WHAT'S SO COOL ABOUT AN OYSTER REEF?

Oysters are a keystone species. As such, they're crucial for bringing abundance and diversity back to San Francisco Bay. Restoring their habitat and the far-reaching eco-services they provide is crucial to many other species' survival, including salmon and herring.

5,000 years ago, the reefs of our native Olympia oysters (*Ostrea conchaphila* or "Olys") covered as much as 100,000 Bay acres! Olys were an important food for local Native Americans who created hundreds of shell mounds (*middens*) around the Bay, the remnants of millions of shellfish meals.

In the late 1800's, Bay Olys supported the West Coast's largest oyster industry, but by the early 1900's humans had all but extirpated them. During the Gold Rush, hydraulic mining scoured some *12 billion cubic meters* of sediment from the Sierra foothills. As that debris flushed into the Bay, it smothered huge amounts of subtidal habitat. Billions of oysters were buried alive. Those that weren't got raked off the bottom and sold to voracious 49'ers as a delicacy. Finally, from 1850 to1960, a third of the Bay was lost to diking, filling, and land reclamation.

Today, only small pockets of Bay Olys remain, but the mining sediments have started to flush out of the Bay, and researchers working with The Watershed Project have shown that Olys will rapidly re-colonize if given the necessary hard substrate. The Watershed Project is working to recreate the Bay's diversity and abundance. ***Contact us if you want to help create the Bay's first community-based oyster garden. By helping, you can be a keystone species too***!

Oysters as Habitat Engineers

An oyster first spawns as a male, and then alternates its gender each spawning cycle. Since males release their sperm into the water column, oysters like to live near each other to maximize the likelihood of fertilization.

A female pumps sperm into her mantle cavity to fertilize up to 300,000 eggs. Within two weeks, the female releases them (as larvae) into the water where they drift a while before settling, hopefully on a nearby hard substrate like a shell or rock.

The young oysters are called ***spats***. They have eyes and feet (!) that allow them to crawl and find desirable habitat. Spats prefer settling onto other oyster shells which helps to build and expand oyster reefs by keeping the kids close to home. The tightly woven matrix of shells make incredible habitat for many species.

Crab & young oysters in old oyster shell

Without the water quality and substrate stabilizing functions of oyster reefs, eelgrass and other bottom habitats rapidly declined. The feeding, sheltering, spawning and nursery functions of these habitats were also lost. As a result, the human-caused loss had a catastrophic impact on many species.

Loss of the Bay's previous almost unimaginable abundance begs the question "What can I do to bring something like this back?" One answer is to ***support The Watershed Project's efforts!***

Oysters as Habitat Engineers. Oly's Latin name (*Ostrea conchaphila*) tells a story: *Conch* means shell, and *phila* means loving. So, *conchaphila* means 'shell-loving.' Generations of oysters living and colonizing on top of each other create substantial reef structures that host a rich, diverse biota, from tiny shrimp to migrating salmonids, spawning herring, the tiny goby fish that lays its eggs inside their shell, the seahorse-like Bay pipefish, and many, many other species.

Oysters as Water Purifiers. Oysters are also important because, as filter feeders, they clarify water. Each Oly purifies as much as 30 quarts of water a day. For 10 billion bayside Olys, that was 300 billion quarts a day! Imagine how clean the Bay's water was.

That clarification lets sunlight penetrate the water more deeply, improving conditions for another important species, *eelgrass*. In return, the eelgrass settles sediment out of the water column, keeping oyster shells free of sediment so spats have more solid places to attach.

Eelgrass & herring eggs

Eelgrass meadows are home to many small organisms. Some live on the grass' wavy blades, others in their detritus on the Bay floor. They are prey for larger organisms that use the meadow to hide from even larger predators! The sticky blades of also eelgrass capture the spawn of Pacific herring, an important forage food for migrating juvenile salmon.

SALMON— FROM FRESH TO SALTWATER AND BACK AGAIN

Salmonids are born in freshwater, migrate to the ocean, reach maturity, and then return to fresh water to spawn. With Fall's first rains, mature salmon re-enter the estuary to retrace their juvenile footsteps, return to their freshwater birthplace, and spawn.

In late Winter, the eggs hatch. Nestled in streambed gravel, the hatchlings live on the nutritious yolk "pot belly" on their undersides. Once the yolk sac is gone, they must find food (mostly insects) quickly. Only about 20% of the eggs survive to become fry. Depending on the species, they may spend years in freshwater before moving downstream toward the estuary, which, by definition, is where saltwater meets freshwater.

When fry enter the estuary, they begin to adapt to saltwater a process called "smoltification." This change includes becoming less active and therefore more vulnerable to predators. Ocean-bound smolts may spend days or months in the estuary and to survive, they need places to hide and feed. Sadly, almost all such habitat has been lost. Restoring a *Living Shoreline Highway* is critical to their survival.

FROM OYSTER GARDENS TO A LIVING HIGHWAY

Unfortunately, human activities have so degraded the estuary that smolts, instead of finding food and shelter to help them thrive and grow, actually lose vigor on their way to the ocean. What's missing is an unbroken highway of healthy subtidal habitat. Our Oyster Garden will demonstrate a way to remedy this problem.

Species that will Benefit from Oyster Reef Restoration

Ostrea conchiphala	Olympia oyster
Zostera marina	Eelgrass
Acipenser medirostris	Green Sturgeon
Acipenser transmontanus	White Sturgeon
Clupea pallasi	Pacific Herring
Oncorhynchus tshawytscha	Chinook Salmon
Oncorhynchus mykiss	Steelhead
Oncorhynchus kisutch	Coho Salmon
Pholis ornata	Saddleback Gunnel
Eucyclogobius sp	Goby
Syngnathus leptorhynchus	Bay Pipefish
Cramgon franciscorum	Bay Shrimp
Cancer antennarius	*Spot-Bellied Rock Crab*
Metacarcinus magister	Dungeness crab
Leptocottus armatus	Pacific Staghorn Sculpin
Cymatogaster aggregata	Shiner Perch
Aythya marila	Greater Scaup
Aythya affinis	Lesser Scaup
Ardea alba	Great White Egret
Pelecanus erythrorhynchos	American White Pelican
Larus sp	Gulls
Anas sp	Wigeon, Pintail

And Many, Many Others

LOCATION, LOCATION, LOCATION!

The Oyster Garden will be located on the North Richmond shoreline inside the Point Pinole Regional Shoreline. The National Audubon Society and BirdLife International have designated this area as an Important Bird Area. It is one of only three areas along the entire Pacific Coast that supports large numbers of Red Knots, a small shorebird and "Species of High Concern" that migrates from the Arctic to the extreme southern tip of South America. The park also supports one of the few nesting pairs of osprey in the San Francisco Bay. Restoration of oysters at our site is (1) identified in the *Rheem Creek Watershed Assessment and Restoration Plan* as a priority, and (2) included in the San Francisco Bay Subtidal Goals Project.

EDUCATION, EDUCATION, EDUCATION

We'll use the Oyster Garden as an outdoor classroom to deliver our *Oysters on the Half Shell* curricula to local schools and offer service-learning opportunities to middle and high school students. The Garden will also be used by our growing group of *Conchaphiles*, the "Friends of Oysters" community of adults and student volunteers who learn about and help us steward subtidal habitat Bay-wide.