

major stressors are commonly known. Some of the challenges for this habitat were due to a type conversion of wetlands into other habitats such as uplands, and the issues associated with coastal wetland loss and development over time. Additionally, recent regulatory changes to definitions of wetlands have occurred at both a federal and state level, which may cause challenges for cross-referencing data over time. Climate vulnerability was informed by the Climate Change Vulnerability Assessment (CCVA) conducted by SMBNEP in 2016 (Grubbs et al. 2016).

Indicators

Utilizing indicators helps track changes in the environment, and consistently collecting data on these indicators over time allows for long-term trends in habitat condition to be evaluated. The coastal wetland habitat includes 16 indicators across four categories which will be used to detect changes in the environment (Table 7.1). Indicators will be monitored using a variety of programs and studies identified in the subsection below. Where possible, indicators are reflective of quantitative measurements at specific geospatial scales. Note that the indicator list is not intended to be comprehensive or exhaustive, rather it is intended to be representative to capture extent, condition, and trends over time for this habitat.

Table 7.1. Indicators for coastal wetland habitats in the Santa Monica Bay region.

| Indicator Category | Coastal Wetland Indicators |
|------------------------------|--|
| Habitat Extent | Area of Wetland Habitats |
| Ecological Condition | Trophic Food Web Support and Pollution Tolerance Index |
| | Nursery and Habitat Provisioning for Fish |
| | Forage and Breeding Function for Birds |
| | Habitat Structure and Complexity |
| | Vegetation Community (Change) |
| Stressors | Eutrophication |
| | Sedimentation and Contamination |
| | Anthropogenic Disturbance and Land Use |
| | Altered Hydrology |
| | Physical Structure |
| Climate Change Vulnerability | Inundation |
| | Change in Freshwater Input to System / Flow |
| | Estuary Mouth Dynamics |
| | Dissolution of Carbonate Structures (Organismal) |
| | Ecosystem Metabolism |

Monitoring Program and Current Studies

This section of the report contains details on specific monitoring program implementation components that will be used to evaluate trends in the indicators over time. Information is provided on monitoring programs, responsible parties, and frequency of data collection.

For habitat extent, this indicator will be evaluated by tracking area of coastal wetland habitats providing ecosystem functions by type (e.g., perennial estuarine, bar-built estuary, unvegetated salt marsh, etc.); estimates of type-conversion or loss over time; and using jurisdictional wetland delineation data. Data may be acquired from historical topographical maps (referred to as t-sheets) data, categorizations through the Southern California Wetland Recovery Project archetypes, National Wetland Inventory data, and site-specific sources such as jurisdictional delineations. Aerial photographs such as from the California Coastal Records Project (www.californiacoastline.org) may also serve to inform this indicator or others below. In general, due to the protections afforded wetland systems in the State of California and the public ownership of many of the wetland systems in the Bay, this metric is unlikely to vary considerably in the future unless large scale restoration actions are taken. Data should be updated every few years or after major restoration activities.

For the other three categories of indicators, i.e., ecological condition, stressors, and climate change vulnerability, details on implementation strategies and monitoring program elements can be found in Tables 7.2, 7.3, and 7.4, respectively.

Data collected to inform trends associated with various indicators are often informed by monitoring or research programs that are conducted opportunistically, as components of restoration planning efforts, or not comprehensive throughout the Santa Monica Bay. For example, site-intensive baseline studies are being conducted beginning in 2020 at Topanga Lagoon to inform restoration planning for that site. Similarly, long-term data were collected at Malibu Lagoon through early 2019 (Johnston et al. 2019), which informed restoration trajectories and evaluated success criteria. New data at Malibu Lagoon will be collected in conjunction with the Estuarine MPA Monitoring program. There may be opportunities to integrate future Bight data as well. Note that monitoring programs that do not have a formal plan associated with them or are largely associated with opportunistic filling of data gaps state “opportunistic surveys / research” or “no current programs” in the tables below as they may not currently be funded programs.



Figure 7-1. Topanga Lagoon, in Malibu, a small bar-built estuary (credit: TBF).



Figure 7-2. Malibu Lagoon, a small bar-built estuary, approximately six years after restoration. Top: low tide photograph looking towards estuary mouth; bottom: interpretive element intentionally covered during estuary mouth closure (credit: TBF).



Figure 7-3. Area A uplands in the Ballona Wetlands Ecological Reserve (credit: TBF).



Figure 7-4. Area B muted tidal channel in the Ballona Wetlands Ecological Reserve (credit: TBF).

Table 7.2. Ecological Condition Metrics and Monitoring Program Details.

| Indicator | Monitoring Metric / Parameter | Monitoring Data Program / Responsible Party | Frequency |
|--|--|--|--|
| Trophic Food Web Support and Pollution Tolerance Index | Pollution toleration indices for invertebrates | M-AMBI index data collected by SCCWRP; Bight Survey Program data collected by SCCWRP and partners | Opportunistic surveys / research |
| | Fish community assessments | Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | Semi-annually |
| | Benthic invertebrate community | Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | Semi-annually |
| | eDNA data | SCCWRP | Opportunistic surveys / research |
| Nursery Habitat Provisioning for Fish | Presence and size categories of estuarine fish | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs; data collected by RCDSMM and UCLA; Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | EMPA data semi-annually; others opportunistic |
| | Tidewater gobies, steelhead trout | Long-Term Steelhead Trout surveys by RCDSMM; Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs; additional data collected by RCDSMM and UCLA; Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | EMPA data semi-annually; RCDSMM steelhead surveys annually; others opportunistic |
| | SAV physical and biological characteristics | No current programs | No current programs |
| | Presence and size of macro invertebrates (e.g., crabs, shrimp) | Some data collected in conjunction with fish seining surveys (see above) | No current programs |

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| Indicator | Monitoring Metric / Parameter | Monitoring Data Program / Responsible Party | Frequency |
|--|---|--|---|
| Forage and Breeding Function for Birds | Activity surveys of birds | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs | EMPA data semi-annually; others opportunistic |
| | Breeding surveys of Belding's Savannah Sparrow | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs; eBird data | Opportunistic surveys / research |
| Habitat Structure and Complexity | CRAM index values for the biotic structure component | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs; RCDSMM data for Topanga; Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | Previously conducted annually, now opportunistically; Topanga opportunistic; EMPA CRAM annually |
| Vegetation Community (Change) | Native/non-native vegetation cover change over time | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs; Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | EMPA CRAM data annually; others opportunistic |
| | Rare species presence/area | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs | Opportunistic surveys / research |
| | Codominant species or vegetation assemblages (vegetation mapping, CRAM) | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs; Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | EMPA CRAM data annually; others opportunistic |
| | Percent invasion (CRAM) | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs; Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | EMPA CRAM data annually; others opportunistic |

Table 7.3. Stressor Metrics and Monitoring Program Details.

| Indicator | Monitoring Metric / Parameter | Monitoring Data Program / Responsible Party | Frequency |
|--|---|---|---|
| Eutrophication | Dissolved Oxygen | Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | EMPA data downloaded monthly |
| | Submerged Aquatic Vegetation and algae cover | Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | EMPA data semi-annually |
| | Nitrogen and phosphorous levels | Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | EMPA data semi-annually |
| Sedimentation and Contamination | Concentrations of various contaminants in sediments (e.g., organics, heavy metals, trash) | No current programs | No current programs |
| | Channel cross-sections and flood-plain elevation | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs | Opportunistic surveys / research |
| Anthropogenic Disturbance and Land Use | CRAM index values for the buffer and landscape context component | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs; Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | Opportunistic surveys / research; EMPA CRAM data annually |

| Indicator | Monitoring Metric / Parameter | Monitoring Data Program / Responsible Party | Frequency |
|--------------------|--|---|---|
| Altered Hydrology | Flow | Flowmeters | Opportunistic surveys / research |
| | CRAM index values for the hydrology component | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs; Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | Opportunistic surveys / research; EMPA CRAM data annually |
| Physical Structure | CRAM index values for the physical structure component | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs; Estuarine MPA data from Malibu Lagoon collected by CSULB and partners | Opportunistic surveys / research; EMPA CRAM data annually |

Table 7.4. Climate Vulnerability Metrics and Monitoring Program Details.

| Indicator | Monitoring Metric / Parameter | Monitoring Data Program / Responsible Party | Frequency |
|---|--|--|---|
| Inundation | Water surface elevation and inundation area/time | Deployed water quality sondes (e.g., Hydrolab, YSI) in Malibu Lagoon as part of EMPA surveys (CSULB); deployed sonde in Topanga (RCDSMM) | EMPA and RCDSMM data downloaded monthly |
| | Key species distribution changes | Data collected by TBF / CRI associated with Ballona Wetlands monitoring programs; EMPA surveys in Malibu Lagoon (CSULB) | Opportunistic surveys / research; EMPA data semi-annually |
| | Adjacent buffer and adjacent habitat (CRAM) | Data collected by TBF / CRI associated with Malibu Lagoon and Ballona Wetlands monitoring programs | Opportunistic surveys / research |
| | SLR and thresholds of submergence | No current programs | No current programs |
| Change in Freshwater Input to System / Flow | Flow | Flowmeters | Opportunistic surveys / research |
| | Stream gauge data | LA County Public works stream gauges (5 min interval data loggers in multiple locations) | Data available upon request |
| | Salinity regimes | Deployed water quality sondes (e.g., Hydrolab, YSI) in Malibu Lagoon as part of EMPA surveys (CSULB); deployed sonde in Topanga (RCDSMM) | EMPA and RCDSMM data downloaded monthly |
| Estuary Mouth Dynamics | Frequency and length of closure of mouth opening | Satellite imagery (NASA/JPL) | Opportunistic surveys / research |
| | | Camera stations or water level sensors for water surface elevation | Unknown |
| | | Elevation/LiDAR/Bathymetry for estuary mouth dynamics | Opportunistic surveys / research |

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| Indicator | Monitoring Metric / Parameter | Monitoring Data Program / Responsible Party | Frequency |
|--|--|--|---|
| Dissolution of Carbonate Structures (Organismal) | Indicator not developed | No current programs | No current programs |
| Ecosystem Metabolism | Net balance of O ₂ /CO ₂ | No current programs | No current programs |
| | Dissolved oxygen and salinity | Deployed water quality sondes (e.g., Hydrolab, YSI) in Malibu Lagoon as part of EMPA surveys (CSULB); deployed sonde in Topanga (RCDSMM) | EMPA and RCDSMM data downloaded monthly |
| | Temperature (water) or SST | Deployed water quality sondes (e.g., Hydrolab, YSI) in Malibu Lagoon as part of EMPA surveys (CSULB); deployed sonde in Topanga (RCDSMM) | EMPA and RCDSMM data downloaded monthly |

Data Sharing and Reporting

Coastal wetland monitoring data will be compiled and analyzed approximately every five years associated with production of the SMBNEP SotB Report and led by the NEP's Technical Advisory Committee. The SotB Report will be made publicly available via website. Data will be consolidated and used to develop the SotB condition and trend graphics and will be represented visually when possible. Detailed information on data quality control, quality assurance, database management, and analysis will be available in the next update of SMBNEP's Quality Assurance Program Plan, scheduled for review in 2021. Data will be stored on TBF's servers with summaries available to the public upon request. When possible, data will be incorporated into public databases like the California Rapid Assessment Method database or other similar public data sharing portals.

Data Gaps and Future Studies

Former data gaps identified for wetland habitats by the 2015 SotB Report were extensive, including a lack of development of most of the biological response indicators such as benthic invertebrate community, nursery function for fish, and forage function for birds. However, long-term datasets collected by TBF and partners at the Ballona Reserve and Malibu Lagoon began filling some regional gaps from previous monitoring periods. Additional data gaps identified in the 2015 SotB Report include all of the vulnerability indicators (not developed) and the biological response indicators (not developed). Some of these indicators have been evaluated and updated for this revised CMP and are reflected in Tables 7.2-7.4 as condition metrics. Several new metrics associated with the new "climate change vulnerability" category were identified in the tables above as data gaps (e.g., pCO₂, species migration, tracking bar-built estuary mouth closure patterns, camera stations or water level sensors for water surface elevation). Several indicators need to be more fully developed, such as 'SLR and thresholds of submergence' and 'dissolution of carbonate structures'. These indicators need metrics developed, monitoring plans compiled, and data to be collected.

Although Malibu Lagoon will be monitored as part of the Estuarine Marine Protected Area grant for at least one year with data evaluated and compared to previous monitoring data, most of the other wetland systems, including the Ballona Reserve, have no funding for long-term monitoring of any of the indicators listed in the tables above. Thus, while there was a substantial amount of new data included in the 2015 SotB Report, most of these systems still have temporal data gaps for many of the indicators in recent years. Most of the smaller systems in the northern Bay (e.g., Zuma, Big Sycamore, Trancas) have some opportunistic data collected associated primarily with tidewater gobies or steelhead trout surveys, but they are largely understudied and remain as a significant data gap for most of the indicators. Additionally, there are some indicators that have a lack of identified data collection for most or all sites (e.g., contaminants, SAV monitoring, ecosystem metabolism). Table 7.5 summarizes priority data gaps identified for the coastal wetlands

habitat; types of data gaps; potential sources of funding at the federal, state, and local levels for filling these data gaps; and cross-references to relevant actions and potential funding sources identified in the 2019 CCMP Finance Plan (also provided in Table 9.6 of Chapter 9).

Next steps for this habitat type include continuing to prioritize and fill data gaps listed above and in Tables 7.2-7.5, especially the categories that are “unknowns” and require more information, as well as additional new studies that could further support the evaluation of the key indices for this habitat. Note that Tables 7.2-7.4 may look complete, but still may have spatial or metric data gaps. New studies that are recommended include habitat extent assessments for the smaller lagoon systems, assessments of commercially or recreationally important fish species, rare plants or birds, eutrophication studies, tracking plant invasions, hydrology studies especially associated with climate change stressors, and many others.

Table 7.5. Coastal Wetlands Habitat – Summary of Data Gaps and Potential Funding Sources.

| Indicator Category | Coastal Wetlands Habitat Data Gaps | Data Gap Type | Potential Funding Source(s) |
|-----------------------|--|--|--|
| Habitat Extent | Habitat extent assessments for the smaller lagoon systems | Special study (new data acquisition) | Prop. 50, others |
| Ecological Condition | Long-term monitoring of all indicators/indices (CRAM) Ballona Wetlands and Malibu Lagoon | Index component; Single metric | CDFW, others |
| | Baseline assessment for most indicators and long-term monitoring for all indicators/indices (CRAM) for most smaller systems in the northern Bay (e.g., Zuma, Big Sycamore, Trancas, many others) | Index component; Special study (new data acquisition) | Prop. 50, others |
| | Native/non-native vegetation cover change over time | Index component; Single metric | Unknown |
| | Survey of the condition (presence/area) of commercially or recreationally important fish species, rare plants or birds | Index component; Single metric | Unknown |
| Stressor | Long-term monitoring of all indicators/indices | Index component; Single metric | CDFW, others |
| | Eutrophication studies | Special study (existing data, new data acquisition) | Unknown |
| Climate Vulnerability | Hydrology studies associated with climate change stressors (inundation, freshwater input, estuary mouth dynamics, etc.) | Special study (existing data, new data acquisition) | Sea Grant, OPC, SCC, UCLA, CRI, others (2019 CCMP Finance Plan Action #36) |

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