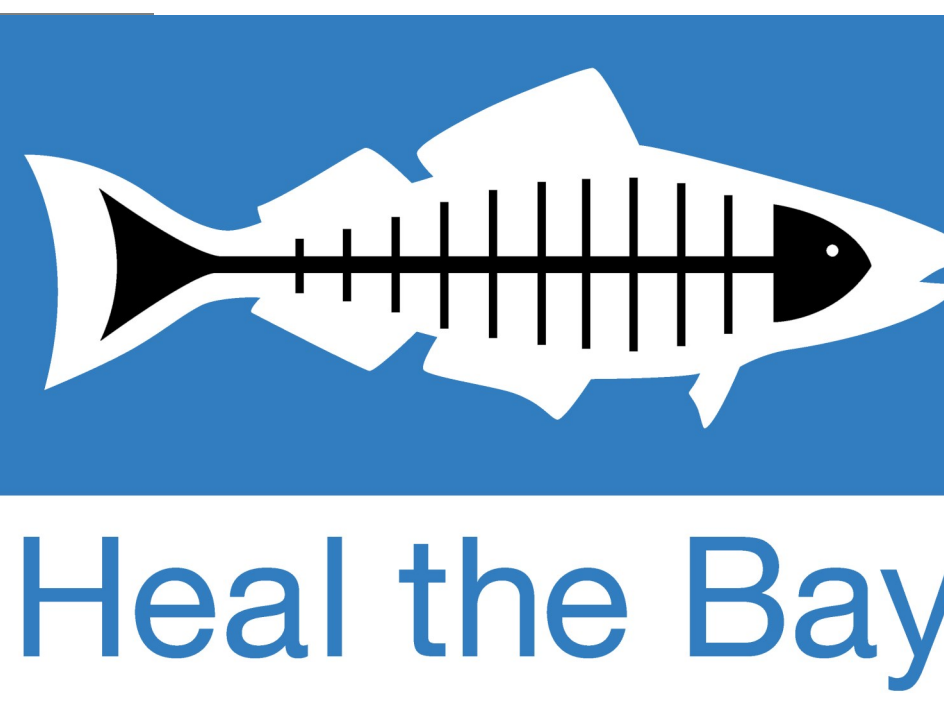




Heal the Bay's Beach Report Card®

Communicating Complex Water Quality Issues and Improving Public Health Notification

Leslie Griffin and James Alamillo



What is the BRC?

The Beach Report Card (BRC) was first published in 1991 as a resource for beach-goers to better understand local water quality at their favorite ocean beaches.



The BRC is based on the routine monitoring of beaches conducted by local health agencies and dischargers.

The Need for a BRC

Historically, shoreline water quality data was simply collected for regulatory compliance. When ambient monitoring and public notification was required, the data was used to merely determine sign posting.



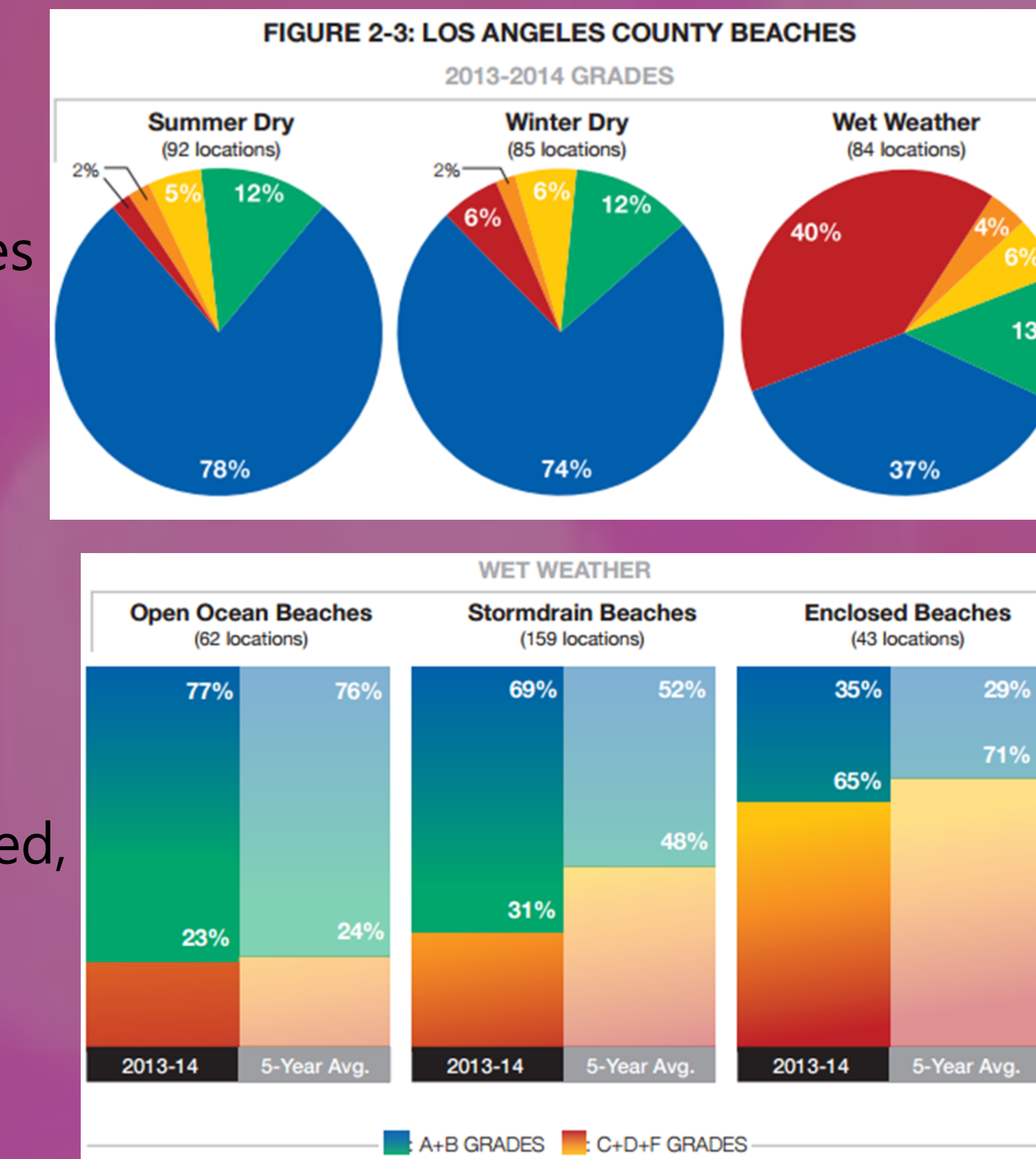
Lost in this process was any effort to understand trends, source identification or abatement, or public notification efficacy.

Date	Time	Source	T. COLI MPN/100 ml	E. COLI MPN/100ml	ENTERO MPN/100 ml
03/28/16	0845	OCEAN	10	<10	<10
03/28/16	****	OCEAN	NO	SAMPLE	COLLECTED
03/28/16	0908	OCEAN	<10	<10	<10
03/28/16	0921	OCEAN	10	10	<10
03/28/16	0930	OCEAN	10	<10	<10
03/28/16	0943	OCEAN	41	<10	<10
03/28/16	0953	OCEAN	10	<10	<10
03/28/16	1003	OCEAN	52	20	<10
03/28/16	1015	OCEAN	5,172	<10	<10
03/28/16	1041	OCEAN	2,481	<10	<10
03/28/16	1100	OCEAN	2,613	2,014	<10
03/28/16	1102	OCEAN	134	<10	31
03/28/16	1106	OCEAN	880	<10	<10
03/28/16	1111	OCEAN	816	<10	<10
03/28/16	1148	OCEAN	388	<10	<10
03/28/16	1217	OCEAN	160	63	<10
03/28/16	1223	OCEAN	62	30	<10
03/28/16	1227	OCEAN	<10	<10	<10
03/28/16	1247	OCEAN	31	<10	<10
03/28/16	1300	OCEAN	<10	<10	<10

Analysis of Classifications

Heal the Bay produces grades for monitored beaches by:

- Season (Summer Dry, Winter Dry, and Wet)
- Weather (Dry vs. Wet)
- Beach Type (Open, Enclosed, and Storm Drain)
- Time (Weekly or Annual)



Methodology and Data

The BRC uses an 'A—F' grading system. Grades are solely based on fecal indicator bacteria sampling results. Grades consider the magnitude and frequency of exceedances, single sample and geometric mean results.

Our methodology has been approved by our partner agencies, SCCWRP, and CA SWRCB as an effective tool for public notification.

Public agency monitoring data is cleaned and classified by location type, rain influenced, and season.

TABLE 4-2: CALCULATING THE TOTAL POINTS LOST FOR THE GEOMETRIC MEAN COMPONENT

Indicator Exceedance	Calif. Beach Bathing Water Standard	% of Total Available Points Lost Due to Exceedance	Total Available Points
Enterococcus	35	100%	50
Fecal Coliform	200	40%	
Total Coliform	1000	20%	

* Colony forming units per 100 milliliters of ocean water

TABLE 4-3: SINGLE SAMPLE GRADIENT THRESHOLDS IN CFU/100ML*

Indicator Bacteria	SLIGHT T = 1 SD	MODERATE T = 1 SD	HIGH > T + 1 SD	EXTREME Very High Risk
Total Coliform	6,711-0.999	10,000-14,900	> 14,900	N/A
Fecal Coliform	268-399	400-596	> 596	N/A
Enterococcus	70-103	104-155	> 155	N/A
Total Fecal Ratio (when total > 1,000)	10.1-13	7.5-10	2.1-7	< 2.1

Benefits of the BRC

For the past 25 years, the BRC has:

- Increased public notification and awareness
- Identified water quality trends and problem locations
- Led to 303(d) listings and policy elements like BMPs, Source ID, and special studies.
- Been utilized by public agencies for grant / funding opportunities
- Celebrated 'great' beaches.

Predictive Modeling Phase I and II

Over the last three years, Heal the Bay, Stanford and UCLA determined the feasibility of implementing predictive models in California.*



Sunny with a Chance of Gastroenteritis: Predicting Swimmer Risk at California Beaches

W. Thoe,¹ M. Gold,² A. Griesbach,³ M. Grimmer,³ M. L. Taggart,³ and A. B. Boehm¹

¹Department of Civil and Environmental Engineering, Environmental and Water Studies, Stanford University, Stanford, California 94305, United States
²Institute of the Environment and Sustainability, University of California, Los Angeles, California 90095, United States
³Heal the Bay, Santa Monica, California 90401, United States

Supporting Information

ABSTRACT: Traditional beach management that uses concentrations of culturable fecal indicator bacteria (FIB) may lead to delayed notification of unsafe swimming conditions. Predictive, nowcast models of beach water quality may help reduce beach management errors and enhance protection of public health. This study compares performance of five different types of statistical, data-driven predictive models: multiple linear regression model, binary logistic regression model, partial least-squares regression model, artificial neural network, and classification tree, in predicting advisories due to FIB contamination at 25 beaches along the California coastline. Classification tree and the binary logistic regression model with threshold tuning are consistently the best performing model types for California beaches. Beaches with good performing models usually have a rainfall flow related dominating factor affecting beach water quality, while beaches having a deteriorating water quality trend or low FIB exceedance rates are less likely to have a good performing model. This study identifies circumstances when predictive models are the most effective, and suggests that using predictive models for public notification of unsafe swimming conditions may improve public health protection at California beaches relative to current practices.



Phase I: Proof of concept (2012-2014)

Could models be developed for CA marine beaches?

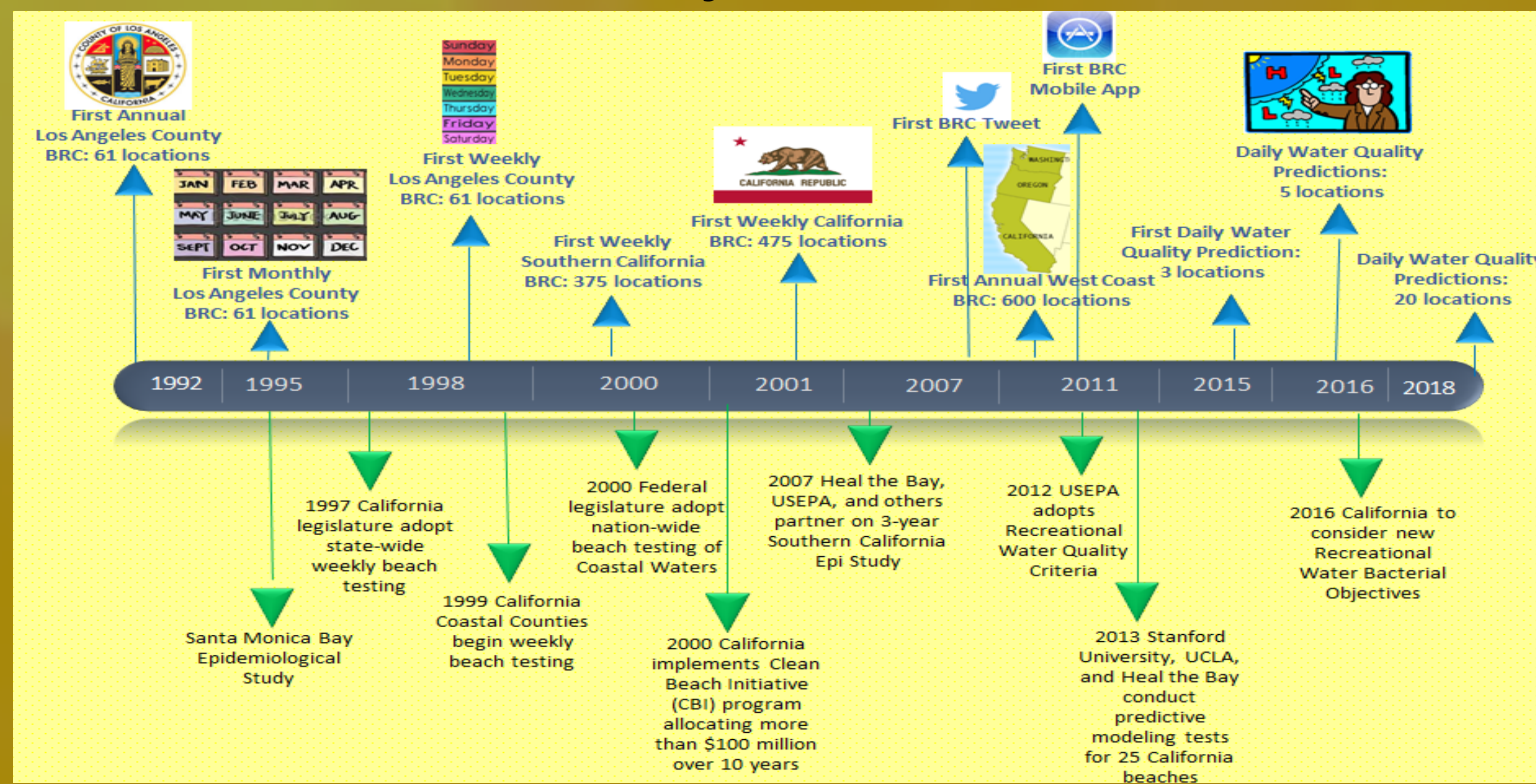
Phase II: Pilot test at 3 beaches (2015)

Could a model be readily integrated into an existing M&PN programs?

Promising Results:

- Improved accuracy in public notification over current method;
- Daily notification to beach-goers in the morning everyday including weekends;
- Improved understanding of FIB pollution at the beach and how to mitigate sources; and
- Models can be successfully integrated into existing M&PN programs.

History of the BRC



Public Notification

Heal the Bay produces weekly, summer, and Annual grades for beach locations when data is available.

The grades are made available free to local press, partner organizations, and the general public via email, twitter, mobile app, and our web page.

For more information on the Beach Report Card Program, please visit:

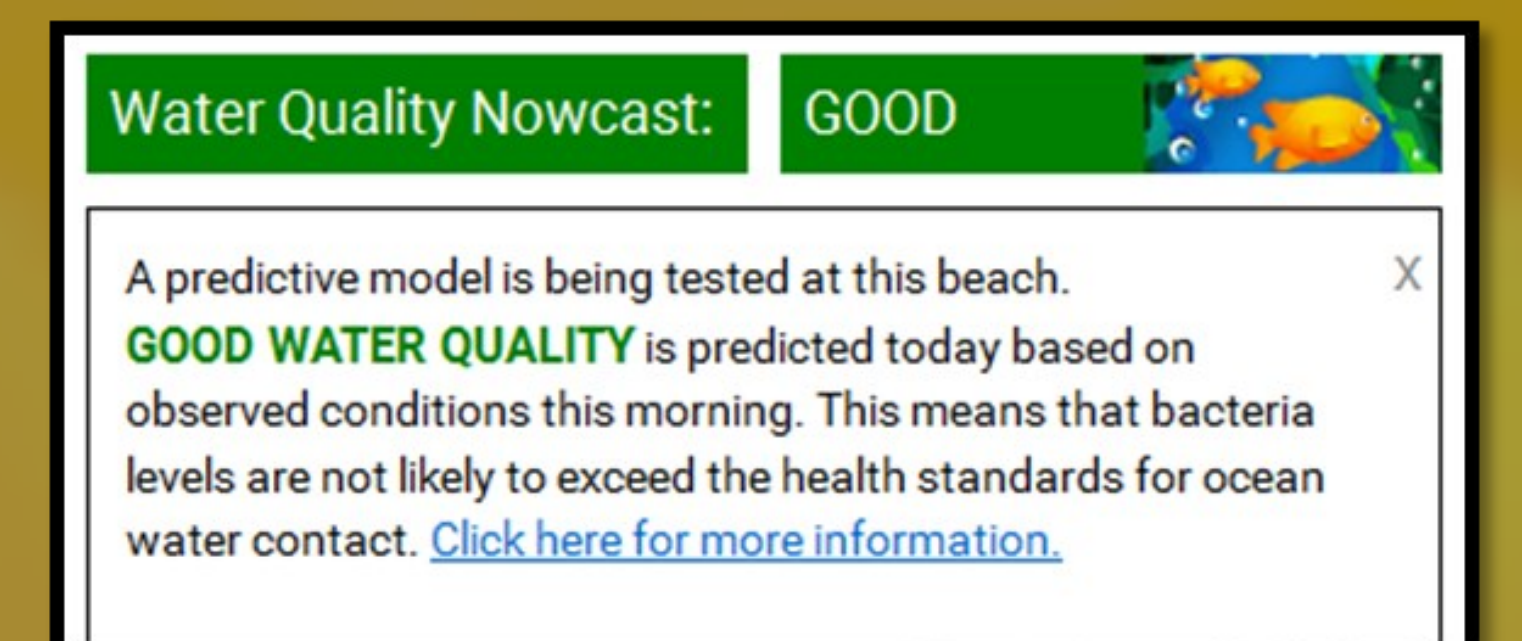
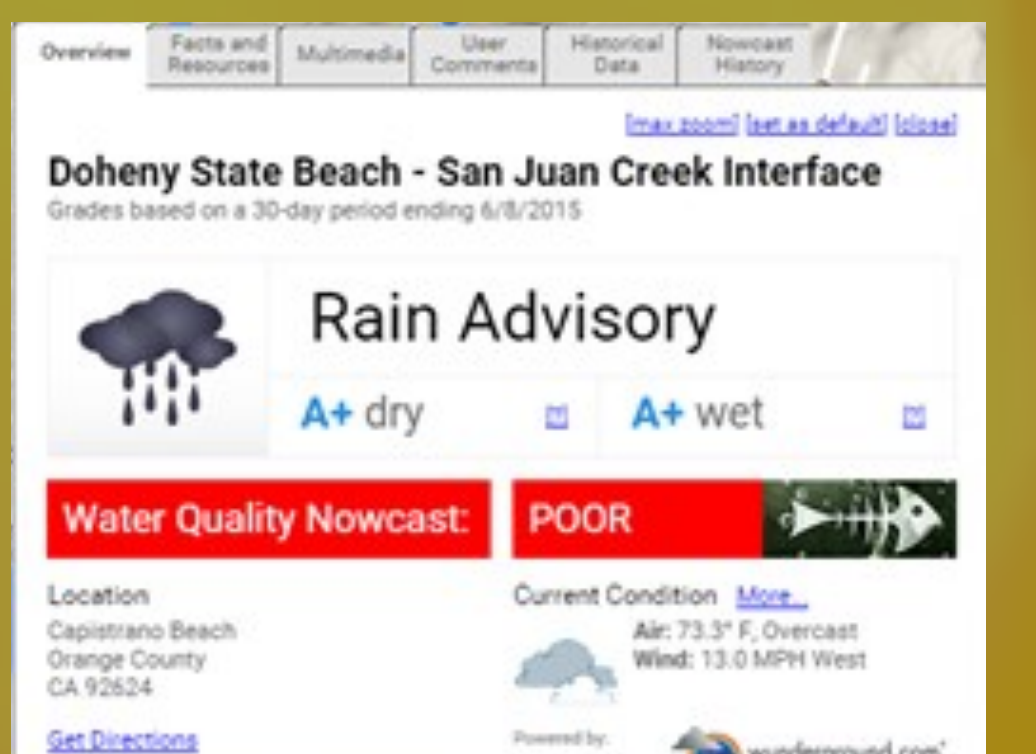
www.brc.healthebay.org



The Future of the BRC: Next Steps

In the next three years, Heal the Bay, in partnership with Stanford University and UCLA, will:

- Expand the use of predictive models in California to 20 beaches during the summer months;
- Develop predictive models for 5 winter surf beaches;
- Upgrade the mobile app to allow for volunteer environmental monitoring, collection; and
- Upgrade the BRC Web page.



Partnerships: The BRC would not be possible without the cooperation of the various State and County public agencies that conduct beach water quality monitoring programs.