9.0 MERCURY MASS ESTIMATES

Mass estimates of THg and MeHg in water, soil, floating periphyton, soil periphyton, and mosquitofish were calculated for each synoptic sample. Note: This is not a mass balance or budget, but mass estimates to provide a relative perspective of instantaneous masses among constituents. The models used to calculate Hg mass estimates are shown in Table 9.1.

Table 9.1 Mercury mass estimate models.

Water:	$Mass_w$ =	$\dfrac{k \cdot A \cdot \sum_{i=1}^{n} \dfrac{Z_i \cdot d_i}{\pi_i}}{\sum_{i=1}^{n} \dfrac{1}{\pi_i}}$
Soil:	$Mass_s$ =	$\dfrac{k \cdot A \cdot \sum_{i=1}^{n} \dfrac{Z_i \cdot s_i \cdot 0.1}{\pi_i}}{\sum_{i=1}^{n} \dfrac{1}{\pi_i}}$
Periphyton:	$Mass_p$ =	$\dfrac{k \cdot A \cdot \sum_{i=1}^{n} \dfrac{Z_i \cdot M_i}{\pi_i}}{\sum_{i=1}^{n} \dfrac{1}{\pi_i}}$
Fish:	$Mass_f$ =	$\dfrac{k \cdot A \cdot \sum_{i=1}^{n} \dfrac{Z_i \cdot N_i}{\pi_i}}{\sum_{i=1}^{n} \dfrac{1}{\pi_i}}$

A	=	area of study region, km^2	s	=	soil bulk density at a sample site, g/cc
Z	=	concentration Hg at a sample site	0.1	=	soil depth, m
d	=	water depth at a sample site, m	M	=	density of periphyton, g/m^2 (Trexler personal communication)
π	=	sampling design inclusion probability	N	=	$fish/m^2$*Average fish weight for fish, g/fish (Trexler personal communication)
k	=	constant used to convert to appropriate units			

Periphyton densities were assumed to range from 171 g/m^2 dry weight in the ENP to 452 g/m^2 dry weight in WCA-3; based on ash free dry weight measurements collected by J. Trexler (personal communication). The density of fish was assumed to be 3.5 fish/m^2 during dry seasons and 14.5 fish/m^2 during wet seasons based on data gathered by J. Trexler (personal communication).

Mass estimates of THg in precipitation were also calculated for the wet and dry seasons corresponding to the sampling cycles. The mass estimate was calculated by multiplying total precipitation for the season by the average of THg in precipitation measurements for the season. The wet season was assumed to be June through October, and the dry season was assumed to be November through May. The precipitation data used for this calculation came from 5 National Oceanic and Atmospheric Administration (NOAA) weather stations located in the study area; Belle Glade Experiment Station, Devils Garden, Homestead Experiment Station, Royal Palm Ranger Station, and Tamiami Trail. Measurements of THg in precipitation were available for the 4 stations monitored for FAMS.

The mass estimates for THg by media and cycle are compiled in Table 9.2. The systemwide estimates for water range from 4.0 to 4.3 kg during the dry cycles and from 6.8 to 10.1 kg in the wet cycles. Higher loading during the wet season is consistent with the pattern of atmospheric deposition. Wet deposition of Hg during the wet season accounts for 80% of the annual total atmospheric deposition of Hg in the Everglades system.

Table 9.2 South Florida THg mass estimates (kg).

	Cycle 0 (Dry)	**Cycle 1 (Wet)**	**Cycle 2 (Dry)**	**Cycle 3 (Wet)**
Input				
Precipitation	53	163	52	112
Sinks				
Water	4.3	10.1	4.0	6.8
Soil	14,135.0	14,888.0	15,330.0	13,962.0
Floating Periphyton	222.0	—	132.0	341.0
Soil Periphyton	835.0	—	473.0	345.0
Mosquitofish	0.68	0.80	0.66	0.64
TOTAL	**15,197**	**14,898**	**15,939**	**14,656**

Systemwide estimates of soil THg were relatively consistent in all four cycles ranging from 13,962 to 15,330 kg. The soil represents the largest Hg sink in the system. Soil loads would not be expected to change significantly during this period of study. The consistency of these mass estimates also shows the utility of the randomized design in providing consistent estimates of a relatively constant indicator.

THg mass estimates for periphyton were able to be calculated for only one wet cycle. Floating periphyton dry cycle THg mass estimates ranged from 132 to 222 kg, while the single wet cycle was estimated at 341 kg. The higher wet season estimate was coincident with high wet season atmospheric deposition of Hg. Soil periphyton THg mass estimates were higher than those for the floating periphyton ranging from 473 to 835 kg during the dry cycles and 345 kg for the single wet cycle.

THg mass estimates in mosquitofish were extremely low ranging from 0.66 to 0.68 kg during the dry cycles and 0.64 to 0.80 kg during the wet cycles. These estimates are remarkably consistent among cycles. The low estimates obtained may be partly due to low biomass estimates used to represent the standing stock.

Systemwide mass estimates of MeHg for water, soil, floating periphyton, and soil periphyton by cycle are presented in Table 9.3. MeHg mass estimates in water ranged from 1.3 to 2.0 kg during the dry cycles to 1.0 to 1.9 kg during the wet cycles. The consistency in these estimates indicates that the amount of MeHg is likely controlled by internal processes in the marsh rather than outside influences external to the marsh (e.g., atmospheric deposition).

Table 9.3 South Flo rida MeHg mass estimates (kg).

Sinks	Cycle 0 (Dry)	Cycle 1 (Wet)	Cycle 2 (Dry)	Cycle 3 (Wet)
Water	2.0	1.9	1.3	1
Soil	88.4	76.4	92.4	89.9
Float Periphyton	9.2	6.1	7.1	4.5
Soil Periphyton	9.5	2.9	4.8	2.1
Mosquitofish	0.68	0.80	0.66	0.64
TOTAL	**108.9**	**87.1**	**105.4**	**97.3**

Systemwide mass estimates of MeHg in soil ranged from 88 to 92 kg during the dry cycles and 76 to 90 kg during the wet cycles. Even though these estimates are higher than the water estimates, as expected, the consistency among the cycles further indicates internal processes control MeHg production.

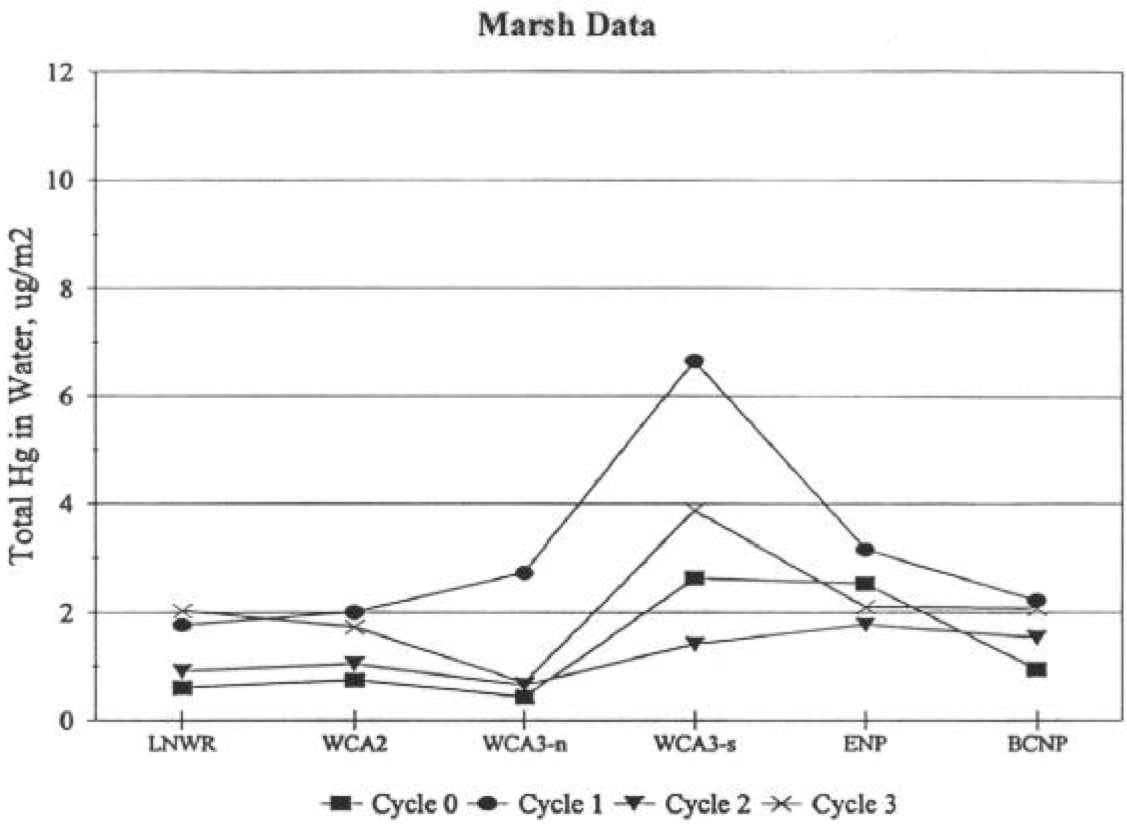
Mass estimates of MeHg across the system for floating periphyton ranged from 7.1 to 9.2 kg during the dry cycles and 4.5 to 6.1 kg during the wet cycles. Comparable estimates for soil periphyton found the dry cycles ranged from 4.8 to 9.5 kg and the wet cycles ranged from 2.1 to 2.9 kg. Both parameters appear to be higher in the 1995 cycles and lower in the 1996 cycles. In contrast to THg mass, which was higher in soil periphyton, MeHg mass was higher in floating periphyton.

Areal mass estimates were also calculated for subareas of the Everglades for each cycle. The subareas were LNWR, WCA2, WCA3-n (north of Alligator Alley), WCA3-s (south of Alligator Alley), ENP, and BCNP. Figures 9.1 and 9.2 are plots of areal mass estimates of THg and MeHg in water and soil.

As expected, areal THg mass estimates of THg in water tended to be higher during the wet cycles. During the wet cycles the greatest THg mass occurred in WCA3-s. During the dry cycles, THg masses in the ENP were very similar to those in WCA3-s.

As expected, areal mass estimates of THg in soil were consistent between cycles, with no seasonal pattern apparent. For the soil, there was a strong north to south gradient with greater loads in the southern subareas. This pattern corresponded to the general pattern of water flow in the system.

Areal mass estimates of MeHg in water and soil were fairly consistent between cycles. MeHg in water tended to decrease from north to south. MeHg mass estimates in water were also more variable in LNWR and the WCAs than in the ENP and BCNP. MeHg mass estimates in soil were highest in LNWR and WCA3-n. Areal masses of MeHg in soil were very similar for all cycles in WCA2 and WCA3-s.



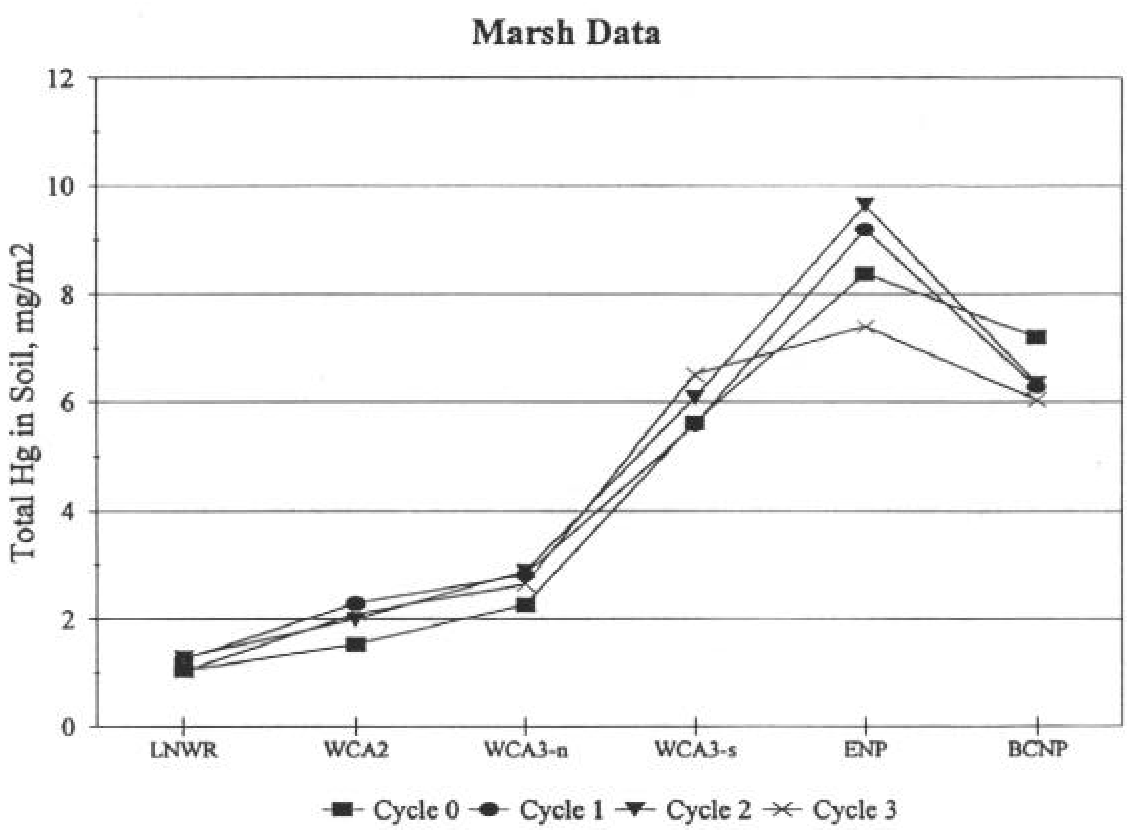
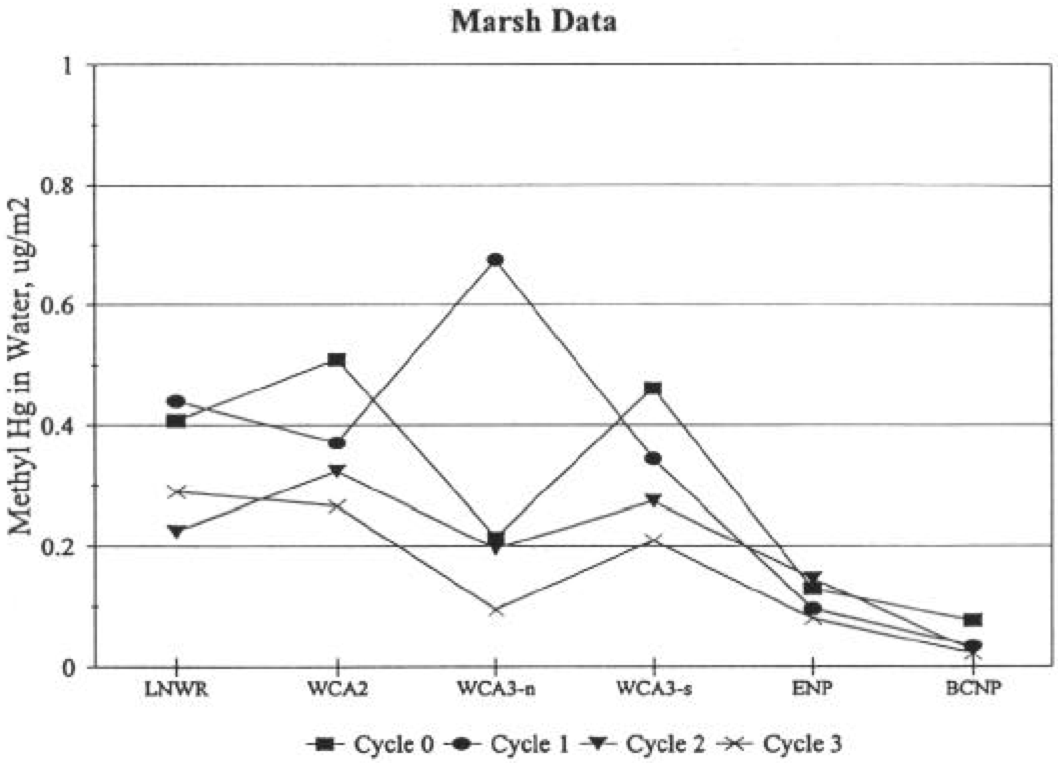


Figure 9.1 Marsh data THg in water (top) and soil (bottom).



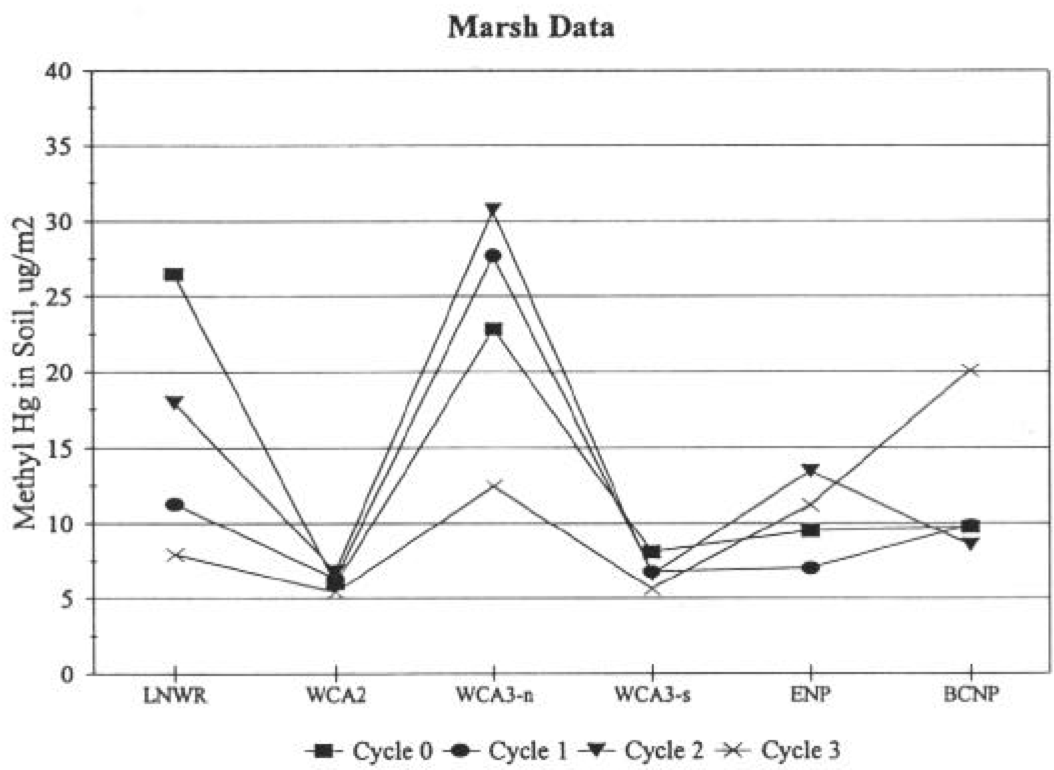


Figure 9.2 Marsh data MeHg in water (top) and soil (bottom).