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Executive Summary: At a Glance

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AT A GLANCE

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The 2015 State of the Bay Report is a science-based comprehensive assessment of the environmental conditions of the Santa Monica Bay. The Santa Monica Bay National Estuary Program (SMBNEP) periodically conducts and reports this assessment with the goal of measuring progress in restoring the Bay's natural habitats and resources, educating the public about the Bay's valuable natural resources, and identifying and helping scientists and managers to address remaining and emerging challenges. More specifically, this report provides information that can be used to both gauge the progress in implementing the Bay Restoration Plan (BRP) and inform updates of the BRP to meet ongoing and new challenges.

This report covers all major Bay habitats and a broad range of issues, which follow closely the three priority issues addressed by the BRP: water quality, natural resources, and benefits and values to humans. The habitat assessments provide an overview of the habitats in the Bay and the Bay watershed, and an assessment of the ecological health of these habitats using the refined rating system applied to available data on indicators recommended by our panels of experts.

Additionally, the report identifies and discusses in more detail issues that affect the health of the Bay's beneficial uses, with feature articles and sidebars written by members of the SMBNEP Technical Advisory Committee (TAC) and invited experts. The topics of these articles were selected to represent the most current and pressing issues in the Bay and the Bay watershed. Many of the stories also provide good examples of how various issues have been addressed, including areas of progress, current status, information gaps, major obstacles, causes of the remaining problems, and ways to ameliorate them. Finally, the Report looks ahead at emerging issues that will need to be addressed in the coming years.

The SMBNEP TAC is made up of scientific and technical professionals from universities, research institutions, and governmental agencies, representing a wide range of expertise and disciplines. The role of the TAC is to ensure that the SMBNEP has the necessary scientific and technical information upon which to base its decision-making. Over the years, the TAC has assisted the SMBNEP in developing research agendas, monitoring programs, and overseeing the implementation of key research projects. The TAC led the development of the State of the Bay report by providing content guidelines, developing assessment framework, and participating in writing feature articles.

WATER RESOURCES

This chapter of the report features five articles that present major ongoing and new programs and projects that increase the region's water

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supply and improve water quality in the Bay watershed. These articles discuss, in detail, both the progress made over the last five years (2010–2015) and remaining or emerging challenges to our local water resources. One noteworthy trend of the past five years is a more incorporated consideration of water resources with increased levels of coordination in and among agencies. Careful consideration has been given to the inputs and outputs of traditional water management, with an understanding that drought, climate change, and water pollution need to be considered collectively as we look to improve water security and a healthy environment in Los Angeles and in Santa Monica Bay.

FEATURES AND KEY MESSAGES

Water Supply and Use. Four years of drought have put increased focus on water supply. The State's Recycled Water Policy will increase water supply, while assisting with the implementation of water quality regulations. Examples of such measures that are already underway include conservation, rainwater harvesting, stormwater harvesting, groundwater treatment, greywater reuse, and water reclamation (Section 1.1).

Water Quality. Four new Total Maximum Daily Loads (TMDLs) were enacted in the last five years to address the impacts of marine debris, dichloro-diphenyl-trichloroethane (DDT), and Polychlorinated biphenyl (PCB) on Santa Monica Bay, sediment and invasive exotic vegetation in the Ballona Wetland Ecological Reserve, and sedimentation and nutrients affecting the benthic community (animals and other organisms that live on or in the bottom) of Malibu Creek and Malibu Lagoon. The beach bacteria TMDL, designed to reduce bacterial levels along the beaches of Santa Monica Bay, has been successful. Bacteria levels at the beaches have been in decline, showing a measurable improvement in beach water quality. These improvements are attributable to sewer system and low-flow diversion upgrades, as well as the implementation of Low Impact Development (LID) stormwater management strategies and lower rainfall. Additionally, toxics in Santa Monica Bay sediments are no longer having adverse impacts on aquatic life, although seafood contamination is still an issue (Section 1.2.2). Monitoring data from Ballona Creek indicate that dry weather metal loading now rarely exceeds the TMDL targets, lessening impacts on wildlife in the creek and on the sediments in the Bay (Section 1.2.2). Finally, compliance with the Ballona Creek Zero Trash TMDL has reached 96.7% as of the 2013/2014 reporting year (Section 1.2.3), and trash found on Santa Monica Bay beaches has declined since 2008 (Section 1.2.3). However, a regional survey of trash in streams found that streams in the Santa Monica Mountains contain more cigarette butts, sports balls, and plastic bottles than elsewhere in Southern California (Section 1.2.3).

New Water Quality Issues. More knowledge has been gained in the last five years about contaminants of emerging concern (CECs; e.g., current use pesticides, pharmaceuticals, and flame retardants). For example, 12% of streams in the Santa Monica Bay watershed

contain potentially toxic concentrations of two common use pesticides (cyhalothrin and bifenthrin) in the pyrethroids group. As a result, new strategies are being developed to manage and regulate the CECs (Section 1.3), including pilot studies testing a new monitoring framework that targets 16 of these CECs (Section 1.3).

HABITAT

This chapter of the report provides an assessment of the condition**s** of the seven major habitat types found in the Bay and its watershed, as well as three articles highlighting conditions and efforts designed to improve several habitats in the Bay. The assessment was conducted under a new framework developed by the SMBNEP's TAC for identifying indicators and assessing habitat health that can be applied to all major types of habitats in the Bay in a consistent manner. Four categories of indicators were applied that relate to habitat health: extent, vulnerability, structure and disturbance, and biological response. Due to limited data availability and the high level of uncertainty, the scores for the four categories were not combined into one overall score for each habitat. Overall**,** the assessment finds that most habitats in most areas are degraded to some degree due to human disturbances. There are areas of improvement because of restoration efforts at Malibu Lagoon and in kelp forests in the Bay. There are also concerns that the conditions of some habitats are still in decline, such as rocky intertidal habitat**s,** due to intensive human trampling and collecting activities.

FEATURES AND KEY MESSAGES

Stream Health in the Santa Monica Mountains. A report by the Stormwater Monitoring Coalition found that 43% of stream miles in the Santa Monica Mountains are in near reference condition, while 20% are severely degraded. Sites in Malibu Creek generally have the lowest condition based on benthic invertebrates (Section 2.2.1).

Wetland Restoration. Restoration of Malibu Lagoon was completed in October of 2012. Post-restoration monitoring describes increased levels of dissolved oxygen, with patterns of dissolved oxygen that are typical of similar estuarine systems. Additionally, plants and animals are repopulating the restored area, and the benthic invertebrate community has shifted from pollutant-tolerant species to one that contains more sensitive species (Section 2.2.2).

Marine Protected Areas. Four Marine Protected Areas (MPAs) took effect in January 2012. Implementation efforts focus on outreach, education, and enforcement. Successes include the creation of the Los Angeles MPA Collaborative, the formation of several community-based monitoring programs, and an expansion of the state's violation reporting system. Initial monitoring results indicate that commercial fishermen tend to be complying, recreational fishermen in the Santa Monica Bay demonstrate

better compliance than fishermen further south, and fishing vessels are not currently displaying compaction as they shift away from now-closed fishing grounds (Section 2.2.3).

BIODIVERSITY

The articles in this chapter focus on several issues of biodiversity, such as restoring endangered populations and their genetic diversity (Section 3.1), population decline and what that may mean for coastal ecosystems (Section 3.2, Section 3.3), and managing populations to maintain diversity while allowing extraction (Section 3.4). More discussion on the issues surrounding ecosystem diversity can be found in Chapter 2 of this report.

FEATURES AND KEY MESSAGES

Endangered Species. Forty-one species were listed as federally or state endangered or threatened species in the Santa Monica Bay watershed. Another 29 are considered critically imperiled or imperiled by outside entities. The majority of these are plants, mosses, and arthropods. The habitat most affected is the chaparral and oak woodlands (Section 3). One specific project to improve the survivability of the threatened red-legged frogs in the Santa Monica Mountains is underway. Biologists have been reintroducing these frogs to streams where they once occurred that have good water quality and surrounding habitats (Section 3.1).

Beach and Intertidal Organisms. Grunion runs have declined in the Bay and throughout their range. This decline is likely due to a combination of several issues, including disrupted runs due to fishing activities, loss of spawning habitat due to "coastal squeeze," and changes in ocean chemistry. On a positive note, beach managers have altered their grooming practices to leave the area below the high tide line undisturbed during the grunion nesting season, in an effort to help these fish continue to survive (Section 3.2). Also, in June 2013, at least 20 different species of sea stars along the entire west coast of North America experienced a mass mortality event. In some parts of the Santa Monica Bay, local populations have completely disappeared. While recovery, fueled by unusually high recruitment, has begun elsewhere, there is no evidence of this as yet in Santa Monica Bay (Section 3.3).

Fisheries. Recreational and commercial fishing in Los Angeles County contributes $53.5 million in wages and 1,550 jobs to the local economy. While many types of commercial fishing gear are not allowed inshore of a line drawn from Malibu Point to Rocky Point, significant fishing activity occurs north of Point Dume, around Palos Verdes, and at Short Bank. Commercial fishing in the Santa Monica Bay primarily targets market squid, pacific sardine, red sea urchin, spiny lobster, hagfish, and thornyheads (related to rockfish).

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Improved fishery management plans, data collection, and stock assessments for these species are critical and needed to ensure that these important fisheries are sustainable over time (Section 3.4).

LOOKING AHEAD

After briefly recapping major success stories of the last five years, this chapter discusses in detail major challenges that threaten the Bay and its watershed's environmental health in the coming years. These challenges include climate change, human development in remaining natural areas, sediment management, the development of new monitoring tools, ocean acidification, nutrient loading, and harmful algal blooms.

FEATURES AND KEY MESSAGES

Climate Change Impacts. Local impacts of climate change are expected to include more extreme weather patterns; severe drought; increased extreme heat waves; more frequent Santa Ana wind events; sea level rise; increased frequency, intensity, and reach of storm surge; and increased acidity in coastal waters. In order to respond, local municipalities and agencies have initiated independent and collaborative adaptation planning. In addition, the SMBNEP plans to conduct a broad, risk-based climate change vulnerability assessment of all goals and objectives in the Bay Restoration Plan in 2015–2016 (Section 4).

Natural Habitat Protection in the Santa Monica Mountains. In 2014, a local coastal program (LCP) was adopted for the unincorporated areas of the Santa Monica Mountains, which puts limits on development; requires stormwater BMPs, improved on-site wastewater treatment, erosion prevention, slope stabilization, and ridgeline protection; and adopts a strong biological resource protection approach (Section 4.1). However, more efforts are needed to ensure effective implementation of the LCP and to address other challenges, such as pollution from septic systems, coastal lagoon restoration, removal of Rindge Dam and other fish migration barriers, and control of invasive species.

Sediment Management. Increasingly, management agencies in the Santa Monica Bay watershed recognize that our coastline is starved of new sediment input as reservoirs, debris basins, and dams trap these sediments upstream. In other areas, our urban landscapes and channelized creeks limit erosion and sediment transport. With expected sea level rise and increased storm surge, the need for sediment along our coast is apparent. The current problems of artificially managing sediment transport from our watersheds to the coast leave management agencies challenged to keep reservoirs and debris basins clear of sediment in order to maintain the flood protection these basins provide, while others attempt to find sources of sediment to add to beaches in order to

reduce the effects of erosion and protect infrastructure. Now, more than ever, a holistic, watershed-based approach is required to restore the natural sediment transport process, which is considered the best long-term solution to both problems (Section 4.2).

New Monitoring Tool Development. Two new, faster methods for measuring beach bacteria contamination are now being tested. Both are molecular methods. The first is called quantitative polymerase chain reaction (qPCR). It is performed in the lab, can give results within two hours, and can also distinguish between human and animal sources of fecal bacteria. The second is automated digital droplet PCR (ddPCR), which is similar to qPCR but has the advantage of allowing lifeguards to perform the test and obtain results while in the field. Both of these methods would allow for more accurate and quicker results than the techniques currently in use, creating better protection for public health. Further testing and financing will be needed to determine if these methods can be implemented to ensure the safety of swimmers, surfers, and others along the beaches of Santa Monica Bay (Section 4.3).

Ocean Acidification. Recent models predict that, within the next 30 years, much of the near-shore California Current System will experience "corrosive" waters all summer long in the upper 60 meters (top 180 feet) of the ocean due to ocean acidification. Locally, ocean discharges containing elevated nutrient levels can exasperate this process. These conditions are believed to reduce the fitness or prevent the development of marine organisms that produce calcium carbonate shells, such as snails, clams, and sea urchins. Such organisms include the commercially important red sea urchin and all seven species of abalone (Section 4.4). It is critically important to monitor for ocean acidification in our coastal waters to understand how intensely and where ocean acidification is likely to impact living organisms in Santa Monica Bay. The SMBNEP and partners are deploying a sensor array in 2015–2016 to begin tracking these changes to our local environment.

Nutrient Loading and Harmful Algal Blooms. Results from several recent studies provide multiple lines of evidence that human-derived nutrients are influencing ecological conditions in Santa Monica Bay and the rest of the Southern California Bight (Section 4.5). Increased focus in the coming years on determining the sources and impacts of nutrient loading will be needed to understand how intensely it influences hypoxia, eutrophication, harmful algal blooms, cyanotoxin, domoic acid, and ocean acidification. In response to increasing frequency and severity of harmful algal blooms in Southern California, monitoring of these events has increased along the coast of California, and more vigilant monitoring for the presence of these algae and their toxins needs to be carried out in the future. Furthermore, studies have found that cyanotoxins are widespread throughout the state, which means that they should be included in all watershed monitoring programs. A better understanding of what causes cyanotoxin production and the potential for effects of cyanotoxins on aquatic life (both upstream and down) will be critical for developing informed management approaches.