Principal Investigators - please use this form to submit your MPA Baseline Program project annual report, including an update on activities completed over the past year and those planned for the upcoming year. This information will be used by the MPA Baseline Program Management Team to track the progress of individual projects, and will be provided to all MPA Baseline Program PIs and co-PIs prior to the Annual PIs workshop to facilitate discussion of project integration. Please submit this form to California Sea Grant when complete (sgreport@ucsd.edu, Subject [Award Number, project number, PI, "Annual Report"].)

Project Information	
Project Year 1	**MLPA Region** North Coast

Project Title & Number: Baseline Characterization of Rocky Intertidal Ecosystems for MPAs along the North Coast of California, R/MPA-33: Invertebrate and Algal Diversity Surveys.

PI name: Pete Raimondi

Co-PI name:

PI Contact Info

Co- PI Contact Info

(please list additional PIs and contact info in the "Project Personnel" section if necessary)

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Address

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Email:

Phone: 831-459-5674

Phone:

Project Goals & Objectives

The objectives of this project are to:

1) Produce a baseline characterization of rocky intertidal ecosystems in four of the newly established Marine Protected Areas (MPAs) in the North Coast Study Region (NCSR). 2) Provide a quantitative comparison between rocky intertidal ecosystems in these MPAs and associated reference areas in the NCSR. 3) Explore baseline characterizations for potential indicators of the state of rocky intertidal ecosystems using newly collected data along with existing PISCO datasets of the region. 4) Integrate these assessments with other components of the baseline survey (kelp forests, sandy beaches, collaborative fisheries, etc.). 5) Generate a fish biodiversity baseline within rocky intertidal habitats. 6) Monitor and characterize rockfish recruitment in tidepool habitats.

These objectives will be met using a combination of survey methods including invertebrate and algal diversity surveys (Raimondi), invertebrate and algal focal species surveys (Craig/Tyburczy/Laucci), fish diversity and settlement surveys (Kinziger/Tyburczy), and high-resolution topographic surveys (Aiello).

Invertebrate and algal diversity surveys will be conducted at each of 12 sites over the course of Years 1 and 2. A combination of point-contact surveys, quadrat counts, and swaths along vertical transects will be used to quantify the abundance and distribution of invertebrate and algal species at both the MPA and reference sites. These surveys follow a set of established Biodiversity Survey protocols that have been used for baseline characterization of the South Coast, Central Coast, and North Central Coast study regions.

Summary of Project Activities Completed to Date

Overview of Project Year 1 Activities, including progress towards meeting goals & objectives

We conducted Biodiversity Surveys at six rocky intertidal sites within the NCSR:

Site	Sample Date	MPA Status	Latitude	Longitude
False Klamath Cove	May 2014	reference	41.594264	-124.105328
Pyramid Point	May 2014	SMCA	41.989841	-124.209304
Point St. George	May 2014	reference	41.784644	-124.255127
Kibesillah Hill	June 2014	reference	39.604132	-123.788848
Shelter Cove	June 2014	reference	40.022741	-124.073876
Endert's Beach	July 2014	reference	41.695681	-124.143617

We established and sampled three additional Biodiversity sites within the NCSR as part of a separate Area of Special Biological Significance (ASBS) project:

Site	Sample Date	MPA Status	Latitude	Longitude
Mal Coombs	July 2014	reference	40.021697	-124.068250
Launcher Beach	August 2014	reference	41.057155	-124.145319
Old Home Beach	August 2014	reference	41.055273	-124.136830

We also conducted ongoing long-term monitoring surveys (MARINe/PISCO), including focal species sampling, at the following sites:

Site	Sample Date	MPA Status	Latitude	Longitude
Enderts	May 2014/Dec. 2014	reference	41.6957	-124.1436
Damnation Creek	May 2014/Dec. 2014	reference	41.6530	-124.1301
False Klamath Cove	May 2014/Dec. 2014	reference	41.5943	-124.1053
Kibesillah Hill	June 2014	reference	39.6041	-123.7888
Shelter Cove	June 2014	reference	40.0227	-124.0739
Cape Mendocino	June 2014	reference	40.3412	-124.3630

MPA Baseline Program Annual Report

Highlights from project progress so far, such as successes achieved, new collaborations or partnerships, or interesting stories from the past year that may be suitable for a blog post or other media venue

> The Year 1 field season was very successful. We established six new Biodiversity sites and resampled three existing Biodiversity sites within the NCSR as part of this project and a separate ASBS project. Collaboration between the UCSC, HSU, and MLML field teams has been successful with coordinated and cooperative field sampling. We continued to maintain strong partnerships with the National Park Service and California State Parks for access and support sampling several of these sites.

Description of any unforeseen events and substantial challenges, and resulting effects on project activities and progress. Please indicate any issues that may affect other PI's or require coordination with other Baseline partners (e.g., ME, DFG, Sea Grant).

> We are unable to establish a site within Double Cone SMCA due to private property access issues.

Data status (i.e., paper/raw format or digitized; if digitized, what format?)

> We have entered all data from Year 1 and data are currently in raw format (.xls spreadsheets). We are in the process of QA/QC for this dataset.

Activities Planned for following Project Year 1 (if applicable) – *Please describe remaining work and approximate timelines for completing that work, including any anticipated budget variances necessary to complete the project.*

We will conduct Biodiversity Surveys at the six remaining rocky intertidal sites in Spring/Summer 2015:

Site	Proposed Sample Date	MPA Status	Latitude	Longitude
Damnation Creek	May 2015	reference	41.6530	-124.1301
Palmers Point	May 2015	reference	41.1382	-124.1645
Abalobadiah	June 2015	SMR	39.5700	-123.7735
Fort Bragg	June 2015	reference	39.4392	-123.8184
MacKerricher	June 2015	SMCA	39.4703	-123.8084
Cape Mendocino	June 2015	reference	40.3412	-124.3630

We will also conduct ongoing long-term monitoring surveys (MARINe/PISCO), including focal species sampling, at the following sites:

Site	Sample Date	MPA Status	Latitude	Longitude
Enderts	May 2015/Dec. 2015	reference	41.6957	-124.1436
Damnation Creek	May 2015/Dec. 2015	reference	41.6530	-124.1301
False Klamath Cove	May 2015/Dec. 2015	reference	41.5943	-124.1053
Kibesillah Hill	June 2015	reference	39.6041	-123.7888
Shelter Cove	June 2015	reference	40.0227	-124.0739
Cape Mendocino	June 2015	reference	40.3412	-124.3630

Following the completion of the field season we will complete data entry, conduct QA/QC, and begin analysis of the dataset.

Project Personnel – *Please indicate additional project personnel involved in your MPA baseline project, including students and volunteers, or additional PI contact information if necessary, as well as the nature of their assistance in the project project.*

	Students Supported	Student Volunteers	Nature of Assistance
K-12			
Undergraduate		1	Field sampling
Masters			
PhD			

Number of other Volunteers not counted above and the nature of their assistance in the project:

Additional PI contact info not listed on first page:

Sean Craig (HSU), sean.craig@humbolt.edu

Joe Tyburczy (CA Sea Grant), jtyburczy@ucsd.edu

Andrew Kinziger (HSU), andrew.kinziger@humbolt.edu

Rosa Laucci (Smith River Rancheria), Rosa.Laucci@tolowa.com

Ivano Aiello (MLML), ivano.aiello@sjsu.edu

Cooperating Organizations and Individuals - *Please list organizations or individuals (e.g., federal or state agencies, fishermen, etc.) that provided financial, technical or other assistance to your project since its inception, including a description of the nature of their assistance.*

Name of Organization or Individual	Sector (City, County, Fed, private, etc.)	Nature of cooperation (If financial, provide dollar amount.)
National Park Service	Federal	Site access and field assistance
California State Parks	State	Site access and field assistance

Project Outputs and Materials: *Please provide any other project-relevant information, such as descriptions of attached materials, media coverage your project has received, presentations, publications, images etc.*

Principal Investigators - please use this form to submit your MPA Baseline Program project annual report, including an update on activities completed over the past year and those planned for the upcoming year. This information will be used by the MPA Baseline Program Management Team to track the progress of individual projects, and will be provided to all MPA Baseline Program PIs and co-PIs prior to the Annual PIs workshop to facilitate discussion of project integration. Please submit this form to California Sea Grant when complete (sgreport@ucsd.edu, Subject [Award Number, project number, PI, "Annual Report"].)

Project Information	
Project Year	2014
MLPA Region	North Coast

Project Title & Number

North Coast MPA Baseline R/MPA 33D

PI name	Ivano Aiello
Co-PI name	

PI Contact Info

Co- PI Contact Info

(please list additional PIs and contact info in the "Project Personnel" section if necessary)

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Phone	

Project Goals & Objectives

The goal of this work is to assess the relationship between geology of the rocky substratum and distribution and abundance of intertidal species. The primary product of the work will be a layered GIS based 3 dimensional map of species and habitat for each sampled site. Such linked geospatial/biodiversity maps and datasets will allow broader understanding of the ecology of different species, and serve as a basis for assessment of change resulting from (as examples) sea level rise, temperature variation and change in wave climate due to both climate change and potential wave energy arrays.

The objective is to determine the relationships between geology of the rocky substratum and intertidal ecology in 10 key areas of coastal northern California using Terrestrial Laser Scanning (TLS), a new mapping technology that allows multi-scale geospatial surveys over spatial scales ranging between cm to hundreds of meters, high resolution (0.01 m), accuracy (<0.005m), and repeated survey feasibility, and the ability to collect thousands of high-resolution topographic data points.

As part of the proposed work Dr. Aiello's lab, will map at high resolution 10 separate rocky intertidal outcrops, with each survey area covering approximately ~50*20m.

The proposed work for each survey site includes:

1) Use of Global Navigation Satellite System (GNSS) receivers to establish project controls relative to the existing National Geodetic Survey (NGS) monuments and Continuously Operating Reference Stations (CORS). We will use static differential GPS (DGPS) technology which will yield horizontal and vertical accuracies of about 1". Vertical controls are based upon the North American Vertical Datum of 1988 and for the elevations we will use the Geoid 12A model. Permanent benchmarks will be established for each project control.

2) Field survey are carried out with a Trimble VX, a state-of-the-art Spatial Station equipped with Infrared (IR) Direct Reflex (DR) technology. Survey will be done at ~5cm resolution and from at least two separate fore-sights for a total of ~400,000 points per site (roughly 12 hours of point collection) using direct reflex.

3) Survey data post-processing is done using Trimble's Realworks Advanced 6.5 software. Post-processing operations includes point cloud "cleaning" and survey registrations (for surveys collected form multiple fore-sights).

Summary of Project Activities Completed to Date

Overview of Project Year __ Activities, including progress towards meeting goals & objectives

During the period under consideration we performed, multi-scale, high-resolution topographic surveys and 3D data post-processing and interpretation of 5 rocky intertidal sites in Northern California: Point S. George, Kibesillah Hill, Shelter Cove, False Klamath Cove and Pyramid Point site.
The surveys were carried out using a Trimble VX terrestrial laser scanner which uses Infrared laser and robotic technology in order to measure rock surface morphology at scales ranging between centimeter to meters and produce digital elevation models (DEMs) of the terrain.

For each of the 5 survey sites we established a geodetic framework of benchmarks using a differential GPS and, based on the overall geomorphological characteristics of the outcrop, we established one or two fore-sights from which the surveys were conducted plus one or two back-sights to orient the instrument.
Moreover, 4 or more ground control points were established. The controls were used to match surveys done from different fore-sights.

Each site survey consisted of approximately 2 days of field work. During day one we established the benchmarks, collected georeferenced digital photomosaics of the outcrops and collected single point measurements of the transect tapes used for the ecological survey done in parallel by Dr. Raimondi's team (co-Pi in this project). Day 2 was devoted to high-resolution scanning and the collection of approximately 75,000 survey points per site.
Field reconnaissance was also done to establish the main lithologies and structural features present in the survey area as well as to collect hand samples for future lab analyses.

The survey data collected with the Trimble VX have been then post-processed using Trimble's RealWorks, a proprietary 3D software that allows cleaning and registration of the topographic data points and, ultimately, the creation of high-resolution (cm) DEMs of each of the survey sites.
The DEM were further analyzed to ascertain what are the main geomorphologic characteristics of different rocky intertidal outcrops surveyed, how they change form site to site and between sites having different lithological and/or structural characteristics.
Two main geomorphological parameters have been selected to model the surface characteristics of the rocky intertidal outcrops: 1) "Surface roughness" or root mean squared error (RMSE) of points from an interpolated surface defined by a linear polynomial function; 2) "Relief" or Surface to Planar ratio (S:P).
Using ArcGIS, RMSE and S:P were measured for virtual quadrates created at 5 scales ($0.1m^2$, $0.5m^2$, $1m^{\wedge2}$, $5m^{\wedge2}$, $10m^{\wedge2}$).

MPA Baseline Program Annual Report

Highlights from project progress so far, such as successes achieved, new collaborations or partnerships, or interesting stories from the past year that may be suitable for a blog post or other media venue

I already posted a blog about this project presenting the excitement, challenges and new results in the Ocean Space website (blog on February 23rd 2015)

Description of any unforeseen events and substantial challenges, and resulting effects on project activities and progress. Please indicate any issues that may affect other PI's or require coordination with other Baseline partners (e.g., ME, DFG, Sea Grant).

Nothing to report

Data status (i.e., paper/raw format or digitized; if digitized, what format?)

The interpretation of the geomorphologic data is still in progress.

The preliminary results of this study were presented at the Fall 2014 AGU Meeting in San Francisco by Dr. Aiello's graduate student Ashley Wheeler:

Wheeler and Aiello, 2014, Predicting multi-scale relationships between geomorphology and bedrock geology of the rocky intertidal in Central and Northern California. AGU Meeting, San Francisco, Fall 2014. Abstract #EP41B-3531.

Activities Planned for following Project Year __ (if applicable) – *Please describe remaining work and approximate timelines for completing that work, including any anticipated budget variances necessary to complete the project.*

In Summer 2015 we are planning on surveying the 5 remaining sites and post-process and analyze the DEM data during the Fall.

Project Personnel – *Please indicate additional project personnel involved in your MPA baseline project, including students and volunteers, or additional PI contact information if necessary, as well as the nature of their assistance in the project project.*

	Students Supported	*Student Volunteers*	*Nature of Assistance*
K-12			
Undergraduate			
Masters	*Ashley Wheeler*		
PhD			

Number of other Volunteers not counted above and the nature of their assistance in the project:

Additional PI contact info not listed on first page:

Cooperating Organizations and Individuals - *Please list organizations or individuals (e.g., federal or state agencies, fishermen, etc.) that provided financial, technical or other assistance to your project since its inception, including a description of the nature of their assistance.*

Name of Organization or Individual	Sector (City, County, Fed, private, etc.)	Nature of cooperation (If financial, provide dollar amount.)

Project Outputs and Materials: *Please provide any other project-relevant information, such as descriptions of attached materials, media coverage your project has received, presentations, publications, images etc.*