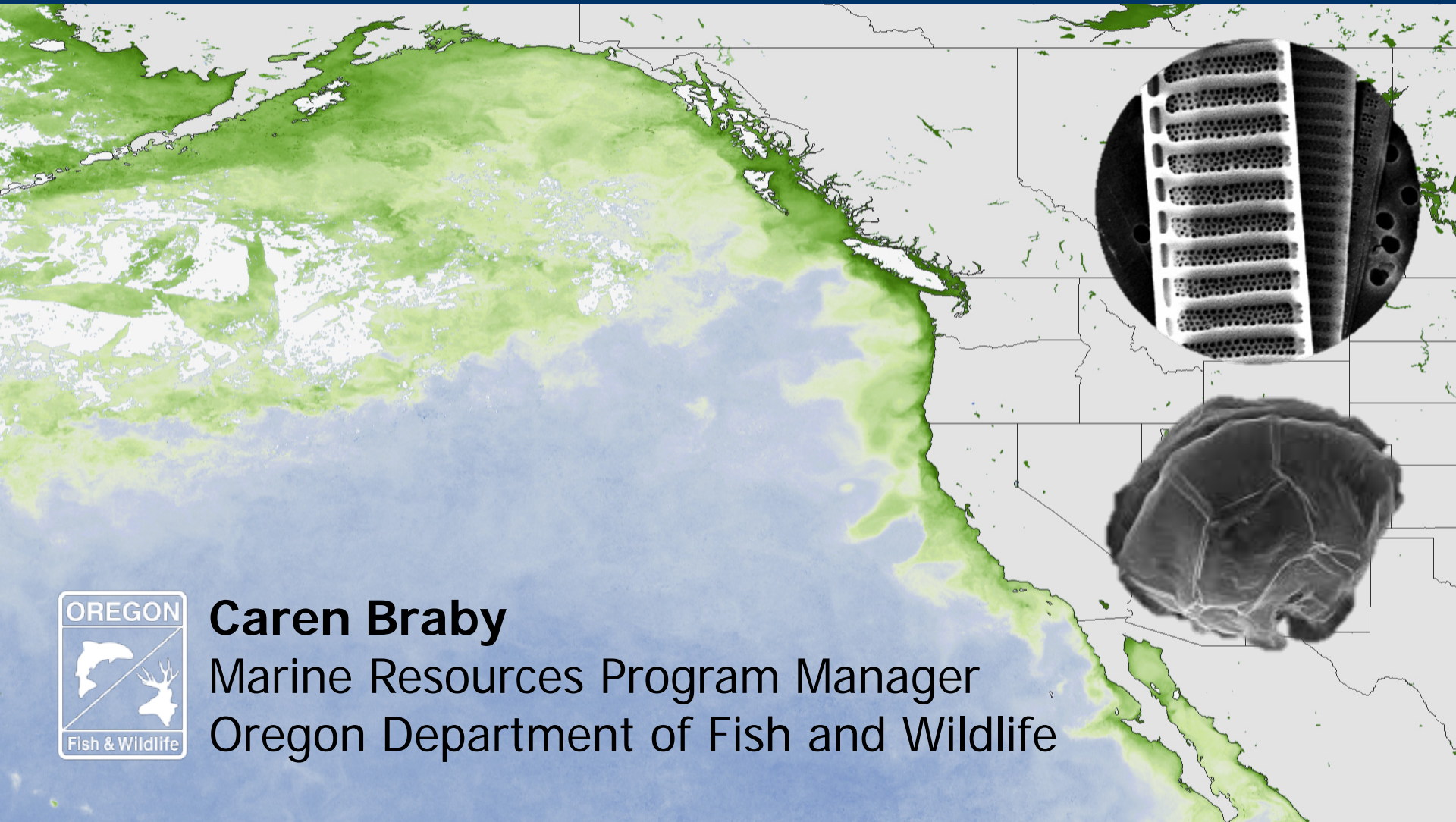


Harmful Algal Blooms and Dungeness Crab



Caren Braby

Marine Resources Program Manager
Oregon Department of Fish and Wildlife



Image: NOAA (July 2015)

HABs & Shellfish Closures AK to CA (2015)

West Coast Harmful Algal Bloom

NOAA **responds to unprecedented bloom**
that stretches from central California to the Alaska Peninsula.

Clam opener canceled due to high toxin count

OLYMPIA — The first
razor clam dig of the fall season
has been postponed due
to elevated levels of marine
toxins on Washington's

Beaches affected by the
health closure include Long
Beach, Twin Harbors,
Copalis, Mocrocks and
Kalaloch.

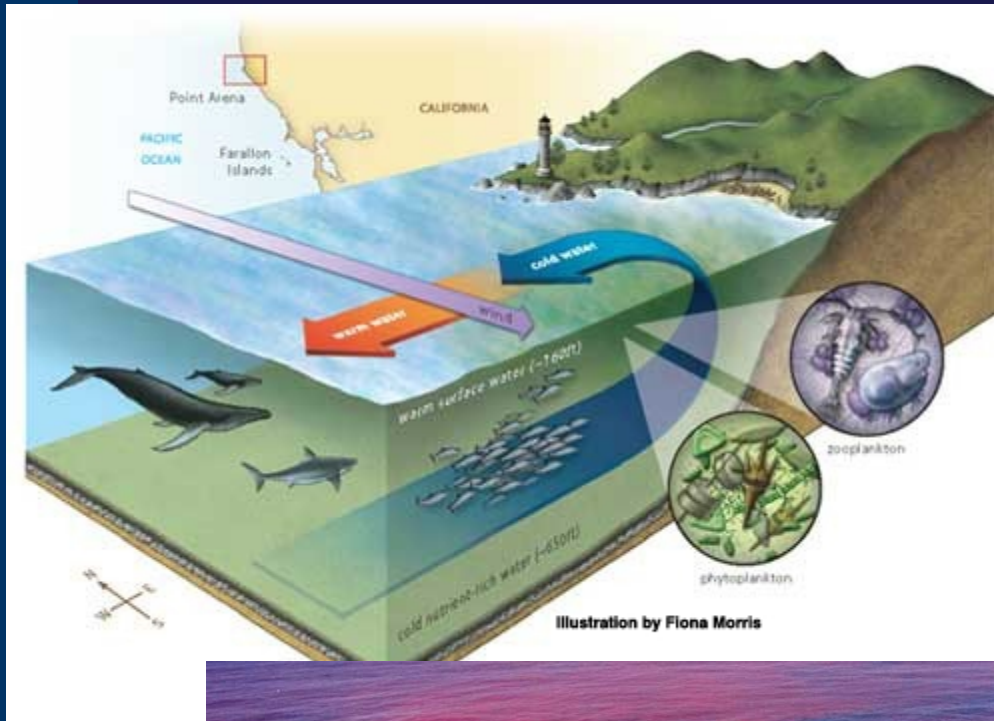


**THE TOXINS ARE LINKED TO A
LARGE ALGAE BLOOM**

Southern coast closed to all Dungeness crab fishing due to increase in marine toxins

Originally published June 9, 2015 at 8:08 am | Updated June 8, 2015 at 1:49 pm

Upwelling Systems



- Remarkable productivity
- Upwelling patterns are changing with climate, and tied to:
 - Oceanographic metrics
 - Ocean acidification
 - Temperature anomalies
 - Primary productivity
 - HABs

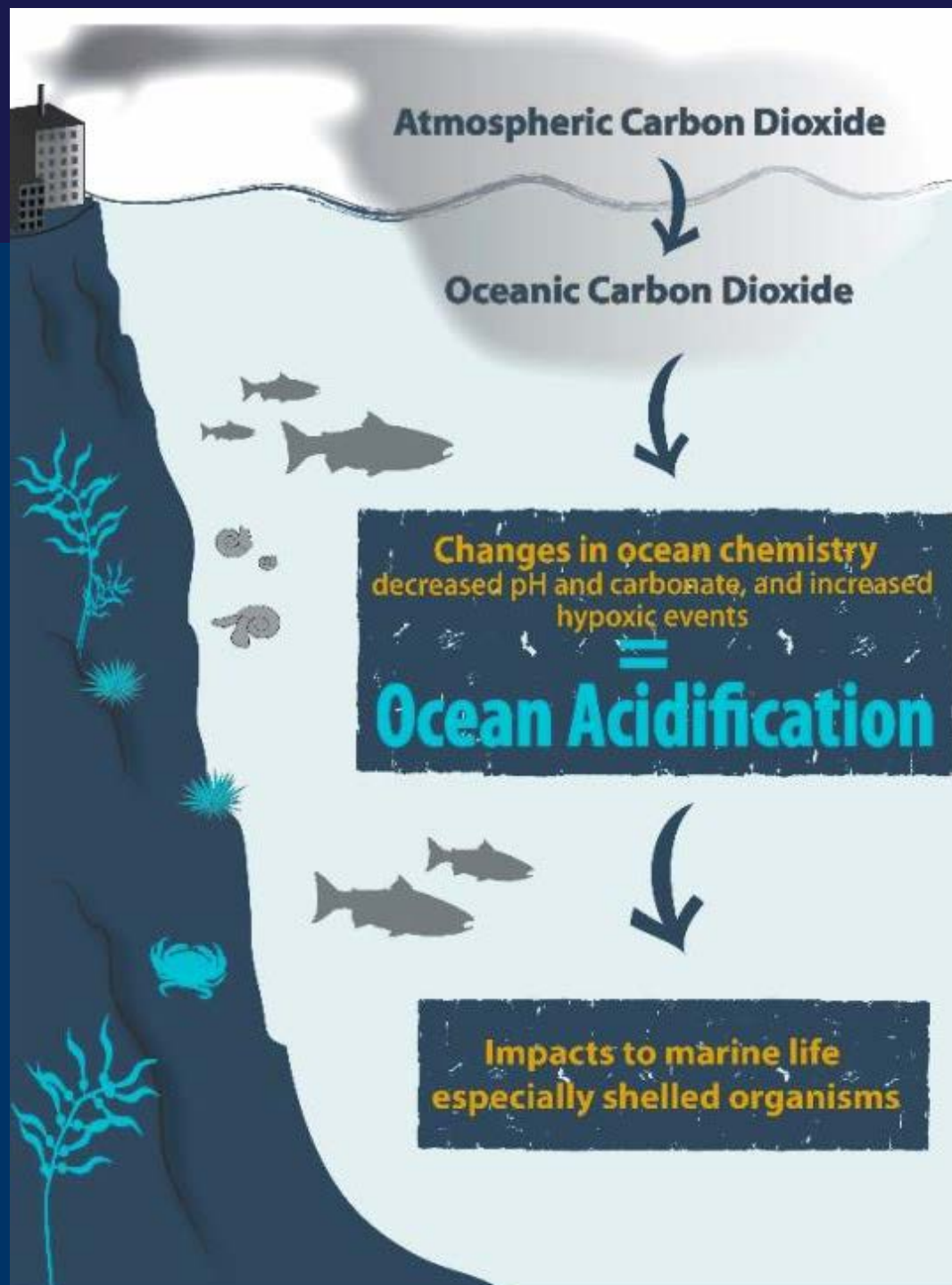


Ocean Acidification

- “Changing ocean conditions”
- West Coast delay
 - 30-50 years
 - Worse is coming
- Change in particular fisheries species, fishery seasonality



*YouTube: Oregon
Ocean Acidification*



Connection to Climate Change

- Changes to oyster culture
 - Ocean acidification caused failure of culture operations
 - Success is tenuous – future uncertain
- Changes to Dungeness crab?
 - Molting season (temp)
 - Recruitment season/rate (all)
 - Distribution latitude, depth (temp)
 - Exposure to biotoxins (all)



Types of Marine Biotoxin Monitoring

Shellfish Tissue Biotoxin Testing (Regulatory)



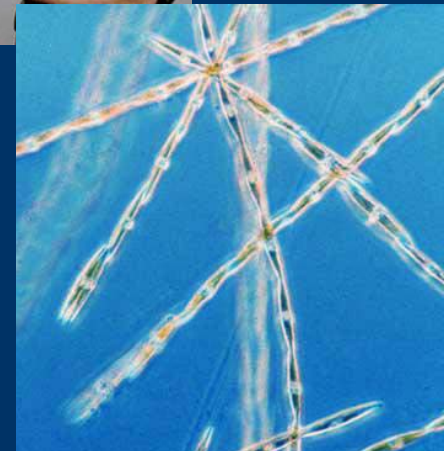
*Shellfish
Filter
Feeders*



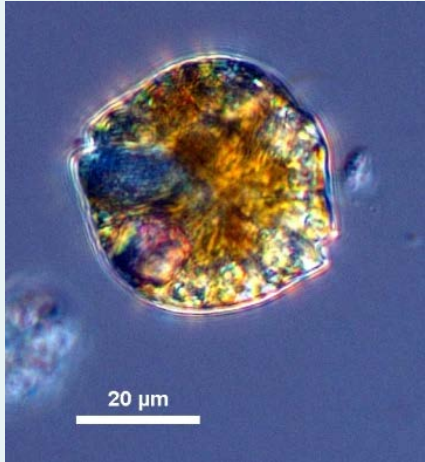
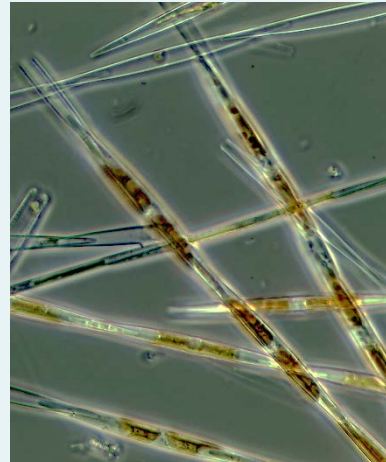

Phytoplankton Monitoring (HAB Early Warning)



*Water
&
Cells*

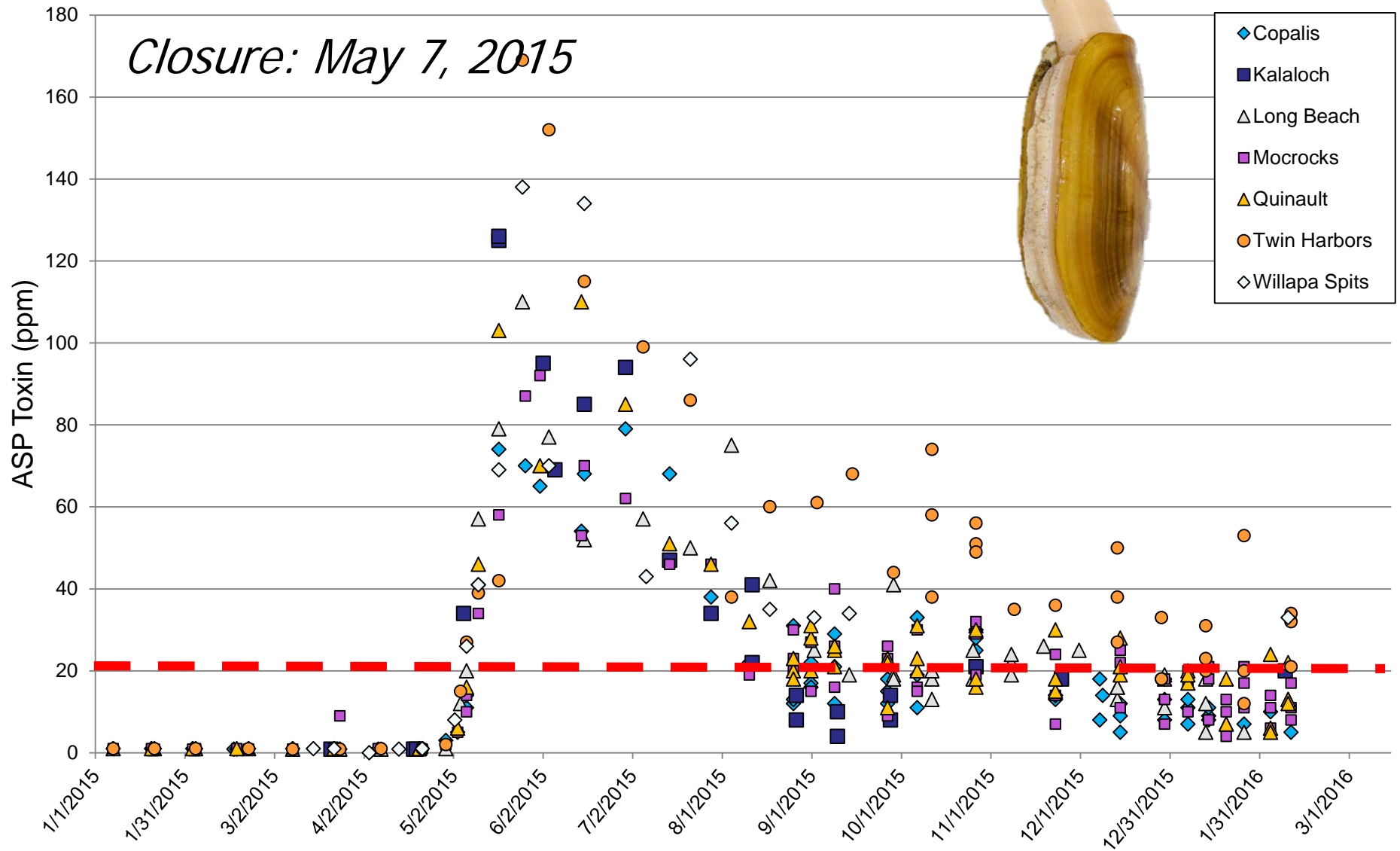


Marine Biotoxins along the West Coast

| Biotoxin Type: | Paralytic Shellfish Poisoning (PSP) | Amnesic Shellfish Poisoning (ASP) | Diarrhetic Shellfish Poisoning (DSP) |
|----------------------------|---|---|---|
| Microscopic Phytoplankton: |  |  |  |
| Caused by: | Dinoflagellate <i>Alexandrium catenella</i> | Diatom <i>Pseudo-nitzschia</i> spp. | Dinoflagellate <i>Dinophysis</i> spp. |
| Toxin Produced: | Saxitoxin (Neurotoxin) | Domoic Acid (Neurotoxin) | Okadaic Acid (Cytotoxin) |
| Alert Action Level: | ≥ 80 μg/100g tissue | ≥ 20 ppm in tissue | ≥ 16 μg/100g tissue |

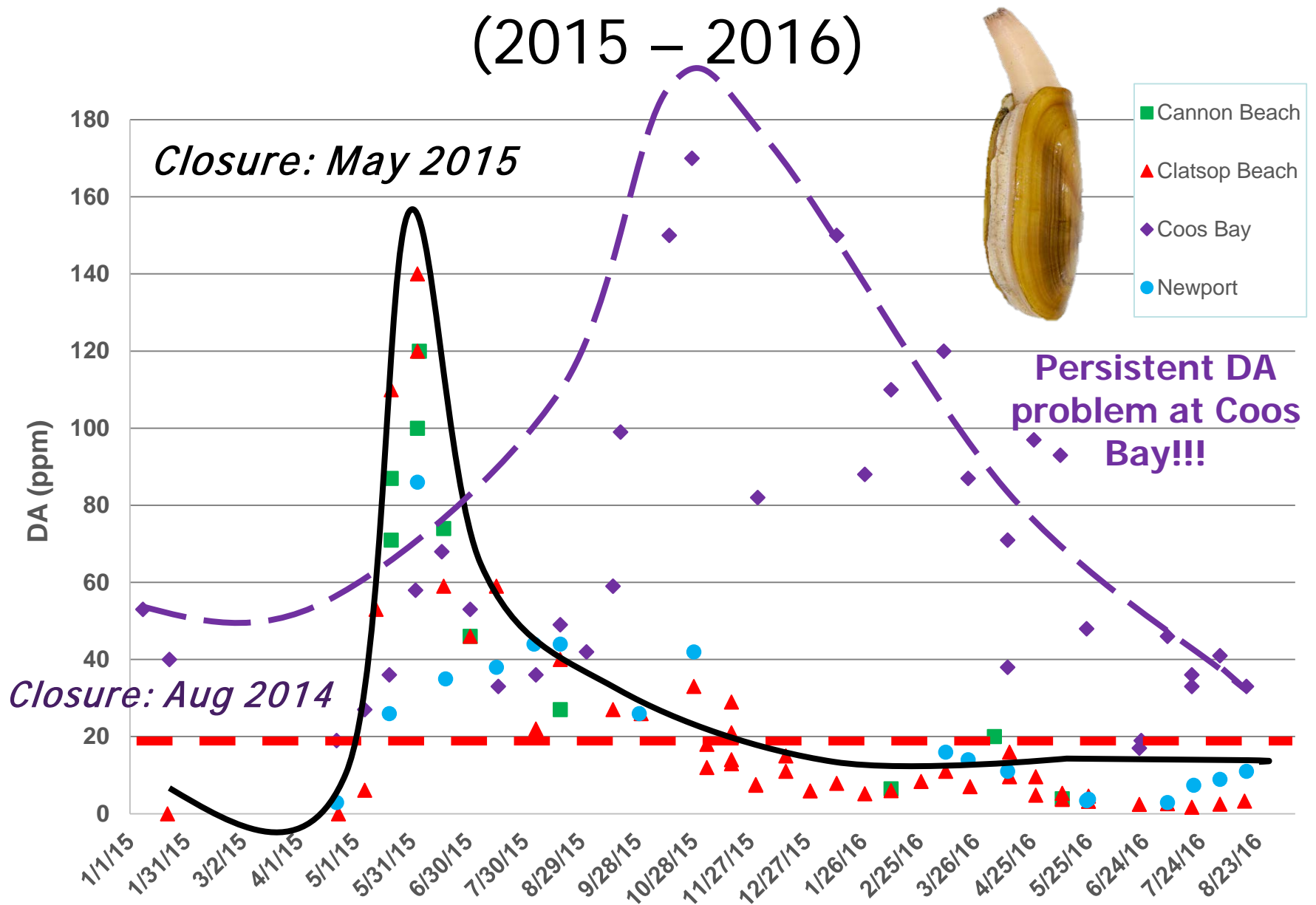
Domoic Acid in WA Razor Clams

(2015 – 2016)



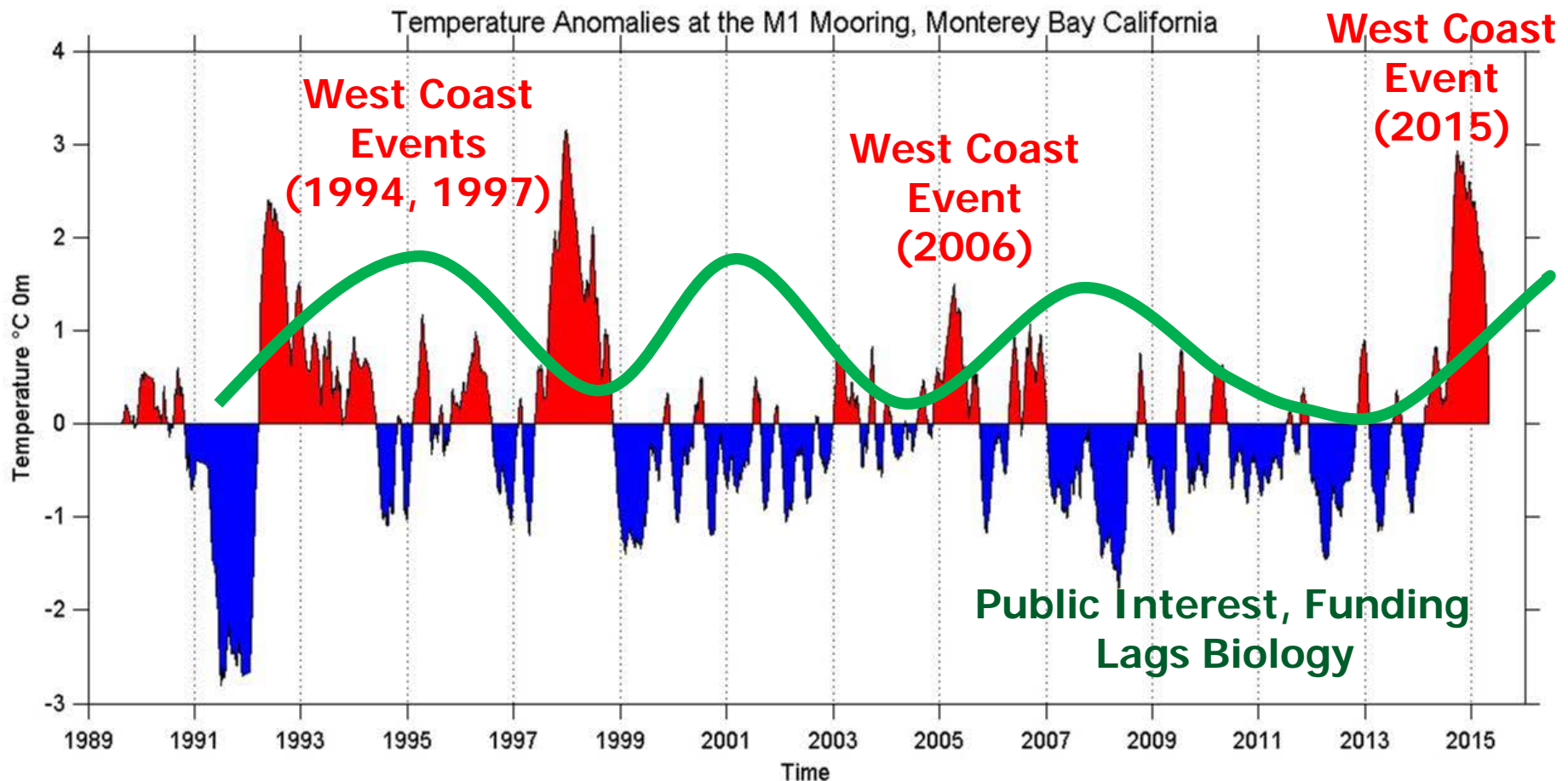
Domoic Acid in OR Razor Clams

(2015 – 2016)



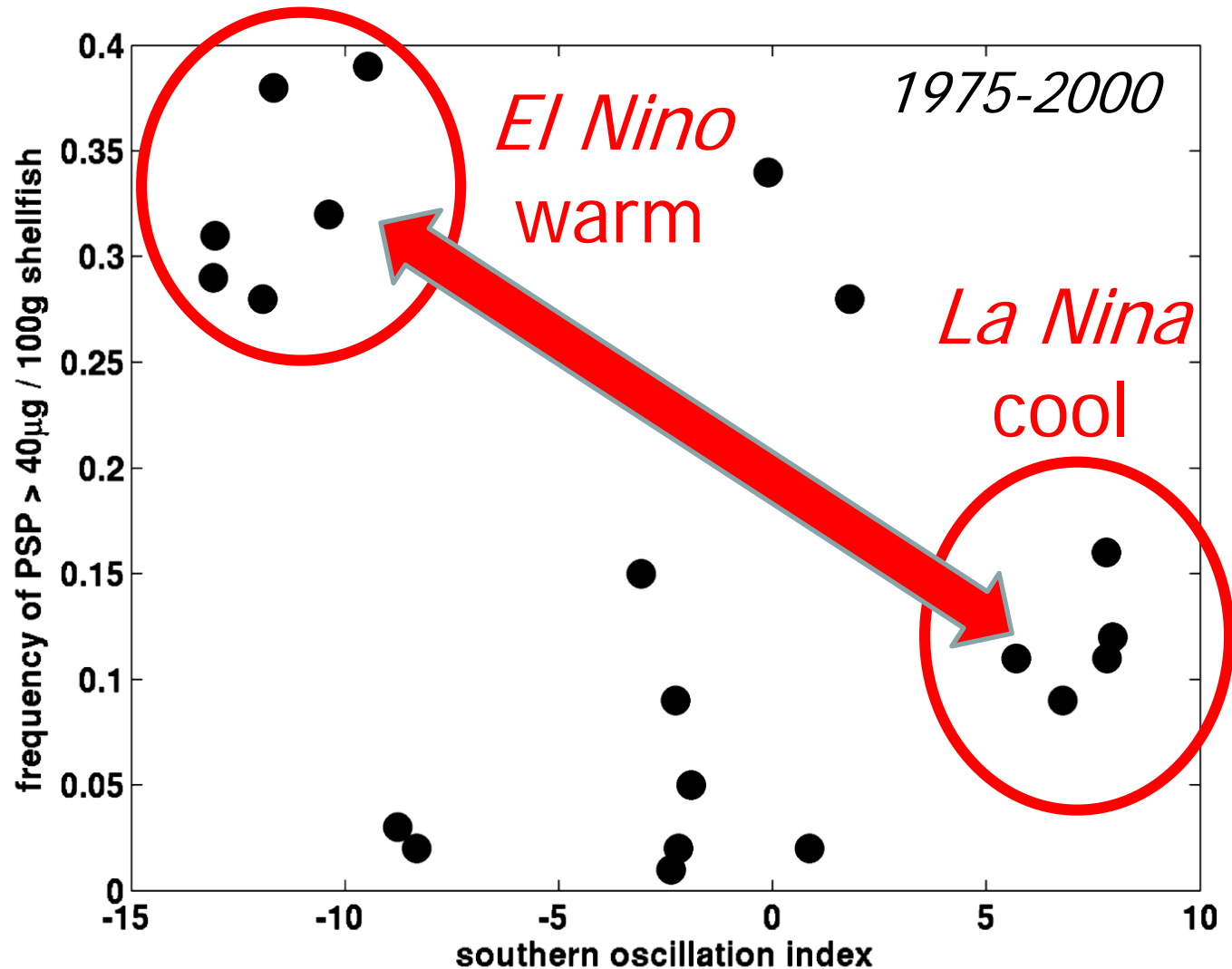
Forecasting the Future?

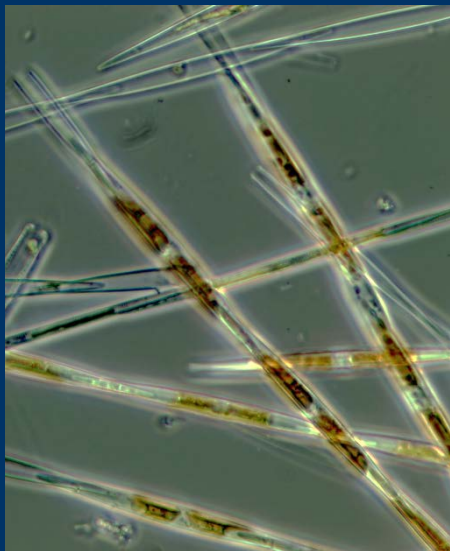
El Nino helps predict HABs, fisheries closures



PSP Toxicity associated with Warm Water El Nino Events

Frequency of razor clam biotoxin closures along Oregon coast





Domoic acid detected in marine wildlife from the Pacific Northwest to Southern California during a record-setting bloom of toxic algae in the North Pacific in the summer of 2015



HABs in Food Chain 2015



Toxin Level
 high
 low
 seizures

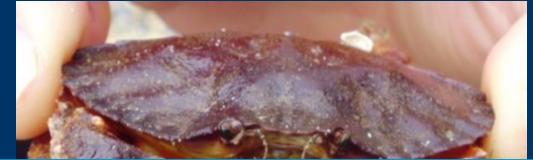
dolphins/
porpoises
 harbor seals
 sea lions/
fur seals
 whales
 seabirds

NWFSC research contact: kathi.lefebvre@noaa.gov



West Coast Dungeness Crab

Tri-State season opens Dec 1



**Oregon \$\$:
1/3 of commercial
Up to \$50 Million**



2015-2016: Season Delayed

WA and OR – opened Jan 4th

Central CA – opened Mar 26th

N CA (except Trinidad) – opened May 13th

Trinidad, CA – opened May 26th

Forecasting

So, what does the future hold?

Marine toxin levels delay razor clam digs

Entire Oregon Coast closes for razor clam and mussel harvesting.

September 23, 2016...The Oregon Department of Agriculture and the Oregon Department of Fish and Wildlife announce the closure of razor clamming and mussel harvesting from the Columbia River to the California border. Recent shellfish samples taken from the area indicate levels of the marine biotoxin domoic acid have risen above alert levels.

Regional monitoring, coordination and collaboration

Ecosystem-based management approaches

Thanks to:

Raphael Kudela, UCSC

Steve Rumrill, Matt Hunter, Kelly Corbett, ODFW

Jerry Borchert, WA Dept of Health



2016 Tri-State Discussions

- Set goals for a successful, coordinated response:
 - Maintain public confidence in high quality and safe product
 - Utilize a transparent, and conservative approach to opening/delaying the season
 - Follow a consistent protocol/plan, that has flexibility and is responsive
 - When an event occurs, Tri-State coordinated public relations strategy

Crab Tri-State Biotoxin Plan



PACIFIC STATES MARINE FISHERIES COMMISSION

205 SE Spokane, Portland, Oregon 97202

PHONE (503) 595-3100 FAX (503) 595-3232

Strategy for preventing consumer exposure to domoic acid from the
Tri-State Coastal Dungeness Crab Commercial Fishery

Month Year

I. Purpose

In 1992, the Food and Drug Administration (FDA) adopted a policy directed at preventing consumer exposure to domoic acid from commercial Dungeness Crab and since codified the policy in the Fish and Fishery Products Hazards and Controls Guidance (<http://www.fda.gov/downloads/Food/GuidanceRegulation/UCM251970.pdf>). This FDA guidance document assists processors with the development of their mandatory Hazard Analysis

Critical
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viscer

In keep
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cooper
and to



- Aligns states' biotoxin testing approach
- Establishes precautionary approach to opening the season
- Allows evisceration order as part of toolbox, for "hot" periods
- Transitioning from single-species management to EBM with this fishery
 - Monitoring needs to inform decisions