

SCCWRP's fact sheet series

Scott Martindale
Commission Meeting
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Background

- We're continuing to receive positive feedback on our 2-page fact sheets
- We've published 5 so far
- Everyone recognizes how impactful these collaborative publications are
- We're expanding our review process for these fact sheets
 - You requested this expanded review last quarter

Rapid beach testing methods

SCCWRP FACT SHEET
Using DNA technology to protect beachgoers from fecal contamination
DNA-based methods provide faster, more insightful information about when it's safe vs. risky to enter the water

For decades, the public health community has tested beach water for fecal contamination using established bacterial culturing methods. But advances in DNA technology are paving the way for faster, more insightful ways to assess water quality and warn beachgoers when it's potentially unsafe to enter. In 2022, San Diego County became the first coastal community in the nation to rely on bacterial culturing in favor of a DNA-based method.

Key advantages of DNA technology

The traditional way to test beach water for fecal contamination is via cell culturing, where bacteria cells from a water sample are grown in a laboratory overnight and then analyzed. DNA-based methods, by contrast, focus on analyzing the bacteria cells' DNA.

- **Faster:** Whereas cell culturing typically takes 24-72 hours after beach water samples reach a laboratory, DNA methods can provide same-day results. Speed is of the essence when it comes to protecting the health of beachgoers, especially following unexpected, transient sewage spills. Public health agencies need to close beaches and/or post warning signs as soon as a potential risk to human health has been confirmed – and then reopen beaches and/or rescind advisories as soon as the risk has passed.
- **More insightful:** Cell culturing cannot determine if fecal contamination originated in the gut of a human or another animal, such as a bird or dog. By contrast, DNA methods can make this distinction. These additional insights help the environmental management community prioritize remediation sources that represent the greatest threat to public health (it is primarily human feces that sicken swimmers and surfers.)

DNA methods agree with culturing methods

For DNA methods to be approved as a replacement for culturing methods, the two methods must produce results that lead public health agencies to take consistently similar actions to close beaches and/or post warning signs. Scientists have conducted extensive side-by-side testing of the two types of methods across Southern California. The testing found about 90% agreement in the beach closure and notification decisions that public health agencies make based on the two methods.

When decision-making differs for a beach, scientists have multiple ways to probe why and determine which set of results is the more appropriate predictor of illness risk.

SCCWRP FACT SHEET
Modeling as a tool to support coastal water-quality decisions
A primer on how computer modeling is used to understand the effects of discharging nutrients to Southern California's ocean

When coastal communities face water-quality problems, they often struggle to understand the extent of the problem across space and time. Environmental monitoring programs can provide some insights, but only for a limited number of sites at discrete time points.

Moreover, as communities identify possible solutions over time to solve water-quality problems, they need reassurance they'll get tangible environmental benefits – before investing millions or even billions of dollars in a particular solution. Modeling programs can quantify the success of these solutions once implemented, but do not provide insights about the likelihood of success for solutions that have yet to be implemented.

Modeling helps communities make informed choices

For decades, managers have relied on computer modeling to generate a more comprehensive view of coastal ecosystem health and to evaluate if proposed interventions to protect water quality are effective. Through modeling, stakeholders can:

- Weigh the benefits vs. costs of different possible interventions
- Consider the risk of taking no action vs. taking action that turns out to be wrong or inadequate
- Use a common set of facts and data to reach consensus on the best course of action

Examples: Modeling informing decisions

Managers routinely use proven computer models as a basis for taking action:

- During hurricanes, weather forecasting models help public officials determine when and where to issue evacuation orders to move millions of people out of harm's way.

SCCWRP FACT SHEET
Tracking the health of aquatic ecosystems through regional monitoring
Southern California managers rely on regional monitoring to understand changing environmental conditions

Regional monitoring is a type of environmental monitoring that focuses on holistic evaluation of ecosystems across time and space. Unlike site-specific monitoring that tends to focus on smaller areas, regional monitoring often calls on multiple agencies with overlapping responsibilities for protecting ecosystem health to pool their resources and work together on more ambitious, comprehensive scientific investigations. In Southern California, the insights provided by regional monitoring help environmental managers to better direct resources and maintain focus on the areas and issues that pose the greatest risks to ecosystem integrity.

Complement to site-specific monitoring

Southern California's water-quality management community spends tens of millions of dollars every year to monitor aquatic environments affected by pollution and other human-caused stresses. Much of this monitoring is focused on understanding the ecological effects of specific human activities, such as wastewater and stormwater discharges. While this type of monitoring provides critical management insights, the data cannot be combined to produce a holistic picture of regional ecosystem health. Regional monitoring helps fill this data gap. Through regional monitoring, managers can contextualize site-specific monitoring insights and answer big picture questions like:

- Which water bodies in Southern California are most polluted?
- Is the overall condition of Southern California's water bodies declining or improving?
- How safe is it to swim at Southern California beaches and consume fish from Southern California waters?

Signature regional monitoring programs

Southern California is home to two expansive, cyclical regional monitoring programs that probe multiple aspects of regional ecosystem health.

- **Southern California Right Regional Monitoring Program:** Conducted in five-year cycles, the Right program examines the health of about 1,500 square miles of coastal waters and includes more than 90 participating organizations. The seventh and newest cycle – Right 23 – features seven major study elements: Sediment Quality, Water Quality, Harmful Algal Blooms, Trash, Microplastics, Microbiology, and Submerged Aquatic Vegetation.

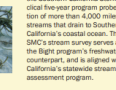


Southern California's offshore sediment and a California halibut

Closing a knowledge gap

In 1990, the National Research Council – the scientific advisory arm of the prestigious National Academies of Sciences, Engineering, and Medicine – cited Southern California as a poster child for a densely populated region that, despite its high-quality investments in monitoring, could not answer broader-scale questions about how human activities have impacted the health of its aquatic ecosystems. Southern California also could not assess overall compliance with the federal Clean Water Act.

- In 1994, Southern California responded by developing the Southern California Right Regional Monitoring Program – a coordinated, cyclical monitoring collaboration that is now one of the nation's premier coastal marine monitoring programs. Other regional monitoring programs have since followed.



A field crew for the SMC stream monitoring program

Water-quality modeling

SCCWRP's management value

SCCWRP FACT SHEET
How SCCWRP adds value to aquatic ecosystems management
The applied-science research agency builds a rigorous technical foundation for management decision-making

The Southern California Coastal Water Research Project (SCCWRP) is an applied sciences institute working to incorporate rigorous, fully-vetted research into the decisions and actions of Southern California's environmental management community. Since its founding as a public-sector research agency in 1960, SCCWRP has been developing strategic, useful and technologically- and biologically-informed research to help understand these problems and evaluate solutions.



SCCWRP member agencies
City of Los Angeles Bureau of Sanitation
San Bernardino County
Orange County Sanitation District
City of San Diego Public Utilities Department

Wastewater treatment agencies
City of Los Angeles Bureau of Sanitation
San Bernardino County
Orange County Sanitation District
City of San Diego Public Utilities Department

Wastewater management agencies
San Diego County Public Works
San Diego County Public Works
San Diego County Watershed Protection
San Diego County Watershed Protection

Water quality regulatory agencies
U.S. Environmental Protection Agency
California State Water Resources Control Board
Los Angeles Regional Water Quality Control Board
San Diego Regional Water Quality Control Board

Natural resources agency
California Ocean Protection Council

eDNA monitoring

Regional monitoring

Expanded fact sheet review process

- We are sending draft fact sheets to CASA and CASQA after CTAG review
 - It's delaying publication by one quarter
- CASA and CASQA see value in reviewing each fact sheet for us
 - The interactions are strengthening SCCWRP's relationship with these groups
 - They're helping us improve accuracy and clarity

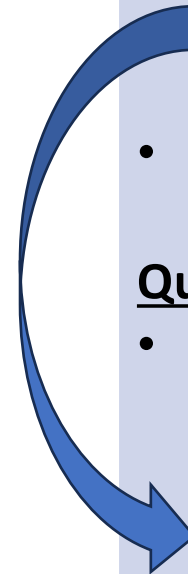
Expanded review process for fact sheets

Quarter 1

- **2 weeks before CTAG meeting:** Draft shared
- **CTAG meeting:** CTAG reviews/signs off
- **After CTAG sign-off:** Draft shared with CASA/CASQA

Quarter 2

- **CTAG meeting:** CTAG reviews/signs off on CASA/CASQA revisions
- **Commission meeting:** Commission reviews/approves for publication



HABs fact sheet

- We piloted the expanded fact sheet review process with the HABs fact sheet
 - Both CASA and CASQA provided helpful suggestions
 - We made minor edits in response
- The HABs fact sheet is ready for your final approval today
 - You received the final version in your agenda packet

HABs fact sheet (draft)

SOCWRP FACT SHEET

DRAFT for Commission review/final approval

Protecting ecosystems and humans from harmful algal blooms

Environmental managers are developing strategies, monitoring programs and modeling tools to gain the upper hand on managing HABs, especially those that produce toxins

Harmful algal blooms (HABs) are overgrowths of algae and cyanobacteria that reduce water quality and harm ecosystems. Although algae and cyanobacteria are part of a balanced ecosystem, too much algal growth can block sunlight and reduce oxygen levels, causing events like mass fish deaths. A major consequence of HABs is the potent toxins HABs can produce; these toxins can sicken and kill animals, contaminate food webs, and cause illness in humans who drink or swim in contaminated waters. In California, both freshwater and coastal marine waters are being affected by HABs. Researchers are working to help environmental managers understand:

- » When, where and why toxin-producing HABs are occurring
- » How to more accurately forecast when and where HABs will produce toxins



A field crew collects samples during a HAB event in the San Diego River. HABs can turn water vibrant shades of green, blue and red.

How HAB toxins manifest in Southern California

HABs often pose a seasonal threat, forming in late spring or early summer and dissipating by fall. However, blooms can occur year-round, and HAB toxins can persist in water bodies for months after the blooms have disappeared. The most common types of toxin-producing HABs in Southern California are:

Marine environments

- **Pseudo-nitzschia blooms:** The diatom *Pseudo-nitzschia* can produce a neurotoxin known as domoic acid that can trigger mass strandings and deaths of sea lions and other marine mammals and birds. When humans consume contaminated seafood, domoic acid can cause gastrointestinal illness and short-term memory loss. Domoic acid can persist in seafloor sediments and sediment-dwelling organisms for months to years after a bloom, extending the time it can affect both wildlife and humans.
- **Red tides:** Some species of dinoflagellates and radiolophytes turn marine and estuarine waters shades of red or brown during events known as red tides; some red tides are bioluminescent. While some red tides are benign, others produce toxins that cause widespread fish kills and contaminate shellfish consumed by humans.



A person is believed to have been poisoned by domoic acid.

Freshwater environments

- **Cyanobacteria:** Blooms of cyanobacteria in lakes, streams and other freshwater and estuarine environments are known as cyanobacteria. They form thick mats along the surface or bottom of water bodies, and can produce cyanotoxins that harm wildlife, dogs and humans. Cyanotoxins can travel to coastal marine waters via streams and runoff, extending their impact across the land-sea interface.



Cyanobacteria bloom in a Southern California lake.

HAB monitoring programs in California

Three statewide HAB monitoring programs are helping managers to better understand bloom dynamics, enable early detection and forecasting, and inform management responses:

- **California HAB Monitoring and Alert Program (HABMAP):** Founded in the mid-2000s, HABMAP provides weekly HAB monitoring at 10 coastal marine stations statewide.
- **California Freshwater and Estuarine HAB (FHEHAB) Program:** The FHEHAB program was formalized by the Water Boards in 2020 to coordinate monitoring and assessment of inland HABs statewide.
- **Shellfish Biotwin Monitoring:** Launched in the 1990s, biotoxin monitoring is California's longest-running HAB monitoring program. It focuses on protecting humans from HAB toxins when they consume coastal shellfish and other seafood.

HAB studies via Bight regional monitoring

Since 2008, the Southern California Bight Regional Monitoring Program has been conducting foundational regional studies illuminating where, when and why algal blooms are occurring. In 2018, Bight '18 found that HAB toxins were detected in 54% of all seafloor sediment in the Southern California Bight. For Bight '23, the program is documenting the degree to which HAB toxins and other contaminants may have contaminated local shellfish that humans consume.



Red tide at a La Jolla beach in San Diego County.

PFAS fact sheet

- The next fact sheet is on PFAS
 - You received a copy in your agenda packet
 - CTAG reviewed it last month
- The next step is to send out the PFAS fact sheet for external review
 - You will be asked to approve it next quarter

PFAS fact sheet (draft)

SCCWRP FACT SHEET

DRAFT to be distributed for external review following Commission review


Managing PFAS in California's aquatic systems

As understanding of the ecological and health consequences of PFAS exposure grows, environmental managers will be poised to take more aggressive actions to protect humans and wildlife

Per- and Polyfluoroalkyl Substances (PFAS) are a ubiquitous class of synthetic chemicals used in a wide range of consumer and industrial products, from non-stick cookware to water-repellant clothing to firefighting foam. Often referred to as "forever chemicals," PFAS are known for their durability and resistance to heat, water, and oil – and also their resistance to breakdown in the environment.

Because PFAS have been linked to harmful effects in humans and wildlife, the environmental management community is prioritizing building capacity to:

- » Monitor PFAS in diverse aquatic systems
- » Remove elevated levels of PFAS to reduce risk of exposure
- » Take source-control actions that reduce the spread of PFAS, including by placing bans on manufacture and use



A wide range of consumer and industrial products are made with PFAS.

How PFAS enter the environment

The thousands of chemicals that make up PFAS enter the environment in places where the chemicals are produced, and where products containing PFAS are used, cleaned, and disposed of. Once PFAS enter the environment, they can be transported long distances by wind and water. When PFAS are inadvertently ingested and absorbed by organisms, they can build up, or bioaccumulate, in each successive predator that consumes its prey – exposing humans and other wildlife at the top of food webs to potentially hazardous PFAS levels.


Health effects of PFAS exposure

Although knowledge about the effects of exposure to PFAS on humans and aquatic life is still growing, early evidence indicates that exposure is associated with adverse health outcomes:

- » In humans, PFAS have been linked to increased risks of cancer, reproductive and development effects, and hormone imbalances.
- » In aquatic life, PFAS are suspected to have effects on growth and reproduction, although data are limited and vary among species.

How PFAS are removed from water

PFAS are most commonly removed from water via special filters optimized to adsorb multiple PFAS compounds. The filters are then sent to landfills or incinerated. However, research is ongoing to identify more cost-effective, environmentally friendly ways to destroy PFAS, including electrochemical and photochemical techniques, ultraviolet light, and potential breakdown by microorganisms.



U.C. Riverside researchers are studying soil bacteria for their potential to break down PFAS.

How PFAS emerged as a contaminant of concern

Originally developed in the 1940s, PFAS did not emerge as a public health concern until the 1990s, following decades of scientific study. Since that time, the U.S. Environmental Protection Agency and other regulatory agencies have been building a scientific foundation for expanding monitoring of PFAS and for taking increasingly aggressive source-control actions to limit the manufacture and use of PFAS.

In California, PFAS were identified in 2012 as a priority pollutant by the Science Advisory Panel for Constituents of Emerging Concern (CECs) in California's Aquatic Ecosystems, which was convened to help the State prioritize managing CECs in aquatic environments.

Summary

- Approve the HABs fact sheet for publication
- Affirm the PFAS fact sheet is ready for external review
 - Affirm our expanded review process is working

Prioritized topics for future fact sheets

- ~~1. Regional monitoring~~
2. Harmful algal blooms
3. PFAS
4. Microplastics
5. HF183
6. Ocean acidification and hypoxia