Project Goals and Objectives

Reef Check California (RCCA) is a community-based organization that seeks to improve marine management in CA by providing high quality scientific data to marine resource managers. The final draft of the CA MLPAI Central Coast Study Region MPA Monitoring Plan (Dec. 6, 2006) identifies Reef Check California (RCCA) as a volunteer group already collecting data on the focal species necessary for informing the CDFGs adaptive management of MPAs. RCCA is extremely cost effective because the use of volunteers offsets the significant infrastructure and maintenance costs associated w/ marine monitoring programs. RCCA also fosters a sense of stewardship and creates a constituency supportive of science-based management. RCCA's objectives are:

1. To use highly trained and certified citizen scientists to conduct scientifically robust shallow subtidal baseline characterization of MPAs and reference areas using the RCCA Methodology.
   a. Continue to monitor the abundance of key indicator species annually at 5 existing sites
   b. Add abalone and urchin size distribution surveys to the PISCO SCUBA Project surveys at 10 sites located inside MPAs and associated reference sites
   c. Add full RCCA survey w/in Stewarts Pt. SMR coordinated w/ PISCO (1 site)
2. Build capacity for baseline and future long-term monitoring needs by conducting 1 community training (10 divers/yr) for the first 2 yrs of the project.
3. Coordinate w/ Bodega Marine Lab's Scientific Diver Class to complement their on-going monitoring efforts. This may include integrating some components of RCCA (e.g. fish surveys) into the class similar to models in place at HSU, UCSB and MLML. Continue relationship w/ Sonoma State University Recreational Dive Program and help integrate w/ research faculty.
4. Post all data on web and produce integrated final report w/ collaborators.

Methodology

The RCCA method is recognized by the CDFG in a [Memorandum of Understanding](#) as being useful for informing marine management. RCCA collects data directly comparable and coordinated w/ other subtidal monitoring being conducted. We deploy random (i.e. haphazard) 30 x 2m (x2m for fish) benthic transects to monitor key indicator species of fishes (35 species), invertebrates (32 species, 1 Order), algae (5 species, 4 invasive species), and characterizes the benthos using UPC. Allocation of transects are stratified into inshore (5 -12m) and offshore (12-20m). Three core transects and 6 fish-only transects are conducted in each stratum. A core transect includes a fish, invert., algae, and UPC survey conducted by a dive team on alternate passes. To help increase precision, 6 transects surveyed for fish-only are conducted in each stratum. An RCCA site corresponds to 250 m of linear coastline and is analogous to a PISCO "cell". RCCA conducts 18 fish transects and 6 invert, algae, and UPC transects per site. Surveys include size distribution information for fishes (15 cm bins), abalone, and urchin.

Outcomes and Deliverables

RCCA has been successfully working in the region since 2006 and has strong active partnerships w/ SSU, HSU, regional CDFG staff, and local dive shops which will facilitate effective outreach, collaboration and education of community members. The RCCA Nearshore Ecosytem Database (NED) w/ the required Ecological Metadata Language for the entire dataset will be delivered at the completion of the project. The final report will be developed in coordination w/ collaborators to provide a synthesis of collected data that describes implementation conditions in the NCCSR at both an individual and network scale. A focus of the final report will be to highlight any initial ecological or socioeconomic changes that were detected through the collaborative monitoring and how the implementation of MPAs may have influenced observed trends which will include evaluation in relation to historical datasets when available. Analyses of the efficacy of the metrics in the NCCSR MPA Monitoring Plan using both historical and baseline monitoring datasets when available will also be included. Detailed recommendations for future monitoring will address; spatial design of sampling, temporal frequency, indicator species, and recommendations to build community-based monitoring.

Baseline Monitoring of Ecosystem and Socioeconomic Indicators for MPAs along the North Central Coast of California: Reef Check California

Project Leader(s) and Associated Staff
Cyndi L Dawson, MS -Co-Project Leader will oversee all aspects of project including: training personnel, ensuring grant deliverables are produced on time, serve as primary liaison with other PL's on collaboration (e.g. UCD, PISCO) to ensure maximum coordination and integration of resources, data QA/QC, and finalizing all analysis and synthesis including manuscripts and final report.

Gregor Hodgson, PhD- Co-PL will serve as project advisor and assist with data interpretation.

Project Goals and Objectives
    The goal of the project is to use highly trained and certified citizen scientists to conduct scientifically robust shallow subtidal baseline characterization of MPAs and reference areas using the Reef Check California (RCCA) Methodology. These data will be incorporated into a comprehensive multivariate ecosystem analysis that incorporates 8 of the 9 ecosystem types indentified in the *Draft MPA Monitoring Framework* for the north central coast study region (NCCSR). RCCA Objectives are:

1. Collect scientifically robust kelp and shallow rocky reef ecosystem data at 17 locations in the NCCSR that establish a baseline for adaptive MPA management.
    a. Continue long-term tracking and data collection of key indicator species of fishes (35 species), benthic invertebrates (32 species, 1 Order), algae (5 species, 4 invasive species), and characterization of the benthos using UPC at 5 locations being monitored annually by RCCA inside and outside MPAs. Size structure information are also collected for fishes (15 cm bins), abalone and urchin (nearest cm). These data will be crucial for developing a context of historical trends and establishing a thorough description of the species assemblages and habitats at specific sites. Currently the 5 sites monitored by RCCA are the only known locations in the NCCSR where annual scientific data are collected that includes density information for fishes, invertebrates, algae and substrate composition.
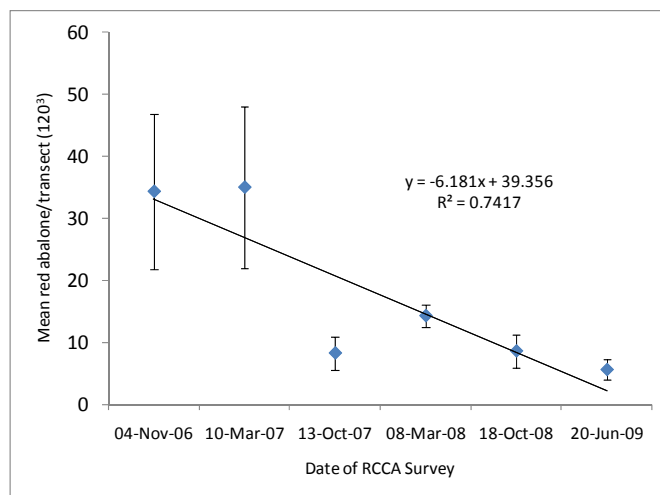

Figure 1. Red abalone (*Haliotis rufescens*) density at Gerstle Cove SMR

    b.   Add fish surveys to the University of California at Davis (UCD) Abalone/Urchin Project surveys being conducted at 5 sites to complement on-going triennial long-term benthic invertebrate monitoring. To increase the ability of the collaboration to assess the ecosystems condition at the time of MPA implementation and ensure maximum cost-sharing fish surveys will be added to the UCD Abalone/Urchin Project surveys. This partnership will help expand the scope of the surveys to comprehensively assess monitored sites for key species of benthic invertebrates, algae, substrate composition and fishes. RCCA monitors 25 of the 28 fishes, whose primary habitats are kelp and shallow rock ecosystems, identified by the MLPA Science Advisory Team as species most likely to benefit from MPAs in the NCCSR. A comparison of results from the UCD Abalone/Urchin Project and RCCA for species monitored by both groups will be conducted at current sites that overlap (n = 4). This comparison will allow for statistical evaluation of the efficacy of both methods to provide data for MPA evaluation and prevent duplication of effort in the future if results indicate data are not different.

    c.   Add abalone and urchin size distribution surveys to the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) SCUBA Project surveys being conducted at 6 sites to expand baseline monitoring to include additional stock assessment data on economically important invertebrate species.

    d.   Add a full RCCA survey within Stewarts Pt. SMR coordinated with PISCO SCUBA Project to increase spatial coverage of baseline characterization and description within that large MPA.

2.   Build capacity for baseline and future long-term monitoring needs by conducting 1 community training (16 divers/yr) each of the first 2 yrs of the project to add to the existing pool of trained and certified RCCA divers in the region. Building the capacity community-based subtidal surveyors within the region will allow RCCA to assess capacity and make detailed recommendations for future long-term monitoring.

3.   Coordinate and develop a partnership with Bodega Marine Lab's American Academy of Underwater Sciences (AAUS) Scientific Diver Class to support their on-going monitoring efforts. This may include integrating some (e.g. fish surveys) or all of the components of RCCA into the class similar to models in place at HSU, UCSB and MLML. Continue relationship with Sonoma State University Recreational Dive Program and help integrate with research faculty on campus.

4.   Post all data within 3 months of collection on the RCCA web-based data viewing and dissemination tool the Nearshore Ecosystem Database (NED, http://ned.reefcheck.org/map.php) and produce integrative final report with collaborators.

    The collaborative proposal of which this project is a part will ensure comprehensive data collection, management and synthesis to provide policy makers with a thorough understanding of the state of the ecosystems in the NCCSR at the time of implementation of the MPAs. Specifically collaborating with the other groups working in the nearshore and shallow rocky reef ecosystems (i.e. PISCO, UCS, Collaborative Fisheries) has allowed us to develop a sample design that eliminates duplication of effort, maximizes cost savings, provides a complete assessment of the ecosystem features identified in the NCCSR Draft MPA Monitoring Plan, focuses effort on species that may respond rapidly to protection (e.g. abalone and urchin) and builds capacity for future long-term monitoring needs.

Rationale

There has been a growing trend in science to use highly trained volunteers to collect scientifically robust data .This approach has been relatively recently been applied to the marine environment specifically to help inform and improve marine resource management (Hodgson 1999, Edgar and Stuart-Smith 2009). The application of this approach in California by the Reef Check to California's kelp forest ecosystems is innovative and has been proven to be highly effective over the past four years. Key accomplishments of the Reef Check CA (RCCA) program to date include: signing of a Memorandum of Understanding with the CDFG recognizing the data collected by RCCA as being useful for informing marine management decisions, successful annual monitoring of over 65 sites statewide from Humboldt to San Diego county and use of RCCA data by Regional Stakeholder groups during the MLPA Initiative process. With the implementation of MLPA regional networks assessments of not just individual MPAs but MPA network functionality requires broad scale data collection at regional levels (Levin et al. 2009, Edgar and Stuart- Smith 2009). The use of highly trained and certified citizen-scientists from local communities significantly increase the capacity of marine resource managers to collect needed assessment data due to the large cost savings provided by volunteer monitoring programs.

The quality of RCCA data has been preliminarily assessed in relation to data collected by the PISCO SCUBA Project along the central coast. The manuscript is in preparation but overall the quality and trends observed by the two programs are remarkably similar.
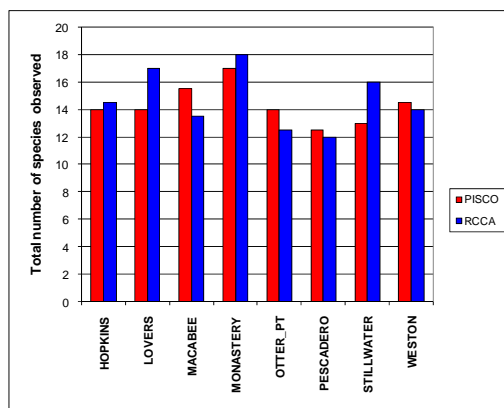

Figure 2. Species richness at central coast sites for invertebrate surveys 2006 - 2007 for species surveyed by both PISCO and RCCA.

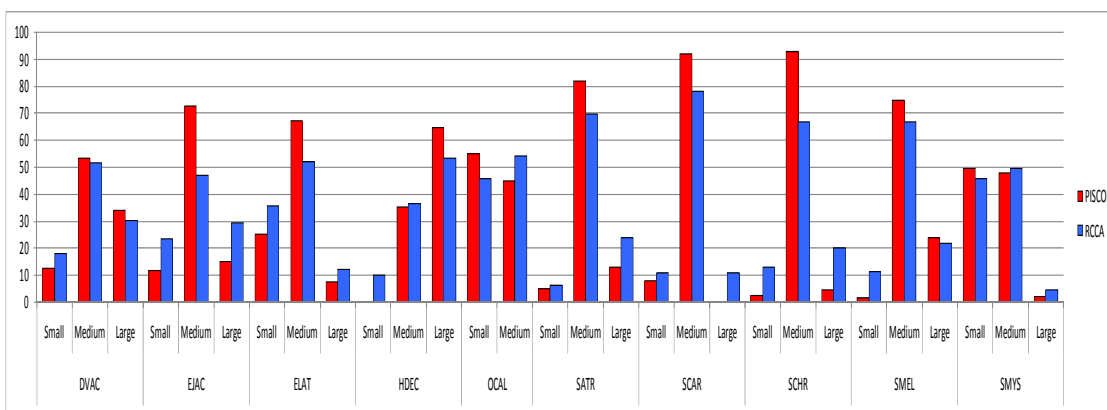

Figure 3. Total percentage of fish counted in each size category (Small = <15cm, Medium = 15-30 cm, Large = >30cm) for 10 most abundant species at 8 sites along the central coast of CA in 2006 and 2007 by RCCA and PISCO. Species are indicated on the x-axis by the first letter of the genus and first three letters of the species name.

Approach to be Used (Plan of Work)

The RCCA methodology is described in the collaborative proposal narrative. Questions addressed by the RCCA Project for the shallow kelp and shallow rock ecosystems include:

- Do the candidate metrics identified by the Draft NCCSR MPA Monitoring Plan provide a comprehensive assessment of MPA performance in relation to MPA goals?
- Are the data collected by RCCA significantly different than those observed by the UCD Abalone/Urchin Project at overlapping existing sites (n= 4)?
- What is the relationship between the estimates produced by alternate methods (e.g. Collaborative Fisheries) to estimates produced by diver surveys?
- Can a subset of organisms be selected through statistical methods to assess the performance of MPAs at an individual and regional network scale?
- What are realistic temporal and spatial scales for long-term monitoring in the NCCSR based on ecological data needs and capacity in the region?

The final report will include trophic level analyses to help identify key indicator species for future long-term monitoring (Figueira et al. 2009, Levin et al. 2009, Jones and Kaly 1996). This may include modeling to identify organisms that will be useful in assessing both individual and network wide MPA performance. Both univariate and multivariate approaches will be applied. Some key factors included in models will be: protection status, rugosity, substrate composition, length of time protected, total abundance of invertebrates, and biomass of fishes. Fish biomass will be calculated using standard length-weight relationships for each species obtain from the published literature. For species where this information is unavailable relationship of the lowest taxon in relation to the species will be used. The midpoint of each size category (<15 cm, 15-30 cm, >30cm) will be used to calculate biomass. Additional analyses will be conducted to compare data collected by RCCA and UCD Abalone/Urchin Project to identify overlaps in effort and compare precision among projects where applicable including Bray-Curtis similarity indices and testing for differences among CVs, species richness, abundance, and size distributions.

The Lessons Learned from the MLPA Initiative North Central Coast Study Region Report (Oct., 2008) identifies increased responsibilities for the CDFG: for monitoring and evaluation to meet MLPA requirements, for public education about new MPAs, and for enforcement. RCCA has components in place that will help assist with the completion of these tasks. RCCA Trainings in the region will focus on educating the public about the need for public participation in long-term monitoring, the MLPA Initiative and the newly adopted MPAs in the region. The availability of RCCA data in near real time in our user friendly web-based data viewing and dissemination tool the Nearshore Ecosystem Database (NED, http://ned.reefcheck.org) will provide on-going updates to constituents on the monitoring of the MPA network. Outreach will be conducted via public presentations describing NED to make interested parties aware of easy and comprehensive access to the monitoring data of their MPAs.

Outcomes and Deliverables

Yearly progress reports will be provided for the first two years of the project that explicitly outline the progress on the grant and link directly to the milestone chart as well as include updated budget information. The RCCA Nearshore Ecosystem Database (NED) with the required Ecological Metadata Language for the entire Reef Check dataset statewide will be delivered to the ME at the completion of the project. The final report will be developed in coordination with collaborators to provide a synthesis of collected data that clearly describes implementation conditions in the NCCSR at both an individual MPA and network wide scale. A focus of the final report will be to highlight any initial ecological or socioeconomic changes that were detected through the collaborative monitoring and how the implementation of MPAs may have influenced observed

trends. This will include evaluating observations in relation to historical datasets when available. An appendix of the final report will include a comparison of RCCA and UCD Abalone/Urchin Project data. The final report will also include analyses of the efficacy of the metrics in the NCCSR MPA Monitoring Plan using both historical and baseline monitoring datasets when available. Detailed recommendations for future monitoring will address: spatial extent, temporal frequency, indicator species, and recommendations to build and maintain community-based monitoring.

TASKS AND MILESTONES	2010 J	F	M	A	M	J	J	A	S	O	N	D	2011 J	F	M	A	M	J	J	A	S	O	N	D	2012 J	F	M	A	M	J	J	A	S	O	N	D
Hire North Central Coast Volunteer Coordinator	x																																			
Develop Metadata for exisiting database	x	x																																		
Train NCC Central Coast Volunteer Coordinator		x	x																																	
Purchase supplies for training and survey season				x													x																			
NCC Volunteer Coordinator attends CDFG Volunteer Diver Training				x																																
PLs attend collaborators meeting at UCSC			x														x																x		x	
Outreach presentations by NCC Volunteer Coordinator to help fill training				x	x												x	x	x																	
Complete RCCA Community Training						x																x														
Assist with academic classes (BML, SSU, & HSU)				x	x			x	x								x	x			x	x														
Conduct RCCA SCUBA surveys				x			x	x	x								x			x	x	x														
Data entry and QA/QC				x			x	x	x	x	x	x	x				x			x	x	x	x	x	x											
Develop report queries and distrbute data										x	x	x														x	x	x								
Final report analyses																													x	x			x	x		
Deliver database w/corresponding metadata to ME																																	x			

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