Assessment Framework and Indicators for the Ecological Health of Habitats in Santa Monica Bay

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A Member of the National Estuary Program
Santa Monica Bay Restoration Commission

- Established as a National Estuary Program by USEPA and State of CA
- A locally-based State agency
- Partnership of federal, state and local, environmental, business, academic community
- Collaborative, watershed based approach
- Mission to develop and oversee implementation of a comprehensive conservation and management plan
Santa Monica Bay and its Watersheds

- 20 cities in the watershed
- 80+ cities in the watershed
SMBRC Core Functions

- Oversee and facilitate Bay Restoration Plan implementation
- Conduct assessment and reporting on environmental conditions of the Bay and Bay watershed.
The Santa Monica Bay Restoration Plan (BRP)

- Action recommendations for achieving 160+ objectives and milestones in three program areas:
  - Improvement of water quality
  - Conservation and rehabilitation of natural resources
  - Protection of human benefits and values
State of the Bay Report

- A comprehensive analysis of the Bay’s environmental conditions
- Highlight accomplishments and challenges
- Rely on data collected under the Comprehensive Monitoring Program and provided by partner agencies
- Publish once every five years
State of the Bay Reporting – Habitat Conditions

How to Read the Habitat Conditions Assessment

<table>
<thead>
<tr>
<th>Status:</th>
<th>CRITICAL</th>
<th>POOR</th>
<th>FAIR</th>
<th>GOOD</th>
<th>EXCELLENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics:</td>
<td>Defaunation and loss of key ecosystem functions</td>
<td>Significantly reduced biodiversity and some loss of ecosystem function</td>
<td>Reduced biodiversity and reduced level of ecosystem function</td>
<td>Biodiversity and ecosystem function are similar to pristine conditions</td>
<td>Biodiversity and ecosystem function are equivalent to pristine conditions</td>
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</table>
The Santa Monica Bay Comprehensive Monitoring Program (CMP)

- A plan for coordinated monitoring to provide a regional, long-term assessment of the condition of the various habitats in Santa Monica Bay.
- First developed in 2000 and last updated in 2007 in collaboration with major dischargers and regulatory agencies.
Why CMP was Needed?

- Existing Problems:
  - Lack of focus on management needs
  - Overlaps and duplication of effort
  - Information gaps
  - Overemphasis on large point sources
  - Inattention to living resources
  - Inability to combine data from separate programs
What is the CMP designed to do?

- Focus on key issues of concern and management needs
- Focus on the ecological health of the natural habitats.
- Fill data gaps for the many types of Bay habitats.
Santa Monica Bay Key Issues of Concern

- How Safe is it to swim in the Bay
- How safe is it to eat local seafood?
- Are marine resources adequately protected?
- Is the health of the ecosystem being safeguarded?
Specific Monitoring Designs Developed in 2000 for

- Bacteriology
- Seafood
- Pelagic System
- Benthic System
- Wetlands
- Kelpbeds
- Intertidal
- Sources and Loading
Key Features of the Santa Monica Bay Comprehensive Monitoring Program

- Clearly defined management needs/objectives
- New design rationale/principles
- Assessment indicators/endpoints included
- New and/or standardized analytical methodology
- Standardized data transfer format
SM Bay Comprehensive Monitoring Design
Shoreline Bacteriology

**The Old**
- To ensure compliance with POTW discharge permit
- Monitoring stations positioned to track POTW plumes (even distribution)

**The New**
- To provide vigilance at popular beaches against fecal contamination from point and nonpoint sources
- More monitoring stations positioned closer to recreational areas and flowing storm drains.
FIGURE 2-5: SUMMER GRADES, PAST THREE YEARS FROM MALIBU TO SANTA MONICA

Monitored locations during summers of 2011, 2012 and 2013

SUMMER 2013
- A+ A A A A A A B C A A A+ A A A+ A A A D

SUMMER 2012
- C C A B A B A B F A A A A+ B A A A A A A B

SUMMER 2011
- B F F F B F A F F F B A A F A A A A A B A+ A
SM Bay Comprehensive Monitoring Design
Seafood Consumption

**The Old**
- To comply with POTW NPDES permit
- Regularly collection of tissue samples from the most contaminated areas and species

**The New**
- To collect data for making risk management decisions
- More sampling effort on sport-caught target species, in sportfishing active areas, and in areas with notable tissue concentration change.
Sediment contamination vs. seafood safety advisories
CMP Update
- Focusing on Habitats

- Persistent gaps in monitoring of many types of Bay habitats and the data need for State of the Bay reporting
- Increased interest in assessing and managing habitats and resources on a regional basis, such as MPAs
Habitat in Santa Monica Bay
CMP 2007 Update

-- New monitoring designs for five habitat types within the Bay

- Pelagic
- Soft Bottom
- Hard Bottom
- Rocky and Sandy Intertidal
- Wetlands
State of the Bay Reporting – Habitat Conditions

- Creeks and Streams: CRITICAL to EXCELLENT depending on location
- Coastal Wetlands and Lagoons: POOR with one GOOD exception
- Coastal Dunes and Bluffs: POOR with one GOOD exception
- Sandy Beaches: POOR to FAIR depending on location
- Rocky Intertidal: Mostly POOR with a few FAIR exceptions
- Seagrass Beds: FAIR to GOOD based on limited data
- Rocky Reefs: CRITICAL to FAIR depending on location
- Soft Bottom: POOR to EXCELLENT depending on location
- Open Ocean: FAIR to GOOD based on limited data
The New Habitat Assessment Framework

- Encompasses all major types of habitats in the Bay

- Ensures that the assessment includes comparable characteristics of habitat health (quality of habitat, quantity of habitat, etc.)
To accomplish the stated objectives, the framework is designed to:

- Define expectations of habitat health (and by inference, habitat degradation).
- Establish the spatial and temporal scale.
- Select a set of characteristics of habitat health (within habitat characteristic categories) and a set of key indicators to capture these characteristics.
- Identify goals and add thresholds where appropriate.
- Relate factors contributing to poor habitat health and management actions.
The Assessment Framework
(Working Version)

- Part 1: Overall framework providing broad level information.
  - Habitat availability and condition using selected indicators
  - Statement of related goals, thresholds (where available), and management actions

- Part 2: An indicator matrix for each habitat that identifies all useful indicators by category
  - Habitat extent
  - Structure and ecological disturbance
  - Biological response
The Assessment Framework
(Working Version)

- Habitat Extent & Vulnerability (Spatial extent, habitat accessibility, availability, temporal variability, and disturbance potential). Examples include:
  - Amount of natural habitat (i.e. natural or concrete channels),
  - Amount of protected habitat (i.e. MPAs),
  - Amount of useable habitat (i.e. miles of stream connected to ocean),
  - Temporal variations in habitat extent (i.e. ephemeral streams),
  - Amount of habitat accessible to wildlife (i.e. miles of streams connected to the ocean),
  - Area at risk of human and natural disturbance (i.e. Oil Terminal, Shipping lanes, beach nourishment, etc)
The Assessment Framework
(Working Version)

- Structure & Ecological Disturbance (physical, chemical, and biological properties that impact condition of habitat). Examples include:
  - Physical structure (i.e. impervious surface area in watershed, wetland profile)
  - Chemical structure (i.e. water quality, sediment contamination, Ocean pH)
  - Biological structure (i.e. vegetation buffer around channel, kelp wrack)
  - Disturbance (i.e. beach nourishment, human use, ship strikes)
The Assessment Framework
(Working Version)

- Biological response (changes to individuals, populations, communities, and ecosystems in response to changes in habitat quality). Examples include:
  - Individual level (i.e. mammal & seabird rescues)
  - Population level (i.e. abundance, reproductive success)
  - Community level (i.e. diversity, Benthic IBI)
  - Ecosystem level (i.e. nutrient cycling, primary productivity)
<table>
<thead>
<tr>
<th>Category</th>
<th>Goals or Expectations for a Healthy Habitat&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Indicators (Include State, Stressor, and Response where possible)</th>
<th>Potential Target/Threshold&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Is Data Available?</th>
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<tbody>
<tr>
<td><strong>Habitat Extent and Vulnerability</strong> (Spatial indicators related to extent, accessibility, availability, temporal variability, and disturbance potential)</td>
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<td><strong>Habitat Condition</strong></td>
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<td><strong>Structure &amp; Ecological Disturbance</strong> (physical, chemical, and biological properties that impact condition of habitat)</td>
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<td><strong>Biological Response</strong> (Changes to individuals, populations, communities, and ecosystems in response to changes in habitat quality)</td>
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<td>Pelagic Habitat</td>
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<td>Habitat Extent &amp; Vulnerability</td>
<td><em>(Spatial indicators related to extent, accessibility, availability, temporal variability, and disturbance potential)</em></td>
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<td></td>
<td>Monitoring hypoxia: Extent and depth of area with low Dissolved Oxygen (DO). Threshold is level that affects marine life (&lt; 30% saturation or other units, see indicator matrix). Looking at changes over time and in relation to historical CalCOFI data or possibly other comparable sites (not identified).</td>
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<td>Monitoring ocean acidification: trends in pH. Need to identify threshold that is protective of marine life. Existing Ocean Plan threshold is levels between 6.0 and 10.0 and changes &gt; 0.2 units but was not designed to be protective of marine life.</td>
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<td>Habitat Condition</td>
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<td></td>
<td>Ambient conditions (including nutrients and algal blooms): Chl a, Dissolved Inorganic N, Dissolved Inorganic P, DO, transmissivity. Compare stations in the Bay to stations elsewhere in the Bight</td>
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<td>HABs: Chl a with threshold of &lt; 1mg/L (based on experiments by R Shipe) and algal toxin concentrations (e.g. domoic acid, saxotoxins) looking for changes over time and in comparison with areas elsewhere in the Bight.</td>
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<td>Biological Response (Changes to</td>
<td>Fish: Trends in egg count diversity and abundance as indicator of spawning and source population health; trends in forage fish and squid measured by landings data from the Bay (bait fishermen); trends in coastal sharks. All compared to areas elsewhere in the Bight.</td>
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<td>individuals, populations,</td>
<td>Marine Mammals: Trends in distribution, frequency and behavior of coastal bottlenose dolphins; abundance, frequency and duration of whale species presence in the Bay; harbor seal biomass and contaminants. All compare to areas elsewhere in the Bight.</td>
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<td>communities, and ecosystems in</td>
<td>Sea Birds: Trends in seabird counts by species at sea. Compare to areas elsewhere in the Bight</td>
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<td>response to changes in habitat</td>
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<td>quality)</td>
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Pelagic Habitat

- Related Management Actions
  - Water quality objectives mandated by the LARWQCB through the NPDES permit system
  - Ocean intakes regulated by the SWRCB
  - Fishing regulated by the CA Dept. of Fish and Wildlife and the NMFS
  - Marine mammals and seabirds managed by the NMFS
  - Shipping regulated by the United States Coast Guard
<table>
<thead>
<tr>
<th>Rocky Intertidal Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat Extent &amp; Vulnerability</td>
</tr>
<tr>
<td><em>(Spatial indicators related to extent, accessibility, availability, temporal variability, and disturbance potential)</em></td>
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<tr>
<td>Amount of habitat (shoreline miles or # of sites) removed from visitor access points, amount of habitat (shoreline miles or # of sites) in close proximity (not defined) to coastal access points,</td>
</tr>
<tr>
<td>% of sites with high-intensity use measured by visitor-hours summed by activity (sitting/standing, walking, handling, collecting, fishing), % of habitat with visitor-hours spent collecting in the rocky intertidal over a certain threshold</td>
</tr>
<tr>
<td>Extent of stable sand-free rocky substrata at rocky intertidal sites along the Palos Verdes Peninsula, timing, intensity, and direction of significant (no threshold) storm events</td>
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<tr>
<td>Habitat Condition</td>
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<tr>
<td>Structure &amp; Ecological Disturbance <em>(physical, chemical, and biological properties that impact condition of habitat)</em></td>
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<tr>
<td>Proximity of rocky intertidal sites to discharges, water quality at discharge sites</td>
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<tr>
<td>High abundances of small, fast-growing, opportunistic algae such as Ulva spp., red turf forming algae, green filamentous algae, and low-lying crustose seaweeds</td>
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<tr>
<td>Presence, abundance of non-native invertebrates (e.g. Monocorophium insidiosum)</td>
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<tr>
<td>% of diseased individuals per species per site</td>
</tr>
<tr>
<td>Biological Response <em>(Changes to individuals, populations, communities, and ecosystems in response to changes in habitat quality)</em></td>
</tr>
<tr>
<td>Abundance and distribution of prey items</td>
</tr>
<tr>
<td>Macrophyte abundance such as Scytosiphon spp. and Petalonia spp. And the anemone Anthopleura elegantissima</td>
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<tr>
<td>High abundances of upper shore rockweeds (e.g. Silvetia, Hesperophycus, Fucus, Pelvetiopsis spp.), lower shore kelp and other large brown seaweeds (e.g. Egregia menziesii, Laminaria spp., Eisenia spp., Alaria spp., Stephanocystis spp.) and surfgrasses (e.g. Phylospadix) indicates low disturbance</td>
</tr>
<tr>
<td>High abundances of black abalone (Haliotis chracherodii) and owl limpets (Lottia gigantea) extracted from rocky shores by humans possibly indicates low human use</td>
</tr>
</tbody>
</table>
Rocky Intertidal Habitat

- Related Management Actions
  - Enforcing no-take regulations in MPAs
  - Restriction of visitor access in rocky intertidal area
  - MS4 permit compliance
  - Invasive species removal
How SMBRC and MC Efforts Converge?

- Same principle
  - Collaboration and coordination
- Similar approach and strategy
  - Program Strategy, objectives, and designs
  - Indicators and methods
  - Data management
  - Consistency of assessment endpoints
  - Reporting
  - Program sustainability
- SMBRC utilizes products from the Monitoring Council Workgroups
Habitat Condition Indicators

- Creeks, streams, and coastal wetlands
- CRAM, CSCI
Habitat Condition Indicators

- Soft Bottom – Benthic response index

1984

1995

2007

2013
Habitat Condition Indicators

- Rocky Intertidal - MARINe
- Sandy Beach – “All Ashore” monitoring protocol
Habitat Condition Indicators

- Rocky Reef (kelp) – Fish guild index (# of trophic guilds, density, fidelity, and size)
Habitat Condition Indicators

- Pelagic (open ocean) – Burton Jone’s index (Chl a, dissolved inorganic nitrogen, dissolved inorganic phosphorous, DO, transmissivity)

**Chlorophyll-a - Selected depths data (0–60m), scale 2 – 3 μg/L**

1995-1999

2000-2004

2005-2009

2010-2014
What’s next:

- Data needed for reporting indicators identified in the SMB habitat assessment framework
- Data needs for addressing emerging issues and management priorities
  - Climate change impacts (sea level rise, ocean acidification)
  - Nutrient loading and its impacts on nearshore environment (harmful algal bloom)
  - Impacts of storm water runoff and plumes on the nearshore zone.