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# Evolution of monitoring program design for marine outfalls in the Southern California Bight

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### ABSTRACT

Southern California is one of the most populated urban coastal regions in the United States with roughly 17 million residents and 19 publicly owned treatment works that discharge about 53.7 m<sup>3</sup>/s (1,226 mgd) of treated wastewater through ocean outfalls (Lyon *et al.* 2006, Lyon and Stein 2008). Each discharger monitors their effluent quality as well as the effects of discharge on the ambient environment. The effluent monitoring component of these programs has remained relatively static over the past 40 years; however, the receiving water monitoring component has evolved significantly. These changes occurred in three phases characterized by differing monitoring questions and associated sampling designs. In the early years, starting around 1970, monitoring designs were focused on assessing differences between outfall sites and outlying reference sites. These programs succeeded at documenting differences and driving enhanced water quality engineering. Yet, as monitoring data accumulated and understanding of the marine environment grew, two serious flaws became apparent: 1) reference sites were not well-matched in all physical parameters, and 2) managers needed more context to interpret the ecological relevance of observed differences. The second phase of monitoring, beginning in the mid- 1980s, focused on development of assessment tools to determine if differences between outfall and reference sites were meaningful to environmental managers. This was accomplished through development of new data interpretation tools that matched results to a scale of values ranging from severely to minimally affected sites. While the new tools better distinguished anthropogenic effects from natural variation, they lacked an integrated regional context to assess whether commingled discharges and other pollution sources might together lead to regional degradation. In the later years, the relevant monitoring question changed from “Is the area around my outfall degraded” to “How much area in the Southern California Bight (SCB) is degraded?” and “How does the area around my outfall compare to the rest of the Bight?” Consequently, monitoring locations were redesigned to achieve wider and more representative coverage. In addition, methods were standardized among organizations to ensure that data were comparable and could be regionally integrated. This evolution in monitoring has culminated in the establishment of a model monitoring program (MMP) framework for wastewater dischargers in southern California (Schiff *et al.* 2002a). The adaptive and flexible mindset espoused in the MMP will be key to meeting the challenges posed by emerging issues in coastal environmental management.

### Full Text

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