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Habitat Conditions: Soft-Bottom Benthos

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2.1.6 Soft-Bottom Benthos

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Habitat Description

Soft sediments composed of sand, silt, and clay make up the majority of the bottom habitat in the Bay. These are found throughout the Bay, with exceptions in the deep-water canyon off Point Dume; on Short Bank in the middle of the Bay; on the shelf off Rocky Point; and along the coast from the county line to Lechuza Point, from Point Dume to Malibu Point, and off the Palos Verdes Peninsula.

Soft sediments provide both shelter and foraging grounds for thousands of benthic invertebrate species, ranging from tiny worms, shrimps, and crabs to sea stars, clams, and sea slugs. These bottom organisms are near the base of the food web that supports an abundant and diverse assemblage of bottom-dwelling fishes. Soft-bottom fish found in the Bay include flatfishes, rockfishes, sculpins, combfishes, and eelpouts. Some of these fish, such as California halibut (*Paralichthys californicus*), California scorpionfish (*Scorpaena guttata*), barred sand bass (*Paralabrax nebulifer*), and white croaker (*Genyonemus lineatus*), also account for a significant percentage of recreational fish catches from piers and boats.

Soft sediments are also a major reservoir of chemical contaminants in the Bay. Many chemical contaminants bind to organic material on sediment particles, where they can accumulate to high levels and provide an ongoing source of exposure to marine life. Chemical contaminants have been introduced to this habitat primarily through historical wastewater discharges at outfalls offshore from Hyperion Treatment Plant (Hyperion) near Los Angeles International Airport and the Joint Water Pollution Control Plant (JWPCP) near White Point on the Palos Verdes Peninsula. Other significant contributors are dry and wet weather runoff from rivers and creeks and industrial discharges to the Bay.

Status and Trends

Extent: EXCELLENT and CONSTANT

Two indicators are needed to describe the extent of soft-bottom habitat in the Bay: (1) the spatial extent (surface area) of the bottom habitat and (2) the depth range (vertical distribution) of near-bottom water quality conditions indicative of high-quality habitat.

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HABITAT CONDITIONS: Soft-Bottom Benthos

The overall score for extent in this assessment is based solely on the available surface area of soft-bottom habitat, as the vertical distribution indicator is still under development. The extent of the soft-bottom habitat is considered to be in EXCELLENT condition with no change in the last five years. Confidence in this overall score is MODERATE, due to the use of only one of the two indicators in the category (Table 2.1.6, Line 1).

Surface Area

This indicator tracks changes in the availability of the soft-bottom habitat due to activities, such as the creation of artificial reefs that convert part of this habitat to other purposes. Quantitative data for this indicator exist; however, the availability of historic and future data is uncertain, and thresholds for evaluating this indicator have not yet been established. Despite the limitations, this indicator is considered to be in EXCELLENT condition due to the ample amount of habitat available. Its condition is CONSTANT due to the lack of substantial changes in area in the last five years. For this report, best professional judgment (BPJ) was used to score this indicator. Despite the lack of quantitative data and thresholds, which limit full evaluation of trends, the extent of this habitat is well known. As a result, confidence in the current assessment is HIGH (Table 2.1.6).

Vertical Distribution

While this indicator is not fully developed, it is intended to describe changes in the distribution of water quality conditions near the sediment surface needed to support healthy benthic communities (e.g., depth range of temperature, pH, and dissolved oxygen). While near-bottom water quality data are available, the development of thresholds for data interpretation is incomplete. As a result, this indicator is not scored at this time. However, ongoing research into this topic, including ways to relate changes in near-bottom water quality data to changes in benthic infauna species distribution, will help inform the development of this indicator for use in future assessments (Table 2.1.6).

Vulnerability: Not Scored

The indicators for this category have not been developed yet. However, the intention is to identify and track changes in how exposed the soft-bottom habitat is to activities that have the potential to negatively impact it (i.e., certain types of bottom trawling, sea floor drilling, and the installation and maintenance of equipment on the seafloor) (Table 2.1.6).

Structure and Ecological Disturbance: FAIR and IMPROVING

The assessment for this category is based on the sediment concentrations of three chemicals that bioaccumulate through the food web and have the potential to pose risks to humans and wildlife through the consumption of contaminated fish and shellfish. The chemicals are dichlorodiphenyltrichloroethane (DDT), polychlorinated biphenyls (PCBs), and mercury (Hg). Trends in this category are evaluated in approximately 10-year time-steps for this report. In future reports, this will be revised down to five-year time-steps that are aligned with the State of the Bay reporting periods.

Based on the scores for all three indicators in this category, the overall score for structure and ecological disturbance is FAIR. The condition is IMPROVING. Confidence is HIGH due to the high confidence in two of the three indicators scored and moderate confidence in the third (Table 2.1.6).

DDT

Sediment contamination from DDT is pervasive throughout Santa Monica Bay, with most of the contamination related to inputs to the Palos Verdes Shelf. From the late 1950s to the early 1970s, an estimated 1,700 tons of DDT were deposited on the shelf through the JWPCP wastewater outfall at White Point (Environmental Protection Agency 2015). This chemical is believed to be the cause of reproductive failure in several bird species in the 1970s, including the California brown pelican (*Pelecanus occidentalis californicus*), and is subject to Total Maximum Daily Load (TMDL) regulations in Santa Monica Bay. DDT in surface sediments is closely monitored by both the Sanitation Districts of Los Angeles County (LACSD) going back to 1972 and the City of Los Angeles Environmental Monitoring Division (CLA-EMD) going back to 1974. The target for Santa Monica Bay sediment DDT concentration established in the TMDL is used here to define the threshold for interpreting this indicator.

The indicator is scored by evaluating the percentage of surface area exceeding the DDT TMDL-based threshold. The condition of DDT in the Bay is FAIR due to 30% of Bay sediments exceeding the threshold. The condition is IMPROVING, although the pace of this improvement has slowed. Confidence in this assessment is HIGH given the availability of an established threshold and high-quality, long-term monitoring data (Table 2.1.6).

PCBs

PCB contamination of Santa Monica Bay sediment is primarily associated with historical wastewater outfall discharges from JWPCP and Hyperion. There is also a TMDL in place for sediment PCBs, and this contaminant has been monitored by both LACSD and CLA-EMD since 1984 and 1974, respectively. The sediment target for PCB concentration established in the TMDL is used here as the threshold to evaluate conditions. This indicator is scored by evaluating the percentage of the surface area exceeding the PCB threshold.

The condition of PCBs in the Bay is FAIR due to 25% of Bay sediments exceeding the threshold. The condition is IMPROVING, although the pace of this improvement has slowed. Confidence in this assessment is HIGH given the availability of an established threshold and high-quality, long-term monitoring data (Table 2.1.6).

HABITAT CONDITIONS: Soft-Bottom Benthos

Mercury

There are multiple sources of anthropogenic mercury in Santa Monica Bay sediments, including wastewater discharge, industrial effluents, urban runoff, and atmospheric fallout. While there is no TMDL or preexisting sediment threshold for mercury in Santa Monica Bay, some species of local fish contain elevated levels of this contaminant and pose a potential health risk to humans. Sediment mercury concentrations have been monitored by both LACSD and CLA-EMD since 1972. Thresholds for this assessment are defined as the 50th, 90th, and 99th percentiles of sediment mercury concentration in the 2008 Southern California Bight Regional Survey (Schiff et al. 2011). This indicator was scored by evaluating the percentage of the surface area exceeding each mercury threshold.

Mercury levels in the Bay are in FAIR condition because 89% of Bay sediments have concentrations that exceed those measured in 50% of samples from the rest of the Bight (the 50th percentile). However, the condition is IMPROVING. Confidence in this assessment is MODERATE because the thresholds used are not based on biological responses. However, high-quality, long-term monitoring data are available, and the consensus among the expert panel conducting the assessment was high (Table 2.1.6).

Biological Response: EXCELLENT and CONSTANT

Two indicators comprise the biological response category: a measure of benthic community condition (Benthic Response Index, BRI) and the community structure of sediment-associated fish species. For this report, trends are evaluated in approximately 10-year time-steps. In future reports, this will be revised down to five-year time-steps that are aligned with the State of the Bay reporting periods.

The overall score for extent in this assessment is based solely on the BRI, as further development of a fish community structure indicator is needed. Biological response is considered to be in EXCELLENT condition and a CONSTANT state. Confidence in this overall score is MODERATE, due to the reliance on only one of the two indicators in the category for the score (Table 2.1.6).

Benthic Community Condition

The BRI describes the level of disturbance in the benthic community, based on the presence, abundance, and pollution tolerance level of species occurring at the site. The index values are interpreted using four thresholds that define five response categories that reflect changes in key community attributes (Smith et al. 1999). The BRI thresholds are used as thresholds for this assessment, creating a five-level scoring system, instead of the three-level system used elsewhere in this report. This indicator is scored by evaluating the percentage of surface area in each response category.

The benthic community of the Bay is in EXCELLENT condition because BRI index values are at reference condition or within the uncertainty inherent in the index (marginal deviation) in over 99% of the area (Figure 2.1.6). This condition has also been relatively

CONSTANT over the last 10 years, following substantial improvements between the 1980s and the early 2000s. Within this time period, incremental improvements may have occurred, but are not statistically significant. Confidence in this assessment is HIGH due to the established and accepted e thresholds and the availability of high-quality, long-term monitoring data (Table 2.1.6).

Fish Community Condition

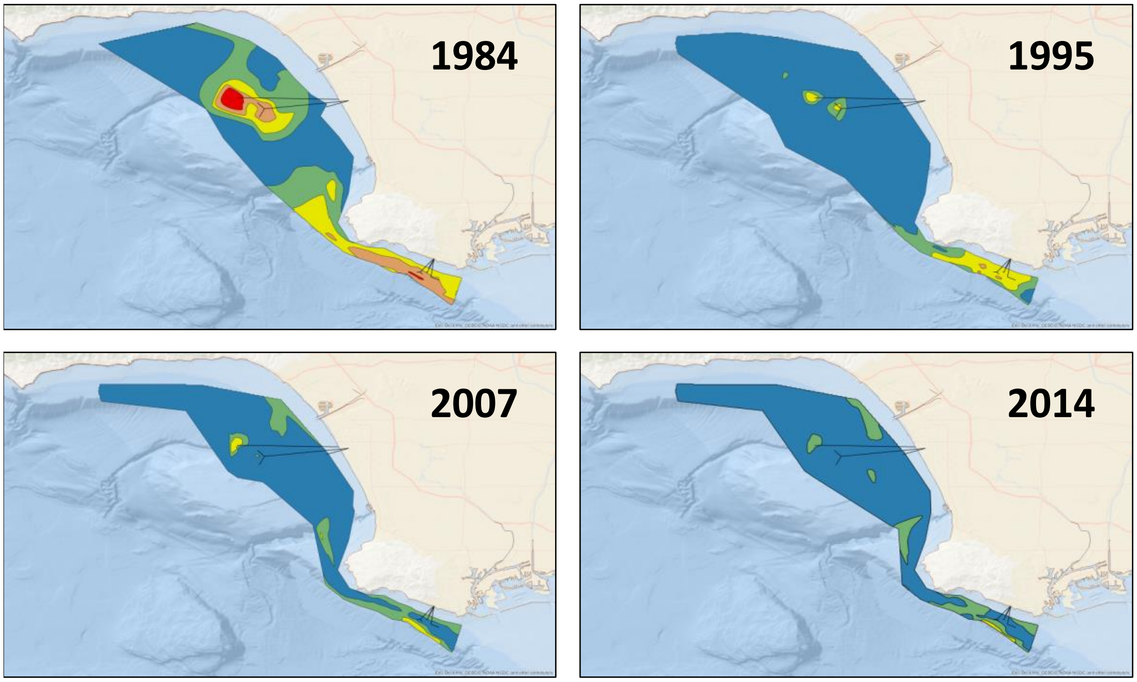
This indicator will allow us to track changes in the diversity and abundance of bottom-dwelling fish. An existing index, the Fish Response Index (FRI), is no longer considered to be an accurate measure of fish community condition. Unlike the BRI, the FRI was not based upon statistically determined pollution tolerances of the fish, but was derived through correlation with existing BRI scores at the time. Since then, some of these correlations have disappeared as oceanographic conditions and other factors unrelated to sediment contamination have changed. The development of a new index that more accurately measures the health of fish communities under changing habitat conditions is needed (Table 2.1.6).

HABITAT CONDITIONS: Soft-Bottom Benthos

Table 2.1.6. Indicators, Related Management Actions, and Status and Trends for the Soft-Bottom Benthic Habitat

INDICATOR	*METRIC*	*RELATED MANAGEMENT*	*SCORE*	*CONFIDENCE*
1. Habitat Extent *(Spatial Indicators related to extent, accessibility, availability, and temporal variability)*				MODERATE
1.1 Spatial extent	Surface area of the soft-bottom habitat. This indicator will be developed further in the future.	State Lands Commission and Coastal Commission permitting of artificial reefs, and other projects	STATUS: Excellent TREND: Constant	HIGH
1.2 Vertical habitat availability	This indicator needs to be developed.			NOT SCORED
2. Habitat Vulnerability *(Spatial Indicators related to disturbance potential)* *The indicators for this category still need to be developed.*				NOT SCORED
3. Structure & Ecological Disturbance *(Physical, chemical, and biological properties that impact condition of habitat)*				HIGH
3.1 DDT	% of surface area in each class of DDT concentration (ug/g %OC dw) as defined by TMDL targets for Santa Monica Bay	SMBRC: BRP Goal 1.1; EPA TMDL for DDT in the Bay; EPA Superfund Site goals	STATUS: Fair TREND: Improving	HIGH
3.2 PCBs	% of surface area in each class of PCB concentration (ug/g %OC dw) as defined by TMDL targets for Santa Monica Bay	SMBRC: BRP Goal 1.1; EPA TMDL for PCBs in the Bay	STATUS: Fair TREND: Improving	HIGH
3.3 Mercury	% of surface area in each class of mercury concentration (mg/kg dw) based on regional results from the Bight '08 study.		STATUS: Fair TREND: Improving	MODERATE
4. Biological Response *(Changes to individuals, populations, communities, and ecosystems in response to changes in habitat quality)*				MODERATE
4.1 Benthic Community Condition	% of surface area in each class of values for the benthic response index (Figure 2.1.6)		STATUS: Excellent TREND: Constant	HIGH
4.1 Fish Community Condition	This indicator needs to be developed.			NOT SCORED

Figure 2.1.6. Map (top) showing Benthic Response Index (BRI) values at various time points as monitored and table (bottom) showing the percentage of area in each class defined by BRI threshold values. Advanced primary treatment of wastewater was used from 1970 to 1983. Partial secondary treatment was used from 1984 to 2002 for JWPCP and from 1997 to 1998 for Hyperion. Full secondary treatment was used from 2002 to the present for JWPCP and from 1998 to the present for Hyperion. The extent of the area monitored has declined over the years, and is responsible for the small decline in the percentage of area in reference condition since 1995. *Data Source: CLA-EMD and LACSD, analysis and map done by LACSD.*



Area coverage in percentage				Benthic Response Index (BRI) Threshold Intervals	
1984	1995	2007	2014		
1.6%	0.0%	0.0%	0.0%	>=72	Defaunation
7.9%	0.2%	0.0%	0.0%	44-71	Loss of community function
13.7%	5.1%	1.5%	0.4%	34-43	Loss of biodiversity
26.0%	6.1%	13.4%	12.1%	26-33	Marginal deviation from reference
50.7%	88.7%	85.1%	87.2%	<=25	Reference conditions

Conclusions and Next Steps

The physical, chemical, and biological properties of the soft-bottom habitat have continued to improve, primarily due to the continuous shrinking of surface areas with high DDT, PCB, and mercury concentrations, even though they are still higher compared to the rest of the Southern California Bight.

Priorities for this habitat include additional research to develop a new index of biological response in soft-bottom fish and invertebrates, in addition to thresholds to interpret near-sediment surface water column parameters that support marine life, such as dissolved oxygen levels and ocean acidity.

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