

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 pelagic habitat includes 13 indicators across four categories which will be used to detect changes in the environment (Table 2.1). 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 and to capture extent, condition, and trends over time for this habitat.

Table 2.1. Indicators for pelagic habitats in the Santa Monica Bay region.

Indicator Category	Pelagic Indicators
Habitat Extent	Area of Pelagic Habitats
Ecological Condition	Pelagic Zooplankton Community Index
	Ichthyoplankton Diversity Index (or Community Structure)
	Fish Biomass Change
	Marine Mammal Strandings and Deaths
	Sea Bird Strandings and Nesting Function
Stressors	Area of Hypoxia
	Land-Based Pollution Assessment Model (or Source Assessment)
	Harmful Algal Blooms (HABs)
	Fishing Pressure
	Marine Debris and Microplastics Presence and Amount
Climate Change Vulnerability	Water Temperature Change
	Ocean Acidification (or Aragonite Saturation)

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 pelagic habitat providing ecosystem function. Coastal bathymetry may be used for mapping purposes, and models or depths zones may be used to categorize the assessment area. In general,

this metric is unlikely to vary considerably in the future unless the pelagic system is redefined in the future as to functional capacity or in another assessment. Data should be updated if major changes to ocean chemistry through pollutant discharge reductions, new desalination or other facilities that impact pelagic waters occurs.

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 2.2, 2.3, and 2.4, respectively.

For pelagic, large-scale monitoring programs that have broad state (e.g., CalCOFI) or regional (e.g., Bight Monitoring Program) surveys have some assessment areas within the Santa Monica Bay and provide data for some of the indicators below. Additional research or modeling should occur to develop some of the recommended indices (e.g., pelagic zooplankton community, ichthyoplankton diversity index, harmful algal blooms). Additionally, 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. “Unknown” frequency metrics require more information.



Figure 2-1. View of the Santa Monica Bay from TBF’s boat (credit: Amber Bratcher-Covino, CRI).

Table 2.2. Ecological Condition Metrics and Monitoring Program Details.

Indicator	Monitoring Metric / Parameter	Monitoring Data Program / Responsible Party	Frequency
Pelagic Zooplankton Community Index	Zooplankton data / community study	CalCOFI surveys	Unknown
Ichthyoplankton Community Index	Larvae / egg community studies	NOAA SWFSC integrated ecosystem assessments; CalCOFI surveys	Unknown
Fish Biomass Change	Fish biomass by size class (as indicator of overfishing)	CDFW Marine Region Statistical Unit / NMFS Southwest Fisheries Science Center	Data compiled annually
	Landings by weight of forage fish (commercial) caught in the Bay by species	CDFW Marine Region Statistical Unit / NMFS Southwest Fisheries Science Center	Data compiled annually
	Catch per unit effort of young thresher sharks by size category	CDFW Marine Region Statistical Unit / NMFS Southwest Fisheries Science Center	Data compiled annually
	Loss of large fish (quantify loss, select larger size classes)	CDFW Marine Region Statistical Unit / NMFS Southwest Fisheries Science Center	Data compiled annually
	Presence, movements, and permanence of great white sharks, giant sea bass and other species of interest	C. Lowe Lab at CSULB has eight receivers deployed throughout SM Bay	Data downloaded and compiled quarterly
Marine Mammal Strandings and Deaths	Distribution, frequency of occurrence, seasonality, and behavior of resident species	Ocean Conservation Society / NMFS / Southern California Cascadia Research Collective	Unknown
Sea Bird Strandings and Nesting Function	Density of seabirds	No current programs	Opportunistic surveys / research
	CECs in bird eggs	Historical data collected as part of Bight program	Historical data available

Table 2.3. Stressor Metrics and Monitoring Program Details.

Indicator	Monitoring Metric / Parameter	Monitoring Data Program / Responsible Party	Frequency
Area of Hypoxia	Habitat compression	ROMS-BEC model estimate (determine problem areas; evaluate stressor inputs)	Once and then only if substantial changes occur
Land-Based Pollution Assessment Model (or Source Assessment)	Proximity to land-based inputs (ID sources and make broader)	POTWs, SCCWRP Bight Monitoring Program are opportunities, this indicator needs to be more developed	Unknown
	Aerial deposition	No current programs	No current programs
Harmful Algal Blooms (HABs)	Season averages of domoic acid and P-N concentrations	SCCOOS harmful algae and red tide monitoring program (some include domoic acid); CRI research by Dr. Amber Bratcher-Covino	Weekly (SCCOOS); Opportunistic surveys for P-N
	Seasonal averages of HAB species (cell / liter)	SCCOOS harmful algae and red tide monitoring program; CRI research by Dr. Amber Bratcher-Covino on HAB species presence	Weekly (SCCOOS); Opportunistic surveys for CRI
Fishing Pressure	Aerial surveys to determine boat activity	LightHawk and TBF conduct quarterly surveys as funding occurs	Opportunistic surveys / research
	MPA Watch (offshore fishing) human activity surveys	MPA Watch collects community science data led by Heal the Bay and LA Waterkeeper (within MPA sites only)	Opportunistic surveys / research
Marine Debris and Microplastics Presence and Amount	Presence and quantification of various types of marine debris by area	Research surveys by Dr. James Landry (CRI); studies by SCCWRP	Opportunistic surveys / research

Table 2.4. Climate Vulnerability Metrics and Monitoring Program Details.

Indicator	Monitoring Metric / Parameter	Monitoring Data Program / Responsible Party	Frequency
Water Temperature Change	Temperature trends over time	NOAA / buoys; Dr. Jeremy Pal climate modeling research project (CRI); remote sensing data (satellite)	Daily for buoys; Opportunistic surveys / research for CRI – one set of 11 projection models
Ocean Acidification (or Aragonite Saturation)	pH, pCO ₂ , aragonite saturation	LACSD and CLAEMD pelagic monitoring / C-CAN – single station with wire walker	Data downloaded quarterly
	Area and frequency of low pH instances in CTD casts	LACSD and CLAEMD pelagic monitoring / C-CAN	Unknown

Data Sharing and Reporting

Pelagic habitat monitoring data will be compiled and analyzed approximately every five years associated with the 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, and summaries will be publicly available upon request. When possible, data will be incorporated into public databases or other similar public data sharing portals.

Data Gaps and Future Studies

Data gaps associated with the pelagic habitat include some indicators with recommended indices that have not been developed yet (e.g., pelagic zooplankton community, ichthyoplankton diversity index, harmful algal blooms). Many of these indicators and others also do not have established thresholds to be able to determine condition of the habitat. For example, the metrics associated with the land-based pollution assessment model indicator are both largely undeveloped and could benefit from data inputs. Data gaps from the 2015 SotB Report also include indicators such as marine mammals and seabirds, and geographic gaps such as breaks in data due to the distance between monitoring stations or too few stations in the Bay (e.g., CalCOFI, SCCOOS). Acquisition of consistent fishery data and stranding data was also identified as a challenge. Thus, additional research and/or monitoring locations are recommended to fill these data gaps. The impacts of some climate stressors such as ocean acidification on the pelagic zone in the Bay are not well understood, but recent research by SCCWRP and others has further developed models to inform this indicator. Table 2.5 summarizes priority data gaps identified for the pelagic 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 9.1 of Chapter 9).

New research and studies that are recommended include further development of pelagic habitat models such as those by Dr. Martha Sutula at SCCWRP modeling ocean acidification and hypoxia in the Bay and surrounding waters. Additional specialized research is recommended for important metrics that intersect with the CCMP Action plan such as microplastics studies, harmful algal bloom studies, and other climate stressor analyses to better inform status and trends throughout the Bay. There may also be existing data sets or pilot studies that could further inform new metrics associated with these indicators (e.g., pteropod study by SCCWRP for ocean acidification).

Next steps for this habitat type include continuing to prioritize and fill data gaps listed above and in Tables 2.2-2.5, especially the categories that are “no current programs” or “unknowns” and require more information, as well as additional new studies that could further support the evaluation of the key indices for this habitat.

Table 2.5. Pelagic Habitat – Summary of Data Gaps and Potential Funding Sources.

Indicator Category	Pelagic Habitat Data Gaps	Data Gap Type	Potential Funding Source(s)
Habitat Extent	Geographic gaps between monitoring stations	Single metric	CalCOFI, SCCOOS
Ecological Condition	Pelagic Zooplankton Community Index	Index development	CalCOFI
	Ichthyoplankton Community Index	Index development; Special study (existing data)	NOAA, SFSC Integrated Ecosystem Assessment
	Fish biomass change	Special study (existing data)	Unknown
	Marine mammal and seabird stranding	Single metric	NMFS and others
Stressor	Area of Hypoxia	Special study (existing data, new data acquisition)	Sea Grant, OPC, SCC, others (2019 CCMP Finance Plan Action #36)
	HAB Seasonal changes (species, domoic acid, P-N concentration)	Single metric; Special study (existing data)	SCCOOS
	Marine debris and microplastics presence	Single metric	SCCWRP Bight Monitoring Program, LMU
Climate Vulnerability	Temperature trends	Single metric, special study (existing data)	Sea Grant, OPC, SCC, others (2019 CCMP Finance Plan Action #36)
	Area and frequency of Ocean Acidification	Single metric, special study (existing data)	Sea Grant, OPC, SCC, others (2019 CCMP Finance Plan Action #36)

Literature Cited

- Bearzi, M., D. Checkley, D. Caron, M. Dojiri, J. Gully, C. Lowe, and E. Miller (2015).
“State of the Bay Report: Habitat Conditions: Pelagic”. *Urban Coast* 5(1): 116-127.
- Grubbs, M.W., K.K. Johnston, G. Wang, and T. Ford. 2016. *Climate Change Vulnerability Assessment of the Santa Monica Bay National Estuary Program’s Bay Restoration Plan*. Final Report prepared by the Santa Monica Bay National Estuary Program for the United States Environmental Protection Agency. 30 September, 2016. 184 pages.