

# UC San Diego

## Research Final Reports

### Title

Patch Dynamics of Nutrients, Fecal Indicator Bacteria and Chlorophyll near the Tijuana River

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California Sea Grant College Program
Final Report

Project Information

Year Grant No.: NA08OAR4170669
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Title Patch dynamics of nutrients, fecal indicator bacteria and chlorophyll near the Tijuana River

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Project Hypothesis

The overall project goal is improved understanding of the physical and biological controls on nearshore (0-15 m water depth) patchiness of nutrients, fecal indicator bacteria (FIB) and chlorophyll (chl) near the Tijuana river.

Project Goals and Objectives

High resolution (meters) data of surface chl, temp, salinity turbidity were obtained with a unique jetski sampling platform. The vertical structure of chl, optical nitrate, temperature and salinity will be observed with wirewalker moorings, water sampling and CTD casts from a small boat. Offshore forcing (internal tide, upwelling) and tidal flushing will be related to observations of nutrient, FIB and chl patchiness. The proposed work will assist in managing coastal pollution (California Seagrant Strategic plan, 2006-2010) by addressing the following objectives: \* Identify sources of nearshore nutrients, and their contribution to the cross-shore phytoplankton gradient and red tides.

Briefly describe project methodology

The proposed biological observations will augment NSF and ONR awards supporting physical of surfzone dispersion and transport at Imperial Beach CA in Fall 2009 (IB09). The physical data, including cross- and along-shore array observations of currents, pressure and temperature, and observations of dye dilution, will provide useful background information. We propose to supplement the physical data with biology-related observations on scales relevant to the physical nearshore processes (meters to kilometers, hours to weeks). An existing jetski platform will be used

to create near-synoptic maps of chl, temperature and salinity in the surfzone (where wave-breaking prevents small boat access). Further offshore, but within 10km of shore, FIB, chl and oceanographic conditions will be monitoring with bottle samples, fixed moorings and hydrographic casts. Comparison of FIB and dye concentrations will allow estimation of the relative importance of solar-induced mortality and dispersion in controlling surfzone FIB levels. FIB sources will be identified, in collaboration with the Tijuana River Bacterial Source Identification Study (Weston Solutions Inc.). The role of transport, diffusion, solar irradiance and particle attachment in determining the fate of pathogenic bacteria at Imperial Beach will be explored. The data will provide highly resolved, 3 dimensional observations of chl, nitrate and fluid dynamics over the 4 week experiment.

**Describe progress and accomplishments toward meeting goals and objectives.**

The major field work was in year 1 (the IB09 experient) and data QC took place subsequently in years 1-2. Two presentations by graduate students Rippy and Omand were be made at the 2010 ASLO/AGU ocean sciences conference. All the nutrient samples were analyzed. All the water samples have been processed for phytoplankton species identification, led by graduate student Omand. IB09 fecal indicator bacteria (FIB), turbidity, and photosynthetically active radiation (PAR) data were analyzed, by graduate student Rippy. A high correlation between fine sediments and FIB concentration was observed during the early stages of IB09, which may suggest that sediments (possibly from a nearby beach nourishment experiment) were a source of FIB during this time. Surfzone light penetration (PAR) near the beach nourishment was low relative to light penetration elsewhere. FIB mortality experiments performed in the surfzone sediment plume emitting from the beach nourishment suggest that solar radiation was not a significant factor influencing FIB mortality rates in the plume. This could suggest that the fine sediments in the plume were not only a source of FIB, but acted to shield FIB from solar radiation, which has repeatedly been found to be a dominant source of FIB mortality in prior laboratory and field experiments. Although the project has officially ended, analysis of the IB09 data set is ongoing.

**PROJECT MODIFICATIONS: Explain briefly any substantial modifications in research plans, including new directions pursued and ancillary research topics developed. Describe major problems encountered and how they were resolved.**

**PROJECT OUTCOMES: Briefly describe data, databases, physical collections, intellectual property, models, instruments, equipment, techniques, etc., developed as a result of this project and how they are being shared.**

A large data set was acquired during the IB09 experiment covering many physical quantities (waves, currents, temp) to biological ones (nutrients, bacteria concentration, phytoplankton species ID). This project led to 5 journal publications by former SIO graduate students Melissa Omand (defended in 2011) and Meg Rippy (defended in 2012).

**IMPACTS OF PROJECT: Briefly describe how this project has contributed to a discipline; to developing human resources; to developing physical, institutional or information resources; technology transfer; and society beyond science and technology. Please notify CASG of impacts that occur after your project ends; CASG may contact you after your project ends to learn about additional impacts that occur over time.**

improved understanding of the factors controlling nearshore phytoplankton blooms and fecal indicator bacteria

**BENEFITS, COMMERCIALIZATION, AND APPLICATION OF PROJECT RESULTS: Please list any companies, agencies, organizations or individuals who have used your project results, scientific/technical advice, etc., and provide names, emails and phone numbers. Briefly describe how results were used and quantify results and socioeconomic benefits, if possible.**

none

**ECONOMIC BENEFITS generated by discovery, exploration and development of new, sustainable coastal, ocean and aquatic resources (i.e., aquaculture, marine natural products, foods, pharmaceuticals).**

Issue-based **forecast capabilities** to predict the impacts of a single ecosystem stressor, developed and used for management (i.e., climate change, extreme natural events, pollution, invasive species, and land resource use).

none

**Tools, technologies and information services** developed (i.e., land cover data, benthic habitat maps, environmental sensitivity index maps, remote sensing, biosensors, AUVs, genetic markers, technical assistance, educational materials, curricula, training).

**Publications (list in appropriate category below) Each listing should be a stand-alone bibliographic reference, including all authors' names. For each Publication type, specify title, authors, date and journal details, where appropriate (repeat headers as necessary).**

**Technical Reports**

Title	Authors	Date

**Conference Papers, Proceedings, Symposia****Peer-reviewed journal articles or book chapters**

<b>Journal</b>	Limnology and Oceanography	<b>Issue Num</b>	Vol 56	<b>Page Num</b>	787-801	<b>Date</b>	2011
<b>Title</b>	Physical and biological processes underlying the sudden appearance of a red-tide surface patch in the nearshore	<b>Authors</b>	Omand, M., J. J. Leichter, P. Franks, R. T. Guza, A. J. Lucas, and F. Feddersen				
<b>Journal</b>	Limnology and Oceanography	<b>Issue Num</b>	Vol 57,	<b>Page Num</b>	1673	<b>Date</b>	2012
<b>Title</b>	Episodic vertical nutrient fluxes and nearshore phytoplankton blooms in Southern California	<b>Authors</b>	Omand, M., F. Feddersen, R. T. Guza, and P. Franks				
<b>Journal</b>	Marine Pollution Bulletin	<b>Issue Num</b>	66	<b>Page Num</b>	151-157	<b>Date</b>	2013
<b>Title</b>	Factors controlling variability in nearshore fecal pollution: Fecal indicator bacteria as passive particles	<b>Authors</b>	Rippy, M. A., P. J. S. Franks, F. Feddersen, R. T. Guza, D. F. Moore				
<b>Journal</b>	Marine Pollution Bulletin	<b>Issue Num</b>	66	<b>Page Num</b>	191-198	<b>Date</b>	2013
<b>Title</b>	Factors controlling variability in nearshore fecal pollution: The effects of mortality	<b>Authors</b>	Rippy, M. A., P. J. S. Franks, F. Feddersen, R. T. Guza, D. F. Moore				
<b>Journal</b>	Environmental Science and Technology	<b>Issue Num</b>	submi	<b>Page Num</b>		<b>Date</b>	2013
<b>Title</b>	Beach Nourishment Impacts on Bacteriological Water Quality and Phytoplankton Bloom Dynamics	<b>Authors</b>	Rippy, M. A., P. J. S. Franks, F. Feddersen, R. T. Guza, J. A. Warrick				

**Non-peer Reviewed Reprints****Publications, Brochures, Fact Sheets****Books & Monographs****Handbooks, Manuals, Guides****Electronic publications:** (non-print formats).**Maps, Charts, Atlases****Theses, dissertations**

Physical and Biological Dynamics of Surfzone Bacterial Pollution: Sources, Transports, and Removal Mechanisms	Megan Rippy	Scripps Institution of Oceanography, UCSD	2012	▲
Physical controls on episodic nearshore phytoplankton blooms in Southern California	Melissa Omand	Scripps Institution of Oceanography, UCSD	2011	▼

**Newsletters, periodicals****Program reports (annual/biennial, strategic plans, implementation plans)****Educational Documents****Topical Websites and Blogs****Miscellaneous documents (not listed above).**

**MEDIA COVERAGE:** Select 'Yes' or 'No'. If yes, describe any radio, TV, web site, newspaper, magazine coverage your project has received. Send original clippings or photocopies to the Sea Grant Communications Office.

\* Union Tribune Section B cover story on Sept 22 2009

**MEDIA NOTES:** Brief description of the type media coverage your project has received.

**DISSEMINATION OF RESULTS:** List any other ways in which results of your project have been disseminated. Indicate targeted audiences, location, date and method.

\* Oct 2012, 2011, 2010: co-hosted the SurfScience Teen Conference at SIO for 40-60 high school students

**WORKSHOPS AND PRESENTATIONS: A brief description of location, date, time, topic, number of attendees and name of presenter.**

**COOPERATING ORGANIZATIONS: List those (e.g., county or state agencies, etc.) who provided financial, technical or other assistance to your project since its inception. Describe the nature of their cooperation.**

**Federal Organizations**

USGS

**Regional Organizations**

Tijuana Estuary Research Reserve

**State Organizations**

**Nongovernment Organizations**

Wildcoast

**International Organizations**

**Industry Organizations**

**Academic Organizations**

Scripps Inst. of Oceanography, UCSD

**Sea Grant Organizations**

**Other Organizations**

**INTERNATIONAL IMPLICATIONS: Does your project involve any colleagues overseas or have international implications?**

**AWARDS: List any special awards or honors that you, or any co-project leaders, have received during the duration of this project.**

**KEYWORDS: List keywords that will be useful in indexing your project.**

**PATENTS: Please list any patents or patent licenses that have resulted from this project, and complete the patent statement form available on the web site.**

**NOTES: Please list any additional information in the notes area**

**FOR ALL STUDENTS SUPPORTED BY THIS GRANT, PLEASE LIST:**

Volunteer Count 4

Graduate Student Info