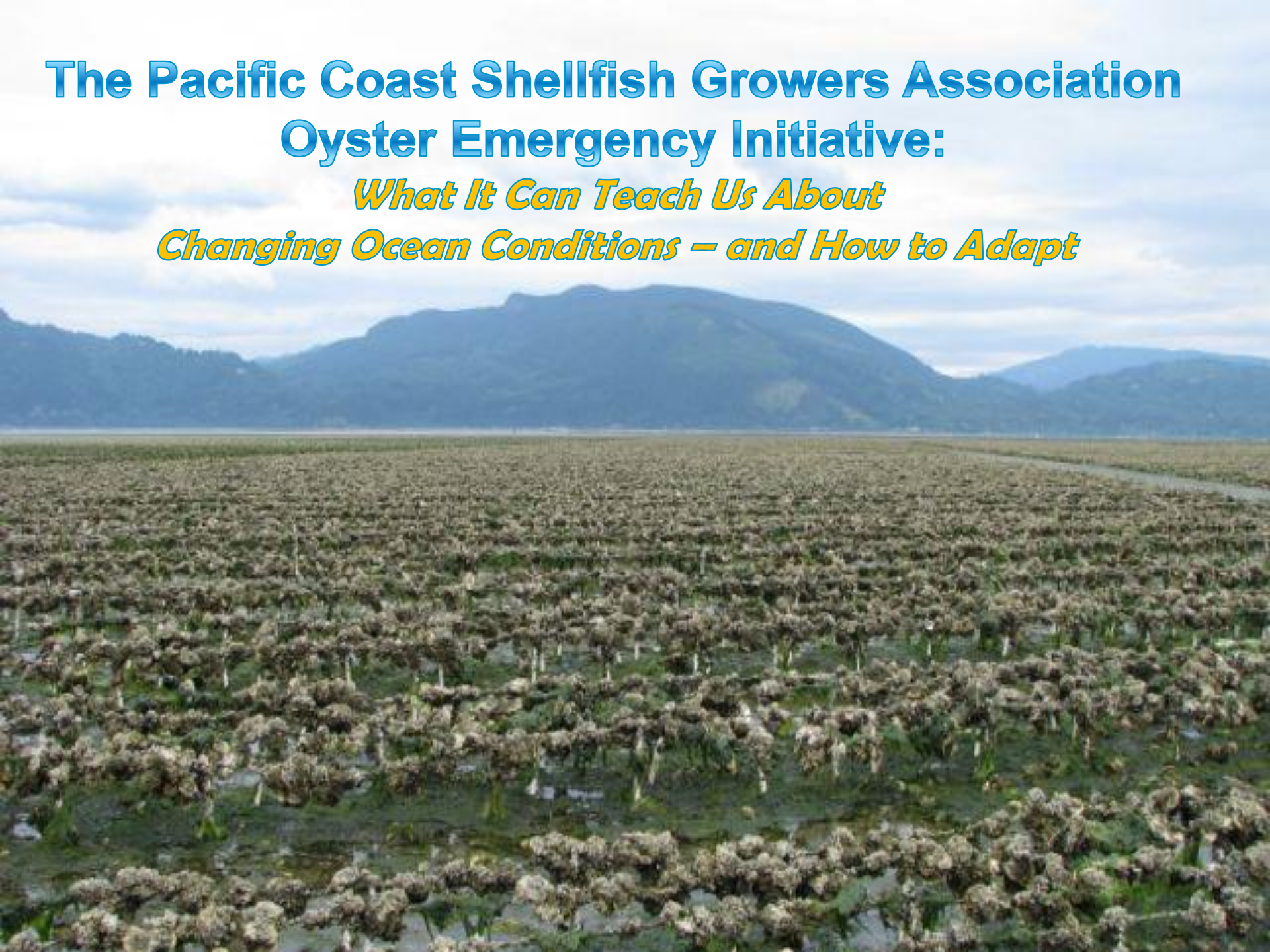
The Pacific Coast Shellfish Growers Association Oyster Emergency Initiative:

What It Can Teach Us About Changing Ocean Conditions – and How to Adapt



Pacific Coast
SHELLFISH GROWERS ASSOCIATION

Partners with Mother Nature

sustainably farmed
oysters, clams, mussels, scallops

Representing growers from:

- Alaska
- Washington
- Oregon
- California
- Hawaii

Growing these lovely molluscs:

- Oysters
- Clams
- Geoduck
- Mussels
- Scallops

Oysters farmed on West Coast since mid -1800's

In the beginning:

Nudging Mother Nature

Seed brought from Japan

Inconsistent natural sets spawned hatchery technology

Problems with Oyster Seed:

- Significant oyster larvae mortalities (80%) in 2 of the 3 major hatcheries serving West Coast farms (Taylor Shellfish, Whiskey Creek)
- Virtually no natural oyster seed sets in Willapa Bay (largest oyster producing region on West Coast) for 6 years

Results of Oyster Seed Shortage

- Oysters are 2-4 year crop. Seed shortage for past 6 years resulting in decreased production (harvest) levels.

Reduced oyster production

- 2005: 94 million pounds - $84 M
- 2009: 73 million pounds - $73 M

(22 % decline in production;13% decline in gross sales

– Total all shellfish produced on West Coast (oysters, clams, geoduck, mussels):
  - 88 M pounds (oysters = 83%)
  - $117 M (oysters = 62%)

PCSGA's Oyster Emergency Initiative:

- Oyster seed scarcity identified as top priority for PCSGA in 2007

• Oyster Emergency Stakeholders Committee formed:

Growers, Hatcheries, NOAA, USDA, UW, OSU, USC, WDFW, WDOE, Aquarium experts, oceanographers, marine ecologists, shellfish pathologists, geneticists, etc

Oyster Emergency Initiative Priorities:

- Develop assay testing method (dipstick) to detect V. tubiashii quickly, easily
  - NOAA: $187,500
  - USDA: $98,000

- Identify genetic traits of high performing oyster families that survive in high stress ocean conditions
  - Washington Oyster Reserve Funds: $65,600

Oyster Emergency Initiative Priorities:

- Monitoring:
  - Correlate environmental data with survival of larvae and seed in hatcheries and the wild
  - Partners include NOAA, UW, OSU, PSI, WDFW, PSRF, PSP, WDOE, Taylor Shellfish
  - Funding sources include:
    - Oyster Reserve Funds (WDFW): $102,150
    - Grays Harbor MRC: $5,000
    - EPA/PSP: $150,000

Oyster Emergency Initiative Priorities:

- Develop tools for adapting to/managing ocean conditions
  - Monitor seawater outside of hatcheries (incoming)
  - Monitor water inside hatcheries
  - Monitor water at key locations in Willapa Bay
  - Develop small-scale experimental water treatment systems
    - UV Sterilization
    - De-gassing
    - Biofiltration/Protein skimmers
    - Probiotics
    - CO_2 stripping/Buffering

- Funding through Congressional appropriation: $499,471

What We Think We Know So Far

- Whiskey Creek Hatchery, Netarts Bay, CA:
  - At first, high *Vibrio tubiashii* populations identified as (one) cause of larval mortalities
  - For 3 years, clear correlation between upwelling events = lowered pH levels = larval mortalities

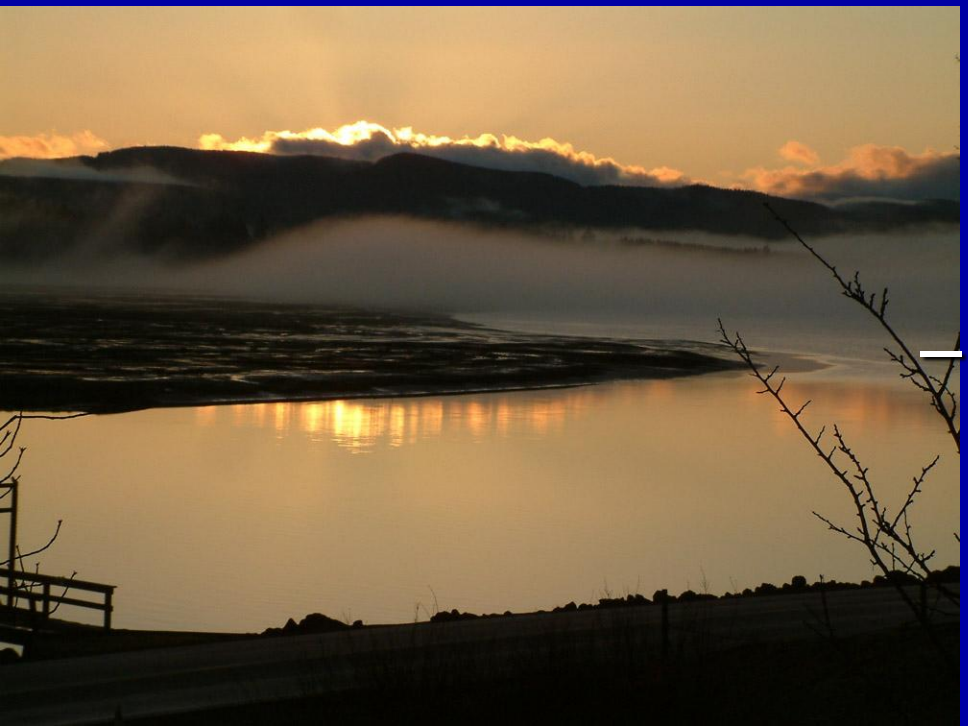
(Alan Barton, Burke Hales)

What We Don't Know

- Lummi Hatchery, Portage Bay/N. Puget Sound, WA
  - No notable problems (Large shallow "pond" intake area)
- Taylor Hatchery, Dabob Bay/Hood Canal, WA.
  - High Vibrio tubiashii populations, sporadic low pH events and high larval mortalities, but no clear correlations/causes
- Coast Hatchery, Quilcene Bay/Hood Canal
  - Production has remained stable

More of what we don't know

- No natural Pacific oyster sets in Willapa Bay for 6 years
  - "Natural" trend?
  - Temperature related?
  - Vibrio tubiashii?
  - Upwelling and low pH?
  - Relation to upland runoff?



Ongoing work

- *Expand and continue monitoring efforts*
- *Experiments with water treatment systems*
- *Study information from large body of existing and historical research*
- *Identify gaps in research/understanding and fill them*
- *Raise awareness of problems and engage critical mass of researchers and policy makers in forging solutions*