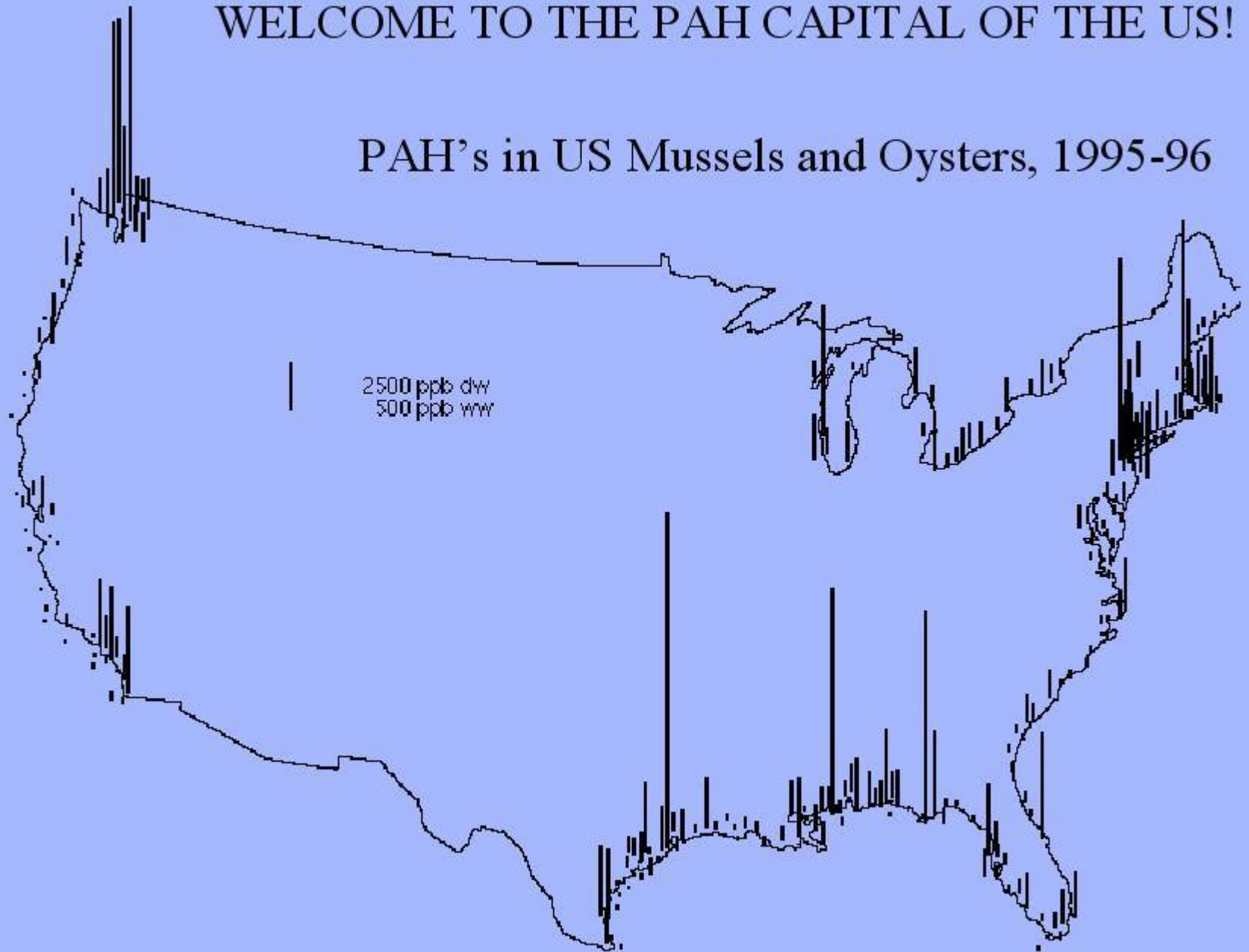


WELCOME TO THE PAH CAPITAL OF THE US!

PAH's in US Mussels and Oysters, 1995-96



---

# HazMat: NOAA's Response Team

Established, 1976

- Scientific support to US Coast Guard
- Seattle, National HQ
  - 40 scientists, technicians, administrators
  - 9 Scientific Support Coordinators around US
- Provide forecasts, trajectories, planning tools, training, lessons learned
- About 100-150 calls each year in US
- International support (Spain, Galapagos, Chile)

# What Is Response?

*noaa*

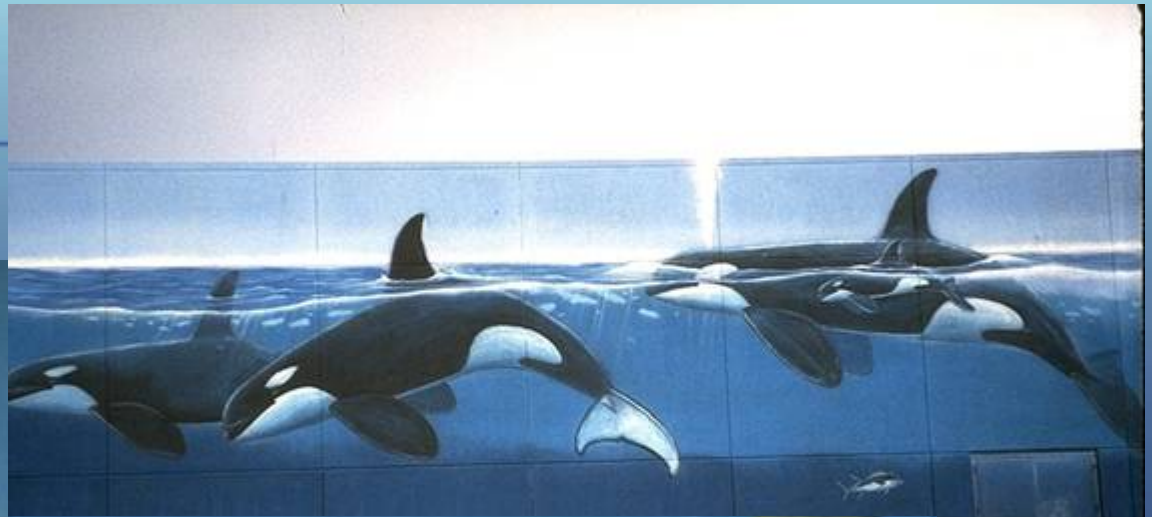




# How Can This Speed Recovery... *NOAA*



...of These?



# Response Options

---

*noaa*

- No Response
- Place of refuge
- Open water
  - Mechanical (Skimmers)
  - Dispersion
  - In Situ Burning
- Shoreline
  - No Response
  - Manual
  - Mechanical
  - Hydraulic washing
  - Chemical Cleaners
  - Bioremediation



# Effectiveness of Response

*noaa*



# Initial Response

- 11,000 people, 100's of boats, 8000 aircraft sorties
- Open water: booming, skimming
- Shoreline: manual, then mechanical, primarily pressure washing with flooding
- Trials with shoreline cleaners, bioremediation
- “Vendor spill”
- Oily wastes shipped to Oregon



## Initial Mass Balance

- 20% Evaporated
- 20% Dispersed
- 50% Beached
  - 40% in western Prince William Sound
  - 7 - 11% outside PWS
- 14% recovered and disposed
  - 8-9% by skimming
  - 5-6% by **solid waste removal**

Source: American Fisheries Society, Symposium 13, 1996, Bethesda, Md.

## Final Mass Balance: 3 Years Later

- Floating 0%
- Beached 2%
- Recovered and Disposed 14%
- Sub-tidal Sediments 13%
- Dispersed 1%
- Aqueous degradation 50%
- Atmospheric products 20%

Source: American Fisheries Society, Symposium 13, 1996, Bethesda, Md.

## Initial Impacts on Birds and Mammals

- 250,000 (100,000 - 650,000) sea and shore birds

<b>90 species</b>	<b>killed</b>	<b>total pop size</b>
• Marbled murrelets	8000	80,000-160,000
• Kittiwakes	1200-2400	268,000
• Bald eagles	300	1000's
• Harbor seals	300	2300
• Sea otter	2800	10,000

## Shoreline Washing at Block Island





After the Omni





# A Genteel Approach

NOAA





# How Clean is Clean Enough?

*NOAA*



Who is exposed to this?

*nooda*



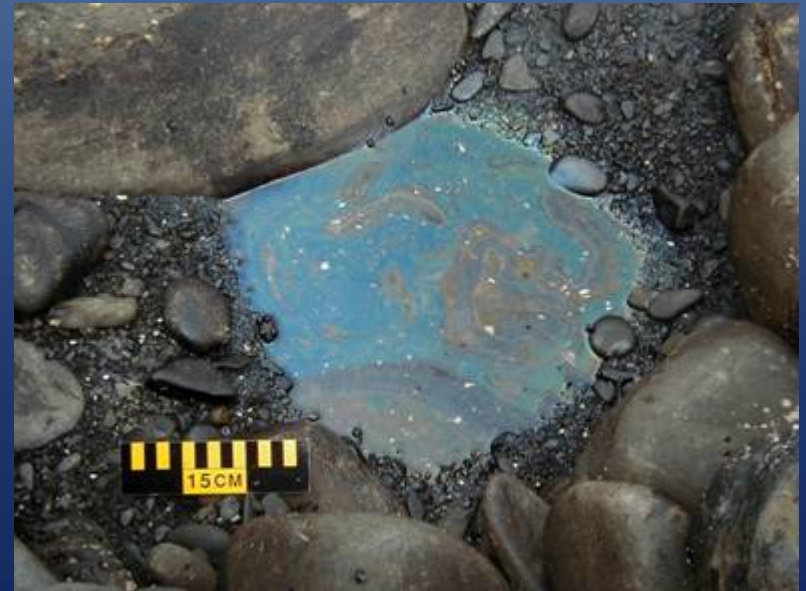
How important are the PAH's?



## PWS: Is the oil gone?



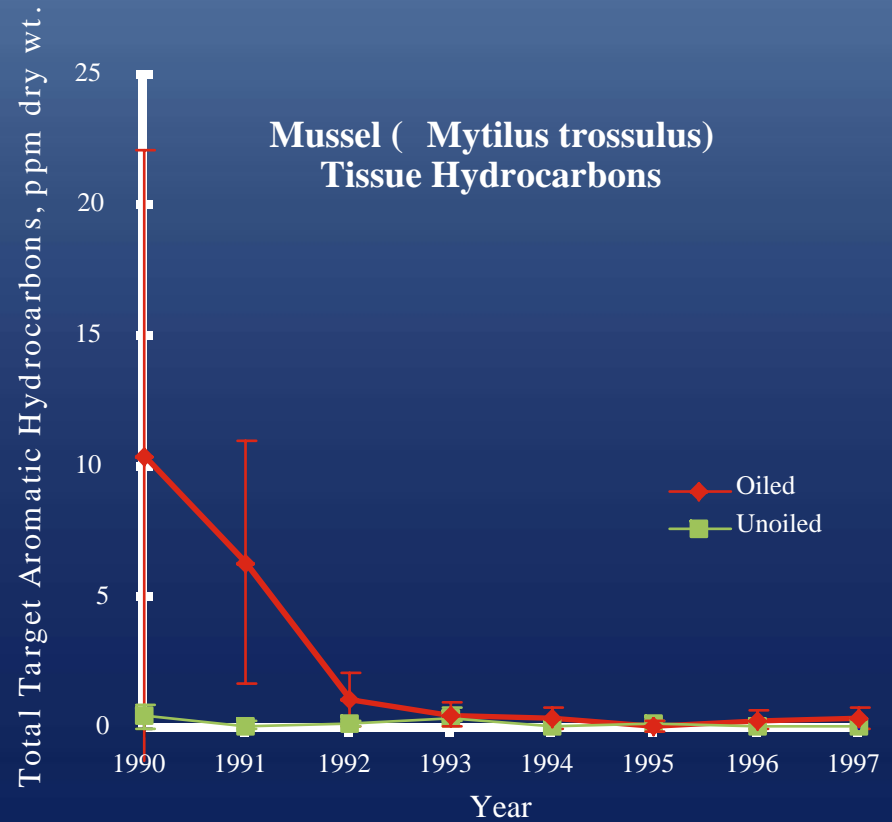
Bay of Isles marsh 2000



Smith Island 2000

Nope. But you knew that.

Most of the oiled mussels were as clean as unoiled mussels by 1992-93 (3-4 years)



## Do Nothing...

- Often imposed by environmental conditions, habitat, or nature of the oil spill



Portland, ME 10/06/96



07/23/97

# Key response issues

- Effectiveness of Response
- Comparing Response Options
- Response as the beginning of Restoration



*noaa*

# A Consensus Process: Ecological Risk Assessment



# Risk Assessment Basics

- Hazard Assessment
- Exposure Assessment
- Risk Assessment
- Risk Communication and management

## Ecological Risk Assessment

What spilled?

Where is it going?

Who will get hit?

What are their recovery times?

What are the response options?

How do the options change recovery time?

What are “best” tradeoffs?

# A Scenario

*nooda*



Using modeling and scenario building to look at benefits and risks



# Risk Matrix



## Recovery Time

P o p u l a t i o n	%	> 10 years	5 - 10 Years	1 to 5 Years	< 1 Year
	60 - 100%	1A	1B	1C	1D
	40 - 60%	2A	2B	2C	2D
	20 - 40%	3A	3B	3C	3D
	1 - 20%	4A	4B	4C	4D

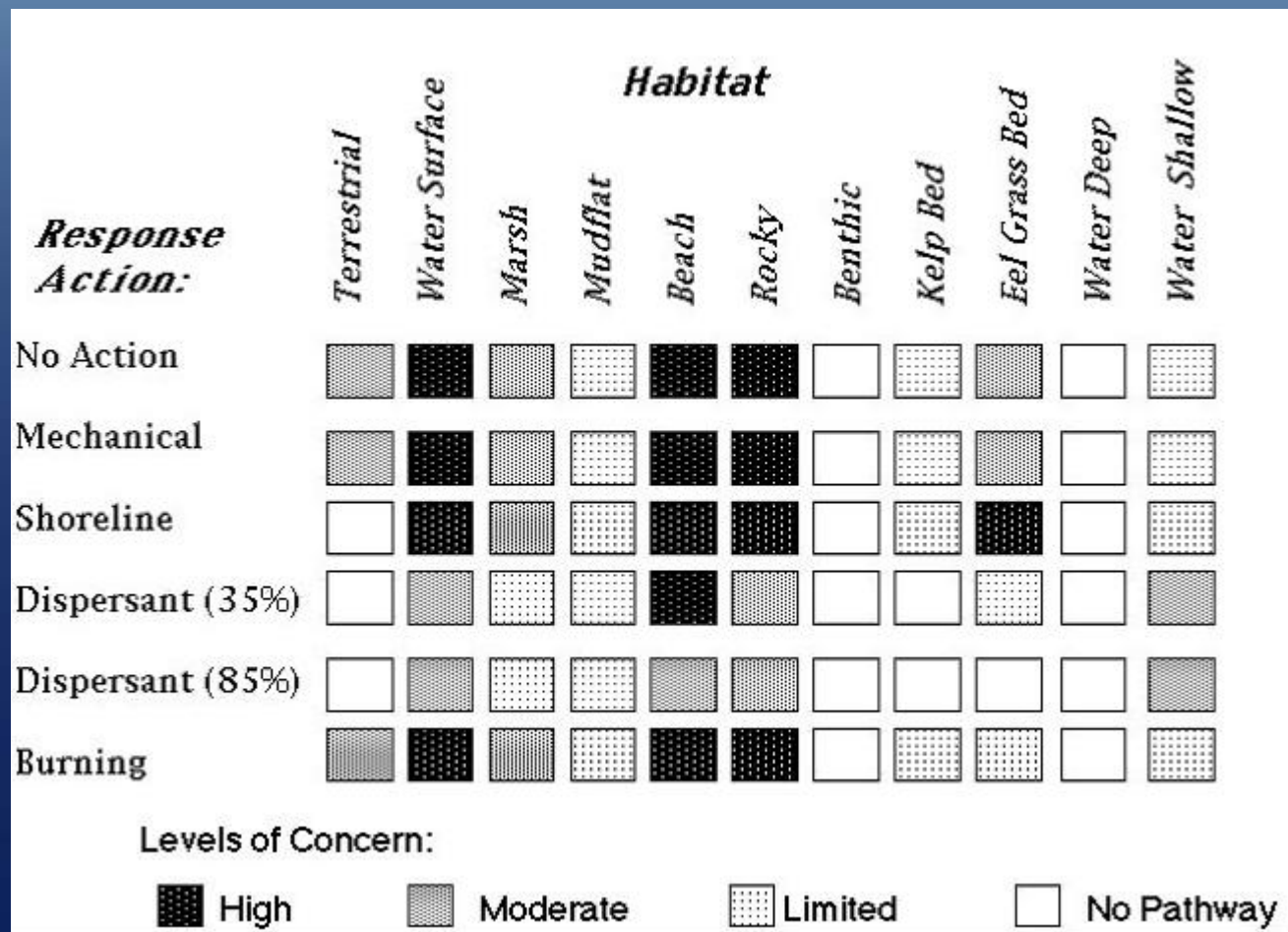
# Comparing Ecological Recovery



Murre Otter Plover Abalone Herring

No Response					
Skimming					
Dispersion					
Burning					
Shoreline Cleanup					

# Comparing Risks Among All Resources



## Results of Risk Assessment Workshops

*Each Response Action has limits and environmental Tradeoffs, which are quantified:*

### **No Action**

Birds, maximum shoreline and water column impacts

### **Skimming**

Weather, sea-state limits, slow, low effectiveness, waste generation

### **Burning**

Weather, sea state, narrow window, logistics, residues



## Results of Risk Assessment Workshops *cont.*

### **Dispersing**

Weather, sea state, narrow window, short-term water column impacts

### **Shoreline**

Long-term, mechanical damage to sensitive habitats, clean-up re-oiling of nearshore water, waste generation

So, is our knowledge good enough to make these kinds of conclusions?

What is the role of PAH Toxicity in all this?

How do we bridge the gap?