

CALIFORNIA MOLECULAR METHODS WORKGROUP CHARTER

MISSION STATEMENT

The mission of the Molecular Methods Workgroup is to serve as a clearinghouse for key technical and programmatic guidance on the use of molecular methods for bioassessment and environmental monitoring programs in California. This workgroup will focus on improving coordination and collaboration among local, state, and federal agencies, tribes, non-governmental organizations, and other California Water Quality Monitoring Council workgroups. Additionally, the workgroup will focus on identifying the key technical challenges of emerging molecular methods and will help coordinate research efforts to address these challenges.

NEED FOR THE MOLECULAR METHODS WORKGROUP

Molecular methods are becoming increasingly popular in environmental monitoring and bioassessment applications. From quantitative PCR to metagenomics, these methods provide rapid, efficient, and affordable solutions to challenges facing monitoring programs. However, the rapid evolution of the DNA field has resulted in a lack of clear guidance on best practices for generating consistent and robust molecular data. Additionally, there is a need for improved communication among researchers to build consensus on analytical methods as well as to identify opportunities for collaboration. As these molecular methods become more widespread, the need for consistency and accuracy in molecular data becomes increasingly important.

OBJECTIVES

The Molecular Methods Workgroup will provide oversight and peer review of molecular methods to ensure that these efforts are technically sound and yield high-quality data for water quality managers. The Workgroup will focus on:

1. **Consensus-building:** Identify and provide recommendations on best practices for molecular methods including sample collection, sample processing, and analytical pipelines. Identify key technical challenges in generating DNA-based data to prioritize further research, as well as discuss emerging molecular methods and their potential utility in monitoring applications.
2. **Communication:** Provide online resources for communicating molecular results to management communities and water quality managers to enhance the interpretation and efficacy of molecular data.
3. **Coordination:** Improve coordination among research groups, sampling programs, and monitoring agencies to enhance collaborations and minimize redundancies in sample collection.

BACKGROUND AND DESCRIPTION

The federal Clean Water Act (CWA) requires states to protect and restore the chemical, physical, and biological integrity of the nation's waters. To this end, California has developed robust bioassessment and water quality monitoring programs to evaluate the health of aquatic communities. The success of these programs has relied heavily on standardized protocols and data management methods, for example the suite of sampling protocols generated by the Surface Water Ambient Monitoring Program (SWAMP) and its partners (https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/sops.html). These protocols help ensure that all sampling programs across the state are generating robust, reliable, and comparable data.

In recent years, a number of water quality monitoring and bioassessment programs have begun to incorporate molecular, or DNA-based, approaches to generating biological data. Molecular approaches such as quantitative polymerase chain reaction (qPCR) and droplet digital PCR (ddPCR) have become increasingly popular for monitoring levels of human fecal contamination in beaches and recreational waterbodies, and the EPA has created a standardized protocol for the detection of human pathogen *Enterococcus* (https://www.epa.gov/sites/production/files/2015-08/documents/method_1609_2013.pdf). Endangered and invasive species monitoring has also seen an increase in the use of DNA-based approaches as they allow for the non-destructive and low-impact identification of species from trace amounts of DNA. Additionally, the State Water Board has supported a number of pilot studies to evaluate the use of DNA sequencing for identifying algal and macroinvertebrate communities in stream bioassessment programs in an effort to alleviate current taxonomic capacity limitations faced by traditional morphological approaches.

While advances in molecular methods in biological monitoring has opened doors for a greater number of researchers to capitalize on these powerful new technologies, the need for standardized methods and consensus-driven guidance is of paramount importance to ensure that resulting molecular data are of comparable quality, especially if these data will be used for environmental management and regulatory compliance. The Molecular Methods Workgroup will focus on providing oversight and recommendations regarding all stages of DNA-based data generation including: DNA sampling, DNA sample preservation, DNA sample extraction and lab processing, amplification protocols, sequencing approaches, bioinformatic processing of raw DNA sequences, DNA reference database selection and maintenance, storage of DNA data, and interpreting and disseminating DNA results. Additionally, the Workgroup will help ensure that these recommendations are available for distribution to water quality managers, as well as helping provide a forum for a multitude of researchers to evaluate novel molecular technologies and find new opportunities for research and collaboration. This Workgroup will help position California as a leader in the application of molecular methods to bioassessment and water quality monitoring.

MEMBERSHIP AND REPRESENTATION

Membership on the Molecular Methods Workgroup is open to all organizations that have an interest in regional-scale and statewide monitoring and assessment using DNA-based approaches in California waters as well as those interested in communicating this information to policy-makers, agency staff, and the public. Current membership of the Workgroup includes State and Regional Board staff and representatives from other agencies and organizations including US EPA, NOAA, California Department of Fish and Wildlife's (CDFW) Aquatic Bioassessment Laboratory (ABL), the Southern California Coastal Water Research Project (SCCWRP), UCLA, etc. Meetings are open, informal, and consensus driven. To inquire about participation in the Workgroup meetings please contact Susanna Theroux (susannat@sccwrp.org).

The Workgroup has also convened an expert technical panel that provides review, evaluation, and recommendations of molecular methods and technological developments to the larger Molecular Methods Workgroup and the Water Quality Monitoring Council. The members of the panel are individuals with extensive experience in DNA-based biomonitoring approaches and/or the application of molecular methods to regional monitoring programs.

SCOPE

The Molecular Methods Workgroup will support the coordination and collaboration of research and monitoring efforts across the state focused on generating biological data using molecular methods for bioassessment and environmental monitoring applications. The Workgroup will identify best practices for generating DNA-based data and provide resources to the management community, policy-makers, and the public for interpreting and distributing molecular results.

WEB INFORMATION

- Molecular methods workgroup website
mywaterquality.ca.gov/TBD
- Molecular methods workgroup listserv
cwqmc_molecular_methods@waterboards.ca.gov