SCCWRP Annual Report: An Alternative Approach?

Presentation to the SCCWRP Commission

Stephen B. Weisberg

June 6, 2014

BACKGROUND

- **One topic discussed at the Commission's Strategic Planning meeting was how to reduce administrative costs**
  - Leaves more money for conducting science
- **Our biggest administrative cost item is the Annual Report**
  - About $238K in 2013
- **We start producing the report in June**
  - The Committee tasked with considering such items suggested we provide the Commission with alternatives to consider at this meeting
  - If we want to choose an alternative, we need that feedback now

REASONS TO CONSIDER AN ALTERNATIVE

- **Scientists already have access to our work**
  - Most of the articles are published in scientific journals
  - 2013: 38 of 39 articles published in another forum
  - 2012: 24 of 25 articles published in another forum

- **The existing format does not serve our most important audience: The Commission**
  - It documents our accomplishments
  - However, it doesn't communicate the findings in a meaningful way to you and the people you report to

- **However, the driver for this discussion was cost**

THREE POTENTIAL ALTERNATIVES

- **Continue with the present approach**
  - Continues a series dating back to 1974
  - Mailing list of 800 people
  - The added internal review provides some training value
- **Eliminate the Annual Report**
  - The quarterly Director's Reports already fulfill the JPA requirements
- **Reshape/refocus (preferred)**
  - Focus on short feature articles targeting a management-level audience
  - Include other aspects that document our scientific achievements

PROPOSED OUTLINE

- Director's message
- General interest thematic articles or topical research syntheses (NEW)
- Abstracts (with information for requesting full-text) of articles that were published in scientific journals (NEW)
- Community contributions (list of staff serving on external advisory committees)
- Commissioner/CTAG membership
- Staff organizational chart

DIRECTOR'S MESSAGE

Ocean Acidification

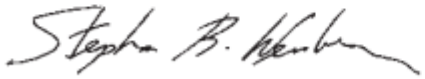
Four years ago, SCCWRP hosted a workshop that brought together shellfish industry representatives and ocean acidification (OA) scientists to address concerns that acidification might be responsible for West Coast shellfish hatchery failures. After three days, 50 participants left SCCWRP feeling confident in the validity of those concerns and motivated to refocus acidification science from deep-ocean water to near-coastal areas. Since that workshop, the partnership has flourished: scientists now regularly visit (or work for) shellfish hatcheries and hatcheries have become the best-instrumented coastal locations for measuring acidification on the West Coast.

That workshop and others that followed, several of which were held at SCCWRP, led me to the conclusion that OA poses a greater threat to ocean health than anything else SCCWRP studies. The potential impact of stressors that SCCWRP typically studies has limited geographical boundaries and achievable pathways for recovery. For example, the Santa Barbara oil spill that sparked passage of the 1969 Porter-Cologne Water Quality Control Act affected a limited regional zone and dissipated within a few years. Even the long-term toxic effects of DDT discharges on the Palos Verdes shelf have ameliorated over time, with recent observations of increased reproduction by bird populations previously affected by eggshell thinning.

These formative pollution issues that grabbed so much of our attention over the past several decades recovered because they were associated with inherently local inputs. Even after disastrous local effects, a large reproductive pool of organisms living outside the immediate impact area provided recolonization potential. In contrast, OA stems from global atmospheric inputs of CO_2 absorbed into the ocean, with origins primarily beyond the reach of local managers. Perhaps more importantly, OA manifests over much larger oceanographic systems, such as the California Current, with the potential to impact the entire geographic range of many species. Thus, as acidification progresses, some of its effects may be irreversible.

This concern about acidification is changing the research we do at SCCWRP, with activities focused in three areas: assessing the potential for local nutrient inputs to exacerbate acidification, testing new technology to measure and rapidly respond to acidification, and facilitating communication and consensus among acidification scientists. Local nutrient inputs can exacerbate acidification by causing large diurnal swings in productivity, wherein higher CO_2 production at night leads to greater acidity. SCCWRP's research is addressing whether these locally-modulated effects are meaningful, and whether mitigating local nutrient sources is likely to forestall a bigger problem. SCCWRP's technology development is exemplified by our partnership with the X-PRIZE Foundation to promote development of new, more sensitive pH sensors. The Wendy Schmidt Ocean Health X-PRIZE offers $1.5M for sensors capable of profiling pH in the ocean. SCCWRP and its member agencies will help to set performance criteria and test the new technologies developed by X-PRIZE contenders. Because managers need clear, unambiguous language on what scientists agree upon to be confident about moving forward, building consensus is a stalwart of SCCWRP science. In order to help build that consensus among acidification experts, SCCWRP is now leading the California Current Acidification Network (http://c-can.msi.ucsb.edu).

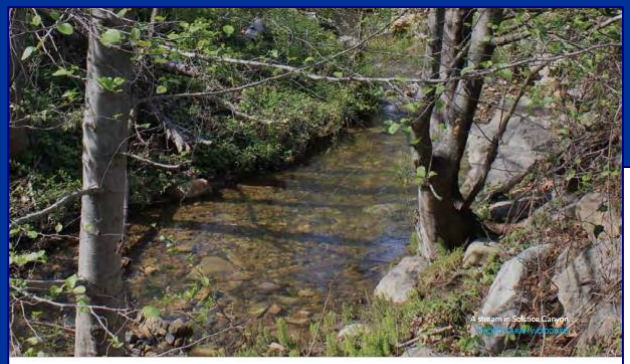
When friends and colleagues ask about current ocean issues, I tell them acidification is the definitive issue for our generation. I believe our success or failure in addressing this issue will define how future generations will view our stewardship of the ocean. As with many other water issues of the past, SCCWRP is committed to providing a scientific foundation that informs potential management actions to address it.



Stephen B. Weisberg, Ph.D.

Executive Director

THEMATIC ARTICLES



IMPACT OF DEVELOPMENT ON AQUATIC BENTHIC MACROINVERTEBRATE COMMUNITIES IN THE SANTA MONICA MOUNTAINS OF SOUTHERN CALIFORNIA

KATHERINE M. PEASE, SARAH SIKICH, MARISSA MAGGIO, SARAH DIRINGER, MARK ABRAMSON, & MARK GOLD

Abstract

Urban runoff due to development poses one of the greatest threats to the health of riparian and ocean ecosystems today. Past studies of urbanized watersheds have found that increased urbanization leads to impaired biological diversity in streams. This study assesses the impact of urbanization on aquatic benthic macroinvertebrates in the Santa Monica Mountains watersheds. We calculated the percent of developed area and percent of impervious area at monitoring sites based on geographic information system (GIS) mapping to quantify development in the region. We assessed the relationship between development and benthic macroinvertebrate communities, using the multi-metric Index of Biological Integrity (IBI) score given out of 0–100. At our fifteen sites, the average IBI scores ranged from 13 to 76, percent developed area ranged from 0.2% to 33.1%, and percent impervious area ranged from 2.1% to 21.2%. We found significant negative relationships between percent developed and impervious area and IBI score. Taking into account year and season sampled, as well as field protocol used, both percent developed area and percent impervious area explained a large amount of the variation in IBI scores (62% and 64%, respectively). We identified levels of 8.8% developed area and 6.6% impervious area, where sites with development over these levels showed biological impairments based on the regulatory threshold (IBI score of 39). This research shows that even low levels of urbanization and development impact biological health in streams, indicating a need to reduce impervious surface impacts through low-impact development (LID) and curb further development in the Santa Monica Mountains and Malibu Creek Watershed.

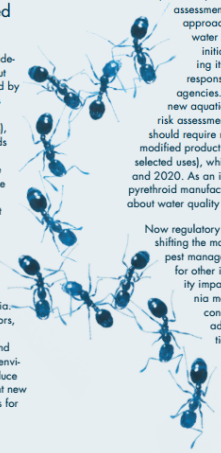
Pesticide Management

California water quality monitoring data have revealed previously unrecognized gaps in pesticide regulatory review procedures intended to prevent water pollution.

In recent years, numerous studies have documented the presence of pesticide-caused toxicity in both water and sediment in rivers and streams throughout California, particularly in urban watersheds, and almost exclusively caused by currently used pesticides (PAGE 79-90). In many locations toxicity that was caused by organophosphate pesticides (e.g., diazinon and chlorpyrifos, formerly the most commonly applied insecticides in California urban areas), has been replaced by toxicity caused by pyrethroids (PAGE 79). Pyrethroids became the most commonly applied insecticides in California urban areas after most urban uses of diazinon and chlorpyrifos were phased out by the US Environmental Protection Agency (USEPA) in 2004. Both USEPA and the California Department of Pesticide Regulation (DPR) have responsibility for regulating pesticides and must consider adverse effects on the environment in their review of pesticides. However, the procedures used to identify an adverse effect under pesticide law allow acceptance of risks that are not consistent with the Clean Water Act and the California Water Code.

In response, Bay Area municipal stormwater management agencies and wastewater treatment plants joined together to work with USEPA and DPR toward the goal of eliminating pesticide-related water pollution in California. This multi-agency collaboration, which also included professional applicators, led to landmark regulations enacted by DPR in 2012 that restrict the ways professional applicators are allowed to apply pyrethroid insecticides around buildings. Together with special restrictions placed on bifenthrin (the most environmentally persistent pyrethroid), the new regulations are expected to reduce pyrethroid-caused toxicity by 80-90%. In 2012, DPR also moved to prevent new water pollution by eliminating procedural gaps in its surface water reviews for new pesticides.

There are also improvements at the federal level. Recognizing that a key regulatory gap stemmed from programmatic differences between its separate Pesticides and Water Offices, in 2009, USEPA began developing a common "effects assessment methodology" to establish a consistent approach for defining when pesticides are causing water pollution. From 2009 to 2012, USEPA initiated reviews of all pyrethroids, advancing its regularly scheduled periodic reviews in response to input from California water quality agencies. The reviews now involve generation of new aquatic toxicity data, preparation of detailed risk assessments, and decisions as to whether USEPA should require nationwide risk mitigation actions (e.g., modified product application instructions, discontinuing selected uses), which would be implemented between 2016 and 2020. As an interim measure, in 2009, USEPA asked pyrethroid manufacturers to voluntarily place user instructions about water quality protection on product labels.



Now regulatory actions addressing pyrethroids are again shifting the market, creating opportunities for less toxic pest management, but also creating a growing market for other insecticides associated with water quality impacts, such as fipronil (PAGE 83). California monitoring data show rapidly increasing concentrations of fipronil, a reminder that additional work will be needed to end pesticide-related toxicity in urban watersheds, to prevent a transition to other harmful products, and to achieve the ultimate goal of ensuring that pesticides do not harm San Francisco Bay and aquatic ecosystems in the Bay watershed.

LAND-SEA INTERACTIONS

We are striving to deliver viable and affordable methods to rapidly detect marine pathogens and to enhance our understanding of hypoxia in the coastal ocean. Our Land-Sea Interactions focal area reached an important milestone when a device for detecting pathogens in coastal waters went operational for the first time in winter 2011. Also, a working group on coastal hypoxia substantially advanced its research on dissolved oxygen (DO) in California's waters. This year MARINE, COS's ocean leadership development and curriculum enhancement program for graduate students, focused on land-sea interactions in a series of seminars.

MARINE Program

Under Margaret Krebs' and Adina Abeles' leadership, we refined our curricular approach. The National Science Foundation, the National Academy of Sciences and the Stanford Commission on Graduate Education have called for more interdisciplinary experiences in post-secondary education. Inspired by this collective charge, we designed the leadership development experience for graduate students and postdocs as a "collaboratory" to extend their learning beyond the classroom and research lab by giving early career scholars the opportunity to engage in real-world problem solving in the role of pro bono consultants to NGO or government decision-makers. This year the collaboratory focused on water quality in the Elkhorn Slough, with The Nature Conservancy as the "client." We coupled the collaboratory with our continuing academic year seminar series, each seminar preceded by related journal clubs led by COS early career fellows. The first seminar linked knowledge to action in a case study of Mexico's Yaqui Valley while the second offered a panel discussion on implementing ocean acidification research with speakers from science, business and government. The final seminar explored desalination scientific and technological issues, an important and growing form of coastal infrastructure.

Photo: Christina Preston, MBARI

COS Early Career Fellow Kevan Yamahara in the Cawthron Lab with two ESPs shipped to New Zealand.

Deploying the ESP, jointly developed by MBARI and COS, in Tasman Bay, New Zealand.

Detecting Marine Pathogens

Placed on Santa Cruz Wharf in the Monterey Bay, the Environmental Sample Processor (ESP) and Microfluidics Block (MFB), developed in conjunction with MBARI, began feeding real-time results of microbial water quality that can inform decisions on issuing beach warnings and closures in a more timely manner. The ESP can yield water quality testing results to coastal managers in 120 minutes instead of 24 hours after samples are collected.

The ESP/MFB methodology for water quality monitoring was developed by COS's Rapid Detection of Marine Pathogens working group convened by COS Early Career Fellow Kevan Yamahara. The working group facilitated critical coordination and communication among four academic

PUBLICATION ABSTRACTS

SCCWRP #803

Does DNA barcoding improve performance of traditional stream bioassessment metrics?

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[2]*Stroud Water Research Center, Avondale, Pennsylvania, USA*
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ABSTRACT

Benthic macroinvertebrate community composition is used to assess wetland and stream condition and to help differentiate the effects of stressors among sites. Deoxyribonucleic acid (DNA) barcoding has been promoted as a way to increase taxonomic resolution and, thereby, to increase the sensitivity of bioassessment metrics. We compared the ability of several commonly used bioassessment metrics calculated with data derived from morphology and from DNA barcoding to detect differences in stream condition of 6 paired sites in southern California with relatively subtle impacts to habitat. At each site, we sampled an upstream (reference) reach and a downstream (impact) reach with armored stream banks. We counted and identified ~600 organisms/ sample based on morphology (generally to species, but to genus for midges). We then extracted mitochondrial (mt)DNA from each individual and sequenced the ~658-base pair (bp) barcoding region of the cytochrome c oxidase subunit I (COI) gene. Most (91%) organisms yielded sequences >350 bp in length, but high failure rates for all taxa collected from 1 stream required that we exclude it from analysis. Sixteen metrics calculated with morphological data showed subtle but not significant differences in community composition between armored and unarmored reaches. The statistical power of 10 of the 16 metrics was substantially higher when calculated with DNA than with morphological data, and we were able to discern differences between armored and unarmored reaches with the DNA data. These differences were associated with increased taxonomic richness detected for midges, mayflies, noninsects, caddisflies, and black flies when DNA data were used. Our results suggest that identifications based on DNA barcoding have the potential to improve power to detect small changes in stream condition.

SCCWRP #808

Comparison of four species-delimitation methods applied to a DNA barcode data set of insect larvae for use in routine bioassessment

Bryan P. White[1], Erik M. Pilgrim[2], Laura M. Boykin[3], Eric D. Stein[1], and Raphael D. Mazor[1]

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ABSTRACT

Species delimitation (grouping individuals into distinct taxonomic groups) is an essential part of evolutionary, conservation, and molecular ecology. Deoxyribonucleic acid (DNA) barcodes, short fragments of the cytochrome c oxidase subunit I (COI) gene, are being used in environmental bioassessments to assign specimens to putative species, but no method for delimiting DNA barcodes into species-level entities is universally accepted. We investigated the effect of delimitation methods on outcomes

To request full-text articles, please contact pubrequest@sccwrp.org.

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NEED A DECISION

- **Should we pursue the existing Annual Report format for this year?**
  - Would need to get started now

- **Alternatively, we can come back to you in September with a more comprehensive example of the alternative format**
  - Would want to agree on format by September so that we can produce the document by year end