Santa Barbara, CA.*

Scientific information is often interpreted to the public long after it has been discovered. NOAA programs and private organizations are interested in more immediate sharing of information with the public so that it can be more effectively used in resource management. The Davidson Seamount is an underwater volcano off the coast of Central California, and recent advances in technology provide the opportunity to explore and characterize the biology of this deep-sea habitat. With an interdisciplinary team of scientists, outreach specialists, and resource managers, this exploration was presented to the public as it was happening with daily updates on a web site. The public also interacted by e-mail with the explorers during the expedition. Huge corals and sponges, deep-water fishes, and the technology needed to study this deep, dark habitat particularly engaged the public, resource managers, and scientists alike. Following the cruise there was national media interest in discoveries from the expedition, not only because the findings were spectacular, but because significant efforts were made to provide the media with access to the explorers

MBARI's ROV *Tiburon*.

NATIONAL MARINE SANCTUARIES ™

and images of the findings. Resource managers are already using summary information from the cruise in processes that may potentially protect Davidson Seamount habitats. Even before the scientific data has been completely analyzed, the public and resource managers have been engaged in a healthy process of information sharing. In characterizing the biology of Davidson Seamount, we found that this model of an interdisciplinary expedition effectively integrated new scientific information into public understanding and management options for a unique area.

DeVogelaere, A.[1], R. Kochevar[2], M. Tamburri[3], G. Cailliet[4], E. Burton[1], and W. Douros[1]. [1]Monterey Bay National Marine Sanctuary, [2]Monterey Bay Aquarium, [3]Alliance for Coastal Technologies, [4]Moss Landing Marine Laboratories.
EXPLORING THE DAVIDSON SEAMOUNT: COMBINING SCIENCE, PUBLIC OUTREACH, AND RESOURCE MANAGEMENT. *Poster presentation at the Sanctuary Currents Symposium, Seaside, CA.*

Scientific information is often interpreted to the public long after it has been discovered. NOAA programs are interested in more immediate sharing of information with the public so that it can be more effectively used in resource management. The Davidson Seamount is an underwater volcano off the coast of Central California, and recent advances in technology provide the opportunity to explore and characterize the biology of this deep-sea habitat. With an interdisciplinary team of scientists, outreach specialists, and resource managers, this exploration was presented to the public as it was happening with daily updates on a web site. The public also interacted by e-mail with the explorers during the expedition. Huge corals and sponges, deep-water fishes, and the technology needed to study this deep, dark habitat particularly engaged the public, resource managers, and scientists alike. Resource managers are already using summary information from the cruise in processes that may potentially protect Davidson Seamount habitats. Even before the scientific data has been completely analyzed, the public and resource managers have been engaged in a healthy process of information sharing.

DeVogelare, A.P.[1], E.J. Burton[1], T. Trejo[2], D.A. Clague[3], M.N. Tamburri[4], G.M. Cailliet[2], R.E. Kochevar[5], W.J. Douros[1]. [1]Monterey Bay National Marine Sanctuary, [2]Moss Landing Marine Laboratories, [3]Monterey Bay Aquarium Research Institute, [4]Alliance for Coastal Technologies, [5]Monterey Bay Aquarium.
DEEP SEA CORALS AND RESOURCE PROTECTION AT THE DAVIDSON SEA-MOUNT, CALIFORNIA, U.S.A. *Oral presentation and chapter submitted for the Proceedings of the Deep Sea Coral Symposium.*

The Davidson Seamount is located 120 kilometers to the southwest of Monterey, along the California coast, USA. It is 2,400 meters tall; yet, it is still 1,250 meters below the sea surface. In May 2002, 90 hours of digital video was recorded from all depths of the Davidson Seamount, using a remotely operated vehicle, and deep sea coral specimens were collected. Preliminary analyses indicate that 20 coral taxa were found, and they were almost exclusively located in high relief, crest areas. Other species were noted on or adjacent to the corals. Because of its pristine nature, as well as human threats and great potential for education, the Davidson Seamount is under consideration for protection as part of the Monterey Bay National Marine Sanctuary.

King, C.E. Monterey Bay National Marine Sanctuary.
SPATIAL ECOLOGICAL ANALYSIS OF MEGAVERTEBRATE POPULATIONS (SEAMAP). *Poster presentation at the Data Providers Meeting, Duke University, North Carolina.*

The Sanctuary Integrated Monitoring Network (SIMoN) has been designed in partnership with the regional science and management community to identify natural and human induced changes to the National Oceanic and Atmospheric Administration's (NOAA) Monterey Bay National Marine Sanctuary (SANCTUARY). Initiated in 2000 and just now fully staffed, SIMoN is intended to coordinate and enhances regional monitoring of the sanctuary. The principal goals of SIMoN are to integrate existing monitoring conducted in the SANCTUARY, initiate basic surveys or characterizations of all habitats and regions of the SANCTUARY, and specific, hypothesis-driven monitoring efforts of fixed duration, establish and maintain a series of essential long-term monitoring efforts that will continue into the future, and disseminate timely and pertinent information to resource managers and decision makers, the research community, educators, and the general public. A website will be the primary outreach vehicle, giving the user the ability to access general information regarding a specific habitat, issue or organisms. An interactive map will provide a means of visualizing the spatial distribution of every catalogued monitoring program. This availability of information facilitates communication and networking among researchers, resource managers, educators and the public. The success of SIMoN depends on the continued support of the research community. Submitting high-level project information, filling identified knowledge gaps with new research, and providing feedback are some of the ways researchers and the public help shape the future of the SIMoN website.

King C.E. Moss Landing Marine Laboratories.
FACTORS INFLUENCING THE PEDAL LACERATION FREQUENCY OF A SUBTROPICAL ANEMONE. *Master of Science Thesis, Moss Landing Marine Laboratories, Moss Landing, CA.*

Adaptation of sea anemones to changing environmental parameters such as temperature, irradiance and disturbance can manifest itself in the modification of individual size and frequency of asexual reproduction. The purpose of this study was to investigate, through manipulative field experiments and observational data, the effects that light, nutrition and disturbance have on size and asexual reproduction of Aiptasia californica, a subtropical zooxanthellate anemone that uses non-geniculate coralline algae as a common substrate within Bahía Concepcíon, Mexico. Diversity of the symbiont (Symbiodinium sp.) was also investigated using restriction fragment length polymorphisms of partial 18S ribosomal DNA.

Results indicate that rhodolith instability is the primary determinant of pedal laceration frequency and biomass of A. californica. Biomass increases with depth, where water motion and disturbance decrease. The effects of irradiance and nutrition remain uncertain. Symbiosis occurs with one of five previously described clades of Symbiodinium. The adaptive significance of monomorphic symbiosis and worldwide symbioses are discussed.

King, C., A. DeVogelaere, S. Lonhart, and J. de Marignac. Sanctuary Integrated Monitoring Network (SIMoN), Monterey Bay National Marine Sanctuary.
A MAP OF MONITORING SITES IN THE MONTEREY BAY NATIONAL MARINE SANCTUARY. *Poster presentation at the Sanctuary Currents Symposium, Seaside, CA.*

Long-term ecosystem monitoring is a fundamental element of effective conservation and a requirement of the Monterey Bay National Marine Sanctuary's management plan. By integrating ongoing efforts at over 30 regional marine research institutions, and filling in critical gaps, the Sanctuary can gain a comprehensive understanding of its resources and processes. The Sanctuary Integrated Monitoring Network (SIMoN) has therefore been designed in partnership with the regional science and management communities to identify and track natural and human induced changes to the Sanctuary (see related poster by Lonhart et al.). This map represents SIMoN's initial effort at compiling historic and current monitoring sites. Associated with these sites are metadata, detailing who, when, where, why and how the data were collected, processed, and analyzed. These site locations represent a wide array of data types, resolution, time duration, age and complexity from varying sources, including state, federal and private organizations. However, some basic patterns are clear. For example, while the Monterey Bay is heavily studied, there are few monitoring data sets off of the Big Sur Coast. This poster presentation is interactive in that we are asking the reader to provide additional locations and contact information on data sets they feel are important. Within the next year, these data will be made available through an interactive mapping site on the World Wide Web.

King, C.[1], R. Kvitek[2], G.H. Greene[3], N. Wright[4]. [1]Sanctuary Integrated Monitoring Network (SIMoN), Monterey Bay National Marine Sanctuary, [2]California State University Monterey Bay, [3]Center for Habitat Studies, [4]California Department of Fish and Game.
INTEGRATING GEOSPATIAL TECHNOLOGIES FOR EFFECTIVE RESOURCE MANAGEMENT. *Poster presentation at the Sanctuary Currents Symposium, Seaside, CA.*

A pilot study to map the distribution of rockfish along the Monterey Formation outcrops off Del Monte Beach in Monterey, California was conducted using SCUBA sampling methods, remote sensing, and GIS technology through a cooperative, multi-agency effort. Reflective sonar (244 kHz) data were collected and processed to generate a shaded relief image, and acoustically different substrata were mosaicked and interpreted for construction of substrate maps. ArcView 3.2 was used to visualize these layers, and to plot a small sample of non-random transects) that included SCUBA diver observations. The observations made were of rockfish abundance and estimates of rocky substrate within each 2-meter wide and 10-meter long transect. Two hundred thirty-five (235) fish, belonging to 11 species were counted in 21 transects completed by SCUBA divers in September 2000. Rockfish densities were spatially and qualitatively correlated with percent cover of rock within each transect. The overall density was estimated as 2.88 +/- 0.191 (S.E.) fish per 100 m2 in transects that consisted of primarily rocky substrate. Breaking down the 21 transects into two groups of rock percent cover, 80-90% and less than 80%, yields a density twice as high in the 80-90% group. The area of study is not under any fishing protection and potentially low densities may warrant a management plan to protect the stock that is left in the area. This suite of technology holds the potential to correlate fish assemblages with habitat type, make related predictions, and develop management strategies.

Kogan, I.[1,2], C.K. Paull[1], L.Kuhnz[1], S. von Thun[1], E, Burton[2], H.G. Greene[1], J.P. Barry[1]. [1]Monterey Bay Aquarium Research Institute, [2]Monterey Bay National Marine Sanctuary.
ENVIRONMENTAL IMPACT OF A SUBMARINE CABLE: CASE STUDY OF THE ACOUSTIC THERMOMETRY OF OCEAN CLIMATE (ATOC)/PIONEER SEAMOUNT CABLE. *Oral presentation at the American Geophysical Union Meeting, San Francisco, CA.*

To better understand the potential impacts of the presence of cables on the seabed, a topic of interest for which little data is published or publicly available, a study of the environmental impacts of the ATOC/Pioneer Seamount cable was conducted. The 95 km long, submarine, coaxial cable extends between Pioneer Seamount and the Pillar Point Air Force Station in Half Moon Bay, California. Approximately two thirds of the cable lies within the Monterey Bay National Marine Sanctuary. The cable is permitted to NOAA- Oceanic and Atmospheric Research for transmitting data from a hydrophone array on Pioneer Seamount to shore. The cable was installed unburied on the seafloor in 1995. The cable path crosses the continental shelf, descends to a maximum depth of 1,933 m, and climbs back upslope to 998 m depth near the crest of Pioneer Seamount. A total of 42 hours of video and 152 push cores were collected in 10 stations along cable and control transects using the *ROVs Ventana* and *Tiburon* equipped with cable-tracking tools. The condition of the cable, its effect on the seafloor, and distribution of benthic megafauna and infauna were determined.

Video data indicated the nature of interaction between the cable and the seafloor. Rocky nearshore areas, where wave energies are greatest, showed the clearest evidence of impact. Here, evidence of abrasion included frayed and unraveling portions of the cable's armor and vertical grooves in the rock apparently cut by the cable. The greatest incision and armor damage occurred on ledges between spans in irregular rock outcrop areas. Unlike the nearshore rocky region, neither the rocks nor the cable appeared damaged along outcrops on Pioneer Seamount. Multiple loops of slack cable added during a 1997 cable repair operation were found lying flat on the seafloor. Several sharp kinks in the cable were seen at 240 m water depths in an area subjected to intense trawling activity. Most of the cable has become buried with time in sediment substrates on the continental shelf whereas much of the cable remains exposed in sediments at deeper depths. The cable is exposed in rocky environments of the nearshore region and on all of Pioneer Seamount.

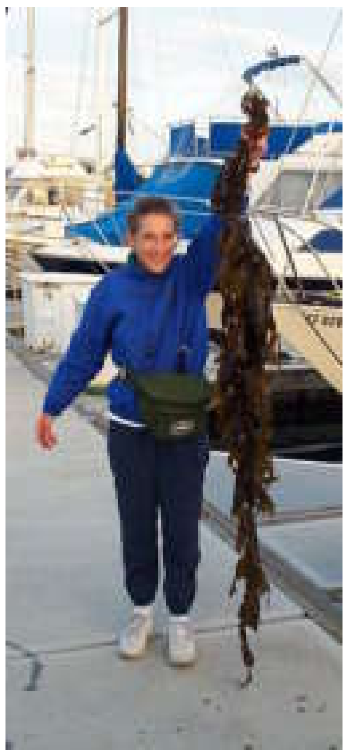
The main biological features associated with the cable were organisms utilizing the cable as substrate and occasionally as shelter. Considerable care was taken to count megafauna in video transects and macrofauna from the top 5 cm of push cores. Few differences were found between cable and control sites at the 95% confidence level. Anemones *Metridium farcimen* and *Stomphia sp.* colonized the cable and were more abundant in cable transects at most soft sediment sites. Coarse extrapolation of the transect data suggest that more than 5,000 *M. farcimen* may live on the continental shelf portion of the cable. Several other species of anemones living on the cable are common along deeper sections of the cable route. Where the cable was buried, the presence of linear rows of sea anemones proved to be a reliable indicator of the cable's position. Flatfish and rockfish apparently congregate near the cable and were as much as 1 order of magnitude more abundant near the cable at some sites.

Lonhart, S. Monterey Bay National Marine Sanctuary.
STATUS OF THE INVASIVE ALGA *UNDARIA PINNATIFIDA* IN MONTEREY HARBOR. *Oral presentation at the Western Society of Naturalists conference, Long Beach, CA.*

In the last decade, the invasive brown alga *Undaria pinnatifida* has spread throughout the Northeastern Atlantic and Southwestern Pacific, and most recently to California. In March 2000 it was detected in Los Angeles Harbor, and subsequently spread northward, reaching Monterey Harbor in 2001. *Undaria* is considered a threat because it can grow and spread quickly, and has the potential to overgrow native algae, although few studies have assessed its actual ecological impact. In October 2002 research divers surveyed the floating docks in Monterey harbor and mapped the distribution of *Undaria*. Volunteer divers used this information to begin a removal effort, diving the harbor monthly from December 2002 until April 2003. For each individual removed, researchers recorded total length, damage, reproductive status, and location. In one year volunteers removed almost 2000 *Undaria*, many of which were pre-reproductive. However, a dockside survey of the harbor in September 2003 indicated that despite these efforts the alga has spread within the harbor and is more abundant than last year. It remains unclear whether a more concerted and systematic effort can reduce the spread of *Undaria*. This program is an on-going collaboration between the Sanctuary Integrated Monitoring Network (SIMoN) at the Monterey Bay National Marine Sanctuary, Elkhorn Slough National Estuarine Research Reserve, Department of Fish and Game, City of Monterey (Volunteer Services and Office of the Harbormaster), Moss Landing Marine Laboratories, and the University of California at Santa Cruz.

Lonhart, S. Monterey Bay National Marine Sanctuary.
AN INTEGRATED RESPONSE TO A NEW COASTAL INVASION: MONITORING AND MANAGING *UNDARIA PINNATIFIDA* IN MONTEREY BAY. *Oral presentation at the International Conference on Marine Bioinvasions, San Diego, CA.*

The Asian kelp *Undaria pinnatifida*, recognized as a marine threat because of its record of rapid spread and high abundance in invaded regions elsewhere, was first reported in 2001 from a site in the Monterey Bay region, California. Already widespread in other parts of the world, *Undaria* has recently appeared in various southern California harbors from Los Angeles to Santa Barbara. Because of its rapid population growth, high density, canopy-forming growth form and potential availability as a source of food and habitat for invertebrates, *Undaria* could have profound influences on the structure and function of our highly productive and species-rich coastal reef ecosystems. The population reported from Monterey Harbor is the northern-most known occurrence of the alga along coastal California. Regional agencies and researchers are collaborating to study: 1) the spatial extent of the invasion, 2) habitat associations, 3) seasonal dynamics of growth and reproduction, and 4) the costs/benefits of different potential eradication methods. This effort is also being used to create a regional management structure and decision-making process for rapid response to future coastal invasions.



Dr. Pamela Roe holding *Undaria pinnatifida* at Monterey Harbor.

Because the distribution of *Undaria* in central California is unknown, we are surveying *in situ* the four harbors in the Monterey Bay region and various adjacent natural sites along the open coast. To determine the phenology of the alga in its new environment (which can vary regionally), we use stratified random sampling to encompass all habitat types within each study site and across all seasons. Although eradication efforts rarely succeed, we will experimentally evaluate different methods of removal within the harbor.

Concurrent with measuring the response of *Undaria* to eradication efforts, we will monitor community composition in each of the treatments, employing multivariate analysis to assess community-wide impacts of the eradication methods and the presence/absence of *Undaria* in experimental plots.

Lonhart, S.I.[1], M. Carr[2], M.Fuller[2], M. Graham[3], S. Pryor[4], C. Syms[2], R. Walsh[2], and K. Wasson[5]. [1]Sanctuary Integrated Monitoring Network (SIMoN), Monterey Bay National Marine Sanctuary, [2]University of California, Santa Cruz, [3]Moss Landing Marine Laboratories, [4]City of Monterey Harbor and Marina, [5]Elkhorn Slough National Estuarine Research Reserve.
AN INTEGRATED RESPONSE TO A NEW COASTAL INVASION: MONITORING AND MANAGING *UNDARIA PINNATIFIDA* IN MONTEREY BAY. *Poster presentation at the Sanctuary Currents Symposium, Seaside, CA.*

The Asian kelp *Undaria pinnatifida*, recognized as a marine threat because of its record of rapid spread and high abundance in invaded regions elsewhere, was first reported in 2001 from a site in the Monterey Bay region, California. Already widespread in other parts of the world, *Undaria* has recently appeared in various southern California harbors from Los Angeles to Santa Barbara. Because of its rapid population growth, high density, canopy-forming growth form and potential availability as a source of food and habitat for invertebrates, *Undaria* could have profound influences on the structure and function of our highly productive and species-rich coastal reef ecosystems. The population reported from Monterey Harbor is the northern-most known occurrence of the alga along coastal California. Regional agencies and researchers are collaborating to study: 1) the spatial extent of the invasion, 2) habitat associations, 3) seasonal dynamics of growth and reproduction, and 4) the costs/benefits of different potential eradication methods. This effort is also being used to create a regional management structure and decision-making process for rapid response to future coastal invasions.

Lonhart, S.I., A. DeVogelaere, C. King, and J. de Marignac. Sanctuary Integrated Monitoring Network (SIMoN), Monterey Bay National Marine Sanctuary.
THE SANCTUARY INTEGRATED MONITORING NETWORK (SIMoN): A NEW PROGRAM AT THE MONTEREY BAY NATIONAL MARINE SANCTUARY. *Poster presentation at the Sanctuary Currents Symposium, Seaside, CA.*

Comprehensive, long-term monitoring is a fundamental element of resource management and conservation. The Sanctuary Integrated Monitoring Network (SIMoN) has been designed in partnership with the regional science and management community to identify natural and human induced changes to the National Oceanic and Atmospheric Administration's (NOAA) Monterey Bay National Marine Sanctuary (MBNMS). The integration of high quality scientific research and long-term monitoring data sets through this program will furnish the information needed for effective management and provide a greater basic understanding of the Sanctuary, its resources and its processes. The principal goals of SIMoN are to: 1) integrate existing monitoring conducted in the MBNMS; 2) initiate basic surveys or characterizations of all habitats and regions of the MBNMS, and specific, hypothesis-driven monitoring efforts of fixed duration; 3) establish and maintain a series of essential long-term monitoring efforts that will continue into the future; and 4) disseminate timely and pertinent information to resource managers and decision makers, the research community, educators, and the general public.

McConnico, L.[1], M. Foster[1], R. Walder[1], A. DeVogelaere[2]. [1]Moss Landing Marine Laboratories, [2]Monterey Bay National Marine Sanctuary.
SHIPWRECKS ON SANCTUARY SHORES: DISTURBANCE AND RECOVERY ALONG A HEIGHT GRADIENT IN THE ROCKY INTERTIDAL ZONE. *Oral presentation at the Western Society of Naturalists Meeting, Long Beach, CA.*

The shipwreck and subsequent salvage of a fishing vessel in Monterey Bay, California (1996) caused physical and chemical damage over a gradient from the low to high rocky intertidal. Recovery from this anthropogenic disturbance was monitored and data were used to examine patterns of recovery and variability in recovery rates across the range of tidal heights. Disturbed and control (undisturbed) plots were established in a mid/high intertidal red algal (dominated by *Endocladia muricata* and *Mastocarpus papillatus*), mid intertidal mussel (*Mytilus californianus*), and low intertidal surfgrass (*Phyllospadix torreyi*) assemblage. Percent cover of sessile organisms in 0.25 x 0.25-m plots in each of the assemblages was assessed between 1996-1998 and 2001-2002. Results indicated recovery varied over the exposure gradient. Ephemeral seaweeds initially colonized all disturbed plots, but were replaced by later successional species within 2-12 months. Contrary to expectations, recovery rates did not vary inversely with tidal height. Instead, relative recovery was greatest in the high intertidal red algal assemblage, followed by surfgrass, and *Mytilus* assemblages. The patterns of recovery suggest that assemblages characterized by a few dominant species that recruit rapidly and grow quickly will recover faster than those dominated by organisms with variable, episodic recruitment, or those that have limited success with sexual reproduction relative to vegetative propagation.

Nevins, H.[1], K. Newton[2], J.T. Harvey[1], S.t Benson[1], A. DeVogelaere[2]. [1]Moss Landing Marine Laboratories, [2]Monterey Bay National Marine Sanctuary.
BEACH COMBERS: MONITORING CHANGES IN OILING RATES OF BEACHED MARINE BIRDS IN THE MONTEREY BAY NATIONAL MARINE SANCTUARY.
Poster presentation at the Sanctuary Currents Symposium, Seaside, CA.

In 1997, we initiated the Coastal Ocean Mammal and Bird Education and Research Survey (Beach COMBERS) to monitor deposition rates of marine birds within the Monterey Bay National Marine Sanctuary (MBNMS). Chronic oil pollution, originating from leaking shipwrecks, urban runoff, and additional non-point sources, continues to affect seabirds in the MBNMS. The average oiling rate (percent oiled carcasses km^{-1} month^{-1}) during 1997-2002 (2 %) was less than recorded during 1971 – 1985 (8 %) by Pt. Reyes Bird Observatory. During 1997-2002, the greatest percentage of oiled birds occurred during November to May (2.2 – 9.8 %), and the least oiling rate occurred during June to October (0.2 – 2.1 %). Beach COMBERS recorded the greatest numbers of oiled birds during the 1997-98 Pt. Reyes Tarball Incidents. Species composition of oiled birds was similar among surveys, affecting mainly alcids (17- 20 %), and wintering loons (9 %), and grebes (7 %). Our comparison with past data indicates that oil pollution prevention measures implemented during the past 20 years have likely reduced oiling rates. However, the persistent occurrence of oiling (71 % of surveys have at least 1 oiled bird) indicates that chronic oiling is still a major problem for both resident and migratory seabirds in the MBNMS. Continued efforts to monitor oiling rates and document species-specific deposition patterns will aid sanctuary managers and help to identify those seabirds most vulnerable to oil pollution.

Paduan, J.[1], S. Benson[2,3], K. Bruland[4], F. Chavez[5], D. Costa[4], D. Croll[4], A. DeVogelaere[6], C. Edwards[4], G., Griggs[4], C. King[6], R. Kudela[4], J. Harvey[3], B.L. Lipphardt, Jr[7]., S. Lonhart[6], P. Mantey[4], B. Marinovic[4], M. McManus[4], L. Rosenfeld[1], M. Silver[4], J. Vesecky[4]. [1]Naval Postgraduate School, [2]National Marine Fisheries Service, National Oceanographic and Atmospheric Administration, [3]Moss Landing Marine Laboratories, [4]University of California, Santa Cruz, [5]Monterey Bay Aquarium Research Institute, [6]Monterey Bay National Marine Sanctuary, [7]University of Delaware.

OCEAN OBSERVING AND MODELING SYSTEM DEVELOPMENTS AROUND MONTEREY BAY. *Chapter submitted for the Proceedings of the California and the World Oceans Conference, Santa Barbara, CA.*

MBARI mooring.

Participants within the Center for Integrated Marine Technologies are helping to bridge the gaps between disciplines within the marine sciences and between marine scientists and present and potential users of information from our coastal waters (*http://cimt.ucsc.edu*). CIMT is one of several projects making use of the wide range of interests and expertise around Monterey Bay as a "natural laboratory" for the understanding of coastal ocean processes and better dissemination of this understanding to the public. The scientific organizing theme of the Center, "wind-towhales," points out the complexities and interconnectedness of coastal marine ecosystems. No less complex is the adaptation of technology within the harsh ocean environment over extended periods of time and the efficient communication and archival of the data collected by the instruments deployed, which are the core technological goals of CIMT.

Pederson, J., S. Lyberg, and S. Smith. Monterey Bay National Marine Sanctuary, Monterey Bay Sanctuary Foundation.
THE SIMON WEBSITE AS A TOOL FOR SHARING MONITORING INFORMATION OVER THE INTERNET. *Poster presentation at the Western Society of Naturalists Meeting, Long Beach, CA.*

SIMoN, the Sanctuary Integrated Monitoring Network, is a comprehensive, long-term program designed to promote better understanding and protection of the Sanctuary and its resources. By gathering data on the historical and on-going monitoring efforts of over 40 research institutions operating within the MBNMS, SIMoN is able to provide important information to researchers, managers and the public. The internet is the primary medium SIMoN uses to disseminate this monitoring information. For each of the major habitats and issues in the Monterey Bay National Marine Sanctuary the SIMoN website shares overview information, maps and graphs, details on current and historic monitoring projects, educational materials, and links to other relevant websites. Coupled with an internet mapping application that allows users to create maps using MBNMS GIS data layers, the SIMoN website is an innovative new approach to sharing monitoring-based information with a wide audience. SIMoN is a collaborative effort, managed by the Monterey Bay National Marine Sanctuary in cooperation with the Monterey Bay Sanctuary Foundation and the Monterey Bay Aquarium.

Zacher, D.[1,2], S.D. Gaines[1], S.I. Lonhart[3]. [1]Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA, [2]Department of Organismic Biology, Ecology and Evolution, University of California, Los Angeles, CA, [3]Institute of Marine Sciences, University of California.
THE LIMITS TO BIOGEOGRAPHICAL DISTRIBUTIONS:INSIGHTS FROM THE NORTHWARD RANGE EXTENSION OF THE MARINE SNAIL, *KELLETIA KELLETII* (FORBES, 1852). *Journal of Biogeography 30:913–924.*

The development of accurate models predicting species range shifts in response to climate change requires studies on the population biology of species whose distributional limits are in the process of shifting. We examine the population biology of an example system using the recent northward range expansion of the marine neogastropod *Kelletia kelletii* (Forbes, 1852).

This is a marine coastal shelf neogastropod species whose range extends from Isla Asuncion (Baja California, Mexico) to Monterey (CA, USA). Research sites spanned the extent of the range.

We examine abundance distributions and size frequency distributions of K. kelletii for evidence of factors determining historic and contemporary distributional patterns. Population studies were supplemented by historic and contemporary hydrographic data, including seawater temperature data from California Cooperative Oceanic Fisheries Investigations (CalCOFI) and National Data Buoy Center (NDBC), and seawater circulation data.

The structure of recently established populations varied dramatically from that of historic populations. Markedly low densities and irregular size frequency distributions characterized recently established populations and suggested only occasionally successful recruitment. The point of transition between historic and recently established populations also corresponded to the location of a gradient in seawater temperature and the confluence of two major oceanic currents. The accumulated data suggest that temperature and/or barriers to dispersal could have set both contemporary patterns in population structure as well as the former northern range limit.

Early life stages play a critical role in determining distributional patterns of *K. kelletii.* Dispersal barriers and temperature limitation are two plausible mechanisms that could determine both contemporary and historic distributional patterns. Future studies on this species should attempt to tease apart the relative importance of these factors in maintaining the populations at the northern edge of the range.

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