APPENDIX C

Presentations from
December 10, 2002

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Mr. Barry Burgan
EPA

Opening Remarks and Charge to Workshop

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Atlantic Northeast Coastal Monitoring Summit

New England Center

Durham, NH

December 10-12, 2002

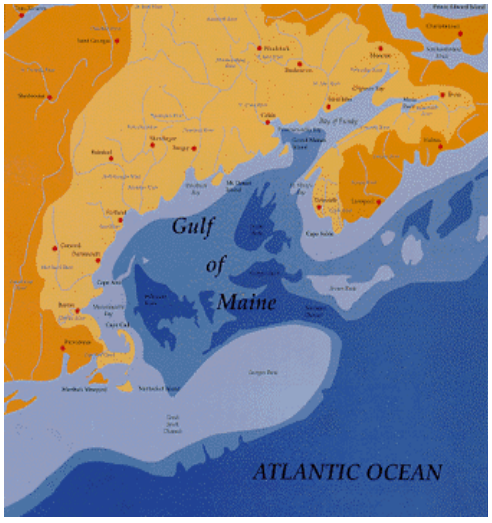
Barry Burgan, USEPA

Atlantic Northeast Coastal Monitoring Summit

Welcome !

Charge

Logistics



Atlantic Northeast Coastal Monitoring Summit

- Meeting Charge:
  - Identify value-added integration of selected monitoring program elements to make better management decisions
  - Identify monitoring gaps and methods to fill them
  - Identify research needed to support region's monitoring agenda

Atlantic Northeast Coastal Monitoring Summit

- Leading Management issues:
  - Habitat
  - Nutrients
  - Contaminants

Atlantic Northeast Coastal Monitoring Summit

- Set the stage:
  - Federal Initiatives (CWAP, NSTC)
  - National Coastal Assessment
  - GoM Action Plan
  - Ocean Commission interest in integration
  - GoMOOS- real time monitoring

Atlantic Northeast Coastal Monitoring Summit

- Integration- *Key word*
  - Pilot
  - Eliminate Stove-pipes
  - Strengthen environmental monitoring
  - Starting point- don't expect to complete in two days!
- We invited you because you can make the technical and management decisions and make this happen

Atlantic Northeast Coastal Monitoring Summit

- How do we use the time together to build a regional monitoring framework?
  - We want you to actively participate
  - Forget past experiences with similar efforts
  - Leave preconceptions at the door
  - Stay open minded, use constructive reasoning to attain the workshop goals
  - Bring a healthy cynicism tempered with sound reasoning when making arguments

Atlantic Northeast Coastal Monitoring Summit

- How do we use the time together to build the regional framework?
  - Discuss with passion and conviction but be ready to change your mind to build a better product
  - Remember, we need to attain your commitments to make this happen
  - Product needs to be practical, doable, and add value

Atlantic Northeast Coastal Monitoring Summit

- Follow-up regional workshop to develop indicators to measure success next year
  - Follow-up in other regions if this approach proves successful
- *"Whole better than the sum of the parts"*
- Personally want to thank the other 16 folks on the steering committee

Atlantic Northeast Coastal Monitoring Summit

- Logistics:
  - Hotel providing complementary meals!
  - Contact Lynn RE: questions about travel support or other logistics during the conference
- Questions on clarity of workshop charge?

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Mr. Paul Stacey
Connecticut Department
of Environmental Protection

Need for Regional Monitoring

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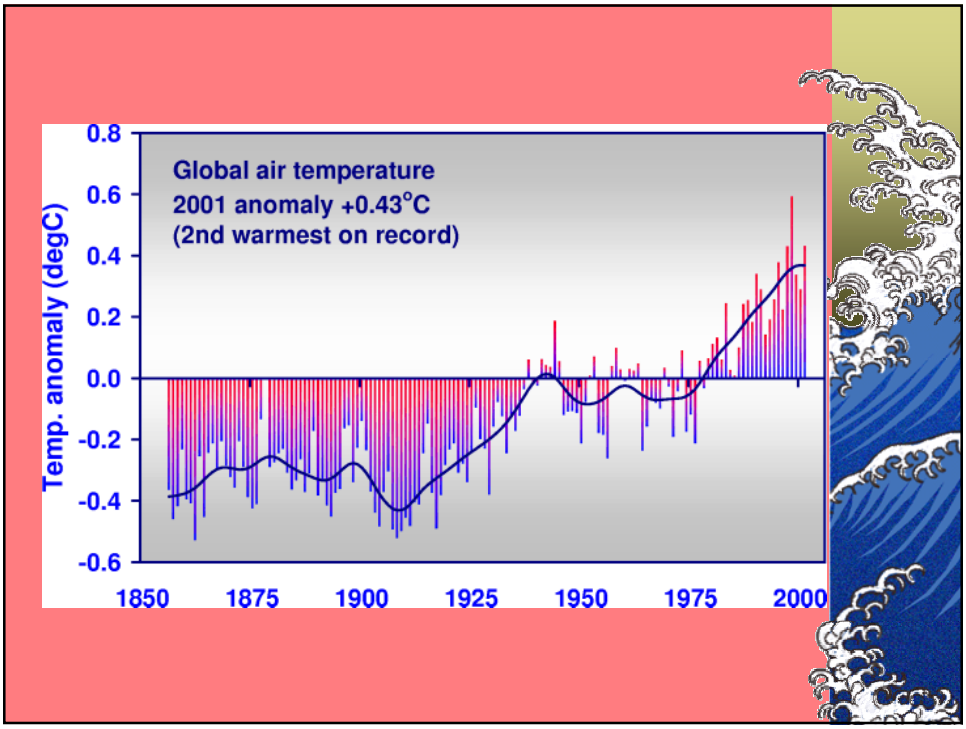
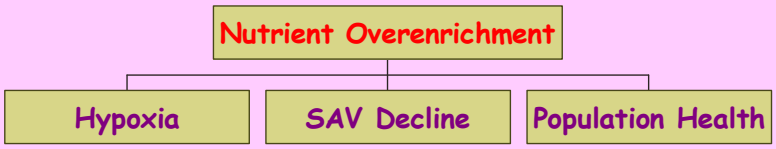
NEED FOR A REGIONAL MONITORING NETWORK FOR THE ATLANTIC NORTHEAST

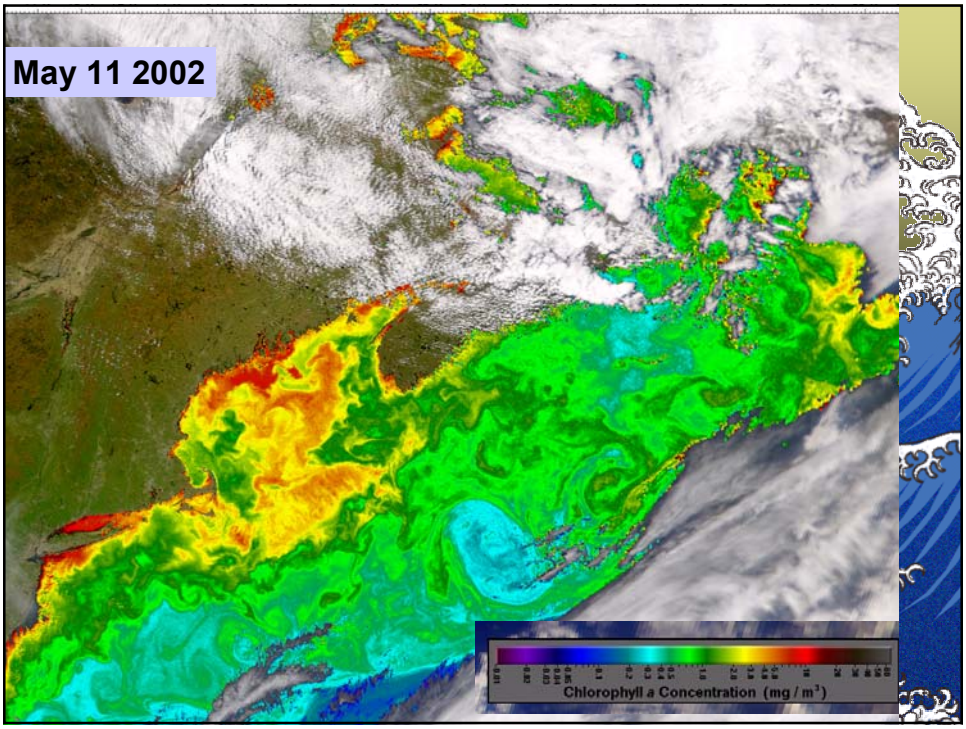
Paul Stacey
Tracy Hart
Ethan Nedeau
Ron Rozsa
Peter Taylor
Mark Tedesco

I. Regional-Scale Processes Affect Local Issues



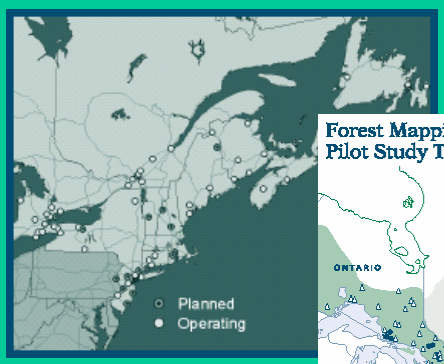
II. Comparative Analyses Can Give Valuable Insight into Local Issues that Occur Regionally

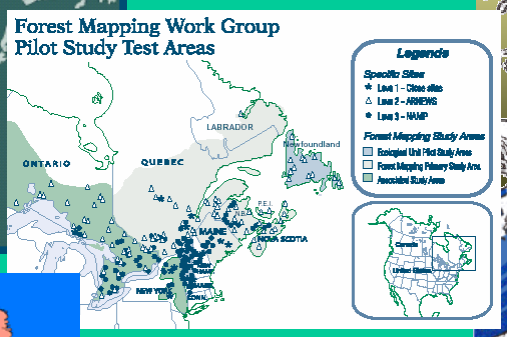




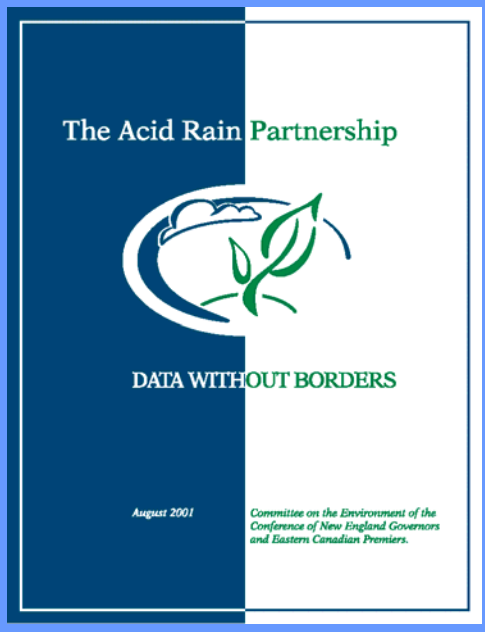
III. Integrated Assessments Provide Powerful Analysis and Communication Tools

ACID RAIN ACTION PLAN





New England Governors
and
Eastern Canadian Premiers



Characterization

Assessment

Trends

Collaboration

Management

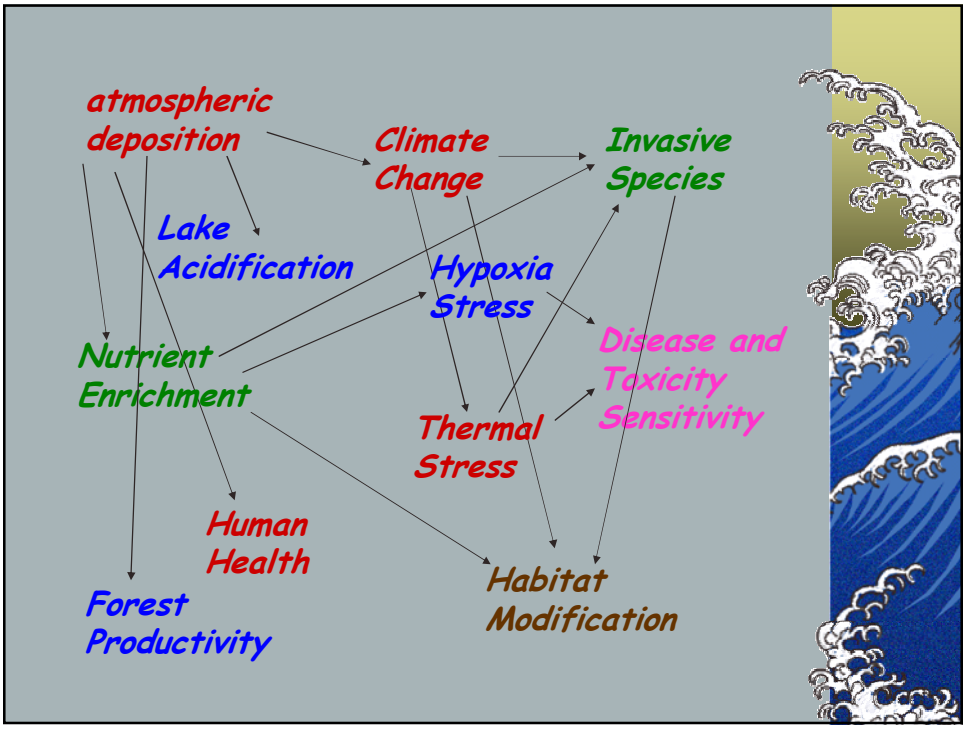
Communication

Regional Monitoring Issues Matrix

Problem	Sources/Cause	Consequences	Primary Indicators	Local/Regional Importance
Habitat Modification and Change	Land use, development, dredging, filling, armoring, storms, accelerated sea level rise, hydromodification and altered hydrology, nutrients, invasive species	Loss or degradation of habitat functions and values	Water: Clarity, nutrients, contaminants, temperature Sediment/Soils: Diversity, grain size, acid sulfate soils, low DO in drained wetlands, resuspension, drift Habitat: Trends mapping, wetland subsidence Biota: Beneral biodiversity, SAV, invasive species, benthic infauna, shellfish, crustaceans, fish, avifauna	Primarily local causes and effects. Understanding is highly transferable throughout the region. Regional implications for sea level rise and possibly from population declines of species with widely dispersing larvae

Regional Monitoring Issues Matrix

Problem	Sources/Cause	Consequences	Primary Indicators	Local/Regional Importance
Accelerated Eutrophication (Nutrient Enrichment)	Nutrient and carbon enrichment from point and nonpoint sources and atmospheric deposition	Hypoxia, SAV decline, overly productive, harmful algal blooms, increases in benthic and sheet algae	Water: DO, nutrients, PAR, Secchi depth Biota: SAV, benthic and sheet algae, phytoplankton, benthic infauna, fish, shellfish, crustaceans	Causes and effects are both local and regional. Local understanding is highly transferable throughout the region


atmospheric deposition
Climate Change
Invasive Species
Lake Acidification
Hypoxia Stress
Nutrient Enrichment
Disease and Toxicity Sensitivity
Thermal Stress
Human Health
Habitat Modification
Forest Productivity

Dr. Stephen Weisberg
SCCWRP

(Please note that this is not his entire presentation)

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COOPERATIVE REGIONAL MONITORING: IS IT WORTH THE TROUBLE?

Stephen B. Weisberg
Southern California Coastal Water Research Project

SOUTHERN CALIFORNIA EXPERIENCE

- **We spend $31M/year on monitoring**
  - 70% by dischargers
- **Can't integrate this data to provide regional assessment**
  - Too site specific
  - Different methods
  - Inaccessible data
- **Initiated cooperative regional monitoring to solve this problem**
  - $3M effort in 1994 involving 12 organizations
  - $8M effort in 1998 involving 62 organizations
  - Planning 2003 effort now

SOME THOUGHTS AS YOU MOVE FORWARD

- Benefits
- Challenges
- Catalysts

THREE COMPONENTS

- Coastal ecology
  - Fish
  - Sediments
- Shoreline Microbiology
- Water Quality

COASTAL ECOLOGY COMPONENT

- **Primary question: What is the spatial extent of chemical contamination in southern California?**
- **Sediment sampling at 446 sites**
  - >100 chemical constituents measured
  - Toxicity and infauna measured to assess effects
- **Fish sampling at 313 sites**
  - Tissue contaminants
  - Gross pathology
  - Biomakers

IMPORTANT ATTRIBUTES OF THE PROJECT

- **Bight-wide scale**
- **Standardized methods used throughout the Bight**
  - Manuals available on the web (www.sccwrp.org)
- **Probability-based sampling design**
- **Multiple types of indicators at each site**

PROBABILITY-BASED SAMPLING DESIGN

- **Allows us to address new types of questions**
  - What percent of area has sediments that are toxic to biota?
  - What percent of fish has measurable levels of tissue contaminants?
- **Statements with known confidence**

SUBPOPULATIONS

- **River mouths**
- **Large POTW outfalls**
- **Small POTW outfalls**
- **Bays/harbors**
  - Ports/industrial
  - Marinas
  - San Diego Bay
- **Mexican coastal waters**
- **Islands**
  - California current
  - Davidson current

SHORELINE MICROBIOLOGY

- **Primary question: What percent of shoreline-mile days meet water quality standards**
- **300 sites**
  - Santa Barbara to Ensenada
- **Stratified random sampling**
  - Beaches
  - Freshwater outlets (within 100 m)
  - Freshwater outlets (wavewash)
- **Four measures**
  - Total coliforms
  - Fecal coliforms
  - Enterococcus
  - Viruses (subset of sites)

WATER QUALITY COMPONENT

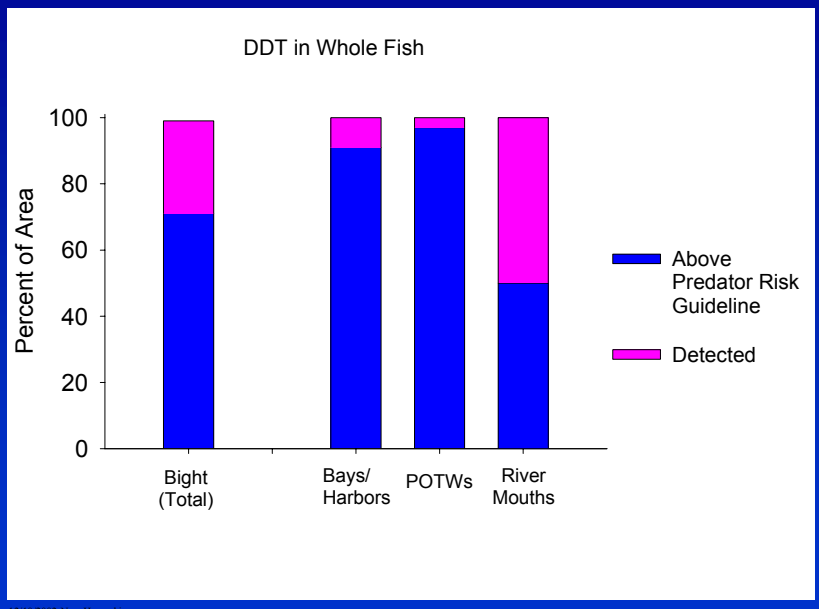
- **Primary question: What is the spatial influence of stormwater on the coastal ocean?**
  - Do stormwater plumes interact with offshore sewage plumes?
- **CTD casts at 535 sites**
  - Nine ships/two days
  - Each CTD equipped with a fluorometer
  - Two CTDs equipped with bio-optics package
- **Towed package to increase horizontal coverage near harbors**
- **Satellite imagery will provide temporal and spatial integration**

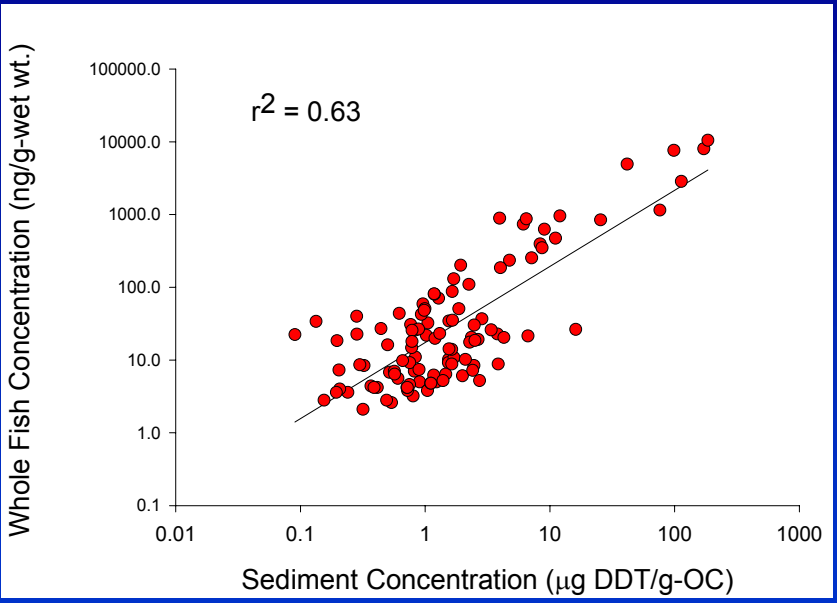
PRODUCTS OF COOPERATIVE REGIONAL MONITORING

- **Assessment of condition**
- **Methods standardization**
  - Intercalibration
- **Regional assessment tools**
- **Information management**
- **Dialogue**
  - Agreement on how to interpret data

Parameters /Harbors	Entire Bight POTW	Bays	Rivers	
Percent Dry Wt.				
Fines (≤ 63 um)	30.74	63.3	37.0	32.0
TOC	0.76	1.30	0.92	0.56
TN	0.080	0.119	0.080	0.057
µg/g (ppm) Dry Wt.				
Antimony	0.91	2.20	0.53	0.34
Arsenic	5.46	8.40	5.89	5.08
Barium	131.13	123.30	172.28	91.32
Cadmium	0.35	0.49	0.83	0.37
Chromium	27.57	44.71	43.71	21.52
Copper	14.94	80.48	23.62	12.04
Lead	12.85	36.64	19.10	15.44
Mercury	0.054	0.32	0.13	0.032
Nickel	20.12	20.50	13.91	14.22
Selenium	0.65	0.59	0.53	0.43
Silver	0.33	0.70	1.23	0.20
Zinc	56.78	153.55	64.04	56.35
Ng/g (ppb) Dry Wt.				
Chlordane	0.21	1.97	0.15	1.55
Total DDT	46.79	41.16	396.56	9.47
Total PAH	134.10	1106.18	168.33	197.43
Total PCB	7.06	25.57	36.23	10.11

Parameters	Bays & Harbors	POTWs	River Mouths
% of Area	6.1	5.6	1.0
% of Mass			
Arsenic	9.3	6.0	0.9
Cadmium	8.5	13.0	1.1
Chromium	9.8	8/8	0.8
Copper	32.7	8.7	0.8
Lead	17.3	8.2	1.2
Mercury	34.9	12.5	0.6
Nickel	6.2	3.8	0.7
Silver	12.9	16.7	0.6
Zinc	16.4	6.2	1.0
Chlordanes	57.0	4.0	7.4
Total DDTs	5.3	46.5	0.2
Total PAHs	50.1	6.9	1.5
Total PCBs	22.0	28.1	1.4
Average Hampshire % of Mass	21.7	12.0	1.4





NON-INDIGENOUS SPECIES

- 25 of 625 (4%) Bay/Harbor species were NIS
- NIS averaged 23% of abundance per sample
- NIS found in 112 of 113 Bay/Harbor samples

	NON-NIS TAXA	
	Number of Taxa	Abundance
NIS Abundance	0.13	0.39*
Musculista Abundance	-0.01	0.17
Pseudopolydora Abundance	0.10	0.31*

PALOS VERDES SEDIMENTS – FIRST ROUND

COMPOUND	LAB-1	LAB-2	LAB-3	LAB-4	LAB-5	LAB-6
Naphthalene	ND	35	45	ND	31	58
2-Methylnaphthalene	ND	57	78	5	54	119
1-Methylnaphthalene	ND	23	32	ND	28	66
Biphenyl	ND	44	54	17	25	57
2,6-Dimethylnaphthalene	28	30	62	ND	39	64
Acenaphthylene	25	6	36	11	32	40
Acenaphthene	ND	ND	ND	ND	ND	ND
2,3,5-Trimethylnaphthalene	ND	ND	ND	ND	ND	15
Fluorene	ND	7	9	ND	ND	20
Phenanthrene	ND	36	60	9	64	52
Anthracene	ND	ND	48	6	ND	49
1-Methylphenanthrene	ND	42	ND	ND	21	ND
Fluoranthene	ND	ND	53	12	57	64
Pyrene	43	255	374	20	109	108
Benz[a]anthracene	ND	ND	79	9	47	49
Chrysene	ND	ND	67	9	53	25
Benzo[b]fluoranthene	ND	ND	292	14	160	61
Benzo[k]fluoranthene	ND	ND	104	10	55	64
Benzo[e]pyrene	ND	233	241	19	191	77
Benzo[a]pyrene	ND	ND	236	16	186	64
Perylene	41	359	312	20	165	138
Indeno[1,2,3-c,d]pyrene	ND	ND	26	ND	ND	53
Dibenz[a,h]anthracene	ND	ND	ND	ND	ND	ND
Benzo[g,h,i]pyrene	ND	ND	91	ND	112	37
Total PAHs	137	1130	2300	177	1430	1280

12/10/2002-New Hampshire

SANTA MONICA BAY SEDIMENTS – FIRST ROUND

COMPOUND	LAB-1	LAB-2	LAB-3	LAB-4	LAB-5LAB-6
Naphthalene	54	171	279	27	139	259
2-Methylnaphthalene	129	485	721	59	405	615
1-Methylnaphthalene	61	172	272	23	181	222
Biphenyl	233	756	1140	97	606	770
2,6-Dimethylnaphthalene	131	217	401	37	228	203
Acenaphthylene	ND	4	ND	ND	ND	ND
Acenaphthene	ND	15	46	ND	ND	ND
2,3,5-Trimethylnaphthalene	ND	19	ND	4	15	ND
Fluorene	ND	38	75	2	24	69
Phenanthrene	ND	137	469	9	109	112
Anthracene	ND	ND	111	13	19	18
1-Methylphenanthrene	ND	154	ND	ND	51	ND
Fluoranthene	76	ND	495	26	87	108
Pyrene	91	ND	1120	28	79	111
Benz[a]anthracene	ND	ND	284	30	65	38
Chrysene	60	ND	320	31	83	46
Benzo[b]fluoranthene	ND	ND	672	19	205	38
Benzo[k]fluoranthene	ND	ND	205	18	77	41
Benzo[e]pyrene	ND	ND	367	11	171	63
Benzo[a]pyrene	ND	ND	409	13	162	ND
Perylene	ND	249	183	5	72	32
Indeno[1,2,3-c,d]pyrene	ND	ND	ND	ND	69	23
Dibenz[a,h]anthracene	ND	ND	ND	ND	ND	38
Benzo[g,h,i]pyrene	ND	ND	60	ND	109	30
Total PAHs	835	2420	7630	453	2960	2840

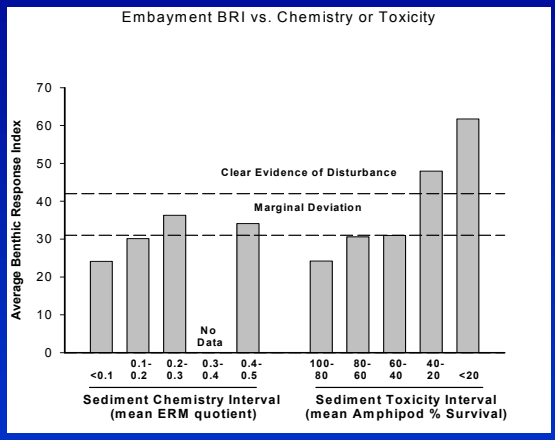
SANTA MONICA BAY SEDIMENTS – FINAL ROUND

COMPOUND	LAB-1	LAB-2	LAB-3	LAB-4	LAB-5	LAB-6
Naphthalene	173	162	170	191	139	193
2-Methylnaphthalene	388	435	480	532	336	525
1-Methylnaphthalene	***	145	185	166	153	144
Biphenyl	650	644	850	800	535	796
2,6-Dimethylnaphthalene	365	212	255	343	214	269
Acenaphthylene	***	8	ND	ND	ND	ND
Acenaphthene	***	ND	25	15	ND	ND
2,3,5-Trimethylnaphthalene	***	22	ND	119	47	ND
Fluorene	ND	25	49	40	39	52
Phenanthrene	114	131	145	130	142	141
Anthracene	***	33	34	58	41	29
1-Methylphenanthrene	ND	62	27	68	73	128
Fluoranthene	183	280	150	135	146	183
Pyrene	211	196	155	230	125	185
Benz[a]anthracene	93	126	145	118	37	114
Chrysene	115	88	120	152	127	145
Benzo[b]fluoranthene	***	164	330	179	60	92
Benzo[k]fluoranthene	***	63	103	167	60	90
Benzo[e]pyrene	117	115	155	183	51	115
Benzo[a]pyrene	94	109	195	191	52	65
Perylene	ND	91	78	110	70	26
Indeno[1,2,3-c,d]pyrene	***	44	ND	ND	88	66
Dibenz[a,h]anthracene	***	26	ND	ND	ND	ND
Benzo[g,h,i]pyrene	34	100	ND	ND	80	97
Total PAHs	***	3280	3650	3930	2610	3450

Assessment Measure	Mean Values	
	Original Data	Reanalysis Data
Total Abundance (per sample)	334.25	339.00
Number of Taxa (per sample)	80.90	83.15
Shannon-Wiener Diversity Index	5.162	5.199
Benthic Response Index	14.242	14.238

ASSESSMENT TOOL DEVELOPMENT

- **Benthic Response Index**
- **Sediment quality criteria**



CHALLENGES

- **Time**
  - Interminable planning meetings
- **Flexibility to change**
  - New collection methods
  - Provides an opportunity for upgrading
- **Intercalibration costs**
  - Can initially be larger than implementation costs Groups like ACT can help
- **Loss of autonomy**
  - Need to place priority on group objectives
  - Most program managers are too invested in their own thing
  - Challenge is even greater during data interpretation

CATALYSTS

- **A common question**
  - Must truly need each other
- **Available resources**
  - Seed money
  - Resource exchange
- **Perception of likely success**
  - It will happen without you
  - Previous success as an illustration
- **A neutral party**
  - Trust is essential

	OCSD	LACSD
Chemistry		
Committee meetings	27,884	$59,339
Intercalibration	39,538	97,754
Survey sample processing	34,950	11,184
Microbiology		
Committee meetings	$4,706	8,607
Intercalibration	4,064	10,359
Survey sample processing	13,317	3,203

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Ms. Lynn McLeod
Battelle

Lessons Learned

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Atlantic Northeast Coastal Monitoring Summit

Durham, NH
December 10-12, 2002

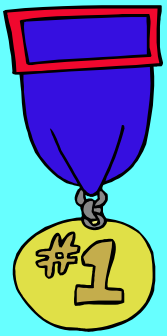
Lessons Learned from Coordinated Monitoring Programs

Lynn McLeod
Battelle
397 Washington Street
Duxbury, MA 02332

Battelle

Coordinated Monitoring Programs Interviewed

- National Programs
  - National Coastal Assessment
    - Gerald Pesch
- Federally Supported Regional Programs
  - Chesapeake Bay Program
    - *Environmental Outcome-Based Management: Using Environmental Goals and Measures in the Chesapeake Bay Program*
    - *Managing Troubled Waters*
    - Richard Batiuk
  - Great Lakes Program
    - *Coordinated Monitoring Efforts Throughout the Great Lakes – Meeting Summary*
    - Judy Beck



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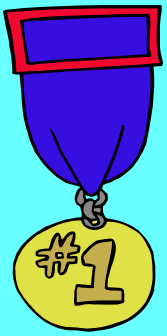
Coordinated Monitoring Programs Interviewed

- State Funded Regional Programs
  - Gulf of Maine – Gulf Watch Program
    - Steve Jones
  - Massachusetts Water Resources Authority
    - Kenneth Keay
    - Michael Mickelson
- Joint Powers Agency
  - Southern California Coastal Water Environmental Resources Program
    - *Managing Troubled Waters*
    - Stephen Weisburg



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Information Gathered

- What lessons have been learned throughout the programs existence.
- What would you consider are the most important steps, if starting a new program:
  - Planning and Products
  - Communication and Coordination
  - Data Management
  - Program Review
  - Information Reporting
  - Funding

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Results of Interviews

- Early identification and articulation of the program goals, objectives and products
  - Includes buy-in on a detailed purpose for conducting a coordinated effort
  - Develop a plan that can be reasonably implemented
- Identify a set of core indicators that are measured throughout the ecosystem
  - Base indicators on parameters that measure the overall status of the ecosystem
  - Link budgets and commitments to develop tangible measures

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Results of Interviews

- Minimum spatial and temporal requirements for each indicator should be defined
- Collect information on external factors exerting influences to a system
  - Ensures the cause and extent of any trend is correctly interpreted

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Results of Interviews

- Monitoring and Analysis
  - Standardized protocols and specific analytical laboratories

    OR
  - Various laboratories who have participated successfully in interlaboratory calibration exercises

"Bad data is worse than no data."

Results of Interviews

- Report monitoring results in a timely and public friendly manner to keep the public managers and policy makers interest in the program
- Storing data can use a centralized or distributed database as long as everyone has access to the data needed to write the reports

"Data access is critical for interpretation and reporting"

Results of Interviews

- Program reviews are very important
  - Suggested every five years
  - Best if done by an outside group
- Clear and Open Communication
  - Cooperative agreement vehicles
  - Meetings – small and large at a defined interval
  - Coordination Network Diagram
- Funding

There will never be enough!

But that should not stop us from trying!

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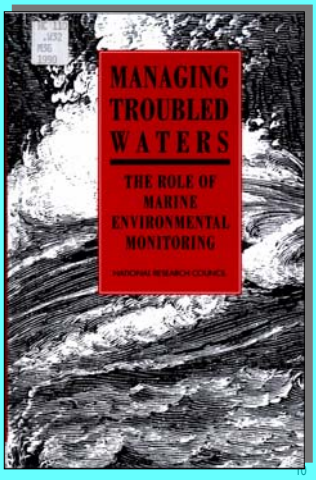
Managing Troubled Waters

The findings of these interviews were similar to the ten steps noted in *Managing Troubled Waters* for strengthening the role of monitoring in environmental management



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Ten Steps to Strengthening the Role of Monitoring in Environmental Management

- Clear guidance is necessary on how data are to be used and what type of decisions are to be made.
- The goals established should be achievable scientifically, technologically, logistically, and financially.
- The monitoring program should be integrated into the decision-making system, with decision points and feedback loops clearly established before the data are collected.

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Ten Steps to Strengthening the Role of Monitoring in Environmental Management

- Where authority and control reside should be made explicit. Fiscal controls should be compatible with program controls and objectives.
- Channels of communication among agencies and other participating individuals and groups should be identified and efforts made to ensure that the channels are interconnected and functional.
- The monitoring program should integrate the regulatory, data, and management needs and responsibilities of the local, state, regional, and federal agencies to optimize the use of available resources.

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Ten Steps to Strengthening the Role of Monitoring in Environmental Management

- Viable mechanisms should be established to involve the public and the scientific community as program participants early and often.
- The monitoring program should include built-in mechanisms to ensure that its conclusions are communicated to decision makers and the public in terms that they can understand and act upon.

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Ten Steps to Strengthening the Role of Monitoring in Environmental Management

- Monitoring programs should include mechanisms for periodic review and easy alteration or redirection of efforts when monitoring results or new information from other sources justifies a change.
- The management action to be taken in response to both the expected results and unexpected but possible outcomes should be identified in advance.

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Conclusions

- Coordinated monitoring efforts can be achieved
- Necessary Ingredients
  - People who are committed to creating a coordinated monitoring effort.
  - Clear goals and objectives that are also reasonable.

APPENDIX D

Presentations from
December 11, 2002

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Mr. Barry Burgan,
EPA

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Atlantic Northeast Coastal Monitoring Summit

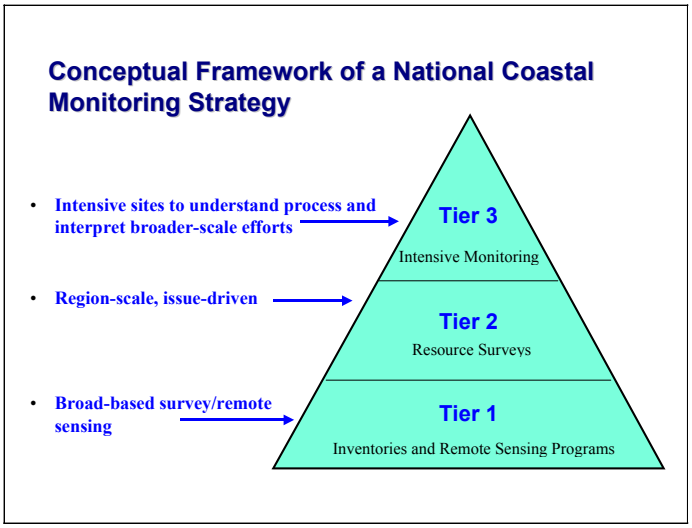
Overview of United States Efforts to Coordinate Coastal Monitoring

Barry Burgan, USEPA

Clean Water Action Plan

- A multi-agency national coastal research strategy and a coastal monitoring plan
- USEPA National Coastal Assessment

National Coastal Research and Monitoring Strategy



National Coastal Research and Monitoring Strategy

- What are the recommendations?
  - Periodic national/regional coastal reports
  - Management of data for national and regional use
  - Design/adapt/improve coastal monitoring: TIERs I, II and III
  - Design/adapt/improve coastal research
  - Use of information to improve coastal water quality and science/policy feedback

National Coastal Assessment

- USEPA National Coastal Assessment
  - Strategic partnership with all coastal States
  - Probabilistic sampling design and common set of indicators to measure resources and condition
  - Estimates can be aggregated at State, regional and national level
  - Program is funded through 2004, working with States, other federal agencies to continue

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Dr. Peter Wells,
Environment Canada

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Coordination of Canadian Coastal Monitoring Programs

P.G.Wells,
Canadian Wildlife Service,
Environment Canada.
Dec. 2002 – ANECMS, NH.

Coordinated Monitoring – the Need

“ we are currently practicing coastal monitoring in silos” (David Keeley, Maine Office of State Planning, Dec. 2002).

Canadian Coastal Monitoring Programs – Dec. 2002

- What are examples from Atlantic Canada?
- Which Canadian federal initiatives have occurred recently to coordinate or integrate coastal monitoring programs?
- What is the status of such initiatives?

Summary

In Canada, we have:

- many coastal monitoring programs relevant to the Gulf of Maine (Bay of Fundy region);
- lots of thinking and frameworks!
- potential for coordination.

Through coordination, the programs would gain additional benefits, e.g.

- coupling programs – methods, sampling.
- contributing to common data sets for assessments of MEQ/MEH.

Atlantic Canada (1)

- Water Quality - bacteria and algal toxins
  - EP/DFO Maritime Shellfish Sanitation Program (since 1948) – fecal coliforms. (US Linkage)
  - DFO Harmful Algal Blooms (since 1980s) - PSPs, domoic acid. (US Linkage)

Atlantic Canada (2)

- Chemical contaminants
  - Gulfwatch, GOMCME (since 1991) – metals and organics, mussel tissues, Canada-USA program.
  - NE-NA Mercury Network.
  - EP EEM Program (pulp and paper) (since 1992) – 3rd phase underway, biomarkers in inverts and fish.

Atlantic Canada (3)

- Contaminants and Seabirds
  - CWS Toxic Chemicals in Canadian Seabirds Program (since 1968) – Hg, OCs.
  - CWS, CSA, CCG, etc – satellite monitoring of oil spills and oily releases (from shipping) in the offshore (since mid-90's).

Atlantic Canada (4)

- Air Quality Monitoring Program – HMSC, Keji Nat'l. Park, Sable Is. – acids, organics, ozone. Since 1978.
- PIROP Seabird PAD Monitoring – CWS – phaloropes and razorbills – transects in mouth of Bay of Fundy – A.R. Lock. Started 2002.

Atlantic Canada (5)

- DFO Involvement in GOMOOS
- Also see 5-NR report by Brian Petrie (BIO, 1998).
- Stations in Bay of Fundy, interaction with US partners.

Canadian Federal Initiatives to Coordinate Coastal Monitoring Programs(1)

- MEQ Working Group (EC) 1984-1991.
- MEQ Guidelines 1992.
- Action Plan
  - Identified need for coordinated marine monitoring in Canada. Contrib. to Gulfwatch start-up.
  - Health of the Oceans Report 1991.
- Doc. completed, applied to sediments.

Canadian Federal Initiatives to Coordinate Coastal Monitoring Programs(2)

- EMAN program, mid-1990's.
- Mon. wkshp. Nov. '97, with BoFEP and EC.
- Status – regional program & Quoddy node are stalled.
- DFO (P. Strain) – Health of the Oceans 1999 (HOTO).
- Status - unknown. Coord. through Unesco-IOC.

Canadian Federal Initiatives to Coordinate Coastal Monitoring Programs(3)

- Federal 'NR' Dept. Reports
  - Bay of Fundy – program activities, management issues, EC-BOFEP 1998.
  - Monitoring Activities of the Federal Natural Resource Departments in the Maritimes, DFO 1998.
- Status - coordination of federal depts. on these initiatives is stalled. 5-NR committee in Ottawa is disbanded (Fall '02).

Canadian Federal Initiatives to Coordinate Coastal Monitoring Programs(4)

- Nat'l Workshop - Objectives and Indicators for Ecosystem-based Management, DFO June 2001.
- P&P EEM
- Considered a framework for regional, ecosystem-level monitoring. Fisheries focus. Not yet in place.
- Often linked to local programs.

Canadian Research Initiatives to Coordinate Monitoring Programs in the Bay of Fundy(5)

- Monette's study 2000 – Integrating ACAP and Gulfwatch.
- Chang and Wells – 2000 – MEQ Framework for Bay of Fundy.
- Study completed 2000; coordination not started.
- Study completed; not (yet) implemented.

Summary (1)

- We have:
  - many coastal monitoring programs relevant to the Gulf of Maine (Bay of Fundy region);
  - lots of thinking, frameworks, reviews of activities!
  - programs are not yet coordinated.
  - opportunities exist through the Oceans Act (1997) Office of DFO, under MEQ initiatives.

Summary (2)

- Through coordination, the monitoring programs would gain additional benefits e.g.
  - Coupling programs for sampling and maintaining sites.
  - Contributing to common data sets for assessment of MEQ/MEH for GOM-BoF.

How to stimulate coordination of Canadian federal coastal monitoring programs

- **Mandate: Find a clear place/mandate for coordination and networking e.g. the Oceans Act – MEQ; CEPA.**
- **Information: Communicate on the many values of networked monitoring.**
- **Leadership: Find a champion or champion agency, as leader.**
- **Support: Identify resources.**
- **Crisis: Have an event that demands coordination e.g. a major oil or chemical spill, or dramatic reduction in a species!**

Opportunities in Atlantic Canada – Networked Coastal Monitoring

- **Give talks to build support.**
- **For Bay of Fundy, form a BOFEP Working Group on "Networked Coastal Monitoring" (NetCoM).**
- **Have a session at next BOFEP Science Workshop (2004) on Canadian coastal monitoring and networks in NW Atlantic.**

Appendix E

Breakout Session Participant Lists And Background Information

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Breakout Group Participants

NUTRIENT #1

Carlton Hunt	Chris Deacutis	Melissa Manley
Boris Rukovets	Dana Kester	Mike Doan
Tom Shyka	Gordon Wallace	John Mullaney
Matt Liebman	Mark Tedesco	Jonathan Pennock
Phil Trowbridge	Todd Janeski	

NUTRIENTS #2

Rich Langan	Christian Krahforst	Ethan Nedeau
Suzanne Bricker	Keith Robinson	Gary Wikfors
Veronica Berounsky	Marieka Arnold	Judy Yaqin Li
Laura Blake	Brian Howes	Blaine Kopp
Jim Latimer	Brian Smith	

HABITAT #1

David Keeley	Hilary Neckles	Peter Taylor
Tracy Hart	David Wildish	Levi Cliché
Karen Chytalo	Maurice Crawford	Geno Olmi
Jeremy Pare	Diane Switzer	Doug Grout
Mary Amato	Dwight Trueblood	Jim Kremer
David Mountain	Michelle Dionne	Stormy Mayo

HABITAT #2

Judy Pederson	Jan Smith	Terry McTigue
Diane Gould	Bryan Milstead	Ron Rozsa
Anita Hamilton	David Burdick	Marcia Weaks
Fred Short	Lew Incze	Roland Saminy
Jack Terrill	Phil Colarusso	Sara Ellis
Tony Bowron	Pam Morgan	

TOXIC CONTAMINANTS #1

Barry Burgan	Christy Finlayson	Paul Stacey
Sean Brilliant	Jerry Pesch	Michelle Trembly
Beau Ranheim	Steve Weisburg	Peter Wells
Jim Stahlnecker	Jawed Hameedi	Sue Farquharson
Susan Shaw	Peter Milholland	Steve Jones
David Dow	Greg Shriver	Gail Chmura
Wendy Leo	Marilyn Buchholtz ten Brink	

Integrated Monitoring Network in 2005

Each Breakout Group received the following tables and definitions. The highlighted boxes are suggestions made by the Steering Committee (prior to the workshop) on the level at which the coordinated regional monitoring network would operate. Each Breakout Group was ask to discuss these suggestions and make changes to them as deemed appropriate to their group.

In addition the Breakout Groups were given table specific to their topic and were asked to discuss and comment on these tables (see separate sections of this Appendix).

Functions of Network	**Simplicity** 			**Sophistication**
Scale	Tidal and subtidal	Near-shore & inshore	Coastal	Watersheds and Blue Water/Ocean
Scope/Reach	State & federal marine monitoring programs	Government and volunteer	Government, volunteer and academic programs	All monitoring data
Program design & implementation	Evaluate based on established protocols	Apply standardized protocols selectively	Amend programs to meet regional needs	Standardized protocols and regional needs
Data management	Rely on current mechanisms	Web links to databases with spatial references & metadata		Distributed & linked (e.g., archival and retrieval)
Data synthesis and communication	Existing level of program activity	Embayment assessments by selected issue	Integrated multi-factor regional assessments	Biogeographical trends and assessment w/active marketing/dissem
Links to research	Spontaneous - no formal connection	Identifies priorities linked to monitoring	Active proponent for regional research	Supports and conducts research (e.g., cause & effect)
Services provided @ fee/consulting	Local scale assessments	Gulfwide assessments	Integrated multivariate assessments	Development of plans, strategies, BMPs, etc.

Definitions

Scale - Tidal aquatic habitat encompasses those estuarine and coastal areas directly influenced by tidal incursion. This includes mudflats, sandy and rocky areas exposed between tides (intertidal) as well as estuarine riverine habitat reaching upstream to the head of tide. Subtidal habitat includes permanently submerged coastal habitat (seaward of the lowest tide line).

Scope - The sources of monitoring data will include federal, provincial, state and local government entities as well as non- government (citizen) monitoring groups.

Program design and implementation - For key monitoring parameters, standardized monitoring protocols and quality assurance steps will be developed and approved by the steering body. The participating groups will agree to promote and disseminate these protocols, working towards uniformity in the way data is collected and documented in the future.

Data management - Data management will include development of a network web page. Web links will be created to the monitoring databases of the participating groups. Members will, to the extent possible, provide spatially georeferenced maps. These maps will allow users to click on a map location and access relevant habitat data. Network participants will also agree to document new monitoring data using a

standardized metadata format (e.g., location/time/date/QA etc.) and to make that metadata available through their individual web sites.

Data synthesis and communication - The network will undertake habitat assessments for specific issues and at selected scales (e.g., changes in the areal extent of eelgrass beds in the Gulf of Maine over the past decade). The results will be communicated to the network members through the web and other means.

Links to research - The network will identify research questions arising from the regional monitoring data (e.g., through the data synthesis process, additional monitoring needs will become evident). The network will prioritize these needs and will solicit the assistance of the academic community, NEPs and other partners in meeting these needs.

Services provided - For a fee, the network will coordinate and administer assessment projects requested by the participating groups (e.g., assess changes in the acreage of shellfish habitat closed due to bacterial pollution over the past five years in the area encompassing the southern Maine seacoast and New Hampshire coastal embayments).

Form of Network	**Simplicity**	**Sophistication**		
Structure	A single entity (e.g., steering committee)	Jurisdictional boards (e.g., state/provincial)		Tiered state/provincial board engaging all stakeholders & committees (e.g., science, TAC, etc.)
Type of organization	Association w/no legal standing	US/Canadian non-profit		Regional public agency w/federal sanctions & mandates
Geography	Substate	State/Provincial	Regional by political subdivision	Biogeographical
Governance/decision-making	Advisory - optional participation	Voluntary compliance	Consensus	Mandatory
Operating budget	Existing and in-kind	Seed funding	Incremental growth	Major ongoing initiative
Funding sources	Current array of public and private sources	New grants and contracts (e.g., government, foundations,)	Dedicated program resources	Dedicated public and private funds, philanthropy
Partners	State, provincial & federal agencies (US & Canada)	Volunteer Programs	Regional organizations (e.g., RARGOM, GoMOOS)	Government, NGOs, businesses, academia, regional organizations
Staffing	Existing staff dedicate time to network	New part-time staff		Ongoing full-time professional staff of Network

Definitions:

Structure - A single body will develop, guide and oversee the network. This "steering committee" will include representatives of the key partner groups. They will develop a process for decision-making and strategic planning.

Type of organization - The network organization will not have any regulatory or legislative mandate or authority.

Geography - The network will encompass the northeast North American Atlantic bioregion, its boundaries and activities defined by habitat/biological parameters rather than political boundaries.

Governance - The network will operate as a partnership whose member groups agree to comply voluntarily with goals and guidance (e.g., monitoring protocols) developed by the network.

Operating budget - It is anticipated the operating budget will be modest and focused on developing the network infrastructure (e.g., hiring part-time staff).

Funding sources - Participating groups will be asked to contribute start-up funding. The network partners will actively seek grants and contracts from public and private sources to maintain the network. This is likely to include working towards the dedication of annual funding from participating governments.

Partners - The network will include US and Canadian federal, state and provincial partners as well as non-profit monitoring groups.

Staffing - The intention is to hire a new part-time dedicated staff person with expertise in data management and web systems. This staff person will work with existing staff in the federal/state and non-profit partner programs to create and maintain the infrastructure of the network.

Nutrient Over-Enrichment

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Nutrients – Supplemental Table

Nutrient Monitoring Parameter	Corresponding Nutrient Monitoring Programs
Nutrients Water Column: Nitrogen and Nitrogen Compounds, Phosphorus (Total Nitrogen, Total Dissolved Nitrogen) (Inorganics – nitrates, nitrites, ammonia, silicate, etc.) (Organics – phosphorus, etc.) Air	Massachusetts Water Resources Authority (MWRA), Friends of Casco Bay, Casco Bay Estuary Project, National Coastal Assessment (NCA), NPDES and Aquaculture Permit Monitoring, NAWQA (National Water Quality Assessment Program), University of New Hampshire, Plum Island Long-Term Ecological Research Site, State Monitoring Programs, ENVIRODAT (Environmental Quality Databank (Environment Canada), New Brunswick Community Environmental Monitoring, St. Croix Estuary Project (SCEP), Fisheries and Oceans Canada, Friends of Medomak Watershed, Penobscot Bay Water Quality Monitoring (Maine Maritime Academy), Baywatchers (Coalition for Buzzards Bay), Massachusetts Ecosystem Assessment Program (MEAP), Narragansett Bay Program , New Hampshire Dept. of Environmental Services (NHDES), New York Harbor Water Quality Survey (NYHWQS), National Estuary Programs (NEPs), University of Rhode Island National Acid Deposition Program (Monitoring Stations throughout US including New England States)
Dissolved Oxygen DO continued Biological Oxygen Demand	Massachusetts Water Resources Authority (MWRA), Friends of Casco Bay (FOCB), Casco Bay Estuary Project (CBEP), NEPs, National Estuarine Research Reserve System (NEERS), NCA, MWRA, Penobscot Bay Water Quality Monitoring (Maine Maritime Academy), Baywatchers (Coalition for Buzzards Bay), MEAP, NHDES, Long Island Sound Study (LISS), NYHWQS, Save the Sound, URI, Aquaculture Permit Monitoring MWRA, NPDES permits
Secchi Depth/Turbidity-Light Extinction/Total Suspended Solids	FOCB, Citizen Monitoring Programs in New England, New Brunswick Community Environmental Monitoring, MWRA, NHDES, NPDES Permits, MEAP, NEPs, NHDES, Aquaculture Permits Monitoring
Primary Productivity	MWRA

Nutrient Monitoring Parameter	Corresponding Nutrient Monitoring Programs
Phytoplankton Biomass as Chlorophyll a	FOCB, MWRA, NCA, Gulf of Maine Ocean Observing System (GOMOOS), Marine Resources Monitoring Assessment and Prediction (MARMAP-NMFS), NEERS, Friends of Medomak Watershed, Baywatchers (Coalition for Buzzards Bay), Cape Cod Bay Marine Monitoring, MEAP, NEPs, NHDES, LISS, NYHWQS, Save the Sound, Aircraft Remote Sensing for Chlorophyll *a* (EPA – Atlantic Ecology Division), URI, Aquaculture Permit Monitoring
Sediment Redox	Aquaculture Permit Monitoring, MWRA
Submerged Aquatic Vegetation (SAV)	State Monitoring Programs (Maine Department of Marine Resources), BBP (Buzzards Bay Project), MEAP, URI, Save the Bay
Benthic Algae/Epiphytic Algal Biomass/Leafy Algae (enteromorpha, ulva, etc.)	BBP
Phytoplankton/ Community Structure	MWRA, Fisheries and Oceans Canada, MARMAP, Kennebunk Water Quality and Phytoplankton Monitoring Program, Mount Desert Island Water Quality Coalition Monitoring (MDI), Cape Cod Bay Marine Monitoring, LISS, NYHWQS, URI, Aquaculture Permit Monitoring
Harmful Algal Blooms	State Shellfish/Public Health Programs, URI, Biotoxin Monitoring Program (Canadian Food Inspection Agency), Maine Phytoplankton Monitoring Program (U. Maine Coop. Extension), Marine Environmental Research Institute, LISS
Macroalgae	SCEP, MEAP
Benthic Community Structure	Aquaculture Permit Monitoring, MWRA, NEPs, NPDES Permit Monitoring

Habitat Loss, Degradation and Restoration

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Habitat Loss, Degradation and Restoration – Supplemental Table

Habitat Monitoring Parameter	Corresponding Habitat Monitoring Programs
Eel Grass – location, extent, health (e.g., wasting), restoration successes,	
Algae – community structure & composition, aerial extent, timing, toxic HABs, phytoplankton,	
Wetlands – % change, functional indicators (e.g., estuarine fish species, etc.), permitted & unpermitted activity, climate change/sea level rise, tidal restrictions,	
Shellfish – fecal coliform, location, extent, abundance, HABs, contaminants (metals & organics), land use (impervious surfaces, etc.)	Gulf of Maine Gulfwatch, state/provincial shellfish programs,
Fish Habitat – NPS/water quality, flow, quantity, sediment, fluvial geomorphology, riparian buffers, dams & fish ladders, obstructions	
Beach/Dunes – vegetation, presence/absence of endangered species (e.g., terns, piping plovers, turtles), migratory shorebirds, invertebrates,	
Water column – contaminants, DO, salinity, temperature, clarity, water column profile, nutrients/productivity	
Benthic community – sediment type and contaminants, community structure,	
Marine invertebrates – community structure (composition, diversity, numbers, etc.)	
Island – estuarine & seabird populations, distributions, predators, nesting & fledging, land use impacts & effects,	

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Toxics/Contaminants

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Toxics and Contaminants – Supplemental Table

Toxics/Contaminants Monitoring Parameter	Toxics/Contaminants Monitoring Programs
Organic chemicals, e.g., PAHs (polycyclic aromatic hydrocarbons), PCBs (polychlorinated biphenyls), linear alkyl benzene, in:	
Water	National Pollutant Discharge Elimination System (NPDES) permit monitoring, Maine and other state surface water assessment programs
Sediments	National Coastal Assessment (NCA), NOAA Status and Trends (NSandT), Casco Bay Estuary Project (CBEP), Massachusetts Water Resources Authority, Long Island Sound Study (LISS), Army Corps Disposal Area Monitoring System (DAMOS)
Air	CBEP, MBP
Organisms (e.g., fish, shellfish)	NCA, NSandT (Mussel Watch), Gulfwatch, Massachusetts Bays Program (MBP), Buzzards Bay Program (BBP), CBEP, MWRA, US Fish & Wildlife Service (USF&WS), LISS, state toxics assessment programs, DAMOS
Trace metals (e.g., mercury, lead, copper, cadmium, nickel, zinc, tributyl tin chromium, arsenic, silver) in:	
Water	NPDES permit monitoring, Maine and other state surface water assessment programs
Sediments	NCA, NSand T,CBEP, MWRA, BB, MBP, LISS, DAMOS
Trace metals (cont'd)	
Air	CBEP, Mercury Deposition Network (MDN), National Ambient Air Monitoring Program, LISS, Acadia National Park, Campobello National Park, Cape Cod national Seashore, Maine and Massachusetts IMPROVE, University of New Hampshire, University of Connecticut
Organisms (e.g., fish, shellfish)	NCA, NSand T (Mussel Watch), Gulfwatch, CBEP, LISS, MWRA, state toxics assessment, DAMOS

Toxics/Contaminants Monitoring Parameter	Toxics/Contaminants Monitoring Programs
Pesticides (e.g., dieldrin, DDT, chlordane, toxaphene) in: Water Sediments Organisms (e.g., fish, shellfish)	 NPDES permit monitoring, Maine, CT, RI, MA, VT surface water assessment programs NCA, NSandT, CBEP, MWRA, MBP, LISS NCA, NSandT (Mussel Watch), Gulfwatch, CBEP, MWRA, USF&W, LISS
Dioxins/Furans in: Water Sediments Organisms (e.g., fish and shellfish)	 NPDES permit monitoring, Maine SWAT CBEP, LISS CBEP, state toxics assessment programs, LISS
Bacterial Indicators in: Water Sediments Shellfish	 NPDES permit monitoring, State shellfish sanitation programs, state and local water quality monitoring programs, state and local beach monitoring programs MWRA (*Clostridium perfringens*), NSandT State shellfish sanitation programs
Sediment toxicity	NCA, MBP, LISS
Ambient water toxicity	LISS

APPENDIX F

Summaries from Topic Groups

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Nutrient Over-Enrichment Summary

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Nutrient Over-enrichment in Coastal Waters

"While human perturbations of the global carbon cycle and their impact on climate have been the subject of a great deal of scientific and political attention and debate during recent decades, our appreciation of the even larger human intervention in the global cycles of nitrogen and phosphorus is more recent and perhaps less commonly appreciated." –Rabalais and Nixon, 2002.

Flux of N and P from land to the oceans has increase 2-fold and 3-fold respectively. Much of the N increase has occurred over the past 40 years. Human activity has increased the flux of N in the rivers of the NE by 8-fold. *"The regional nature and variability of nutrient sources require that nutrient management efforts address large geographic areas."* Howarth et al., 2002.

Context

Discussions among participants leading up to this workshop identified nutrient over-enrichment to estuaries and embayments of the North Western Atlantic region as one of three leading management issues. These discussions were, in part, in response to a special workshop held a year earlier on nitrogen management issues for the Gulf of Maine[2]. In fact, nutrient pollution is believed the largest pollution problem in coastal rivers and embayments in the U.S. (Howarth et al., 2002). Approximately half of the inorganic N fertilizer that was ever used on Earth has been applied during the last 15 years. For coastal systems, N is typically more damaging. Our rapidly growing global population, the tendency for human habitation to occur in coastal watersheds, and the profound changes in agriculture fertilization practices over the last four decades has resulted in a 2-fold increase in the export of nitrogen to the coastal waters of the U.S. The environmental consequence of nitrogen over-enrichment in coastal systems – from increased primary production, increased production of organic matter (eutrophication), changes in local ecology, and changes in water quality -are being observed with greater frequency in recent years (Diaz and Rosenberg, 2001; Seitzinger et al., 2002; and references therein). For the Northwest Atlantic region, information is needed about the geographic extent of nitrogen over-enrichment, the severity of coastal eutrophication, the relative susceptibility of different coastal systems to changes in nutrient loading, and the methods needed to design effective policies and management strategies. Much of the needed information can be gained from an organized regional monitoring program that would provide the necessary understanding of functional linkages among more local systems. A regional approach would help to quantify the influence of larger scale processes, (e.g., atmospheric deposition, coastal currents) and strengthen better predictions about the future state of local ecosystems (Nixon, 1996).

Participants in the Atlantic Northeast Coastal Monitoring Summit were charged with identifying the key questions that are best solved through the regional monitoring network and to develop a strategy by which these questions may be answered.

I. Purpose of the Network and How to Build It.

The regional nature of large-scale processes (coastal currents, air sheds, etc.) is important in resource management at the local level. These processes do not conform to the jurisdictional boundaries at the local, state, or even national level. To satisfy existing monitoring needs for the region, a network with the following general purposes was identified:

- Coordinate information from monitoring within the Network for the assessment of the ecological condition of the region
- Provide the regional backdrop for local and targeted monitoring
- Serve as quality assurance on monitoring information for coastal resource managers

[2] NOAA/UNH/CICEET Workshop Report, 2001: Managing Nitrogen Impacts in the Gulf of Maine

- Provide support for determining management options or guidance for higher-level studies
- Enhance stewardship

Participants identified integration of existing monitoring programs, rather than a complete overhaul, as the primary mechanism to forming the Regional Monitoring Network. However, questions still remain with respect to the spatial extent of the region for which this Network will serve. The National Research Council (2000) defines a region as: "the next larger scale of organization in time and space required to understand the local scale of interest". The spatial extent of the region (initially identified by the steering committee to extend from the Bay of Fundy, Canada, to Long Island Sound, USA) is an important aspect in defining the scope (and hence scale) of the Network and to the identification of the key questions that the Network will help to address.

Within the broad intent of the Regional Monitoring Network, more specific purposes for nutrient-related monitoring exists. Typically these purposes center on providing comparable data bases/information for providing the broader regional perspective. These specific purposes are:

- Monitoring of appropriate nutrient (species) concentrations in coastal systems over time for model development, calibration, validation
- Clarify methods and analytical discrepancies, through intercalibration –rather than outright standardization

The color-highlighted sections from the tables on Functions and Form of the Network (Appendix E) were proposed by the steering committee as a starting point of discussion in defining the scope and scale of the Network. The shape and scope of the Network will be largely determined by the type of questions identified, and probably to a greater extent, the type of funding available. Therefore, the following discussion presents the ultimate form and function of the Network, realizing that intermediate stages are more realistic as the Network develops over time. From the nutrient sessions perspective, the following changes are recommended to the **Network Function**:

- Scale: move from tidal/subtidal systems towards more sophistication to include monitoring of inshore and near-shore coastal systems,
- Scope and Reach: move towards more sophistication to include academic partners in addition to governmental and voluntary partners as appropriate.
- Program Design and Implementation: move towards more sophistication, but to *coordinate* and/or *integrate*, rather than amend existing programs and phase in over time.
- Data Synthesis and Communication: move towards more sophistication from selected issue assessments to integrated multi-factor regional assessments as opportunities present themselves.
- Links to Research (no changes recommended)
- Services Provided at Fee: program and questions dependent, to be better defined.

Under the **Network Form**, the following changes are recommended:

- Structure: move to the middle of sophistication from a single entity to developing advisory boards. Design is dependent upon the goals of the Network. Network goals cannot replace the goals of individual research and monitoring goals. A single leading entity where ultimate responsibility and authority lies, should be created as a focusing agent for the Network. The overall Network would be expected to provide guidance, foster dialogue, and build confidence in monitoring results and interpretations.
- Type of Organization: The organization should make use of existing Council or management committees with a strengthening of the mandate. Stating with a small Steering group to develop implementation steps was recognized as a logical first step. Overtime, their organization would grow to support the regional cooperative monitoring needs.
- Geography: Region defined initially as biogeographical, including the coastal waters from systems interacting with the Bay of Fundy to Long Island Sound. Boundaries may be redrawn as a function of driving Network questions and secured funding. Geographical coverage of the

Network may be defined by a tiered approach, with Tier III identified as most meaningful (see Barry Burgan, Plenary Session). Geographical boarders need to adapt to the questions asked of the coordinated effort which may be issue focused or spatially distinct.

- Operating Budget: between $200,000 - $500,000 is needed as seed funding for planning and initial implementation of next steps. A major initiative needs to be identified through consensus among major initial partners (early Council) and developed over the next two years. Future considerations could be identified by linking and leveraging off of national (*e.g.*, Federal Clean Water Act) or international (Ocean Commission) recommendations. Further details of Network staffing and next steps provided below.
- Partners: Move all the way through the sophistication ladder as interest and buy-in allows. Partners would include State, Provincial, and Federal agencies (US and Canada) as well as Volunteer Programs, regional organizations, business, utilities, and academic programs. Partners need to participate in network development and have some stake in the network outcomes.
- Staffing: As appropriate, initially to include an executive director, database person, administration staff or program assistant for the purpose of developing Network protocols and tasks.

II. Key Questions, Monitoring Gaps and Research Needs

Key Questions: The overall purpose of the Network is to understand the extent of coastal over-enrichment to assist in developing effective management strategies. Specific questions related to nutrient over-enrichment that the Network might address are:

- What is the status of the environment (encompassing a variety of spatial scales and ecological compartments)?
- Is the condition of coastal systems improving?
- Are our nutrient management strategies working?
- What are the scales of influence in the region? What is the role and influence of atmospheric deposition as a source of nitrogen to the region?
- By source type, what are the trends in nutrient loading (e.g. atmospheric, riverine, point or non- point sources, oceanic)?
- What are the responses of the ecosystem?
- How does this affect various living resources?
- How does resource extraction affect ecological response?
- Are the major controls on the responses local or regional? By what degree are the controls local or regional?
- How sensitive are various embayments and estuaries to nutrient loading?
- What influence do offshore water mass sources have on nearshore water masses?

Monitoring and Research Gaps:

- Details about nutrient delivery to the coast and estimates of nutrient flux into the future. (Good projections across the region at local and broad scale are needed).
- Tools, methods, and information with respect to differentiating between local and regional scale responses,
- Improved estimates of atmospheric inputs, both locally and regionally,
- Estimates of ground water loading to coastal systems
- Better knowledge and resolution of nutrient exchange across system boundaries (at a variety of spatial boundary scales)
- Understanding the role of upwelling as a source of nutrient (at appropriate scales for system or region of concern).
- Understanding the influence of the North Atlantic Oscillation on water mass properties and linkage to effects on biota and their pelagic habitats.

III. Priority and Secondary Monitoring Variables for Nutrient Over-enrichment issues

The appropriate monitoring designs should to be crafted to specifically address each of the many questions and needs listed above. However, there is a core group of variables (such as location information and sampling time) that is necessary for all monitoring activities. Fundamental to most marine monitoring initiatives is an understanding of the physical nature of the systems being studied. To provide a preliminary evaluation of local versus regional controls, for example, parameters such as bathymetry and those associated with circulation are important first elements and necessary for characterizing the hypsography and hydraulic residence times of the systems of concern. Beyond that, it is the key questions being asked that dictate what additional monitoring variables are needed and the frequency of their measurements. In addition to the fundamental state variables (such as temperature and salinity), the primary and secondary parameters important for characterizing the condition or evaluating effective management practices related to nutrient over-enrichment are:

Primary Variables	Secondary Variables
• Nitrogen species: Dissolved Inorganic N (NO_2+ NO_3, NH_4) Particulate Organic N, Dissolved Organic N, Total N • Phosphorous species (Dissolved PO_4, Total P) • Dissolved Oxygen • Water Clarity* • Chlorophyll *a*** • Particulate Organic Matter • Particulate Organic Carbon	• Silicate • Sediment Redox • Submerged Aquatic Vegetation • Algea (Benthic, Epiphytic, Leafy) • Algal Biomass • Phytoplankton Community Structure • Zooplankton Community Structure(?) • Fisheries community to help understand linkages to broader system

* Measures can include secchi depth, total suspended solids, turbidity-light extinction. These are three ways to measure the same basic thing.

** Initially this was phrased as "phytoplankton biomass as chlorophyll *a*". People suggested that chlorophyll *a* is possibly not a good indicator and that perhaps POC is better. People should be less committed to the idea that chlorophyll a is a good indicator—it is merely the photosynthetic potential in the short term, and varies daily, tidally, seasonally, and with nutrient availability. It's use as an indicator needs to be coupled with POC measurements and further evaluated.

The near-coastal systems of the region range from rocky exposed deep-water embayments to shallow enclosed estuaries with varying degrees of anthropogenic perturbation. Each of these systems experience varying degrees of influence from tides, wind, and waves. The diverse nature of these embayments dictates aspects of nutrient monitoring approaches (e.g., temporal resolution). The Network should follow the recommendations of the Gulf of Maine Council (see first footnote, this section), and assist in the development of a classification scheme of embayments and applied this to the embayments that extend around the region in order to meet the nutrient over-enrichment purposes of the Network. A continuing effort should be maintained that assesses existing monitoring efforts, further refining our knowledge of gaps in data and information. Nutrient monitoring should also help guide research efforts that address:

- The development of assimilative capacity/sensitivity indices,
- The development of *in-situ* remote sensing technology and capacity and evaluate their usefulness,
- The development of ecological response models at appropriate spatial/temporal scales,
- Rates/loadings/input/output variables of nutrient over-enrichment,
- The development of new/better indicators (benthic/biological),
- Data comparability (e.g., turbidity/water color)
- Assessment tools covering aspects of model uncertainty and spatial analysis

IV. Desired Products, Next Steps, and Funding

The Network must realize that region's monitoring (through integration and coordination) does not need to have all aspects measured. Rather, the goal should be an understanding of the underlying processes that control the extent of nutrient over-enrichment in the coastal waters. Key monitoring programs must be identified and encouraged to participate in the development of the Network. The first challenge is to ensure that the short-term steps are being met and then enhance this development towards the well-articulated goals of the Network as opportunities present themselves.

Desired Products and Next Steps:

- Some of the short-term (less than 1 year) products are:
- Workshop summary
- Refinement of management coordination structure (regional monitoring council or oversight committee) that would ensure:
    - Seed funding to support planning staff to develop the framework refinements, work plan, and Network needs,
    - Involvement and commitment of key participants and preserve momentum towards intermediate and long-term goals,
    - Development of data integration concepts further,
    - Establish timelines and refine deliverables for intermediate and long term products.
- Dialogue with state, provincial, and federal leaders and decision makers to garner support (from now forward) that seeks to understand the manger's need for coordinated monitoring at the regional level.
- Expanded networking developed through steering committee and workshop participants
- High visibility, useful short term products:
    - Inventory of monitoring programs that answer who, what, when, where and why,
    - System-wide data and interpretation products (e.g., maps) for a small set of variables (e.g., salinity, temperature, selected contaminants) illustrating distribution and trends at local and regional scales,
    - Advertisements for the Network's success at all levels and to multiple audiences that fosters an understanding of the value and use of a coordinated monitoring network.
- Inventory models of water quality/fisheries/food chain models that can help in understanding systems of concern.

The intermediate products (1.5 – 2 years) are:

- Developed network structure including staffing and roles and responsibilities (organizational chart), maintain and continue to support monitoring coordinator and provide reviews to oversight committee as needed.
- Develop screening protocols for monitoring data/information,
- Evaluate models that can help in understanding systems of concern,
- Continue to seek funding for growth and development of the Network.

The long-term products of the Network are highly dependent upon the development of its structure, its success in delivering the near-term products, the attainment of funding, and success in marketing to the appropriate entities. Long-term products will most likely integrate the aspects of monitoring coordinated and integrated under the direction of the Network to result in more comprehensive ecosystem assessment. Coastal nutrient over-enrichment has received a great of national attention in very recent years. A number of efforts have begun to quantify the export of nutrients to coastal systems and evaluate the extent of coastal eutrophication and the sensitivity of embayments to nutrient loading. Funding for these efforts come from NOAA, EPA, USGS.

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Habitat Loss, Degradation and Restoration Summary

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Habitat Loss, Degradation and Restoration

Context

One of the Gulf of Maine's leading management issues highlights coastal and marine habitats - as loss, degradation, and subsequent restoration of habitat functions and values.[3] Because of the diversity of habitat types and their response to climatic and geological change, long-term monitoring is an essential component of habitat management, restoration, and protection. Monitoring programs can alert coastal and marine resource managers to changes in ecosystem integrity that might trigger management actions. As understanding is increased, models that predict relationships developed between monitoring variables and ecosystem response can further improve scientific understanding of the influence of natural and human stressors on habitats of concern. Threats to habitat integrity include *direct human impacts* (e.g., dredging, dragging, fishing, causeways, etc.) and *indirect human impacts* (e.g., point & non-point source pollution, hypoxia, temperature and climate change, etc.). Important habitat types in the region include estuarine and nearshore water column, rocky intertidal and subtidal areas, mud and sand flats, submerged aquatic vegetation (e.g. seagrasses and non-rooted macrophytes), salt marshes and diked lands, subtidal soft sediments, islands, and riverine migratory corridors. Within each of these are sub-habitat types that further challenge development of meaningful regional monitoring programs. Given the diversity of habitat types, there are two approaches that may be adopted to provide regional insights into discerning human-mediated from natural change. One is to ask key questions and apply these to comparable habitats (e.g. seagrasses) throughout the region, another is to identify key assaults upon the habitats (e.g. nutrient enrichment) and identify impacts on a variety of habitats. Both approaches are touched upon in this discussion.

Key questions a regional monitoring network needs to address

The overarching goal of a regional monitoring initiative is to identify and document the effects of human and natural activities on the extent and the ecological condition of habitats of concern. Within this broad focus are many more specific questions such as:

- What are the impacts of physical alteration (e.g., dredging, dragging, etc.) on seagrass and other benthic habitats?
- How is nutrient enrichment affecting habitat?
- How is climate change and sea level rise affecting habitat?
- Are habitat restoration efforts successful in restoring desired habitat functions and values?

Given the wide range of issues that a regional monitoring network might address it is important to develop and apply criteria to select priority question(s). Examples of these criteria include:

i. What requires a regional response;
ii. What local issue can be assisted by regional scale information;
iii. Existing funding is available or an organization is prepared to move forward;
iv. What habitats are most vulnerable to threats; and
v. Coastal managers have clearly expressed a need for this approach.

Discussion

The issues and questions being addressed dictate the form of a regional monitoring network, its specific functions, and the scale of implementation. A major value of a regional (as opposed to local) approach to monitoring is the ability to document the status and trends in habitats over *both* space and time. The penultimate question is whether habitat loss and degradation are occurring, and if so, what are the causes. What is the influence of various stressors – such as salinity, nutrients, physical alteration, toxics, invasive

[3] In a 1999 survey of New England managers by the Coastal States Organization they identified habitat loss, degradation and restoration as the most important coastal management issue. This report is located at http://ciceet.unh.edu/index_flash.html

species and climate change – on habitats of living marine resources? Are the extent, distribution, and integrity of habitats changing? How much impact is occurring, from which sources, and where? How are biota responding, including fish stocks? The network would monitor performance of habitats and help define impaired areas. Historical data should be compiled as well to serve as an initial baseline for comparisons. Resource managers require such comparisons between places and sufficient time (years to decades) to identify and resolve regional issues. A regional monitoring network should become established by focusing initially on a relatively narrowly defined issue or habitat type; this will then serve as a springboard for expanding to other priority habitats and issues in the region. Criteria for determining where to focus regional monitoring efforts include pragmatic (e.g. available funding, presence of a "champion", ease of expression and interpretation) as well as issue-driven considerations (e.g. habitats that are the most vulnerable to threats, issues that require a regional response for solution).

Priority and secondary monitoring variables needed to respond

Depending on whether one uses overarching questions for different habitat types or a specific human impact for all habitats, monitoring variables will be different. Locational data (x, y and z coordinates), standardized protocols and/or performance standards, and a suite of variables (temperature, salinity, depth, etc.) are required for all monitoring activities. The following example identifies monitoring variables needed to address a priority question that is dependent on a question of concern. For example, if a regional network were formed to monitor the effects of nutrient enrichment on seagrasses and benthic habitats the following variables are important: [note Judy is not sure she agrees with the primary/secondary variables as given – for D.O. you need temp and salinity).

Primary/Priority Variables	Secondary Variables
Location (lat/long, depth) Distribution and abundance of primary producers (phytoplankton, macroalgae, SAV, emergent marsh) Dissolved Oxygen	Water quality (nutrients, suspended sediments, clarity, etc.) Temperature, salinity Infauna

Discussion

A basic set of information for a regional network includes habitat distribution and habitat condition. Resource managers and scientists identify developing a comprehensive map of habitat distributions as one of the highest priorities. Periodic mapping through remote sensing and aerial photography would provide spatial data on areal extent and location of habitats. These data would provide a basis for detecting changes in habitat distribution. The best monitoring variables for detecting changes in the ecological condition of critical habitats are both sensitive and integrative; i.e., they provide early warnings of impending habitat change that are relevant over relatively broad temporal and/or spatial scales. However, other variables should also be included to provide information about living resources. For example, interpretation of observed changes in habitat biota is difficult because data on population biomass, size structure and other biological characteristics are lacking, data on predators in the system and their abundance, other components of the associated community and physical impacts (e.g. propellers, storms) are some examples of ancillary data that is habitat or question specific.

Desired near-term and long-term products

A regional monitoring network needs to produce multiple products for a variety of audiences. Examples of these include (but are not limited to nor are they in any ranked order):

- Web accessible inventory of habitat monitoring programs with a "clickable" resource map to locate their geographic coverage
- Periodic condition assessments of habitat losses and gains
- Identification of action thresholds useful to management
- Improved communication (internal to programs & external to the public/decision-makers)

- Information for predictive models that provide early warning of impending changes
- Regional information to set context for local phenomena
- Tools for data interpretation and integration
- Intercalibration opportunities
- Monitoring protocols and frameworks for critical habitats (e.g., sampling design, etc.)
- Information to interpret early indicators of change

Discussion
Near-term products include 1) a plan detailing the purpose of the network, how it will be organized, what it will monitor, and how it will operate. For this group, we discussed the regional monitoring network and then identified the need for the marketing .2) a marketing package that conveys the need for the regional monitoring network and provides compelling examples of the environmental problems that it can address. Long-term products include periodic habitat assessments and maps; data integration and interpretation tools; reports that synthesize information and relate changes to stressors; and workshops, seminars and other opportunities to share knowledge.

Existing monitoring programs whose participation is essential to a regional network

The concept of a regional habitat monitoring network is premised on extracting data from existing programs and augmenting those data where needed to better address the question being asked.

Discussion
To enhance its success, the network must obtain participation by existing large monitoring programs. These key players provide critical mass for obtaining funding, attracting the participation of smaller monitoring programs, and standardizing methods on a regional scale. Existing programs that are important to include are EPA National Coastal Assessment, Gulf of Maine Ocean Observing System (GOMOOS), Plum Island Sound LTER, industry (e.g., nuclear power plants, Pfizer), aquaculture monitoring programs, NEPS, NERRS, MWRA and NPS.

Funding opportunities

Funding to develop and implement a regional habitat monitoring network could be secured from a wide range of sources including:

- Federal – federal agencies with habitat management, conservation and technology development mandates should be approached. Examples include NOAA (CICEET, CSC, NOS/NEERS, NMFS, etc.), USGS, USDA (e.g., Farm Bill, etc.) and EPA. A direct appeal for support from Congress should also be considered.
- State – state agencies and programs (e.g., wildlife conservation,
- Foundations – public and private foundations are commonly interested in building the capacity of local organizations to monitor their environment
- Industry – industries that discharge to the coastal and marine environment should be identified and approached – especially those implementing state and federal environmental monitoring requirements. Examples include wastewater treatment plants and power generating facilities. Could be a regional monitoring network activity.
- International – the region is party to a number of international agreements and has partners such as the Commission on Environmental Cooperation that might be interested in piloting a transboundary regional monitoring network.

Discussion
A variety of funding streams could be tapped to support components of the network. For example, some agencies might fund development of new technologies, such as remote sensing for habitat assessment, that can be used elsewhere. Other organizations could fund staff for interpretation of findings. Numerous agencies could benefit from funding a regional mapping initiative. Federal agencies could support this

regional program as a model that eventually could be duplicated elsewhere. Private foundations may underwrite the coordination of NGO participants in the network. Pfizer and other companies that already monitor specific sites might be willing to participate in a broader effort. Sewage management agencies could donate man-hours to do sampling. It might be possible to link existing NMFS fisheries monitoring with habitat monitoring by adding parameters to those already being sampled by ships.

Next steps

1. Finalize criteria and select questions and monitoring variables (engage others not at workshop)
2. Identify key monitoring programs that must participate
3. Identify partners and funders to support network
4. Prepare "marketing strategy" with multiple examples of compelling arguments on how regional monitoring will help those making management decisions
5. Secure "buy-in" from agency leaders -- approach Gulf of Maine Council to organize initiative
6. Secure funds to commence pilot – to demonstrate that we can do this and that it has value
7. Develop MOUs to standardize data collection and analysis methods (where needed)

Discussion

An essential next step is to articulate clearly the questions that the network will address. They must be questions to which managers are demanding answers and that the public thinks are important. Then, an organizing committee needs to produce a concept for how the network will be organized and operate. Existing regional entities such as the Gulf of Maine Council on the Marine Environment should be considered for serving as the primary organizing body for regional habitat monitoring. Based on the concept, a team can create a marketing package, including content, visual identity, and Web site, to be used for engaging buy-in from participants, partners, and funders. The goals of these next steps are to obtain seed money, sign agreements with government agencies and other organizations, hire staff (e.g. executive director, science coordinator, technology manager, science communications manager), establish the monitoring and outreach program components, and secure long-term funding.

Toxics/Contaminants Session

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Toxics/Contaminants Session

Breakout Session #1 – Building the Network

Is the "form and function" matrix (seen below) clear (its purpose and content)? Are the definitions and text explanations provided for each shaded box adequate/appropriate?

Change continuum from "Simplicity -> Sophistication" to "Simplicity -> Complexity/Size".
It is understood that in any given row, the shading (choice) of a box in the continuum from left to right precludes the choice of each preceding box.

(Changes recorded directly on the poster-sized matrices during the breakout sessions are transcribed below in bold)

Form of Network	**Simplicity**			**~~Sophistication~~ Complexity/Size**
Structure	A single entity (e.g., steering committee) **Expand as necessary – should include dischargers**	Jurisdictional boards (e.g., state/provincial)		Tiered state/provincial board engaging all stakeholders & committees (e.g., science, TAC, etc.)
Type of organization	Association w/no legal standing **Expand as necessary - e.g. BOFEP**	US/Canadian non-profit **E.g. University Extension Service**	**Incorporate Charitable Service**	Regional public agency w/federal sanctions & mandates
Geography	Substate	State/Provincial	Regional by political subdivision **w/Rereg biog variability- coast/inland**	Biogeographical
Governance/decision-making	Advisory - optional participation	Voluntary compliance	Consensus	Mandatory
Operating budget	Existing and in-kind	Seed funding **With plan @ incremental growth**	Incremental growth	Major ongoing initiative
Funding sources	Current array of public and private sources	New grants and contracts (e.g., government, foundations,)	Dedicated program resources	Dedicated public and private funds, philanthropy
Partners **Expand as necessary**	State, provincial & federal agencies (US & Canada)	Volunteer Programs	Regional organizations (e.g., RARGOM, GoMOOS)	Government, NGOs, businesses, academia, regional organizations
Staffing	Existing staff dedicate time to network	New part-time staff	**1-term position, 1 FTE**	Ongoing full-time professional staff of Network

Notes at bottom of table: Include USDA (ARS) for pesticide coastal waters and Atmospheric Deposition; USGS (Biological Resources Division) contaminants in birds and mammals (BEST program); U.S. National Park Service – Air and water resources divisions, northeast temperate, coastal, barrier inventory and monitoring networks.

Form of Network:
Structure: A single entity, start simple, manageable. Additional levels will develop in time. Start with a structure already in place. Pull steering committee from existing participants. Want maximum flexibility without constraints. Cast tent widely, include participants from every avenue possible (government, NGO, academia, regulatory industry, private). Use the shellfish sanitation program (example given by Steve Weisberg) as a model.
Type of organization: Association with no legal standing; however, consider US/Canadian non-profit to accept funds. Will expand as necessary.
Geography: Regional by political subdivision, based on system recognition of biogeographic variability. "Biogeography" is an incorrect term.
Governance/decision-making: Voluntary compliance
Operating budget: Seed funding with plan to pursue incremental growth.
Funding sources: All sources. Grants and contracts will not ensure the continuation of the network into the future. Must not let effort die. Dedicated program resources necessary to maintain structure.
Partners: Government, NGOs, businesses, academia, regional organizations = diverse with diverse expertise and collaboration
Staffing: At least 1 FTE.

Functions of Network	**Simplicity**		**Sophistication**	
Scale	Tidal and subtidal **Microbial**	Near-shore & inshore	Coastal **Includes shelf**	Watersheds and Blue Water/Ocean
Scope/Reach	State & federal marine monitoring programs	Government and volunteer	Government, volunteer and academic programs	All monitoring data
Program design & implementation **/methods**	Evaluate based on established protocols	Apply standardized protocols selectively	Amend programs to meet regional needs	Standardized protocols and regional needs
Data management	Rely on current mechanisms	Web links to databases with spatial references & metadata	Common currency on reg. basis	Distributed & linked (e.g., archival and retrieval)
Data synthesis and communication **Mgrs, public, NGOs**	Existing level of program activity	Embayment assessments by selected issue	Integrated multi-factor regional assessments	Biogeographical trends and assessment w/active marketing/dissem
Links to research **Problem ID - Links to mgmt extent C & E**	Spontaneous - no formal connection	Identifies priorities linked to monitoring	Active proponent for regional research **C + E**	Supports and conducts research (e.g., cause & effect)
Services provided @ fee/consulting	Local scale assessments	~~Gulfwide~~ **Regionwide** assessments	Integrated multivariate assessments	Development of plans, strategies, BMPs, etc.
QA/QC	**Archiving samples/tissue bank**			

Functions of Network:
Scale: Coastal (including the shelf)
Scope/Reach: Government, volunteer and academic programs
Program design/implementation: Apply standardized protocols selectively and in new programs

Data management: Web links to databases with spatial references & metadata; create a common format/common currency on regional basis
Data synthesis and communication: Integrated multi-factor regional assessments
Links to research: Active proponent for regional research
Service provided: Region-wide assessments

Add functions:
1. QA/QC
2. Links to management: Problem identification/extent/cause and effect
3. Archiving

Does the group understand the rationale, endgame & conceptual costs and benefits of a network?
Regional Concept? Sources:
Transport:
1. Air – Broad Geography
2. Water

Focus – Monitoring? What's Our Domain?
1. Assessment
2. Characterization
3. Management
4. Process

Broad Scale Monitoring
Baseline / Impact

Scale – Contaminant specific and complex
Is the region the right size?
The size of the zone depends upon the pollutant(s) monitored. Considering long-distance transport/ atmospheric transport monitoring could expand the zone of the integrated monitoring network to include the Midwest, the entire east coast, and beyond. Should consider transport of contaminants within and among regions, considering hydrographic regimes, movement of organisms, migration routes, etc. Some sources of contaminants are obvious; others are not. Need to be assessing trends. Need to have a means of identifying control/background sites.

Important to include linkages. Consider fate and transport, the movement of contaminants within and among systems, how systems work together, an intensive assessment of contaminant fate and transport and linkages with other systems nested within the framework of a larger program providing information regarding the long-term understanding of systems.

Microbiological pathogens are included here with chemical contaminants. Can these two categories be adequately addressed together within the category of toxics? When addressing impacts on environmental health and human populations it is appropriate here to combine toxic contaminants and pathogens?

Combine monitoring activities with resource management.
1. Define the nature of the problem.
2. Define the spatial extent of the problem.
3. Relate cause and effect.
4. Form recommendations based upon what options exist.

Conclusions:

Current political/biogeographical area-designation including Nova Scotia, New Brunswick, Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York is adequate.

Agreement on changes made to shaded boxes within the two matrixes.

Breakout Session #2 – Focusing on the Toxics Management Issue

What key items are missing from the monitoring variables chart?
Organisms: add humans

(Additions that were made directly on the poster-sized charts during the Breakout sessions are transcribed below.)

Toxics/Contaminants Monitoring Parameter	Toxics/Contaminants Monitoring Programs
Organic chemicals, e.g., PAHs (polycyclic aromatic hydrocarbons), PCBs (polychlorinated biphenyls), linear alkyl benzene, in:	
Water Notes: Dioxin/furans; Pesticides	National Pollutant Discharge Elimination System (NPDES) permit monitoring, Maine and other state surface water assessment programs, National Water Quality Assessment Program (NAQWA), oils spills, discharges (ships), NOAA/Canada ME SWAT, ACAP
Sediments	National Coastal Assessment (NCA), NOAA Status and Trends (NSandT), Casco Bay Estuary Project (CBEP), Massachusetts Water Resources Authority, Long Island Sound Study (LISS), Army Corps Disposal Area Monitoring System (DAMOS), USGS, NAWQA, Interim Offshore Monitoring Program (Navy, IOMP), CEPA Part VI Sed. Mon. Program (Canada)
Air	CBEP, ~~MBP~~, Canada & US Air Quality Program, NDAM (VT) EPA/ CT Dioxin
Organisms (e.g., fish, shellfish)	NCA, NsandT (Mussel Watch), Gulfwatch, Massachusetts Bays Program (MBP), Buzzards Bay Program (BBP), CBEP, MWRA, US Fish & Wildlife Service (USF&WS), LISS, state toxics assessment programs, DAMOS, NAWQA, IOMP, National Benthic Survey Project (NBSP), Specimen Banking Project (SBP), Rotating Intensive Basin Studies (New York DEC, RITBS), Toxics Substance Monitoring Program – Striped Bass (NYDEC, TSMP), Toxics in Seabirds (Canada) & US (ME), Environmental Quality Databank (Canada, EQBD), Mammals, Toxics in seals (MERI, ACAP), CDC (humans) Notes – Scale, media, type of toxin
Trace metals (e.g., mercury, lead, copper, cadmium, nickel, zinc, tributyl tin chromium, arsenic, silver) in:	
Water	NPDES permit monitoring, Maine and other state surface water assessment programs, NAWQA, ACAP, ME SWAT
Sediments	NCA, NSand T,CBEP, MWRA, BB, MBP, LISS, DAMOS, USGS, MEOP, IOMP, NAWQA, Living Resources Monitoring Program (UNH), RIBS, CEPA Part VI Sed. Mon. Program (Canada)
Trace metals (cont'd) Air	CBEP, Mercury Deposition Network (MDN) – VT/MA, Hg Mon; USGS Hg Mon, National Ambient Air Monitoring Program, LISS, Acadia National Park, Campobello National Park, Cape Cod national Seashore, Maine and Massachusetts IMPROVE, University of New Hampshire, University of Connecticut, Canada/US,
Organisms (e.g., fish, shellfish)	

Toxics/Contaminants Monitoring Parameter	Toxics/Contaminants Monitoring Programs
Notes: mammals (seals), humans	Improve/STN Urban toxics net NCA, NSand T (Mussel Watch), Gulfwatch, NAWQA, NSBP, IOMP, Quanachontaug Pond (URI), CBEP, LISS, MWRA, state toxics assessment, DAMOS, ACAP, mammals, toxics in seals (MERI, ACAP)
~~Pesticides (e.g., dieldrin, DDT, chlordane, toxaphene) in:~~ ~~Water~~ ~~Sediments~~ ~~Organisms (e.g., fish, shellfish)~~	 NPDES permit monitoring, Maine, CT, RI, MA, VT surface water assessment programs, ME SWAT, MBPC/FOCB NCA, NSandT, CBEP, MWRA, MBP, LISS NCA, NSandT (Mussel Watch), Gulfwatch, CBEP, MWRA, USF&W, LISS, ACAP
~~Dioxins/Furans in:~~ ~~Water~~ ~~Sediments~~ ~~Organisms (e.g., fish and shellfish)~~ Notes: Add to subset organics	 NPDES permit monitoring, Maine SWAT CBEP, LISS, IOMP, Maine SWAT, NS&T CBEP, state toxics assessment programs, LISS
Pathogens & ~~Bacterial~~ Indicators (fecal) in: Water Sediments Shellfish Biotoxins Cl	 NPDES permit monitoring, State shellfish sanitation programs, state and local water quality monitoring programs, state and local beach monitoring programs, Cooperative Bacterial Monitoring (New Brunswick), Maritime Shellfish Sanitation Program, Fish Farms (Bacteria), NPDES DEP, ACAP, Enterococcus, viruses MWRA (*Clostridium perfringens,* ~~*viruses*~~), USGS (*Clostridium perfringens*, NSandT, NH-NCA (C.p.) State shellfish sanitation programs, RIBS, NH Gulfwatch HAB US/Canada
Sediment toxicity	NCA, ~~MBP~~, LISS, DAMOS, NS&T, CEPA (Canada) Part VI Sed. Monitoring Program
Ambient and source water toxicity	LISS, RIBS, State Toxicity Programs
Emergent Conditions Water Sediments Organisms: Fish, shellfish, mammals (seals), humans Inverts/fish	Pharme, brom. (PBDEs), flame, retardants, APEs, PFOS, NS&T, LIS Lobster Research Program, CDC (Humans), Toxics in seals (MERI, ACAP) EC-EP, EEM Program on Pulp and Paper, 3rd phase, biomarkers

What modifications to the proposed priorities does the group suggest?
Rename "Bacterial Indicators" to "Pathogens & Bacterial Indicators (fecal) in: Water"
(Modifications were added directly to the charts.)

What significant monitoring programs are missing from the chart?
(Monitoring programs were added directly to the charts.)

What monitoring programs are key to the success of an integrated network?

- Choose a few foci and build on it; cannot start monitoring inventory with everything.
- Skeleton currently exists.

Conclusions: The focus of monitoring programs and primary monitoring concerns are often local or regional in nature. Cannot be boiled down to a few variables assessed in the network that will adequately address local and/or regional issues. ALL programs are key to the success of an integrated network.

Breakout Session #3 – Identifying the Key Questions, Monitoring Gaps and Research Needs

What are the key questions we need a network to help us address?

- What are the sources of contaminants?
- Are sources being reduced?
- Historic/recirculated/recycled contamination vs. new contamination?
- What is the spatial extent of chemical contamination?
- What biological effects are observed?
- What species are heavily impacted by contaminant concentrations?
- What evidence exists of cumulative ecological change in coastal ecosystems attributable to toxic chemicals?
- What are the indicators of ecosystem health/pathology and how do these relate with contaminant concentrations?
- What are the human health implications (effects) of toxic contaminants and pathogens?
- What is the human health significance of non-human sources?
- What are the economic impacts of contamination (beach closings, shellfish bed closures, fisheries resources, consumption advisories, etc.)?
  What is the recovery potential of exposed/contaminated areas?
- How can sites be prioritized (for cleanup, remediation, further study, etc.)?

What monitoring needs are not currently being met?

Integrated approach (including fate and transport mechanisms, acute and chronic toxicity singularly and together, risk assessment approach). Monitoring tied into more complex levels of assessment. Understanding the sources and fates leads to more relevant and more efficient monitoring.

- Contaminant effects on:
- Biological systems (esp. reproductive and developmental)/Endocrine disruption
- Populations
- Ecological effects/ecological risk assessment
- Bioaccumulation through the food chain, trophic levels/transfer; monitoring relevant levels
- Biomarkers
- Use of environmental fate models, fate and modeling, where a chemical is likely to go. Using and improving models; modeling and monitoring informing each other
- Adequately monitoring long-term rate/effect(s)

- Tracking public health effects/impacts
- Filling data gaps. Contaminant distribution based on geographic locations/spatial component
- Science translation/public education/public perception; May not need to change the monitoring-change the message
- Slow in applying new technologies to monitoring; adoption evaluation of new technology, technical efficiency/timing
- Efficiency of data reporting/turn-around information: conduct assessment of the information in a timely manner – accelerated reporting; instant data-availability, where appropriate
- Monitoring programs should incorporate flexibility; monitoring feedback loop; reassessment every 5 years; ability to make changes; reassessment of monitoring program and results

What supporting research (within the theme area) is needed to provide managers with the tools to make more informed decisions?

- Appropriate source-identification methods
- Bioeffects of accumulated contaminants in the environment
- Bioavailability/cumulative effects/ weight-of-evidence biomagnification
- Sort out complexities in multi-impact situations
- Impacts of habitat alterations on mobilization of contaminants; interactive effects; habitat
- alterations; stressors
- Means of sharing/communicating results of research, methods, new techniques. Practical
- workshops to present tools
- Intercalibration
- Background vs. contaminant concentrations: what is background?
- Economic implications of human consumption fish advisory
- Biomarkers: many recommended, but very few with enough knowledge to utilize. Select biomarkers, for which normal ranges can be defined, then test in real world situations.
- Pursue available avenues in biotechnology/new technology.
- Need information regarding the normal range and effects
- Sociological/cultural analyses; sampling different exposure patterns; sociological aspects that
- would help reduce inputs; socioeconomic research on source generation

WHAT 2-3 PRODUCTS WOULD THE GROUP EXPECT TO SEE FROM AN INTEGRATED APPROACH IN 18-24 MONTHS?

(In order of precedence)

1. Inventory by specific contaminants, GIS/spatial distribution/verification of sites, identifying problems and extent of problems
2. Articulation of objectives – terms of reference (Workplan)
3. Protocols for monitoring and data management/standardized data management format
4. Indicators report
5. Agreement of on approach of State of the Environment/State of the Gulf report, method of approach
6. Compare contaminant concentrations within an area. Where should limited resources be focused? Assure consistent methodology if comparing.
7. Establish a library/resource center for methods, intercalibration, field notebooks, etc.

Breakout Session #4 – Pulling it all together

What are some funding mechanisms and/or sources to initiate the network?

Potential Funding Sources	Currently conducting Monitoring?
Atlantic Coastal Action Program (ACAP - NGO)	Y
Commission for Environmental Cooperation (CEC)	N
Department of Fisheries and Oceans (DFO)	
- funding and in-kind support	
Oceans Act Program	Y
Environment Canada (EC)	
Environmental Damages Fund (EDF)	
Environmental Protection Agency (EPA)	
National Coastal Assessment (NCA)	Y
National Estuary Program (NEP)	Y
National Atmospheric Deposition Program (NADP)	Y
Gulf of Maine Council on the Marine Environment	Y
- CA: DFO/EC	
- US: EPA/NOAA	
New England Governors/Eastern Canadian Premiers (NEG/ECP)	N
National Oceanic and Atmospheric Administration	
Integrated Sustainable Ocean Observing System	Y
- to implement, not to initiate	
Global Ocean Observing System	Y
- $50 – 60 million/yr, moored instruments	
NOS/National Estuarine Reserves	Y
NOS/National Marine Sanctuaries	
- developing a system-wide monitoring program	
- 13 Marine Sanctuaries	
NOS/Coastal Ocean Program	N
- one-time seed money, peer-reviewed proposal	
Pew Foundation	
Sea Grant	N
United States Geological Survey	
National Water Quality Assessment	Y
United States Army Corps of Engineers	
Disposal Area Monitoring System	Y
World Wildlife Foundation (WWF)	
- habitat in the Gulf of Maine	

General:

- Industry
- Non-Governmental Organizations (NGOs)
- Non-Profit Foundations

What existing mechanisms or groups exist that might be used to support this effort?

- Alliance for Coastal Technology
- Coastal Service Center
- Atlantic Salmon Federation
- Bay of Fundy Ecosystem Partnership (BoFEP)
- Bottom Trawl Surveys (conducted by each state)

- Gulf of Maine Council on the Marine Environment
- Health Canada
- National Association of Marine Laboratories (NAML)
    - Infrastructure, outreach
- Nature Conservancy (TNC)
- NEIWPCC/ASIWPCA
- Regional Association for Research on the Gulf Of Maine (RARGOM)
- Regional Power Authority
- Sanitation Programs
- Food and Drug Administration (FDA)
- National Shellfish Sanitation Program (NSSP)
- Paralytic Shellfish Sanitation Program (PSSP)
- World Wildlife Foundation (WWF)

General:

- Aquaculture Industry
- Existing monitoring programs
- Industry
- State/Provincial Permitting Mechanisms
- Universities

What does the group suggest are the key next steps over the next 12-18 months?

(In order of precedence)

- Form a Steering Committee
    - team" Reps
- Complete a Workplan
    - define products (e.g. GIS Inventory)
    - schedule
- Complete the Monitoring Inventory
    - identifying monitoring programs, spatial coverage/gaps, total financial investment, etc.
- Identify and contact potential partners/participants
- Presentation of Workplan and Integrated Network's benefits and products to GOM Council
    - May 2003 Council Meeting
- Establish a fiscal agent
- Identify seed money
- Build coalition through participation in program development and product generation
    - conduct workshop(s)
    - orientation of partners
    - involvement of managers and public
    - present idea and proposal to potential participants
- Staffing
    - define need/bring on by the end of 12-18 months
- Pilot program
    - demonstrate that the network can work

Who is willing to help in moving this idea forward?
All participants of Breakout Session on Contaminants committed to network participation/support.

- Program Inventory – Finlayson (GOMC)
- Philanthropies – Shaw
- Workshops – Burgan (EPA/NEP)
- Indicators Meeting - Burgan/Wells/Shaw
- Pilot – Ranheim
- Public Liaison – Shaw
- State of Gulf/Environment report framework – Wells/Jones/Finlayson/Wells (GOMC)
- Buchholtz ten Brink/Pesch (RARGOM) and Pesch (EPA/NCA)
- Steering Committee
- EPA/NCA funding
- monitoring and data management protocols
- Finlayson involvement in all aspects
    - growing understanding of monitoring in the region