SECTION 1 INTRODUCTION

In the 1970s, the California State Water Resources Control Board (State Water Board) initiated two statewide monitoring programs employing the new technique of "bioaccumulation monitoring" – measuring the concentrations of pollutants in fish and bivalves residing in California water bodies. Bioaccumulation monitoring offers several advantages over monitoring of water or sediment, including:

- Measuring the degree to which pollutants are actually entering the food web, which for some pollutants can be quite different from the total concentrations present in water and sediment;
- Yielding a strong signal of contamination, since many pollutants reach concentrations that are much higher and easier to measure than concentrations in water and sediment;
- Providing an integrative measure of pollutant concentrations over time and a cost-effective tool for obtaining information on average concentrations; and
- Especially for fish, providing information that is directly linked to the impacts of pollutants on human and wildlife health.

The Toxic Substances Monitoring Program (TSMP), initiated in 1976, was a statewide program that employed a uniform approach for monitoring pollutants in fish and invertebrates in freshwater and estuarine habitats (SWRCB 1986, Rasmussen 1995, 1997). The TSMP primarily targeted water bodies with known or suspected water quality impairments, and successfully identified and documented many hotspots of contamination.

The State Mussel Watch Program (SMWP) was initiated in 1977 to provide information on long-term trends in water quality in coastal marine waters and to identify specific areas with elevated concentrations (Hayes et al. 1985, Hayes and Phillips 1986, Rasmussen 2000). Bivalves have some advantages compared to fish as indicator species: they are less mobile than fish and therefore good indicators of conditions at specific locations, and they can be transplanted into locations where bioaccumulation monitoring is desired.

Over the years, these two programs yielded a wealth of information on water quality in California. The chemical analyses were performed by top laboratories with excellent quality assurance and the data they generated are considered to be highly reliable. Hundreds of locations were sampled. Many instances of severe contamination were identified, leading to cleanup actions and fish advisories to reduce exposure of humans and wildlife. In addition, many areas with low concentrations (below past or present thresholds of concern) were identified. As described in this report, these programs have documented the successful management of many pollutants that posed serious threats to wildlife and human health in the 1970s and 1980s. These programs were instituted just in time to document the rapid improvements in water quality that resulted from bans on PCBs and legacy pesticides, reductions in metals due to wastewater treatment, and other improvements.

In 1998, a third statewide bioaccumulation monitoring program, the Coastal Fish Contamination Program (CFCP), was implemented (Gassel et al. 2002). This program was developed to assess the health risks of consumption of sport fish and shellfish from nearshore waters along the entire California coast. The CFCP was considered to be a critical component of a comprehensive coastal water quality protection program, and an important opportunity to build a long-term coastal monitoring database for water quality and contaminants in fish.

In 2000, the State Water Board, responding to a bill passed by the California legislature, developed a plan to restructure their existing water quality monitoring programs (including TSMP, SMWP, and CFCP) and create a Surface Water Ambient Monitoring Program (SWAMP) for water quality that addresses all hydrologic units of the state using consistent and objective monitoring, sampling and analytical methods; consistent data quality assurance protocols; and centralized data management (SWRCB 2000). Sampling under the three monitoring programs ended in 2003, as SWAMP began to take shape.

This report was written for the SWAMP as a step toward the development of an improved bioaccumulation monitoring program for California. This report provides a review of bioaccumulation monitoring data generated under the three State Board programs. Future monitoring will be guided by assessment questions developed for the SWAMP (Table 1.1). The objective of this review was to evaluate how well the historic data from the State Water Board programs and from other major monitoring efforts since 1970 address these questions. This exercise has provided a substantial amount of information about present and historical impacts of pollutant bioaccumulation on beneficial uses in California, and also highlights areas where different sampling approaches can better address the assessment questions of current interest.

Table 1.1
Draft objectives and assessment questions for the SWAMP.

FISHING BENEFICIAL USE SUPPORT			
D.1. Determine the status of the fishing beneficial use throughout the state without bias to known impairment D.1.1 What is the extent and location of water bodies not supporting any fishing beneficial use? D.1.2 What is the extent and location of water bodies partially supporting the fishing beneficial use? D.1.3 What is the extent and location of water bodies fully supporting the fishing beneficial use? D.1.4 What is the proportion of water bodies in the state and each region falling within the three levels of support of the fishing beneficial use?	D.2. Assess trends in the fishing beneficial use throughout the state D.2.1 Are water bodies improving or deteriorating with respect to the fishing beneficial use? D.2.2 Have water bodies fully supporting the fishing beneficial use become impaired? D.2.3 Has full support of the fishing beneficial use been restored to previously impaired water bodies?	D3. Evaluate sources and pathways of factors impacting the fishing beneficial use D3.1 What is the relative importance of different pollutant sources and pathways in terms of impact on the fishing beneficial use on a regional and statewide basis?	D4. Evaluate effectiveness of management actions in improving the fishing beneficial use D4.1 How is the fishing beneficial use affected by remediation, source control, or pollution prevention actions and policies regionally and statewide?
AQUATIC LIFE BENEFICIAL USE SUPPORT			
A.1. Determine the status of aquatic life use support throughout the state without bias to known impairment A.1.1 What is the extent and location of water bodies with limited support of the aquatic life beneficial use? A.1.2 What is the extent and location of water bodies fully supporting the aquatic life beneficial use? A.1.3. What is the proportion of water bodies in the state and each region in each level of support of the aquatic life beneficial use?	A.2. Assess trends in support of the aquatic life beneficial use throughout the state A.2.1 Are water bodies improving or deteriorating with respect to aquatic life? A.2.2 Have water bodies fully supporting the aquatic life beneficial use become impaired? A.2.3 Has full support of the aquatic life beneficial use been restored to previously impaired water bodies?	A.3. Evaluate sources and pathways of factors impacting the aquatic life beneficial use A.3.3 What is the relative importance of different pollutant sources and pathways in terms of impact on the aquatic life beneficial use?	A.4. Evaluate effectiveness of management actions improving the aquatic life beneficial use A.4.1 How is the aquatic life beneficial use affected by remediation, source control, or pollution prevention actions and policies regionally and statewide?

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