**MPA Baseline Program**

**Annual Progress Report**

*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** | *Oceanographic context for baseline characterization and future evaluation of MPAs along California's North Coast* | | |
| **PI name** | Eric P. Bjorkstedt | **Co-PI name** | |

**PI Contact Info**

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

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|---|---|---|---|
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| **Phone** | 707.826.3688 | **Phone** | |

**Co- PI Contact Info**

**Project Goals & Objectives**

The goals and objectives of this project are to (1) extract and assemble data relevant to the North Coast Study Region and waters to the north, south, and offshore (hereafter referred to collectively as the NSCR) from existing long-term oceanographic and climatic data sets as well as while more recently developed sources of ocean information (e.g., HF radar and data-assimilative oceanographic circulation models), (2) derive oceanographic products (e.g., multivariate indices) on multiple spatial and temporal scales relevant to evaluating MPA performance, and (3) serve the NCSR baseline monitoring community directly by making these results available and interpretable to colleagues conducting ecological field surveys.

The overall purpose of this work is **to provide critical contextual information** for understanding conditions leading up to and influencing present ecosystem status and to set the stage for interpreting changes in ecosystem status related to MPA implementation. A key goal is for results from this work to have immediate applicability and be of great interest to managers and researchers involved in MPA studies and marine sciences throughout the NCSR.

**Summary of Project Activities Completed to Date**

*Overview of Project Year _1_ Activities, including progress towards meeting goals & objectives*

Over the course of the first year of this project, we have accomplished the following:

1) Extraction of data relevant to the NCSR from a diverse range of observational time series from *in situ* sensors (shore stations, buoys, river gages, meteorological stations, etc.)

2) Development of a preliminary version of a Multi-variate Ocean Climate Index (MOCI) for the NCSR. This index has been furthern analyzed to distinguish seasonal and spatial structure in the oceanographic conditions, and ongoing analysis of this index focuses on characterizing the interplay of factors affecting marine ecosystems in this region.

3) Extraction of data from several sources of satellite-borne remote sensing data, focused on characterizing variability in ocean conditions within a strip of coastal waters that span the MPAs and reference sites within the NCSR. Work on this aspect of the project has recently been accelerated by development of a new R package (xtractomatic) by Roy Mendelssohn at NMFS/SWFSC/ERD that is designed to facilitate extraction of these data from large files housed on remote servers; this project is providing ample opportunity for beta-testing xtractomatic, while benefitting from access to the new and improved code.

4) Extraction and synthesis of flow metrics based on surface current fields observed with HF radar. Metrics of alongshore flow within coastal and offshore regions have been or are being developed for various points along the coast as a measure of energy and transport in the California Current (a correlate of ecosystem productivity in the system). Existing indices from HF-radar are also integrated in MOCI.

5) Analysis of hydrographic and plankton survey data from the Trinidad Head Line. Although sampling is not supported by this project, we have worked to bring these data to bear in describe variability in ocean conditions affecting the NCSR, particularly in light of the unusual warming event of 2014 and emerging El Niño conditions. Zooplankton data in particular provide information on ecosystem productivity and some basis for understanding conditions that may affect recruitment and energy supply to MPAs and other coastal habitats.

6) Although originally struck from our proposal during the budget negotiations, we have proceeded with planning for an informal 'oceanographic context' workshop to initiate broader communication and collaboration with colleagues engaged in baseline ecosystem studies. This workshop will be held in the coming months and is designed to provide an introduction to existing products and to gage needs and opportunities for ongoing support, as well as to provide an opportunity for synthetic work within our group.

*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*

Oceanographic indicators, including MOCI and indices of copepod community structure, captured the arrival of the 'warm blob' and associated warming conditions, and their effects on marine ecosystems of coastal waters. The signal appears to be driven largely by the arrival of warm waters in the fall and winter, rather than substantially reduced upwelling, and has resulted in temperatures several degrees warmer than normal. Direct ocean observations (from work funded independently of this project) also revealed a much more southern, warm-water plankton assemblage off the NCSR. How this has affected ecosystems being monitored in the MPAs and reference sites is uncertain, but we expect that some aspects of the baseline characterization will reflect these unusual and unprecedented conditions rather than the 'normal' (if one can say that) climatological conditions previously observed on the North Coast.

*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).*

The warming event of 2014 and emerging El Niño have posed challenges to this project, in that they have required rapid diversion of energy from funded personnel to the monitoring and analysis of these dynamics, even as we work to integrate this information into the oceanographic context for Baseline Studies of the NCSR. In addition, prior to engagement with NMFS/SWFSC/ERD in the testing of xtractomatic noted above, we faced substantial challenges in obtaining what we expected to be readily-served oceanographic data sets; discussion with ERD colleagues revealed that their servers are heavily taxed and often overwhelmed by incoming requests (from users with poorly designed refresh schedules, query builders, etc.); access to xtractomatic has improved the efficiency of our data calls, and greatly reduced the frequency with which we are encountering server errors.

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

Data assembled to date and indices (e.g., MOCI) are all in digital format. Preliminary results for analyses through 2014 are ready to be uploaded to OceanSpaces.

**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.*

Planned activities include

1) Updating time series of data relevant to the NCSR extracted from a diverse range of observational time series from *in situ* sensors (shore stations, buoys, river gages, meteorological stations, etc.) through 2015

2) Refinement, updating, and ongoing analysis of the Multi-variate Ocean Climate Index (MOCI) for the NCSR through 2015, including development of MOCI for regions north and south of Cape Mendocino (at least as far as the data will support doing so).

3) Completion of extraction and analysis of satellite remote sensing data for the NCSR, including optimally interpolated fields.

4) Completion of extraction and analysis of flow metrics based on surface current fields observed with HF radar.

5) Extraction of comparable transport and tracer fields from data-assimilative ROMS circulation models and corroboration of model results with observational time series in order to explore the potential for using model results to understand factors such as transport that may structure ecosystems within the NCSR.

6) Ongoing analysis of hydrographic and plankton survey data from the Trinidad Head Line (data collection supported with independent funding), and formal integration of these time series into the oceanographic context for the NCSR.

7) Conducting an informal 'oceanographic context' workshop as described above to provide an introduction to existing products and to gage needs and opportunities for ongoing support, as well as to provide an opportunity for synthetic work within our group.

Some of these activities have required modest changes to the budget (which have been approved) to support staff directly involved in these efforts. We anticipate that future adjustments may be necessary, but will be small.

**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* | | | |
| *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:*

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Brian Tissot (tissot@humboldt.edu), Humboldt State University Marine Laboratory, PO Box 690, Trinidad, CA 95570 (707-826-5827)

**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.)* |
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**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.*