NOAA National Status & Trends

Mussel Watch: A Partnership Program

A Presentation To The

National Water Quality Monitoring Council

Gunnar Lauenstein and John Christensen

December 10, 2008

Mussel Watch: A Partnership Program

Program at a Glance

300 sites nationwide

Stations 20 km apart in estuaries, 70 km along open coast

120 contaminants routinely monitored in indigenous bivalve populations

Longest running coastal contaminant monitoring program that is National in scope each year (24 years)

NOAA "Foundation" Data Set

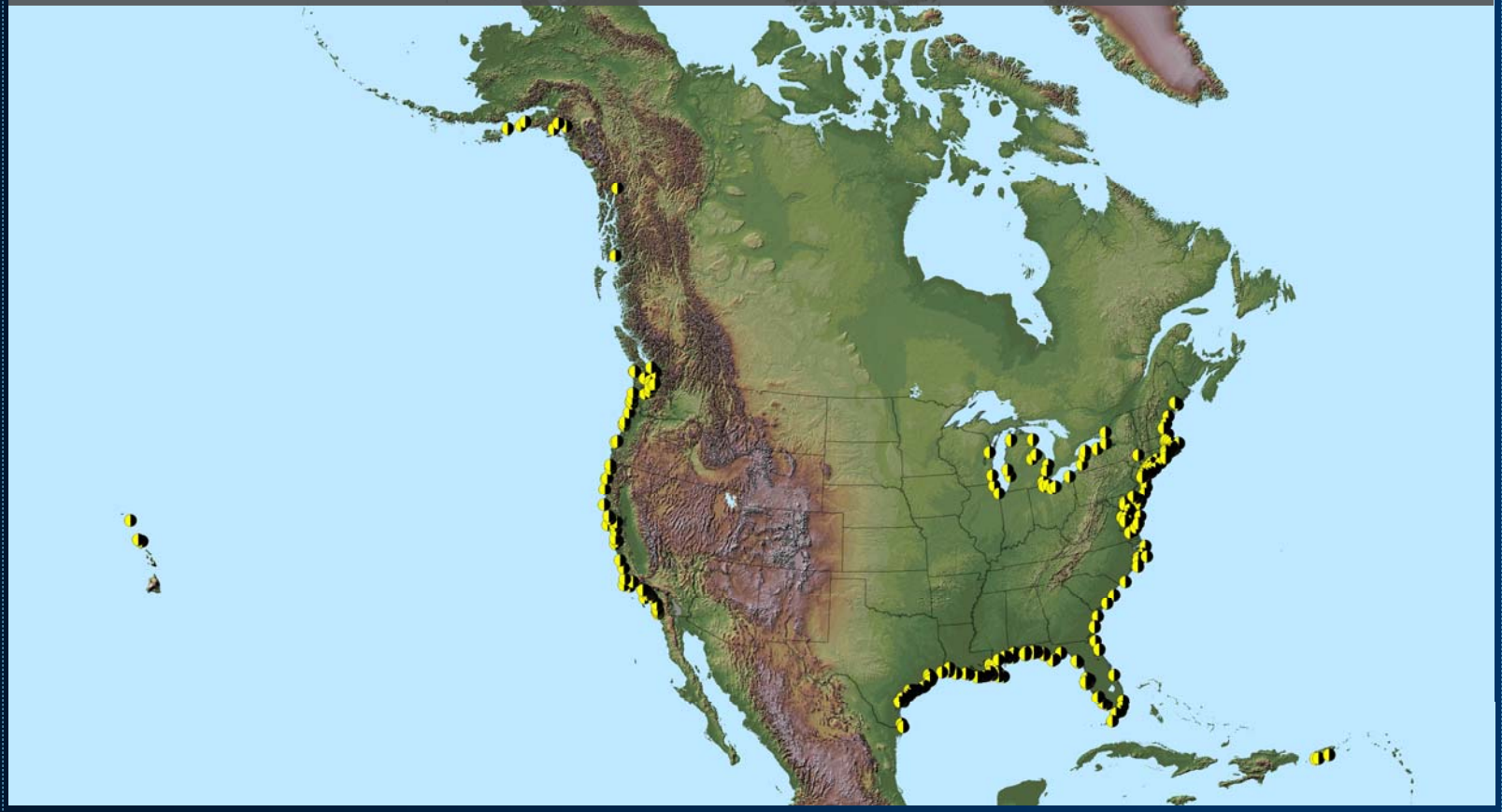
Mission

"Support ecosystem-based management through integrated programs of environmental monitoring, assessment and research to describe the status and trends in the condition of our nation's estuarine and coastal waters"

Mussel Watch: A Partnership Program

Program at a Glance

Monitoring Geographic Domain *(all native bivalve species)*



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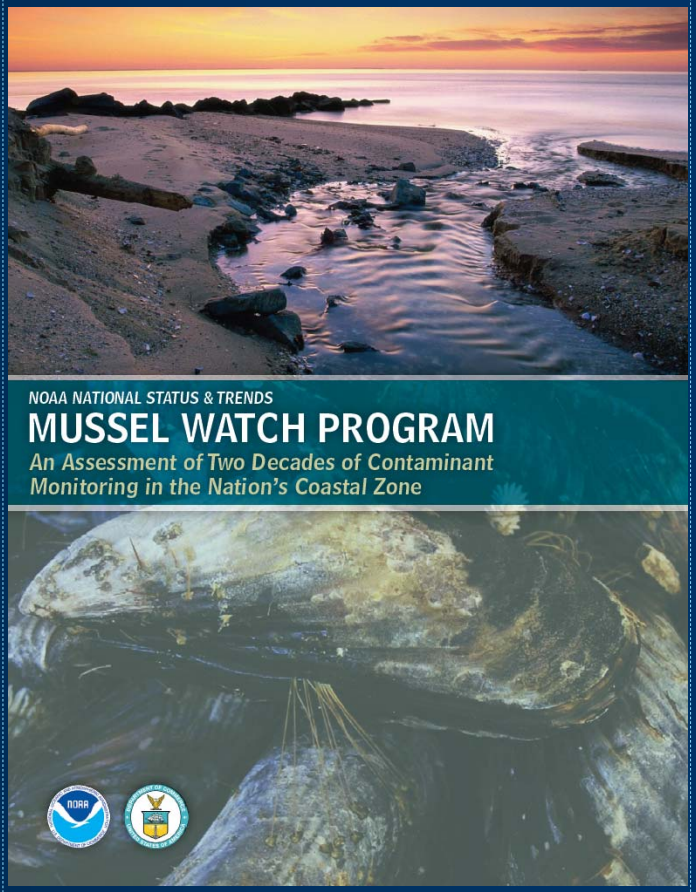
A Report to the Nation (May 2008)

Chemical contamination in our nation's coastal waters is declining, including levels of DDT, hydrocarbons, and industrial contaminants such as PCBs

Improvements credited to environmental laws – including the *Clean Water Act* – indicating that sound environmental policies and associated regulation have measurably improved coastal ecosystem condition

Fossil fuel compounds from motor vehicles, power generation, and shipping activities continue to flow into and affect coastal waters

Mussel Watch adds new and emerging threats to its list of over 120 chemical contaminants. *Polybrominated Diphenyl Ethers* (PBDEs) were recently added to the growing list. NOAA Mussel Watch will issue a report on PBDEs across the Nation in March 2009



http://ccma.nos.noaa.gov/about/coast/nsandt/welcome.html

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PARTNERSHIPS

Through partnerships Mussel Watch has become more efficient enabling the program to continue under the current budget constraints:

- Partners are collecting samples along the US West Coast.
- Discussions are underway for the US East coast areas of the Delware Bay and Chesapeake Bay to be collected by collaborators.
- Mussel Watch now has monitoring sites in nearly all of the MPAs known as the National Estuarine Research Reserves.

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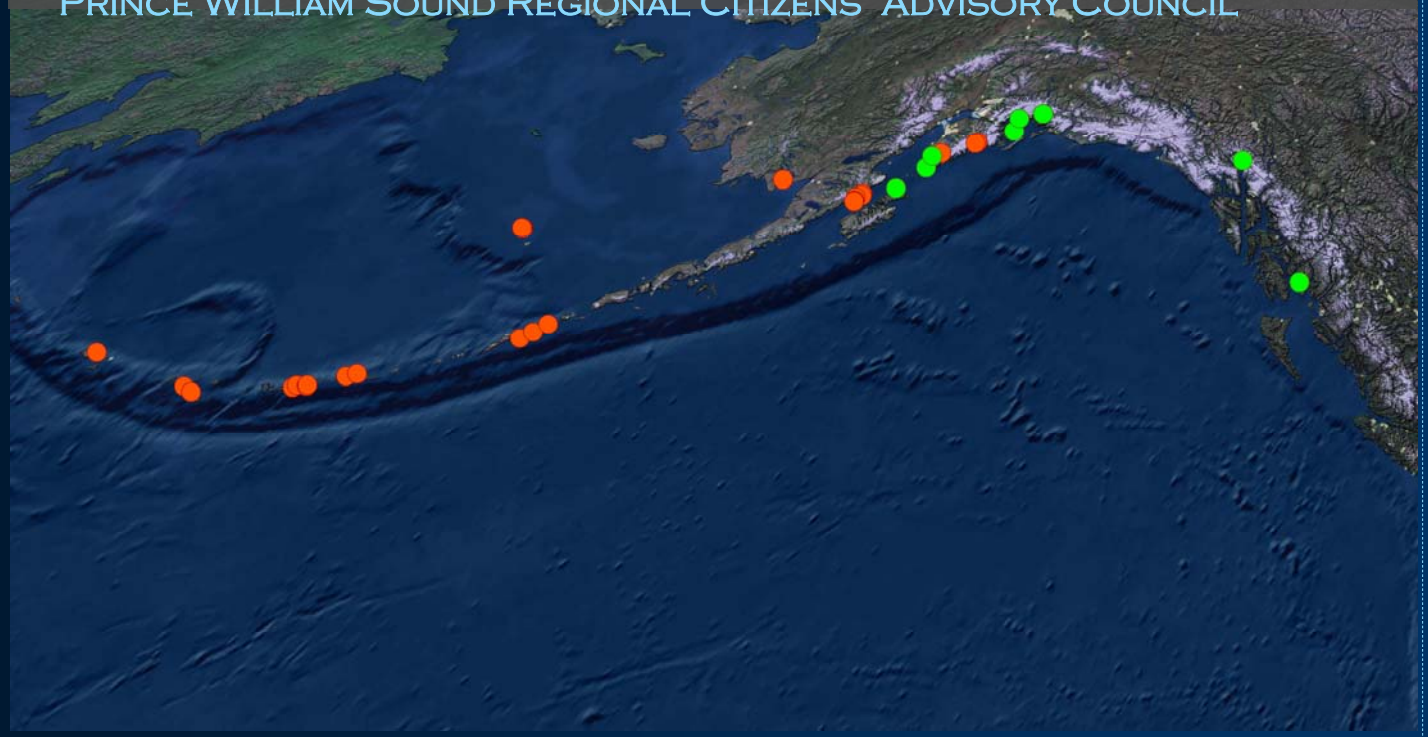
Expanded Coverage through Partnerships: Alaska

- Alaska Department of Environmental Conservation (DEC)
- Alaska Monitoring & Assessment Program (via EPA)
- Chugach Regional Resources Commission (CRRC)
- Alutiiq Pride Shellfish Hatchery
- Bristol Bay Native Association (BBNA)
- Cook Inlet Keeper
- Prince William Sound Regional Citizens' Advisory Council



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Expanded Coverage through Partnerships: SoCAL

Southern California Coastal Water Resources Project (SCCWRP)
Multi-Agency Rocky Intertidal Network (MARINE)
State California Water Resources Control Board (SCWRC)

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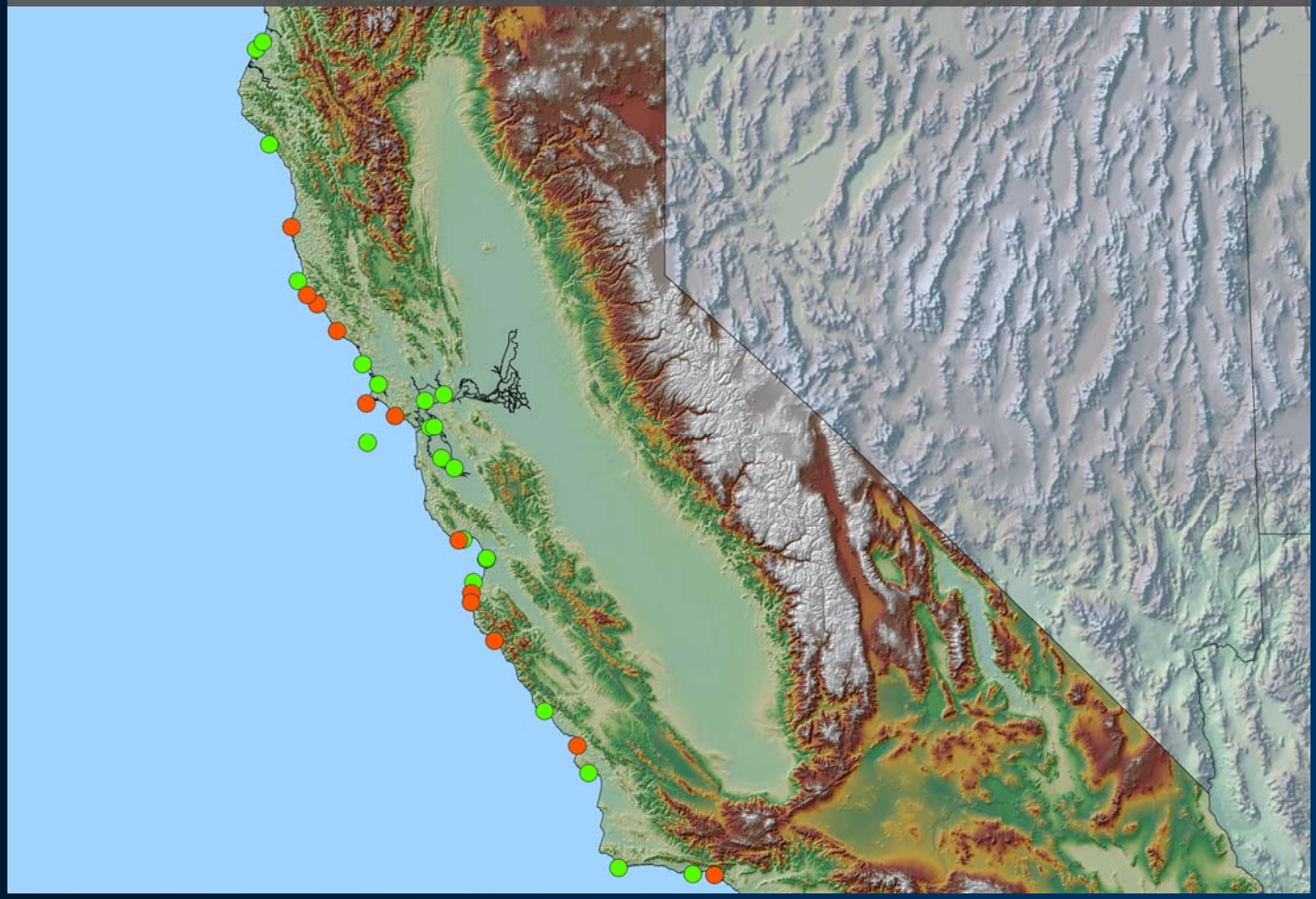
Expanded Coverage through Partnership: NoCAL

State California Water Resources Control Board (SCWRC)



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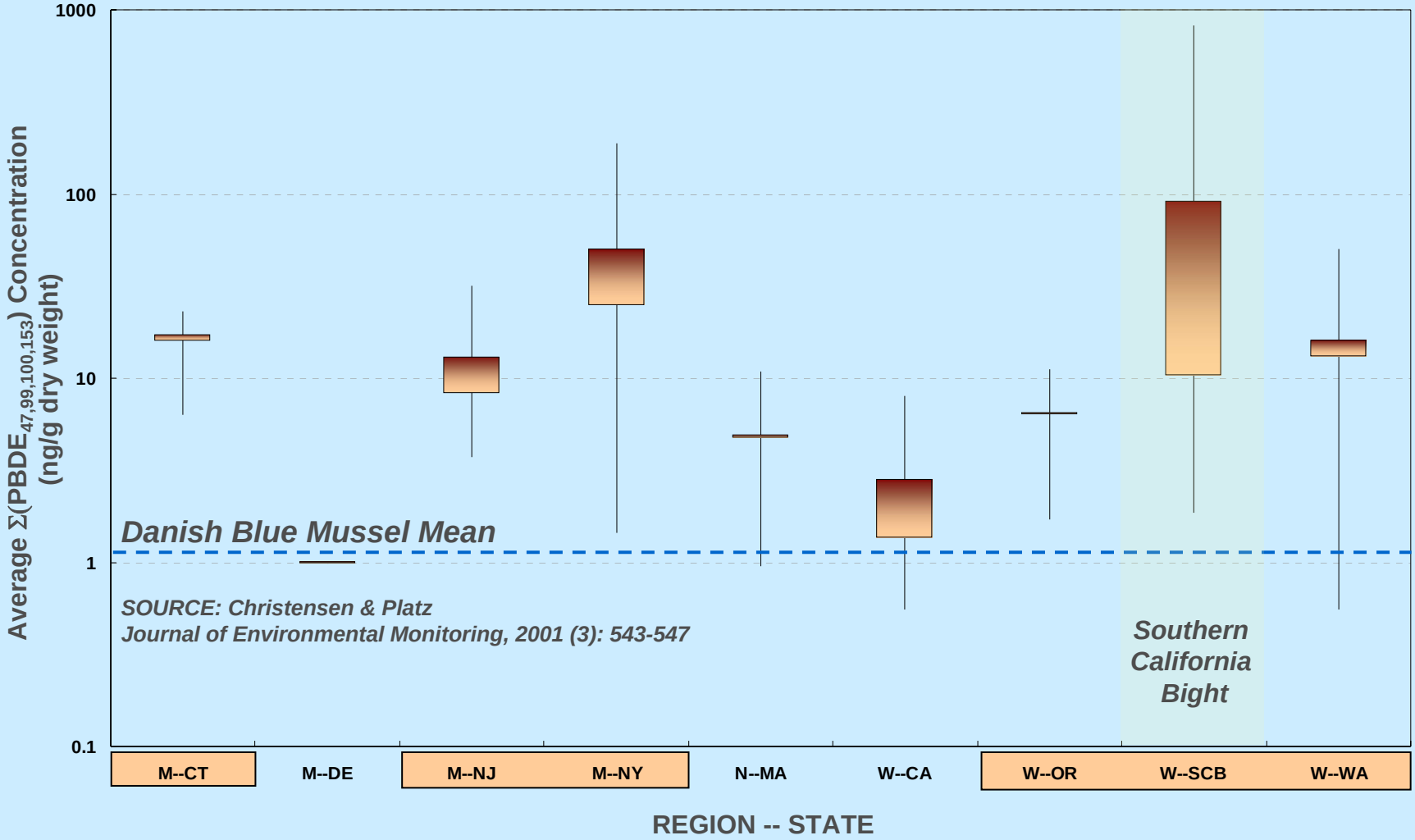
A Report to the Nation PBDEs: March 2009



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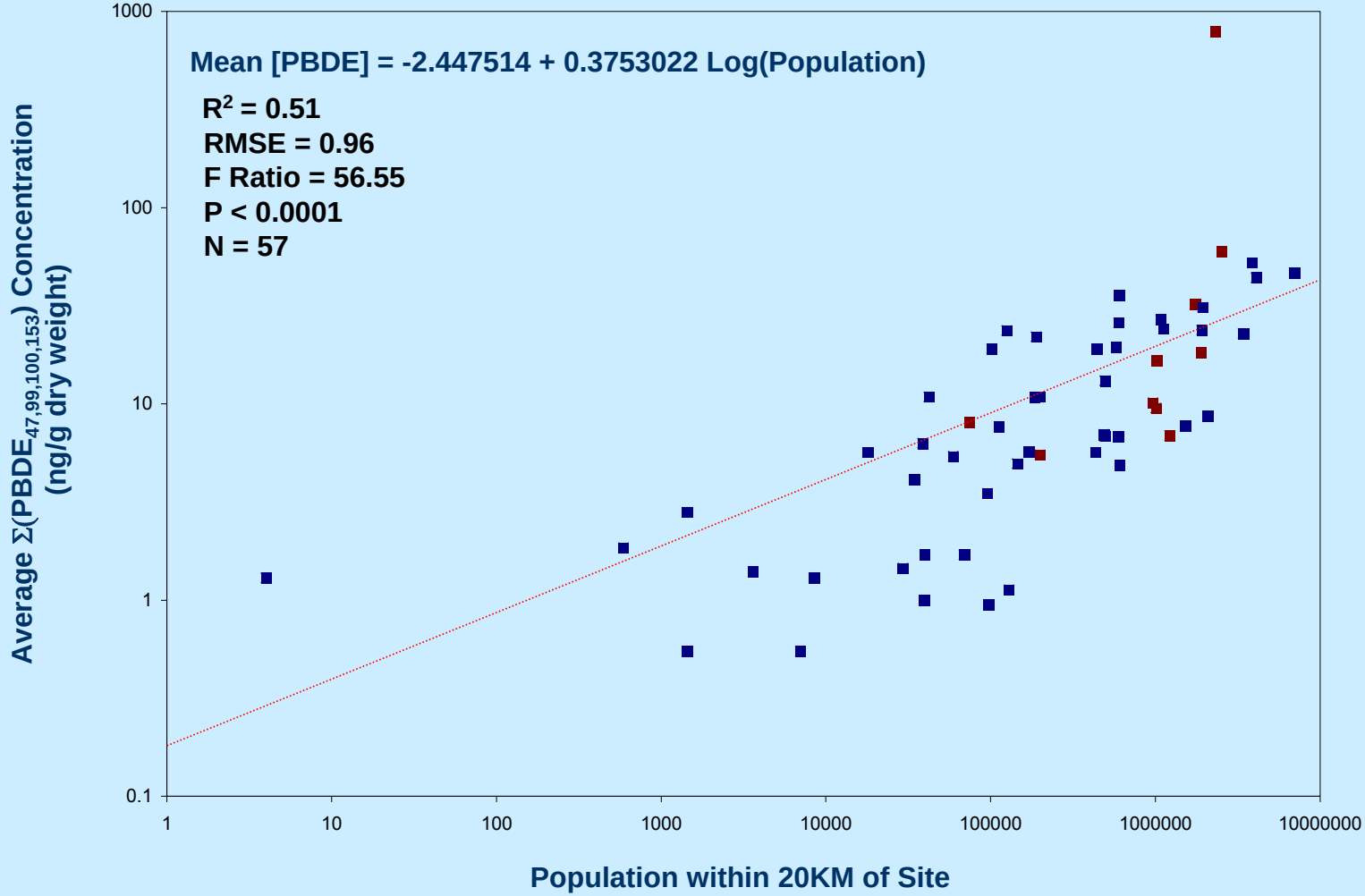
Maroon symbols indicate Southern California Bight Mussel Watch Sites



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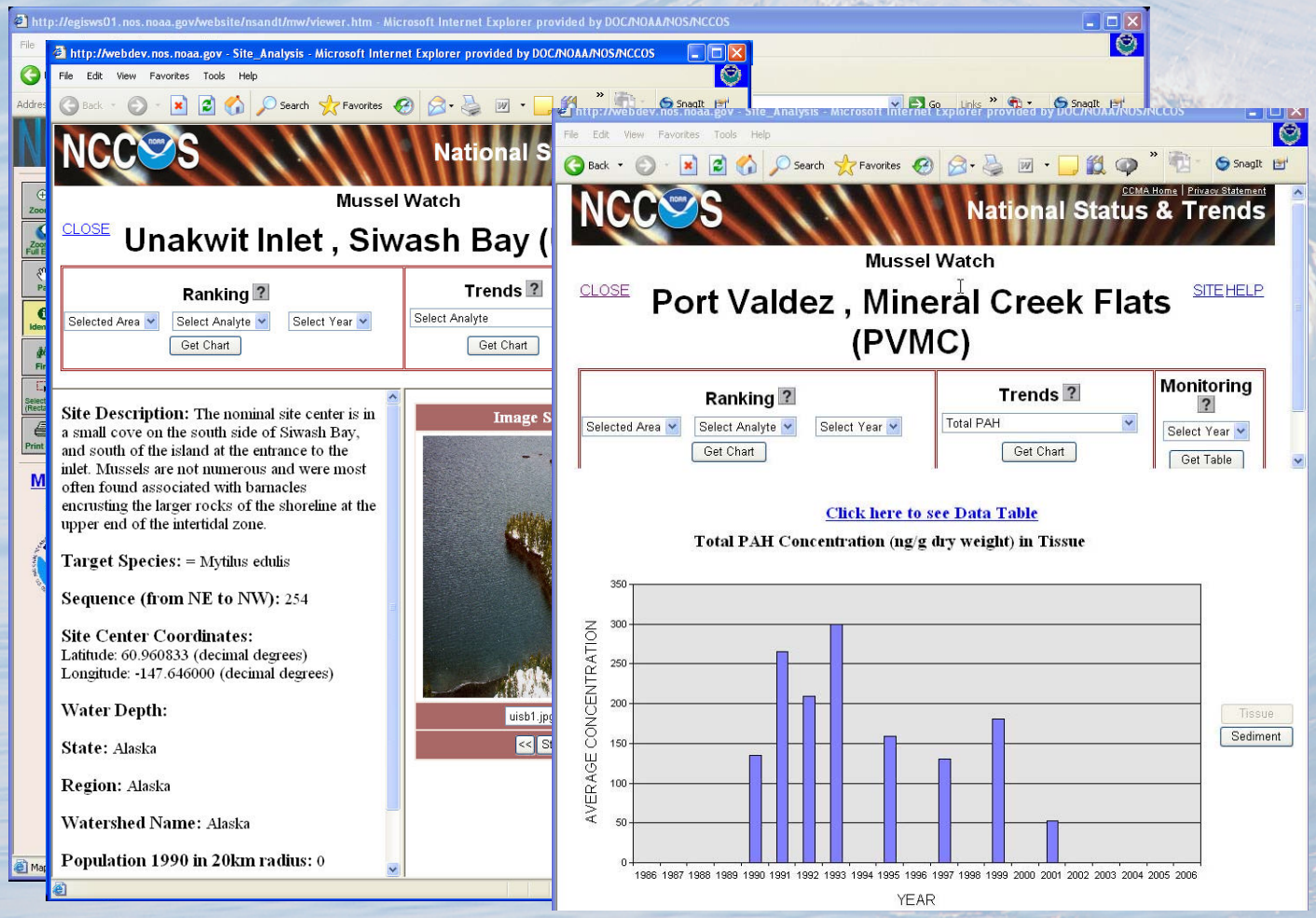
Data Management & Distribution



- Web-enabled database
- Map query to select data
- Site description tool to learn more about the location sampled
- Data plotting and analysis tools to compare sites and evaluate trends

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Recent Method documents updates

Kimbrough, K. L., G. G. Lauenstein and W. E. Johnson (Editors). 2006. Organic Contaminant Analytical Methods of the National Status and Trends Program: Update 2000-2006. NOAA Technical Memorandum NOS NCCOS 30. 137 pp.

Kimbrough, K. L. and G. G. Lauenstein, eds. (2006). Major and Trace Element Analytical Methods of the National Status and Trends Program: 2000-2006. Silver Spring, MD. NOAA Technical Memorandum NOS NCCOS 29, 19 pp.

McDonald, S. J., D. S. Frank, J. A. Ramirez, B. Wang, and J. M. Brooks. 2006. Ancillary Methods of the National Status and Trends Program: 2000-2006 Update. Silver Springs, MD. NOAA Technical Memorandums NOS NCCOS 28. 17 pp.

Kim, Y., K.A. Ashton-Alcox, and E.N. Powell. 2006. Histological Techniques for Marine Bivalve Molluscs: Update. Silver Spring, MD. NOAA Technical Memorandum NOS NCCOS 27. 76 pp.

FOUND AT: NSandT.NOAA.GOV

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Mussel Watch: A Partnership Program

Contact Information

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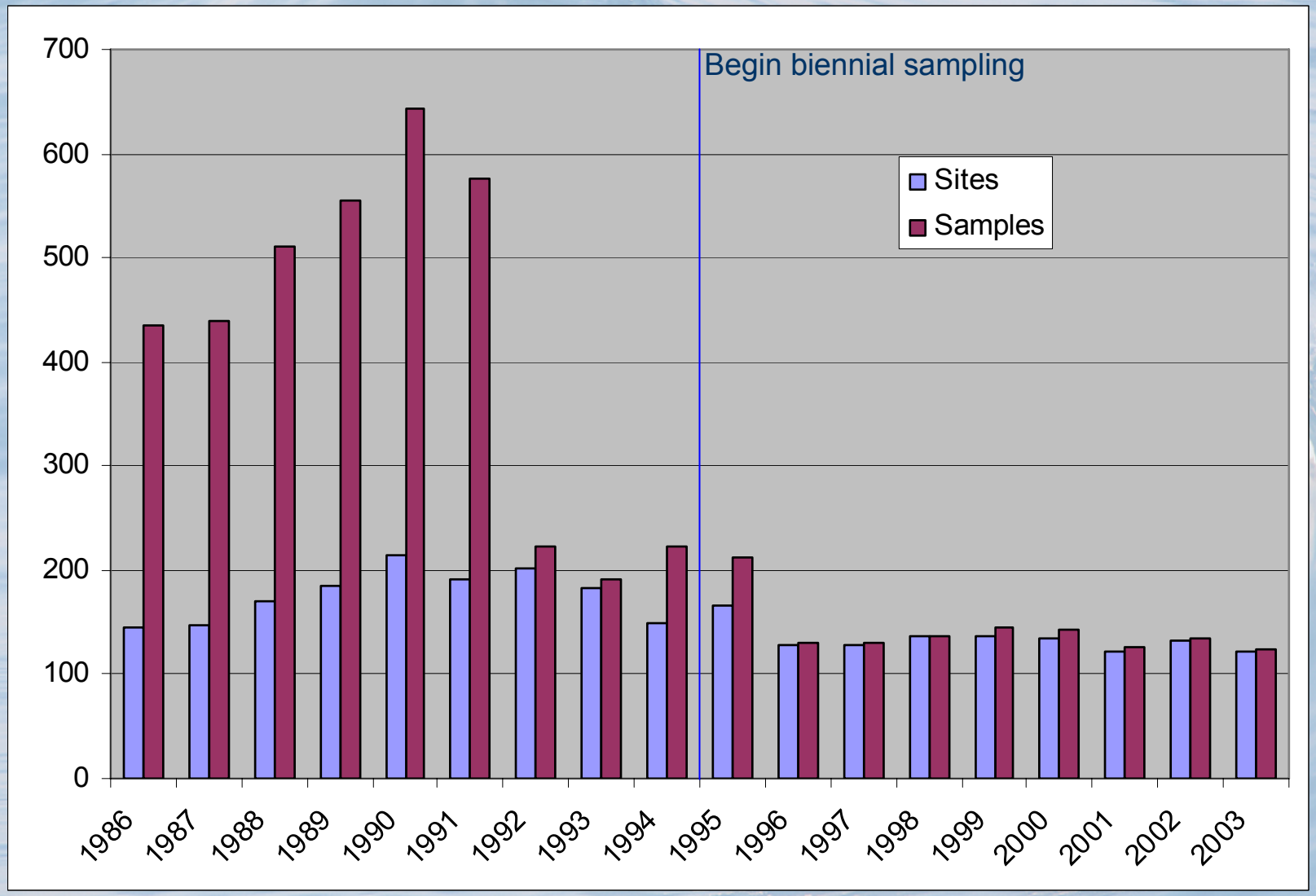
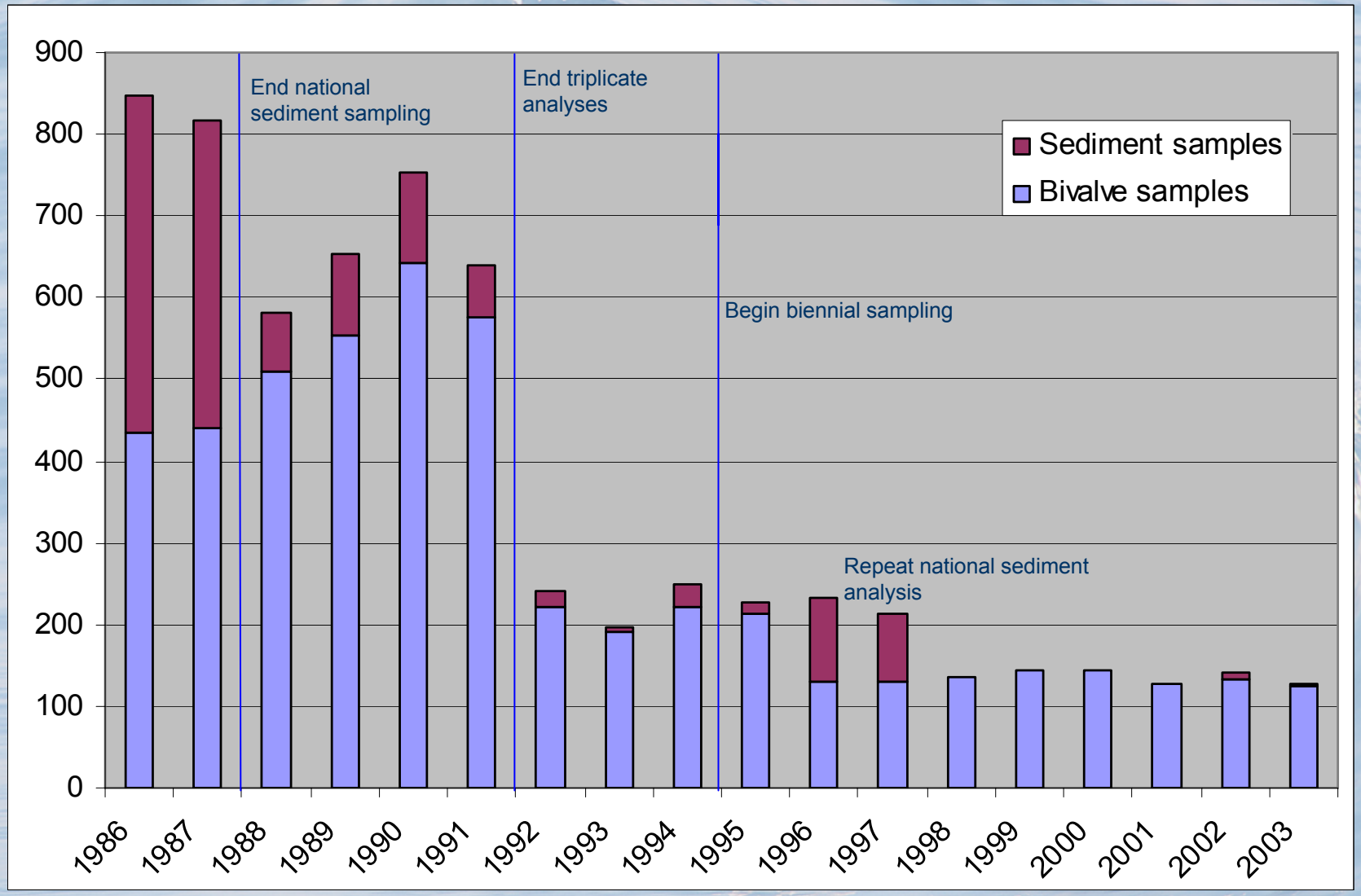
Mussel Watch Sampling and Financial History

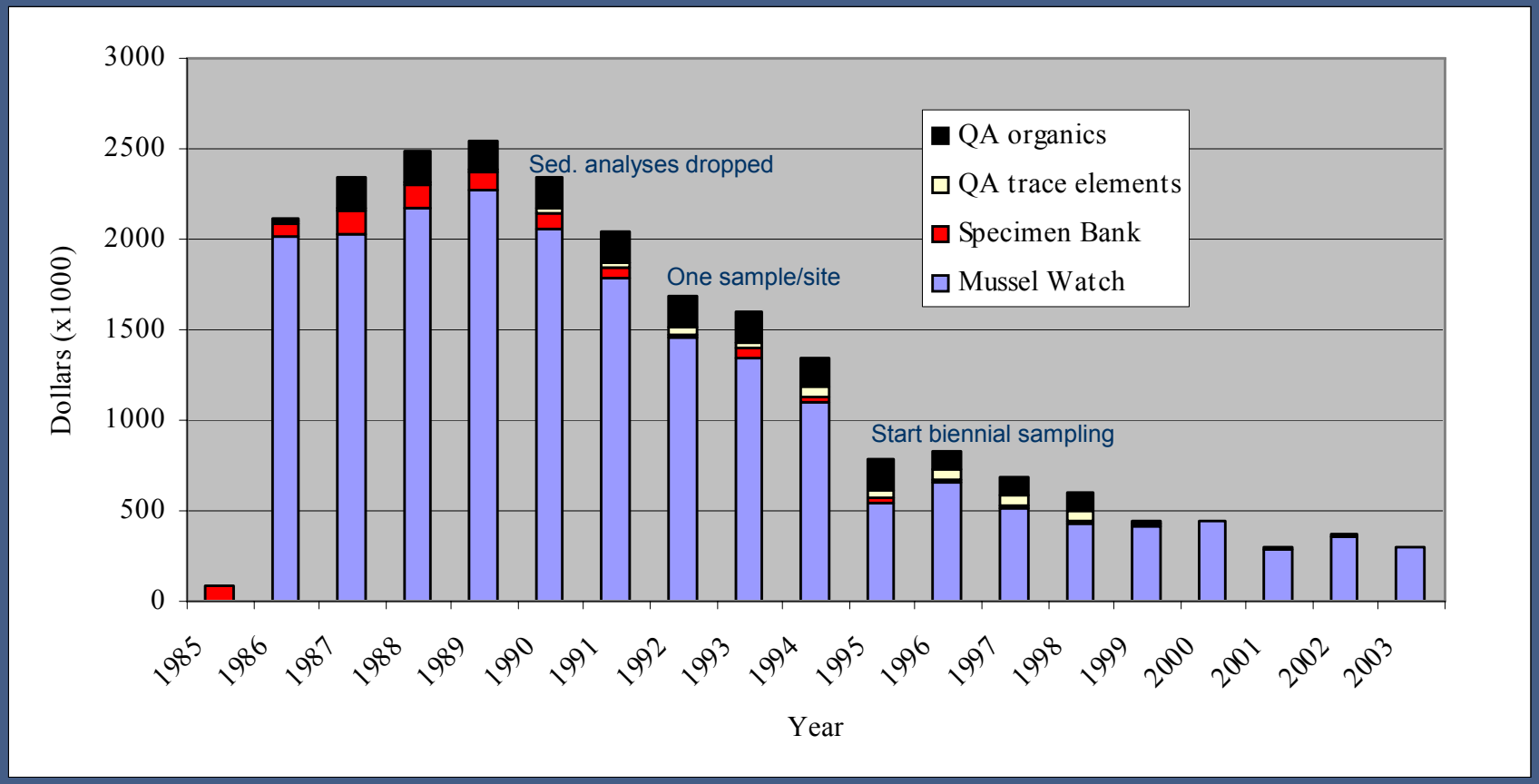
Bivalve Sites and Stations Analyzed per Year



Mussel Watch Bivalve and Sediment Samples per Year



Mussel Watch Funding



NS&T Core Analytes: Butyltins

Monobutyltin

Dibutyltin

Tributyltin

Tetrabutyltin

Butyltins added in 1988/1989

NS&T Core Analytes: Trace and Major Elements

Aluminum
Antimony ◊
Arsenic ◊
Cadmium ◊□
Chromium ◊
Copper ◊□
Iron
Lead ◊□
Manganese
Mercury ◊
Nickel ◊□
Selenium ◊
Silicon
Silver ◊□
Thallium ◊
Tin
Zinc ◊□

◊ Trace elements contained in the EPA Priority Pollutants List
□ Trace elements quantified by both the NS&T Program and the earlier EPA Mussel Watch Program (1976-1978)

NS&T Core Analytes: Polycyclic Aromatic Hydrocarbons

Low Molecular Weight

Acenaphthene ◊
Acenaphthylene ◊
Anthracene ◊
Biphenyl
2,6-Dimethylnaphthalene
Fluorene ◊
1-Methylnaphthalene
2-Methylnaphthalene
1-Methylphenanthrene
Naphthalene ◊
Phenanthrene ◊
1,6,7-Trimethylnaphthalene

High Molecular Weight

Benz[*a*]anthracene ◊
Benzo[*a*]pyrene ◊
Benzo[*e*]pyrene
Benzo[*b*]fluoranthene ◊
Benzo[*k*]fluoranthene ◊
Benzo[*ghi*]perylene ◊
Chrysene ◊
Dibenz[*a*,*h*]anthracene ◊
Fluoranthene ◊
Indeno[1,2,3-*cd*]pyrene ◊
Perylene
Pyrene ◊

◊ PAHs contained in the EPA Priority Pollutants List

NS&T Core Analytes: Chlorinated Pesticides

Aldrin ◊
Endrin ◊
Dieldrin◊
alpha-Chlordane ◊
(*cis*-Chlordane)
gamma-chlordane
(*trans*-chlordane)
Oxychlordane
cis-Nonachlor
trans-Nonachlor
Heptachlor ◊
Heptachlor epoxide ◊

Hexachlorobenzene
Pentachlorobenzene
1,2,3,4-Tetrachlorobenzene
1,2,4,5-Tetrachlorobenzene
Pentachloroanisole
Chlorpyrifos
2,4'-DDD
4,4'-DDD ◊
2,4'-DDE
4,4'-DDE ◊

2,4'-DDT
4,4'-DDT ◊
Lindane (gamma-HCH) ◊
alpha-HCH
beta-HCH
delta-HCH
Mirex
Endosulfan I ◊
Endosulfan II ◊
Endosulfan sulfate ◊

◊ Chlorinated pesticides contained in the EPA Priority Pollutants List
Compounds added since 1993

NS&T Core Analytes: Polychlorinated Biphenyls

PCB	Congener	PCB	Congener
2,4'-CL2	8/5	2,3',4',5-CL4	70
2,2',5-CL3	18	2,4,4',5-CL4	74
2,4,4'-CL3	28	2,2',3,4,5'-CL5	87
2,4',5-CL3	31	2,2',3,5',6-CL5	95
2,2',3,5'-CL4	44	2,2',4,4',5-CL5	99
2,2',3,6-CL4	45	2,2',4,5,5'-CL5	101/90
2,2',4,5'-CL4	49	2,3,3',4,4'-CL5	105
2,2',5,5'-CL4	52	2,3,3',4',6-CL5	110
2,3,3',4'-CL4	56	2,3',4,4',5-CL5	118
2,3',4,4'-CL4	66	2,2',3,3',4,4'-CL6	128

PCBs were added as core analytes in 1987

PCBs added for 2005

NS&T Core Analytes: Polychlorinated Biphenyls (cont.)

PCB	Congener
2,2',3,4,4',5'-CL6	138
2,2',3,4',5,5'-CL6	146
2,2',3,4',5',6-CL6	149
2,2',3,5,5',6-CL6	151
2,2',4,4',5,5'-CL6	153/132/168
2,3,3',4,4',5-CL6	156
2,3,3',4,4',5'-CL6	157
2,3,3',4,4',6-CL6	158
2,2',3,3',4,4',5-CL7	170/190
2,2',3,3',4,5,6'-CL7	174

PCB	Congener
2,2',3,4,4',5,5'-CL7	180
2,2',3,4,4',5',6-CL7	183
2,2',3,4',5,5',6-CL7	187
2,2',3,3',4,4',5,5'-CL8	194
2,2',3,3',4,4',5,6-CL8	195/208
2,2',3,3',4,4',5,5',6-CL9	206
Decachlorobiphenyl-CL10	209

PCBs were added as core analytes in 1987

PCBs added for 2005

Additional NS&T Analytes: Alkylated Aromatic Hydrocarbons*

C1 - Naphthalenes
C2 - Naphthalenes
C3 - Naphthalenes
C4 - Naphthalenes
C1 - Fluorenes
C2 - Fluorenes
C3 - Fluorenes
C1 - Phenanthrenes + anthracene
C2 - Phenanthrenes + anthracene
C3 - Phenanthrenes + anthracene
C4 - Phenanthrenes + anthracene

Dibenzothiophene
C1 - Dibenzothiophenes
C2 - Dibenzothiophenes
C3 - Dibenzothiophenes
C1 - Fluoranthene + pyrenes
C1 - Chrysenes
C2 - Chrysenes
C3 - Chrysenes
C4 - Chrysenes
Retene (methyl isopropyl phenanthrene)

* Presence is indicative of petroleum hydrocarbon source

Alkylated aromatic hydrocarbons analyzed occasionally since 1991

Emerging Contaminants: Polybrominated diphenyl ethers*

- Widely used as flame retardant chemicals, analogous to PCBs in structure
- Increasing concentrations in the environment
- Released into the environment slowly, and tend to persist in sediment and soils
- PBDEs disrupt thyroid hormones; neurobehavioral effects; reproductive impairment

PBDE	Congener	PBDE	Congener
2-MonoBDE	1	2,3',4-TriBDE	25
3-MonoBDE	2	2,4,4'-TriBDE	28
4-MonoBDE	3	2,4,6-TriBDE	30
2,4-DiBDE	7	2,4',6-TriBDE	32
2,4'-DiBDE/3,3'-DiBDE	8/11	2',3,4-TriBDE	33
2,6-DiBDE	10	3,3',4-TriBDE	35
3,4-DiBDE	12	37 (3,4,4'-TriBDE	37
3,4'-DiBDE	13	2,2',4,4'-TetraBDE	47
4,4'-DiBDE	15	2,2',4,5'-TetraBDE	49
2,2',4-TriBDE	17	2,3',4,4'-TetraBDE	66

* NS&T has measured PBDEs in in 2004 bivalve samples

Emerging Contaminants: Polybrominated diphenyl ethers (cont.)

PBDE	Congener
2,3',4',6-TetraBDE	71
2,4,4',6-TetraBDE	75
3,3',4,4'-TetraBDE	77
2,2',3,4,4'-PentaBDE	85
2,2',4,4',5-PentaBDE	99
2,2',4,4',6-PentaBDE	100
2,3,4,5,6-PentaBDE	116
2,3',4,4',5-PentaBDE	118
2,3',4,4',6-PentaBDE	119
3,3',4,4',5-PentaBDE	126

PBDE	Congener
2,2',3,4,4',5'-HexaBDE	138
2,2',4,4',5,5'-HexaBDE	153
2,2',4,4',5,6'-HexaBDE	154
2,2',4,4',6,6'-HexaBDE	155
2,3,4,4',5,6-HexaBDE	166
2,2',3,4,4',5,6-HeptaBDE	181
2,2',3,4,4',5',6-HeptaBDE	183
2,3,3',4,4',5,6-HeptaBDE	190
Deca-BDE	209