Deepwater Characterization and Baseline Monitoring in the Monterey Bay National Marine Sanctuary

A Report to the Monterey Bay National Marine Sanctuary

Submitted by

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Summary

This report describes the most recent activities (2009) in an on-going collaboration between the Institute for Applied Marine Ecology (IfAME) at CSU Monterey Bay and the Monterey Bay National Marine Sanctuary (MBNMS). The primary objective of the project is the characterization of seafloor communities in the deeper (primarily federal) waters of the MBNMS, including fish, macrofaunal invertebrates, and seafloor habitats. A secondary objective is the collection of baseline data that could serve as the foundation for future monitoring efforts.

A remotely operated vehicle (ROV) is used to collect videographic and still photographic imagery of the seafloor and associated organisms at locations throughout the Sanctuary, determined through discussions between IfAME and MBNMS. The ROV (owned by The Nature Conservancy and operated by Marine Applied Research and Exploration) is equipped with both forward- and down-looking digital still and video cameras. There are also two sets of paired 10 cm lasers for sizing of organisms and habitat features. The collection of video imagery is also conducted using a towed-camera sled configured with a single forward-facing video camera.

Videographic and still photographic imagery are collected continuously along transects of greater than 1 km. These transects encompass both sedimentary and hard substrate environments, as well as the transitional areas between the two environments that allow multi-scale sub-sampling post hoc. The ROV is "flown" at an altitude of approximately 0.5 m above the seafloor at a speed of 0.5-1.0 knots to facilitate the highest resolution possible for videographic and photographic imagery. We collect both forward looking and downward still photographic and videographic imagery of 1) topographic and micro-topographic structure[1] on the seafloor, 2) epifaunal macro-invertebrates (both sessile and mobile), and 3) associated fishes (including selected exploited and non-exploited species).

We use a combination of best practices for data compilation and analysis derived from a comprehensive review of existing visual observation research programs, including programs at CDFG, NMFS, WSU, UCSB, MBARI and NURC. These techniques include both live and post-processing techniques and focus primarily on area-based community analyses rather than individual species. Comprehensive, frame by frame video data compilation, recording all structural and biological elements resolvable, combined with still photo techniques for higher resolution microhabitat characteristics and species identification, provide a

[1] Topography refers to both the physical substratum (e.g., sand waves, rock, cobble), any associated structure-forming taxa (e.g., corals, algae, anemones, sponges, brachiopods), and any biogenically built structure (e.g., mounds and depressions). In addition to the organisms that form them, microhabitats are critical for a variety of fish species at different life history stages (Auster et al. 1991).

complete geo-referenced database of habitat features and organisms suitable for a broad range of subsequent analyses.

We identify all fauna to the lowest possible taxonomic level, estimate sizes and document select habitat and microhabitat features and associations across a gradient of benthic habitats. Producing archived video and still photographic records with comprehensive data compilation allows evaluation of all community components to identify those which are most appropriate for long-term monitoring to achieve the goals identified by the MBNMS.

This content of this report is structured by the deliverables agreed to in the contract with CSUMB and MBNMS.

Deliverable 1: Content for SIMoN Website

As per the guidelines provided by Steve Lonhart, below we have provided information formatted for inclusion on the SIMoN website and/or other outreach efforts.

Title of project: Deepwater Characterization and Baseline Monitoring in the Monterey Bay National Marine Sanctuary

Date started: June 1, 2009; on-going

Lead institution/agency: Institute for Applied Marine Ecology (IfAME) at CSU Monterey Bay

Principal investigator and co-PIs:

PI: James Lindholm – IfAME/CSUMB
Co-PI: Andrew De Vogelaere – MBNMS

Project objectives: The primary objective of the project is the characterization of seafloor communities in the deeper (primarily federal) waters of the MBNMS, including fish, macrofaunal invertebrates, and seafloor habitats. A secondary objective is the collection of baseline data that could serve as the foundation for future monitoring efforts.

Collaborators: Marine Applied Research and Exploration (MARE); the Nature Conservancy

Overview of study methods: A remotely operated vehicle (ROV) is used to collect videographic and still photographic imagery of the seafloor and associated organisms. The ROV is equipped with both forward- and down-looking digital still and video cameras. There are also two sets of paired 10 cm lasers for sizing of organisms and habitat features. The collection of video imagery is also conducted using a towed-camera sled configured with a single forward-facing video camera.

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structure[2] on the seafloor, 2) epifaunal macro-invertebrates (both sessile and mobile), and 3) associated fishes (including selected exploited and non-exploited species).

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List of publications derived from this project:

No publications to-date. Several masters theses and undergraduate honors theses are in progress.

Overview of Research To-Date:

A summary of research effort to-date is provided below, including information on the four geographic areas at which sampling effort was focused in 2009.

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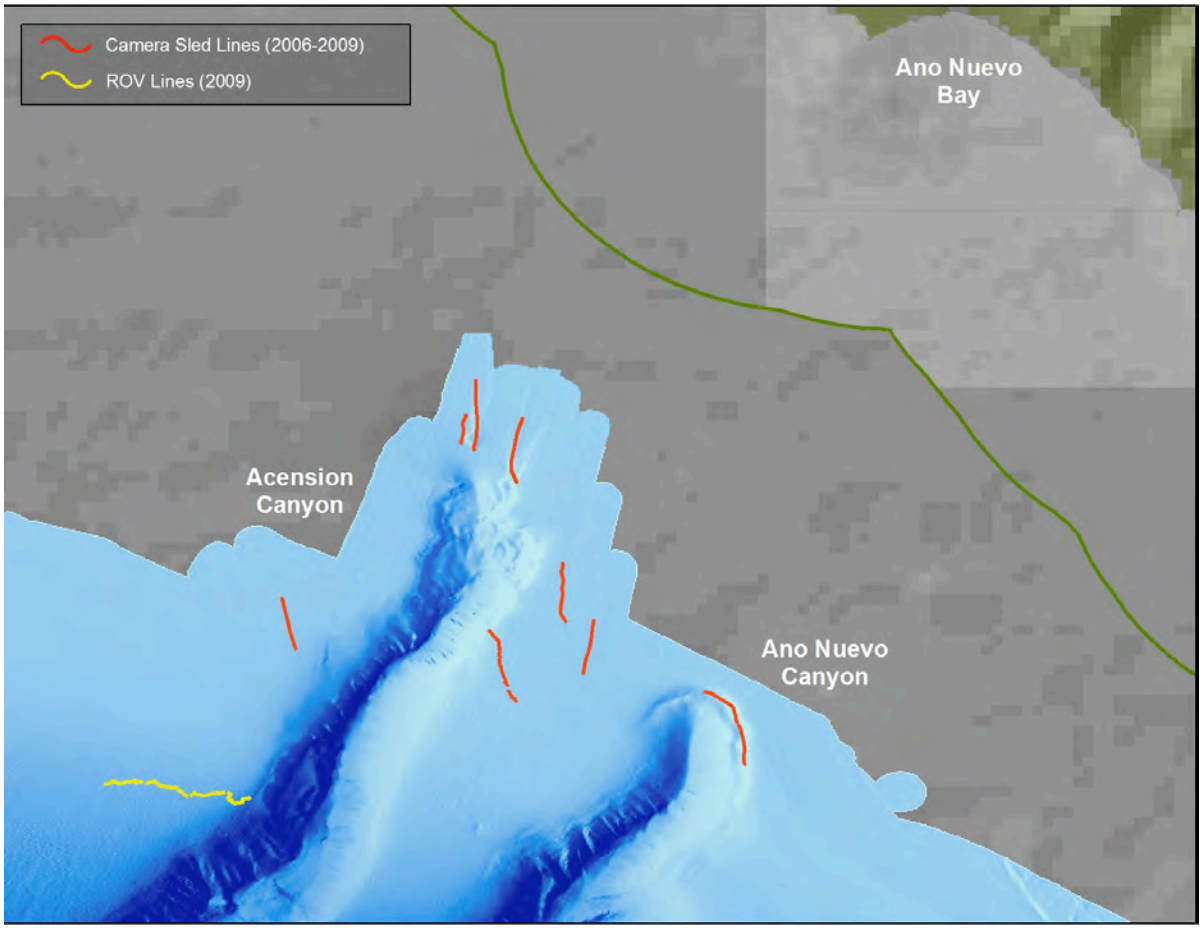
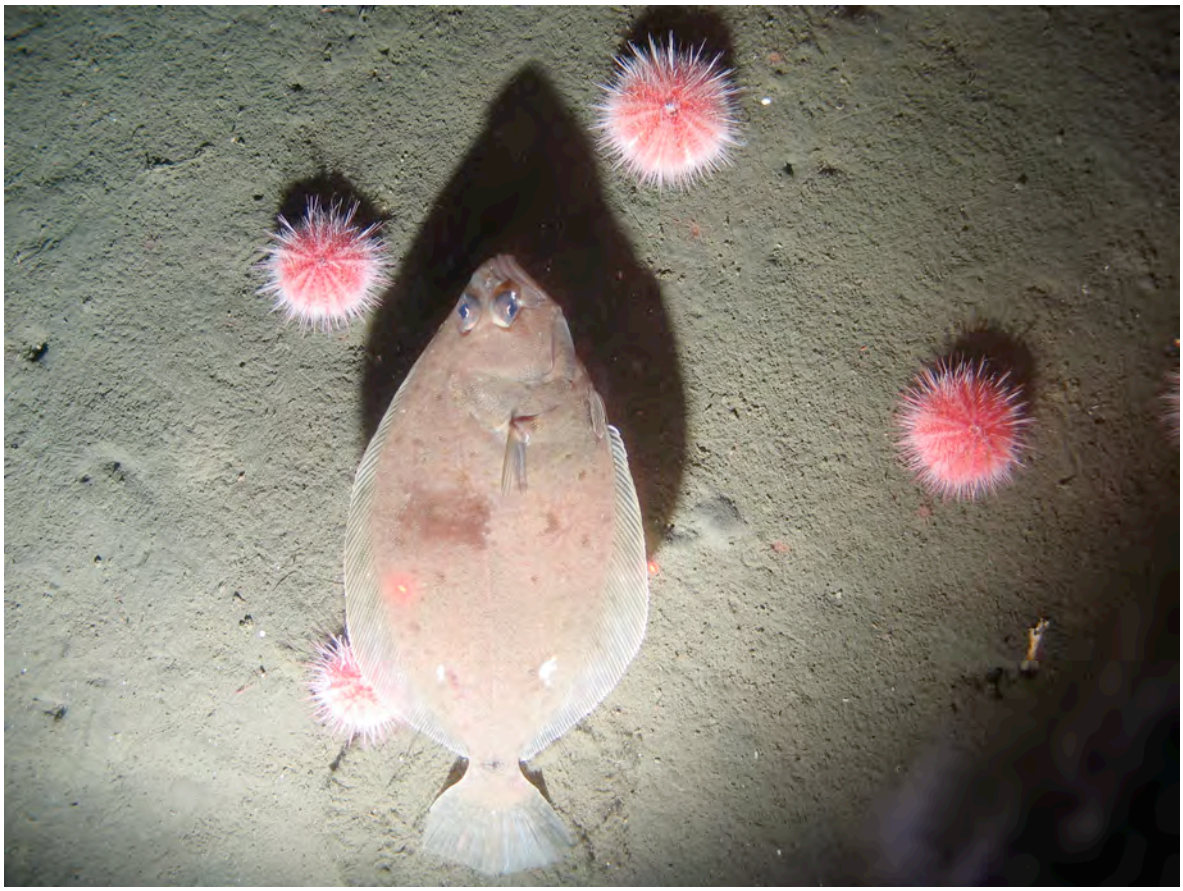
North Sanctuary

Ascension and Aňo Nuevo Canyons

Instrument(s):	Camera sled and ROV
Total length surveyed:	14.4 kilometers
Depth range surveyed:	114-330 meters
Seafloor habitats observed:	Mud and cobble
Common organisms observed:	Flatfish, brittle stars, anemones, sun-flower stars, spot prawns

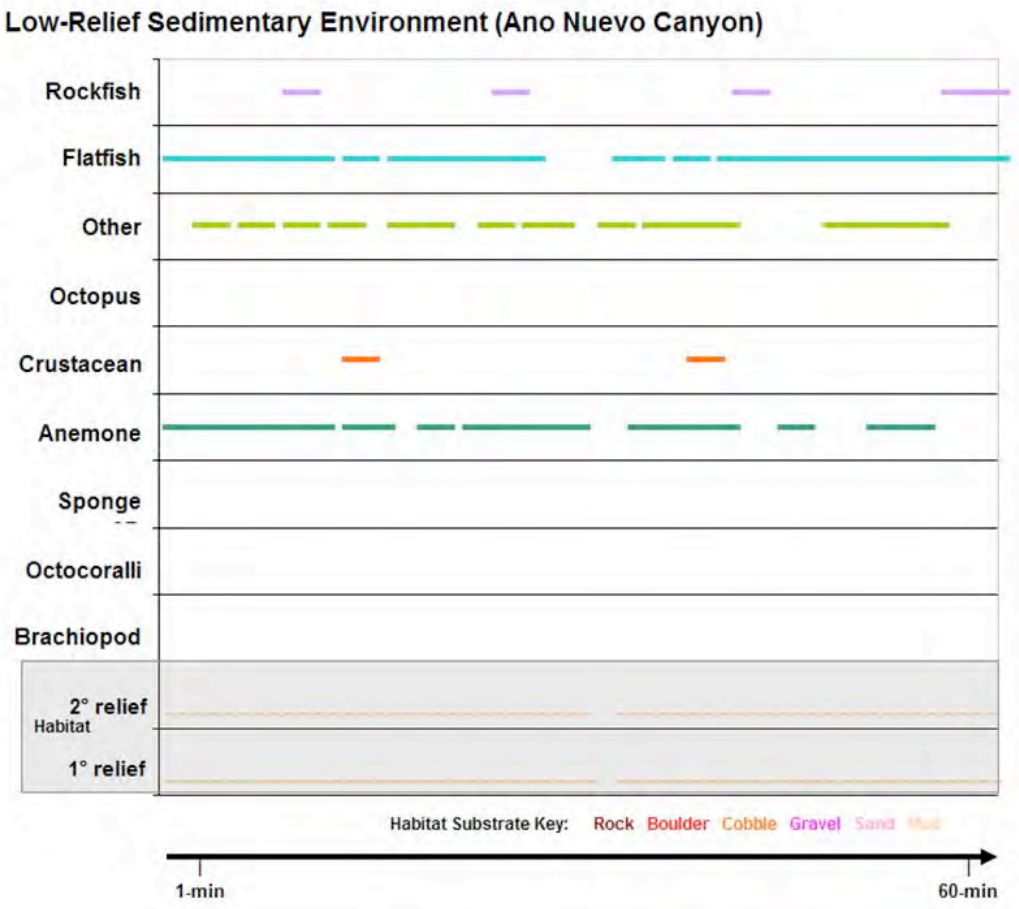


Map of ROV and camera sled sampling effort at Ascension and Aňo Nuevo Canyons in the northern Sanctuary.



ROV still photograph of a Petrale sole and urchins along the edge of Aňo Nuevo Canyon.

ROV still photograph of a Sandpaper skate and urchins along the edge of Ascension Canyon.

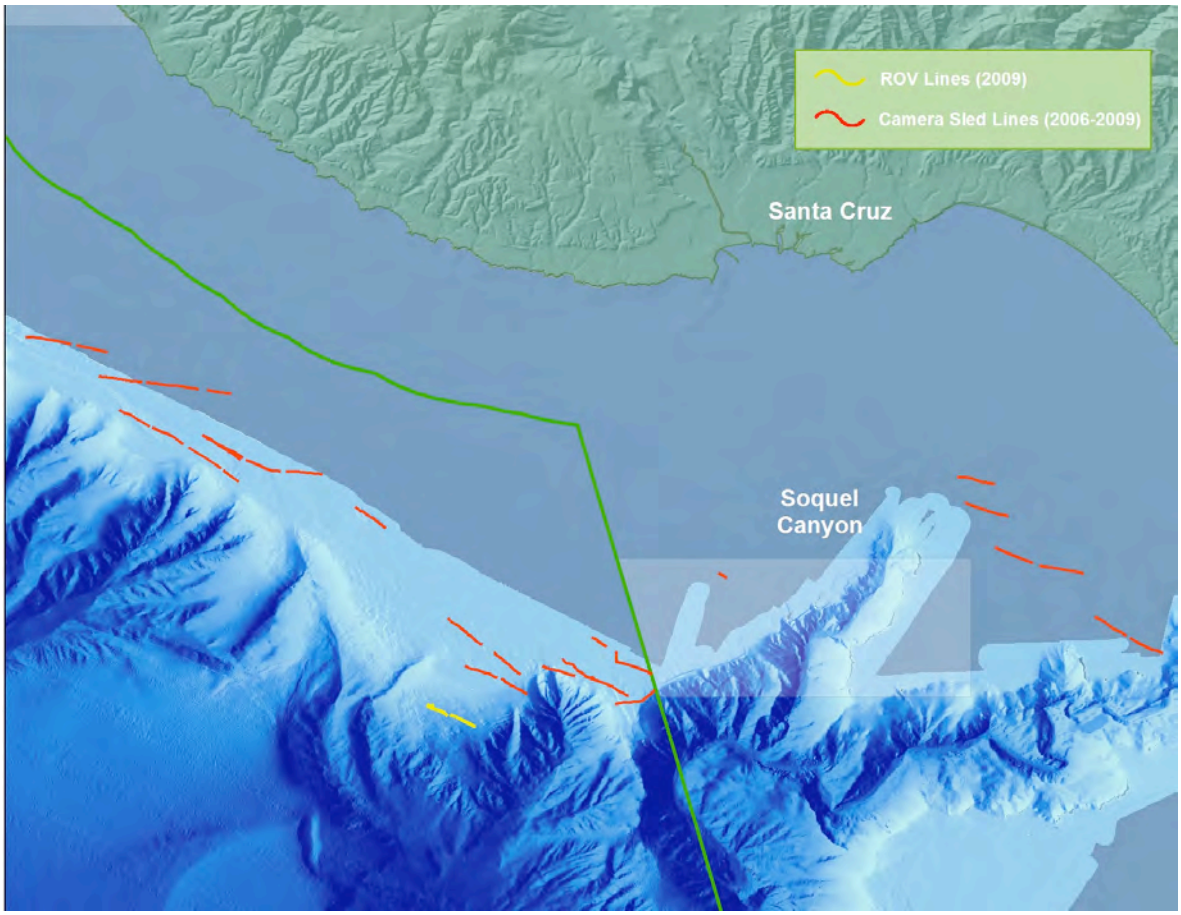


Taxanomic Distribution Plot (TDP) depicting the distribution of organism groups and seafloor habitats (substrate and relief) across a single 1-hr transect along the seafloor in the Aňo Nuevo Canyon.

Middle Sanctuary

North Bay/Davenport

Instrument(s):	ROV
Total length surveyed:	2.1 kilometers
Depth range surveyed:	289-349 meters
Seafloor habitats observed:	Mud
Common organisms observed:	Splitnose rockfish, flatfish, poachers, sun-flower star, fragile urchins, sea stars



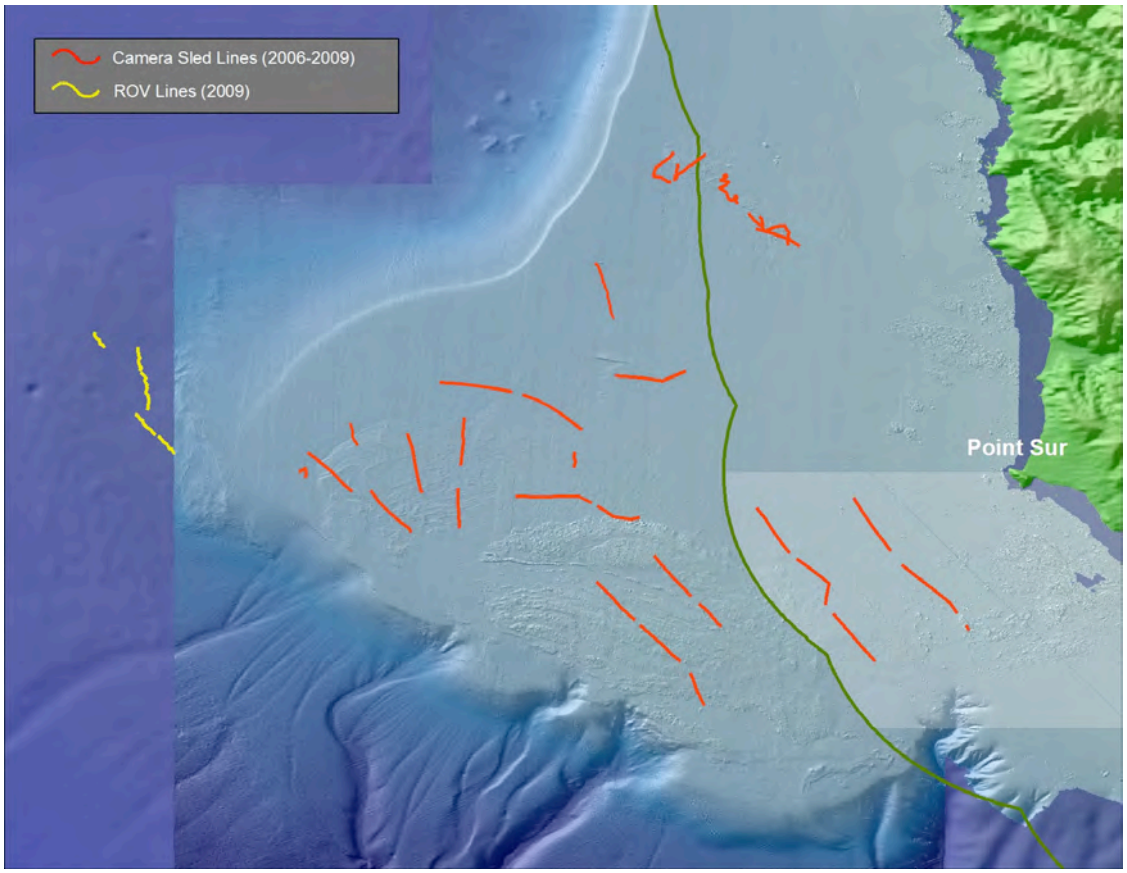
Map of ROV and camera sled sampling effort in the vicinity of northern Monterey Bay, Davenport and Soquel Canyon in the middle Sanctuary.

Camera sled video frame grab of brachiopod field.

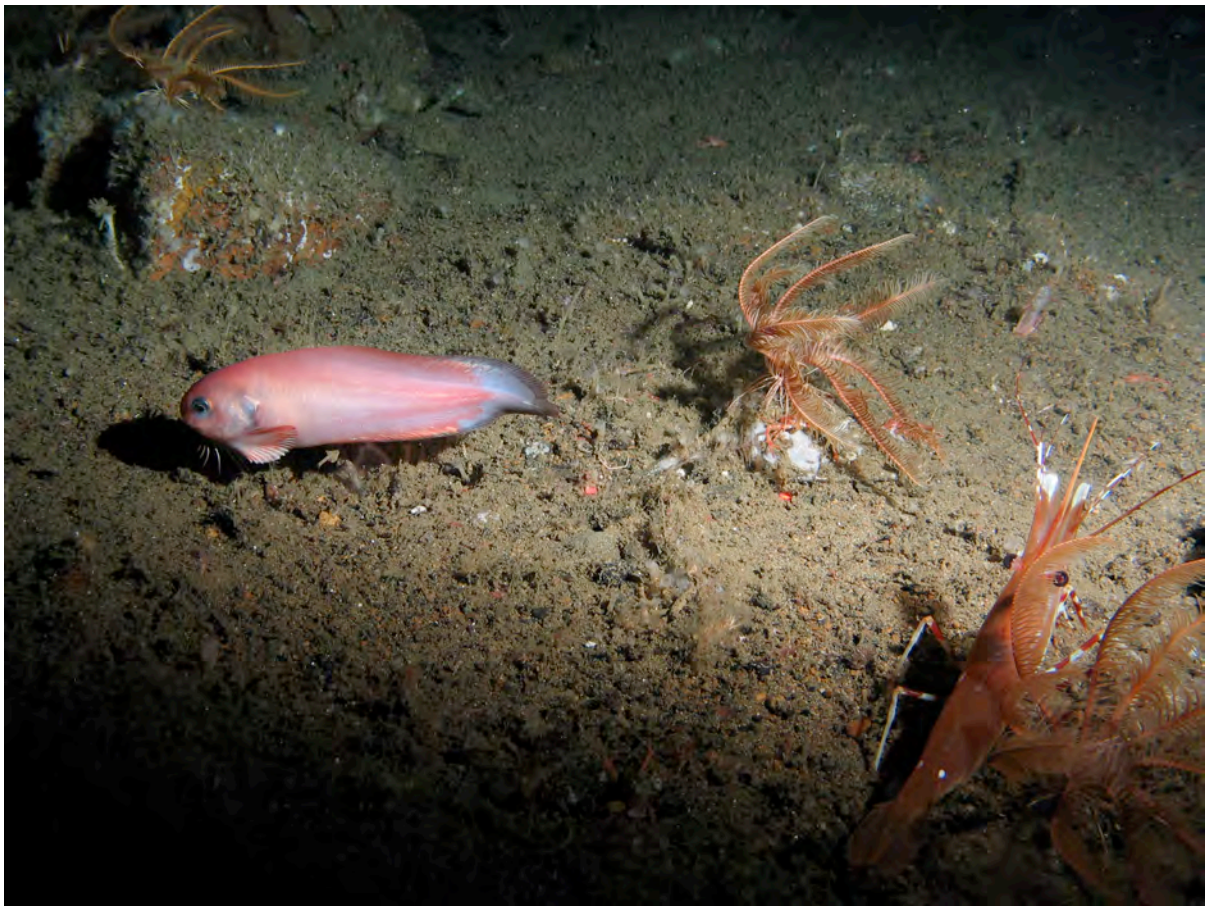
Camera sled video frame grab of red brittle stars.

Point Sur Shelf/Slope

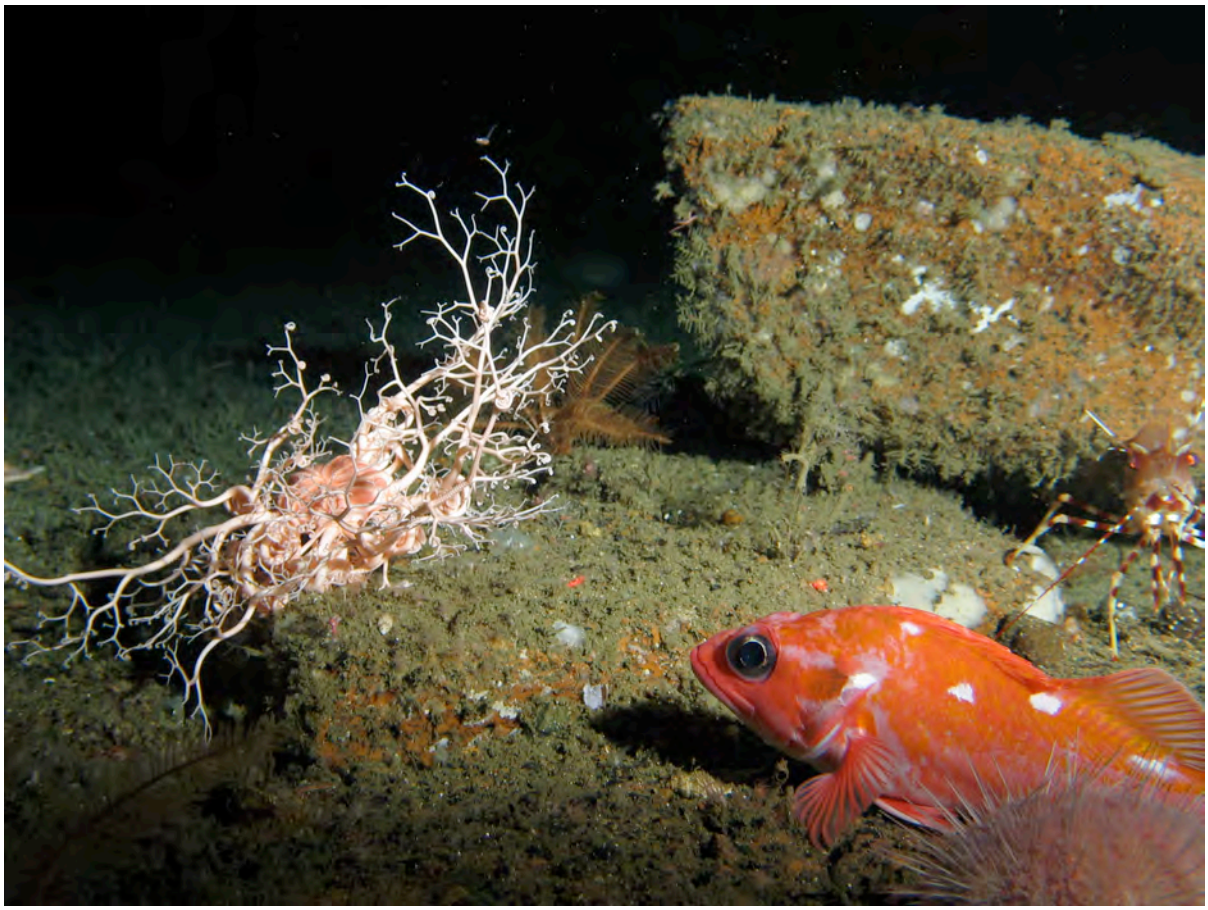
Instrument(s):	Camera sled and ROV
Total length surveyed:	3.4 kilometers
Depth range surveyed:	271-347 meters
Seafloor habitats observed:	Mud and cobble
Common organisms observed:	Rockfish, sea pens, sun-flower star, fragile urchins, crinoids, sea cucumbers, galatheid crabs



Map of ROV and camera sled sampling effort at Point Sur in the middle Sanctuary.



ROV still photograph of a snailfish and feather stars off Pt. Sur.

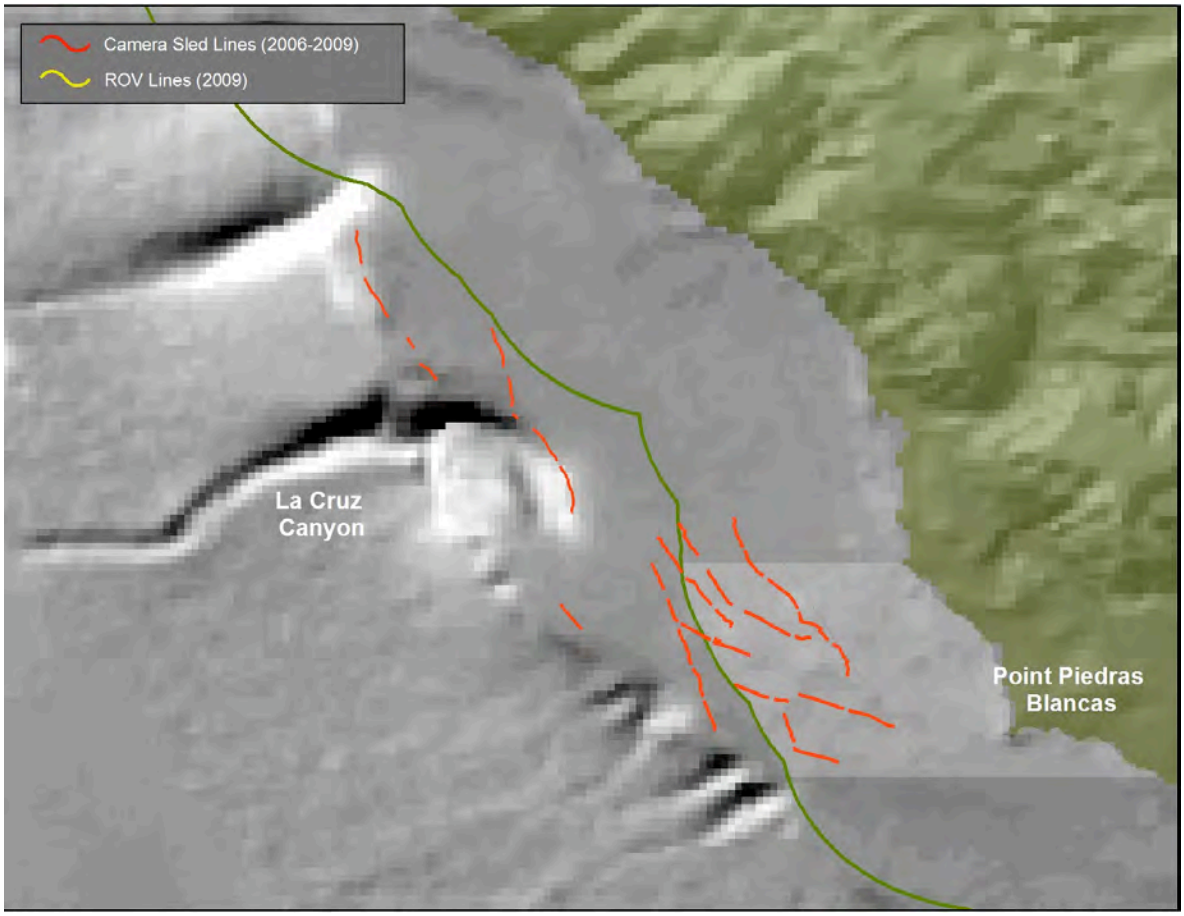


ROV still photograph of a rockfish, basket star and spotted prawn off Pt. Sur.

South Sanctuary

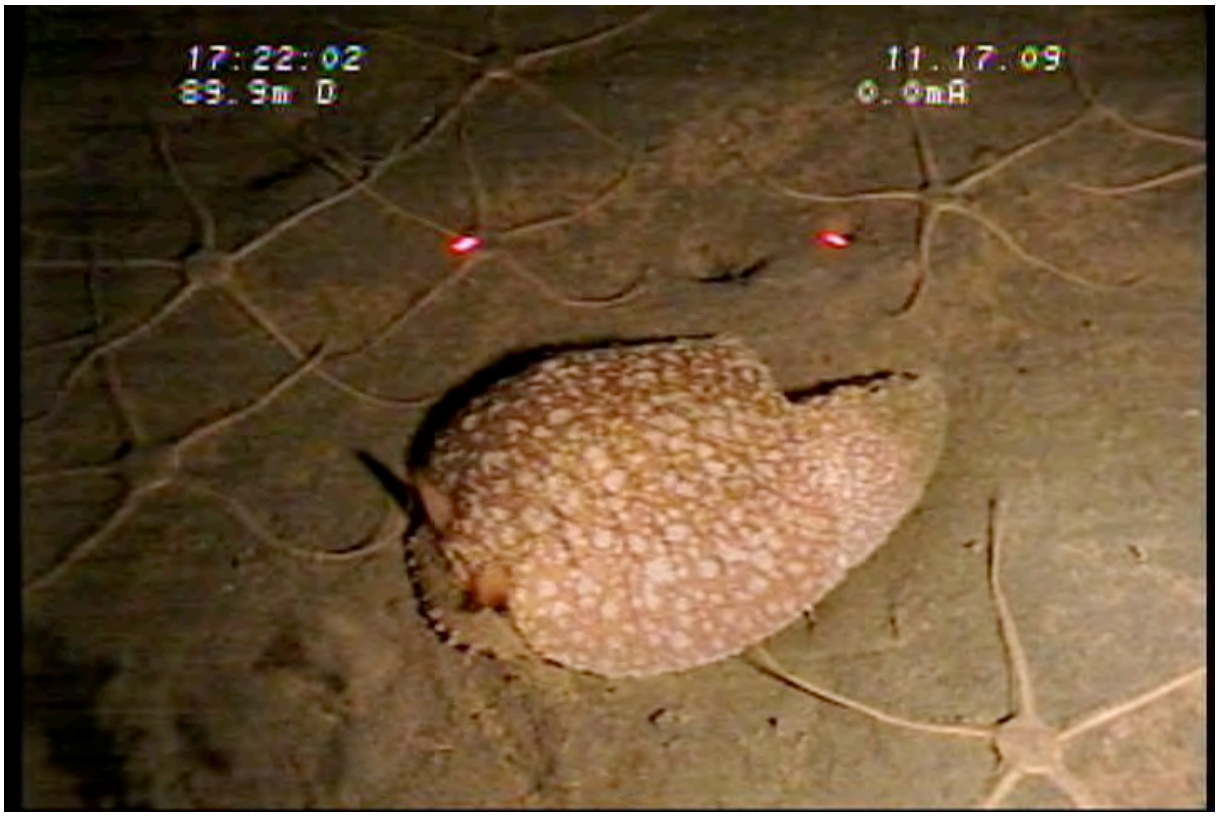
La Cruz Canyon

Instrument(s):	Camera sled
Total length surveyed:	10.2 kilometers
Depth range surveyed:	86-120 meters
Seafloor habitats observed:	Sand and boulder/cobble fields
Common organisms observed:	Rockfish, flatfish, sponges, brittle stars, crinoids, seawhips, mediaster sea stars, anemones

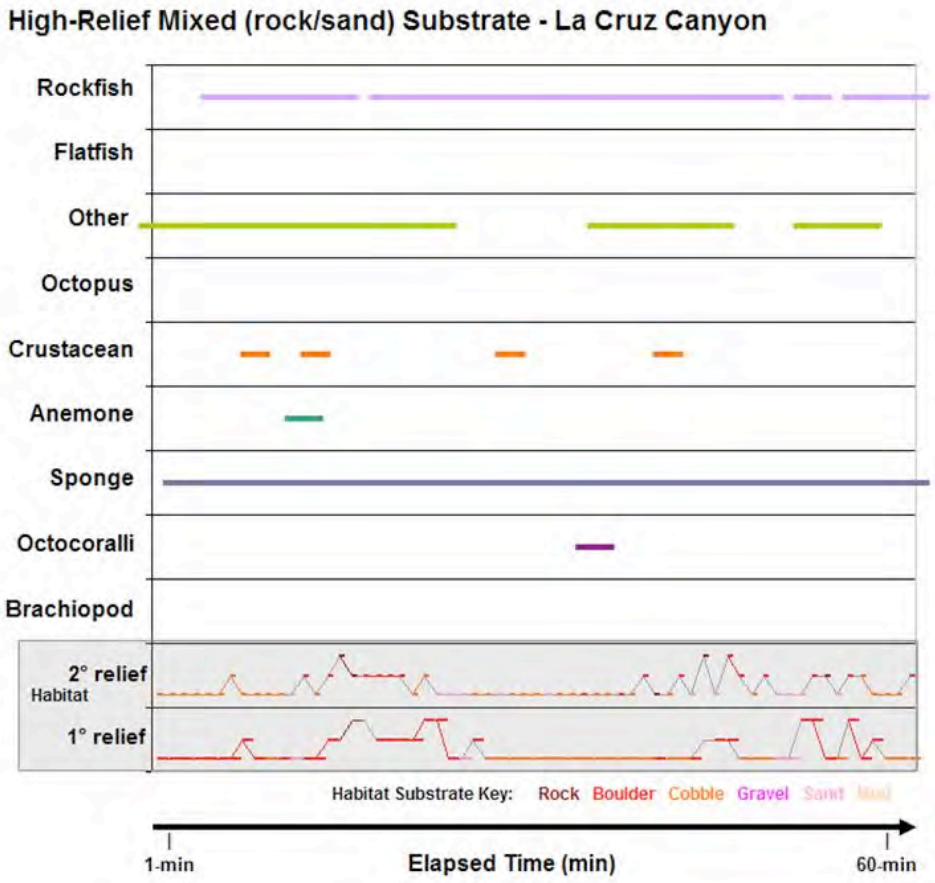


Map of ROV and camera sled sampling effort at La Cruz Canyon and Piedras Blancas in the southern Sanctuary.

Camera sled video frame grab of a Rosy rockfish and sponges along the edge of La Cruz Canyon.



Camera sled video frame grab of a sea slug and brittle stars along the shelf north of Piedras Blancas.



Taxanomic Distribution Plot (TDP) depicting the distribution of organism groups and seafloor habitats (substrate and relief) across a single 1-hr transect along the seafloor in the La Cruz Canyon.

Deliverable 2: Student Theses

CSUMB Undergraduate Honors Theses

Each year several CSUMB undergraduate students use the imagery (both ROV and camera sled) collected as part of this project for their Honors thesis. The two theses below were completed in May 2010.

Distribution of the Blackeye goby, *Rhinogobiops nicholsi*, around temperate reefs along the central coast of California

Megan Kelly
Institute for Applied Marine Ecology
Division of Science and Environmental Policy

A clear understanding of how species interact with each other as well as their habitat is necessary for successful management of marine ecosystems. *Rhinogobiops nicholsi* is an abundant, small, prey species that frequents the sand/rock interface along the edge of temperate reefs from southern Alaska to Baja, and is ideal for a habitat interaction study. To quantify the extent to which the blackeye goby utilizes this sand/rock ecotone, video transects collected by a towed camera sled in 2007 and 2008 were analyzed for the presence of blackeye gobies and their spatial relationship to temperate reefs. Data were collected at several locations within the Monterey Bay National Marine Sanctuary including: Soquel/North Monterey Bay, Point Lobos, Point Sur and Piedras Blancas. A pair of 10 cm sizing lasers were used to calculate the distance between individual gobies and the nearest hard substrate. A mean distance of 0.40 m from hard substrate was calculated, indicating that the utilization of this ecotone is critical for this species. During the data analysis, a green color morph was observed, which is distinctively different than the typical beige. This color morph is hypothesized to be associated with substrate, with green individuals occurring over rock and beige over sand. Corresponding with this, there was also a statistical difference in the distance that the two colors were observed from hard substrate: green 0.14 m and beige 0.44 m. This study has enhanced the knowledge about how blackeye gobies are distributed throughout their habitat, as well as provided baseline information on the ecotones surrounding temperate rocky reefs.

A multi-scale analysis of habitat-mediated megafaunal invertebrate distribution at two locations in the Monterey Bay National Marine Sanctuary

Katie Wrubel
Institute for Applied Marine Ecology
Division of Science and Environmental Policy

Effective marine policy depends on the timely dissemination of research results, informed management agencies, and a knowledgeable public community. However, resource managers frequently lack important information on the locations, resources, and ecological processes in the areas they manage. The inherent patchiness of marine systems impacts the distribution of these resources, requiring detailed research results to be provided to managers on the distribution of taxa and habitats. The reality of scientific analysis often prolongs the time between data collection and dissemination. Using video records, the analysis of data at multiple scales can be conducted to determine if data collected "on-the-fly" adequately records taxa abundance and distribution. This study analyzed towed camera sled video collected at two study sites within the Monterey Bay National Marine Sanctuary (MBNMS) at two sampling scales to determine the utility of data collected at a coarser sampling scale in characterizing the distribution and habitat associations of megafaunal invertebrates. The two approaches to the collection of data from that videographic imagery were a frame-by-frame approach for fine-scale research questions and data collected in real-time at one-minute intervals provided to management agencies. Taxa-habitat associations were compared at these multiple sampling schemes. The one-minute sampling scale was able to record similar taxa-habitat associations as the frame-by-frame approach, but does not adequately record taxon presence within individual transects or differences in taxa-habitat associations between study sites. The frame-by-frame approach collects fine-scale data on taxa abundance and taxa-habitat associations, but is time consuming to analyze. Sampling scale may not be a factor in recording taxa-habitat associations; however, a fine-scale sampling scale is required to determine taxa abundance and overall distribution. On-the-fly sampling techniques are adequate to estimate taxa-habitat associations and allow results to be disseminated to management agencies much more rapidly. This study demonstrates that sampling scale in videographic analysis is important and the extent to which it represents the species within the Sanctuary needs to be understood.

CSUMB Course Projects

Project imagery is also used in course projects at CSUMB. The project below was undertaken as part of a senior undergraduate course in Marine Conservation Biology. A total of 15 students participated in data collection, analysis, and reporting.

Where fish *aren't*; fish-habitat associations along the central Coast of California as determined by videographic imagery

Bardi, J., D. Bauerlein, C. Baughman, B. Frates, D. Hernandez, M. Jaramillo, M. Kelly, D. Kerfield, J. Kirkendall, A. Olson, D. Rimmer, L. Van Beurden, J. Vanderburg, E. Ventura, and K. Wrubel

ENVS 470 Marine Conservation Biology
Division of Science and Environmental Policy

Effective marine management and conservation efforts depend on the understanding of interactions between demersal fish and seafloor habitat. Imagery from a towed submersible camera collected at six sites within the Monterey Bay National Marine Sanctuary was used in this study to quantify fish habitat associations focusing on fish absence. Video analysis of 37 microhabitat types from 31 transects quantified the presence and absence of demersal fin and flatfish with associated soft and hard substrates. These transects indicate that the majority of observations (86%) were absent of demersal fin and flat fish. The greatest observed habitat, soft bottom substrate, also contained the lowest presence of both demersal fish type (6.11%). Hard substrate exhibited a similar proportion of demersal fish (18.92%). The absence of fish across all habitat types implies critical gaps in our comprehension of demersal fish distribution, which may contribute to inadequate marine resource management practices. Conceptualization of fish occurrence is vital to the implementation and continuation of policy through ecosystem based management (EBM).

Deliverable 3: Sub-contract for ROV

A contract was negotiated and signed on June 01, 2010 between CSU Monterey Bay and Marine Applied Research and Exploration for the conduct of ROV operations from June 2-10, 2010.