Evaluating the Performance of a Restored, Bar-Built Estuary in Malibu, CA

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Lagoon - 12 acres
Surfrider Beach
Approx. 1.5 million visitors annually
1st World Surfing Reserve (2010)

Watershed
110 sq. mi
> 75% undeveloped
History

• First inhabited ~10,000 years ago by Chumash
  • Named ‘Humaliwu’ or ‘Where the surf sounds loudly’
• Used as a dump site for DOT and PCH construction
• Restored in 1983
  • But not really!
  • Removed some fill; attempt to dig out channels
  • Not completed
  • Poor science
• Poor circulation and low dissolved oxygen
  • Diffusion of tidal energy
  • Poor drainage
  • Minimal wind driven circulation
• High sedimentation rates
• Habitat fragmentation and disturbance
• Listed as EPA 303 (d) impaired water body
• Low species richness and diversity – “dead zones”
  • Benthic Invertebrates
  • Fish Community
• Non-native / exotic vegetation
Parking Lot

Bird Islands

Recontoured Channels

Vegetation

Removed trash
Monitoring

- California Rapid Assessment Method (CRAM)
- Channel Cross-Sections
- Water Quality
  - Dissolved Oxygen
  - Vertical Profiles
- Biological Communities
  - Vegetation
  - Benthic Invertebrates
- Additional Parameters
  - Sediment
  - Special Status Species
  - Birds
  - Fish
  - Submerged Aquatic Vegetation
  - Photo-point
<table>
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<tr>
<th>Attribute</th>
<th>Pre-restoration</th>
<th>02/14/13</th>
<th>10/04/13</th>
<th>12/23/14</th>
<th>05/05/15</th>
<th>01/19/16</th>
<th>12/27/16</th>
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</table>

- Immediate improvements to Hydrology and Physical Structure
- Biotic Structure has improved to pre-restoration conditions
- Buffer and Landscape context will likely remain stable
Cross sections have remained relatively stable.

No large-scale changes.

General smoothing with minimal deposition and scouring.
Water Quality (Vertical Profiles)

- 5/5/2014 - closed
- 9/25/2007 - closed
• Increased percentage of readings above dissolved oxygen thresholds
• Exceeded closed condition for dissolved oxygen success criteria for time below 1.0 and 1.5 mg/L thresholds
Benthic Invertebrates

*TV = Pollution Tolerance Value, based on CAMLnet, CA Fish and Wildlife

- Increased percent of abundance sensitive to pollution
- Increased percent of number of taxa sensitive to pollution
El Nino Berm Morphology Surveys
Conclusions

• Channel cross-sections appear stable
• Data suggest increased mixing indicated by muted oxyclines and increased times above dissolved oxygen thresholds during closed conditions
• Vegetation assemblages continue to mature on target with restoration success criteria
• Benthic community shows increase in species sensitive to pollution
Additional Challenges
Questions

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