Integrated oyster and eelgrass restoration in Upper Newport Bay

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Outline:

• Overview of living shorelines and Upper Newport Bay project
• Restoration implementation
• Collaborative monitoring
• Initial biological results
• Challenges and strategies for restoration in an urban context
Multiple Benefits

• Natural connectivity between land and water
• Increased habitat value
• Increased abundance of important species and associated ecosystem services
• Wave protection
• Reduced erosion
• Natural adaptation to SLR
Bivalve - seagrass symbiosis

Filtration
Nutrient Cycling

Oxygen
Organic matter

(Van der Heide et al. 2012)
Project Goals

1. Enhance native Olympia oyster and eelgrass populations in Upper Newport Bay
2. Evaluate the ability of different restoration configurations to provide multiple benefits, including increased habitat value and shoreline protection
3. Increase community awareness of the importance of native oyster and eelgrass habitat
Restoration methods

Eelgrass – *Zostera marina* (Initial beds completed July 2016)

- Diver transplant from donor sites
- Researchers and volunteers, on land and using SCUBA
- Goal: 1,280 m² or .32 acres

Oyster – *Ostrea lurida* (March 2017)

- Clean *Crassostrea gigas* shell (10,110 – 15,165 lbs of shell per site, ~40,000 lbs total) placed in hand sewn coir bags
- 1.5m below (MLLW)
- Goal: 240 m²
Experimental Design

Before-After-Control-Impact (BACI) design (Stewart-Oaten et al. 1986)
Oyster restoration methods
Collaborative Monitoring

- Oyster
  - Density
  - Growth
  - Size
  - Bed Area
- Eelgrass
  - Density
  - Growth
  - Size
  - Area
- Invertebrate diversity and abundance
- Fish diversity and abundance
- Bird behavior and visits
- Sediment characteristics

Future work:
- Water Quality
- Shoreline erosion/accretion
- Wave attenuation
Study Design
Initial results: Eelgrass aerial extent

- Eelgrass mapping completed summer 2018 (D. Zacherl, A. Bird, A. Obaza)
- Initial target restoration 1,280 m² - Aerial extent in 2018 was 3,376 m² or .93 acres, 3 x our initial target!
Example site: Westcliff

Photo: N. Sadrpour
Oyster numbers: Settlement 2016, Pre-restoration

Cumulative Settlement of Ostrea lurida

2016 Year and Treatment

Control | Eelgrass | Oyster | Oyster/Eelgrass

V. Wood and D. Zacherl
Oyster numbers: Settlement 2017, Post-restoration

Cumulative Settlement of Ostrea lurida

Year and Treatment

Control | Eelgrass | Oyster | Oyster/Eelgrass

V. Wood and D. Zacherl
Oyster numbers: Adult density by treatment

Ostrea lurida density (m²)

- **Pre-Restoration**
- **6 Months Post-Restoration**
- **12 Months Post-Restoration**

Treatments:
- Control
- Eelgrass
- Oyster
- Oyster/Eelgrass

V. Wood and D. Zacherl
Bed Integrity
Bed Integrity

- Site Factors:
  - Human access
  - Wave energy
  - Sediment?
  - Subsidence/spread
Urban context
Strategies -- Những bị dũng vồ con Hào là gì?

Graphic: Althea Marks
Take aways…

• Utilize creative partnerships to leverage resources and increase scientific capability

• Apply for multi-year monitoring funds at the outset

• Projects should include plans for adaptive restoration
Restoring the Olympia oyster

Cal State Fullerton’s oyster bed research group has made progress since 2010 in restoring Olympia oyster beds. Several artificial shell bed techniques were tested.

ANATOMY OF THE OLYMPIA OYSTER
- Ostrea lurida
- Native to the West Coast
- Adductor muscle
- Ventricle
- Stomach
- Mantle
- Gill
- Hinge

SHELL BED CONSTRUCTION
Dead, cleaned shells were concentrated into beds so oyster larvae could attach and continue their development.

SHELL BED RESULTS AT NEWPORT SITE
Control beds with no applied dead oyster shells were used to measure the starting densities of Olympia oysters.

Future Work
Acknowledgements

Questions?
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