OYSTERS AS A TOOL FOR IMPROVING WATER QUALITY AND COMMUNITY INVOLVEMENT
CLEAN WATER THROUGH OYSTER AQUACULTURE DEVELOPMENT (CWOAD)
A PUBLIC HEALTH, CLEAN WATER AND STEEMS INITIATIVE

• Founded in 1985, the William C. Velasquez Institute (WCVI) conducts policy research and educational activities on issues of concern to underserved communities and their elected and civic leaders.

• WCVI has been active in promoting urban community participation in LA River revitalization since 1999.

• WCVI expanded its LA River Eco Intern project in 2016-2017 to harbor area and southeast High Schools to develop a group of Marine Environment Eco Student Interns to support the Oyster Reef effort.
CLEAN WATER THROUGH OYSTER AQUACULTURE DEVELOPMENT (CWOAD)

WCVI is proposing to develop
• non-commercial native oyster and mussel beds in coastal and river estuaries in the LA region

• mitigate organic runoff
• restore the marine environment
• promote conservation education
• stimulate STEEM’s education and careers
PROPOSED PROJECT

• Start up Funding
  • Research locations for suitable locations to install beds
  • Acquire spat
  • Develop initial beds for the purposes of mitigating urban runoff and habitat restoration
  • Dominguez Channel, Cabrillo Beach, Colorado Lagoon, LA River, SG River, Marina del Rey

• Development of a student Hatchery/nursery
• Permitting
• Community Outreach
THE ABILITY OF OYSTERS TO FILTER WATER

• Three Fundamental Ecosystem Services:
  • Nutrient Cycling and Removal
  • Water Filtration
  • Provision of Habitat
  • Public education and Participation

Clutch Bagged by Volunteers

PBS Documentary – Saving San Francisco Bay
NUTRIENT CYCLING AND REMOVAL

• Oysters capture nitrogen and utilize it to generate body mass and shells

• A single Pacific oyster can biodeposit up to 187 mg of material per day

Dame et al. (1989) estimated that an oyster reef in North Carolina took up:

- 1200 g carbon/m²/year
- 189 g Nitrogen/m²/year
- 98 g Phosphorus/m²/year

• Oysters are 7 to 9% Nitrogen

1 million oysters contain about 290 lb N

Denitrification rates are generally greater at reefs than at control sites

(source: Luckenbach 2013)
Filtration

- A single oyster can filter as much as 30 to 70 liters of water per day.
- At that rate, a cluster of 1,000-2,000 oysters can filter all the water discharged by Puget Sound Energy’s Fredonia generating station (140,060 L/day) (Puget Sound Energy 2008)
PROVISION OF HABITAT

- Oyster reefs provide habitat for:
  - Juvenile crab, shrimp, and numerous species of fish
  - Seabirds, including black oyster catchers, great egrets and great blue herons

Herring and Goby Eggs in San Francisco
OYSTER STATUS

• Historically, the east and west coasts of the U.S. had orders of magnitude more mussels than are found today.

• Oyster populations in Puget Sound and northern California are estimated to be at 1% of historic levels (Zu Ermgassen et al. (2012)).

• The loss of the historically large oyster reefs has reduced the capability of our bays to filter nutrient and sediment and has resulted in reduced water quality.

• Restoration of oyster beds can help to reduce water quality problems.
CAN OYSTERS BE ESTABLISHED TO IMPROVE WATER QUALITY AND HABITAT?
EXAMPLE: NEW YORK’S BILLION OYSTER PROJECT (BPO)

• BOP is an ecosystem restoration and education project aimed at restoring one billion live oysters to New York Harbor
• Oysters have been planted into several locations, some of which are quite successful
• Oyster shells are being collected from area restaurants
• Currently, 11 million oysters have been restored to New York Harbor
• Those oysters have filtered 19 trillion gallons of water, removing 6.75 million pounds of nitrogen from the Harbor
STUDENT PARTICIPATION – STEM PROGRAM

- The project is engaging thousands of school children through restoration based STEM education programs.
- Includes student assisted oyster hatchery, oyster deployment, and monitoring of success.
- Students have learned to SCUBA dive, raise oyster larvae, operate and maintain vessels, build and operate commercial-scaled oyster nurseries, design underwater monitoring equipment and conduct long-term research projects.
CHESAPEAKE BAY

- Chesapeake Bay Program partners embarked on a restoration strategy that focuses on the large-scale restoration of oyster reefs in Maryland and Virginia.

- The goal of the program is to restore and protect oyster reefs in 10 tributaries by 2025.

- Co-operators have planted more than 5 billion oysters on 1,600 acres of oyster reefs and recycled 30,000 bushels of shell to provide homes for new oysters.
Puget Sound Restoration Fund has a 10-year, 100-acre goal to restore Olympia oyster habitat.

Implementing Washington Department of Fish & Wildlife’s 2012 updated Olympia Oyster Stock Rebuilding Plan.

As of 2014, 40 acres of Olympia oyster populations and habitat have been restored in priority locations.

Restoration efforts are actively underway in many of Puget Sound’s remaining 19 priority areas.

Olympia oysters (*Ostrea lurida*)
SAN FRANCISCO BAY LIVING SHORES PROJECT

- Oyster and eelgrass reefs were constructed at two sites in San Francisco Bay in July and August 2012
- Two million native oysters have settled on man-made reefs in San Francisco Bay over the past year
- Wave action has also been reduced and more fish, invertebrates and birds have been seen hanging around the reefs
LIFE HISTORY

Oyster Life Cycle

approximately 2 weeks

- floating fertilized egg
- swimming straight-hinge veliger
- swimming late veliger
- swimming & crawling pediveliger

1 - 3 years

egg and sperm

adult males and females

spat settling and attaching to oyster shells or other hard structures

Credit: Korea B. Stevenson/COSE M/NSF
HABITAT FACTORS AFFECTING SUCCESS

**Requirements** - Numerous environmental factors affect Olympia oysters

- Availability of hard substrate in the low intertidal and shallow subtidal
- Phytoplankton to support feeding
- Water temperature

**Detriments**

- Low salinity
- Low dissolved oxygen
- Too warm water during low tide
- Excess freshwater flow
- Excessive concentrations of toxic materials
- Sedimentation
- Competition with non-native species
- Stormy winters
COMMON APPROACHES TO CONSTRUCTING REEF

Shell mounds  Reef Balls  Layered Cakes
THANK YOU