2002-2003 NC Eastern Regional Mercury Study (Summary and Update, February 21, 2003)

Introduction

Mercury is a global pollutant of growing concern in the State of North Carolina. Each year as the additional monitoring of fish is conducted the extent of the mercury problem grows. When high levels of mercury are found in fish, the Department of Health and Human Services (DHHS) issues fish consumption advisories warning citizens of the dangers of consuming locally caught fish. Currently, DHHS advises restricted consumption of bowfin (blackfish), largemouth bass and chain pickerel (jack). The state has also issued a saltwater advisory for king mackerel; this advisory has the potential to impact the coastal economy significantly. All of these waters are considered impaired by the Division of Water Quality and require Total Maximum Daily Load (TMDL) studies.

There are many questions that agencies need to be able to answer about mercury in waters of the state, particularly those waters on the 303(d) list of impaired waters. This study was designed to answer some basic questions about mercury in the eastern area of the state and to provide information that may be used in water quality standard and TMDL development. The goals identified for this study include:

1) *to determine levels of ambient mercury in the surface water system*. Current monitoring using a higher detection limit (EPA Method 245.1) has consistently yielded non-detected values. This study uses clean sampling techniques and EPA Method 1631, which allow detection levels three orders of magnitude lower than EPA Method 245.1.
2) *to estimate site-specific total mercury:methyl mercury (THg:MeHg) translators to evaluate water quality criteria.* Current water quality standards are based on total mercury, although methylmercury is the form most readily accumulated by biota and is the form most toxic to humans. This study will determine translators for each site studied.
3) *to develop site-specific water to fish bioaccumulation factors (BAFs).* National studies have suggested a variety of BAFs for mercury ranging from 8000 to 6,800,000 L/kg. Site-specific BAFs will allow the development of a more site-specific mercury standard for use in TMDLs and to evaluate waters of North Carolina relative to other waters in the country.
4) *to determine levels of mercury in treatment plant effluent.* Literature indicates that mercury levels in effluent may be on the order of 1 to 100 ng/L. This study uses EPA Method 1631 to determine levels of mercury in effluent from selected facilities.

Project Description

The field study includes thirteen sites North Carolina. The selected waterbody systems will be in the eastern portion of the state where the majority of advisories have been issued or are anticipated.

Intensive monitoring is conducted at each system on a quarterly basis. Thus, seasonal variation in mercury levels and methyl mercury percentages, as well as time-variable data for potential model construction, are captured for the year studied. Surface water, sediment and fish are monitored as part of the study in order

Mercury study sites

River basin	Waterbody	Area
Cape Fear	Black River	Southern Coastal Plain
	South River	Southern Coastal Plain
Lumber	Lumber River	Southern Coastal Plain
	Lake Waccamaw	Southern Coastal Plain
	Waccamaw River	Southern Coastal Plain
Neuse	Eno River	Piedmont
	Contentnea Creek	Northern Coastal Plain
Pasquotank	Kendricks Creek	Northern Coastal Plain
	Phelps Lake	Northern Coastal Plain
Roanoke	Cashie River	Northern Coastal Plain
Yadkin	Abbotts Creek	Piedmont
	Ledbetter Lake	Southern Coastal Plain

to determine levels in all three media. All surface water and sediment sampling uses clean techniques (e.g., clean hands/dirty hands).

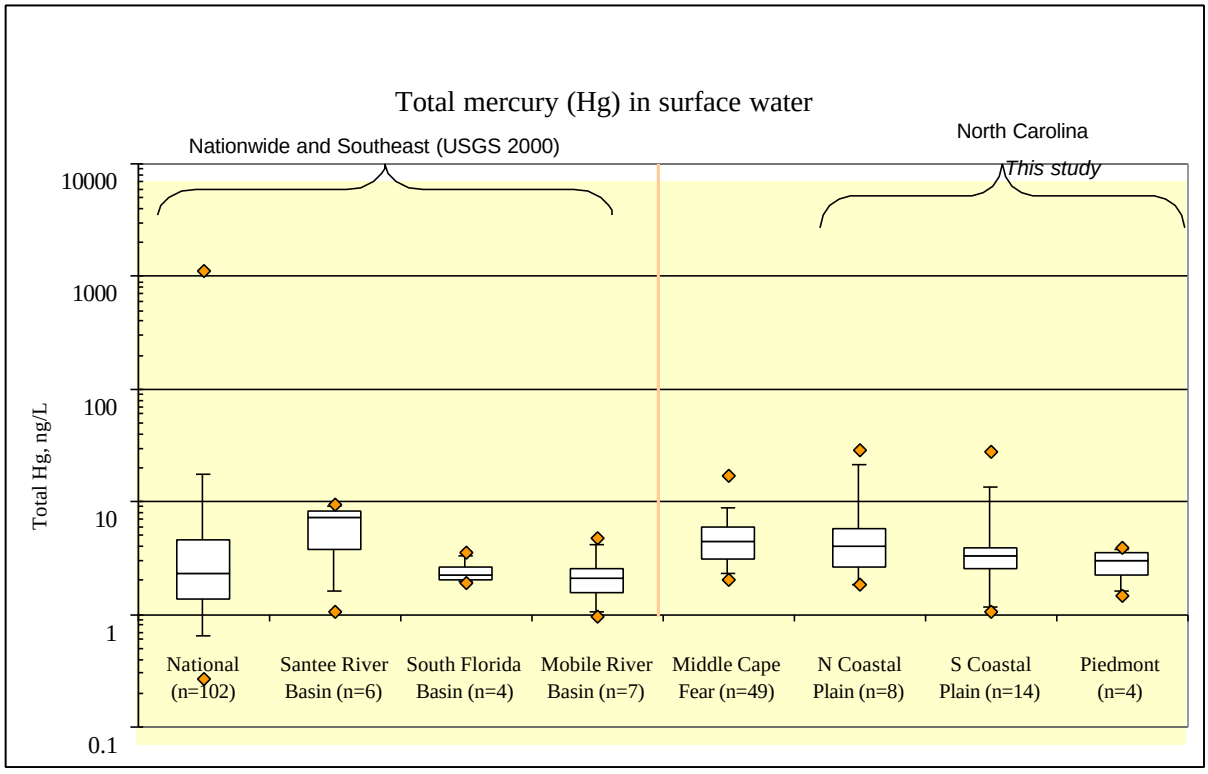
A comprehensive synoptic look at levels in WWTP effluent is also being conducted as part of this project. Effluent from approximately 40 facilities in eastern North Carolina will be sampled and analyzed for total mercury using EPA Method 1631.

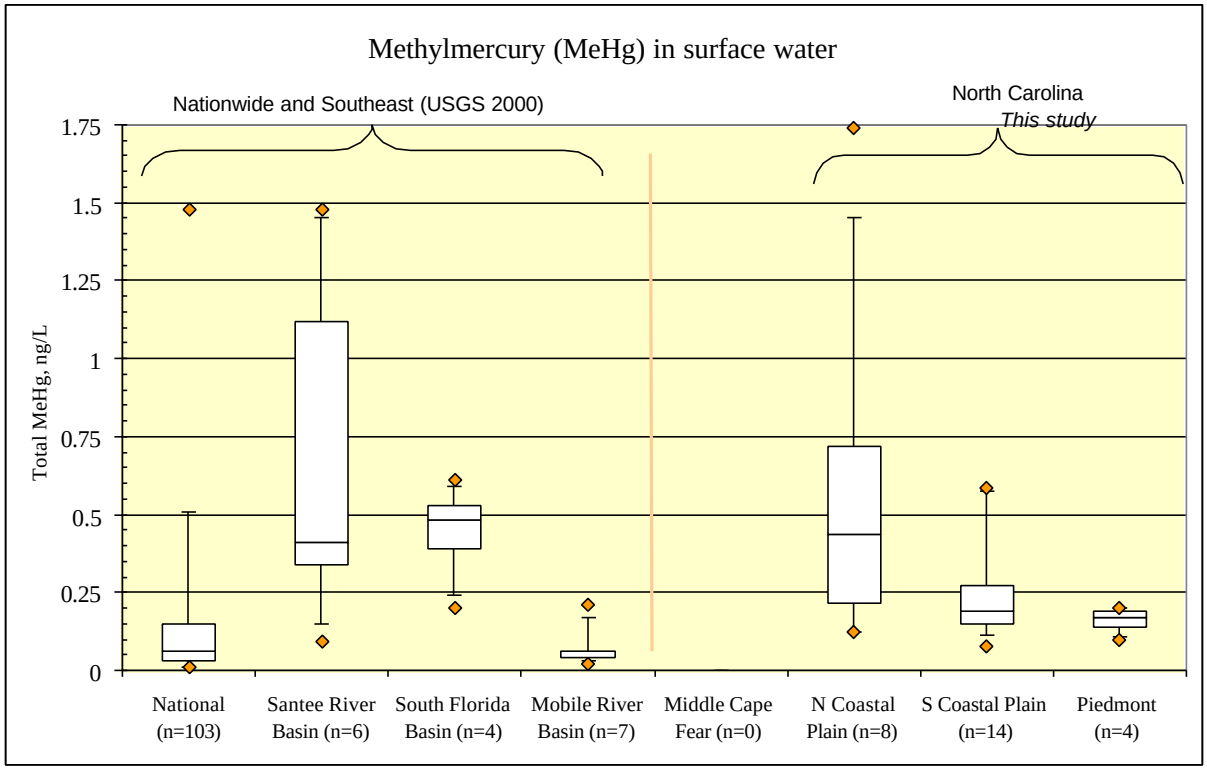
Parameters and Media	
Media	Chemical analysis
Surface water (four quarters)	Total mercury (THg), total methyl mercury (MeHg), dissolved organic carbon (DOC), Total sulfate
Sediment (summer and winter quarters)	THg, MeHg
Fish	THg, length, weight, species

Interim Results

The first two quarters of ambient monitoring are complete. This includes two quarters of data for surface water, and winter data for sediment. The monitoring of WWTP effluent is underway. Ambient monitoring results are plotted against USGS (2000) data collected in NAWQA river basins; southeastern US basins included in the study are highlighted. The Santee River Basin includes the Catawba and Broad River Basins in North and South Carolina. The Mobile River Basin is located in Alabama. Box and whisker charts display the 25th percentile, median, and 75th percentile, with whiskers at the 5th and 95th percentiles. Maximum and minimum values are also plotted.

With two quarters of non-summer data collected, it is difficult to compare actual results with the USGS data, which was a summer synoptic study. However, using the USGS data as a base, total mercury and methyl mercury concentrations in North Carolina waters do not appear to be significantly different than those observed in other areas of EPA Region IV. The total mercury chart includes data the Middle Cape Fear River Basin Association collected in 1999 and 2000.




Methylmercury (MeHg) in surface water
Nationwide and Southeast (USGS 2000)
North Carolina
This study
Total MeHg, ng/L
1.75
1.5
1.25
1
0.75
0.5
0.25
0
National (n=103)
Santee River Basin (n=6)
South Florida Basin (n=4)
Mobile River Basin (n=7)
Middle Cape Fear (n=0)
N Coastal Plain (n=8)
S Coastal Plain (n=14)
Piedmont (n=4)