Estimated Emissions in Cote d'Ivoire from UNEP 2013 and 2017 Technical Reports

Source	2010 (kg emitted)	2015 (kg emitted)
ASGM	225	225 (10.7%)
Waste	87	398 (19%)
Largescale Gold Production	-	952 (45.5%)
Cement	57	273 (13%)
Domestic biomass burning	-	227 (10.8%)
All other sources	7	9.2
Total	*376*	*2084*

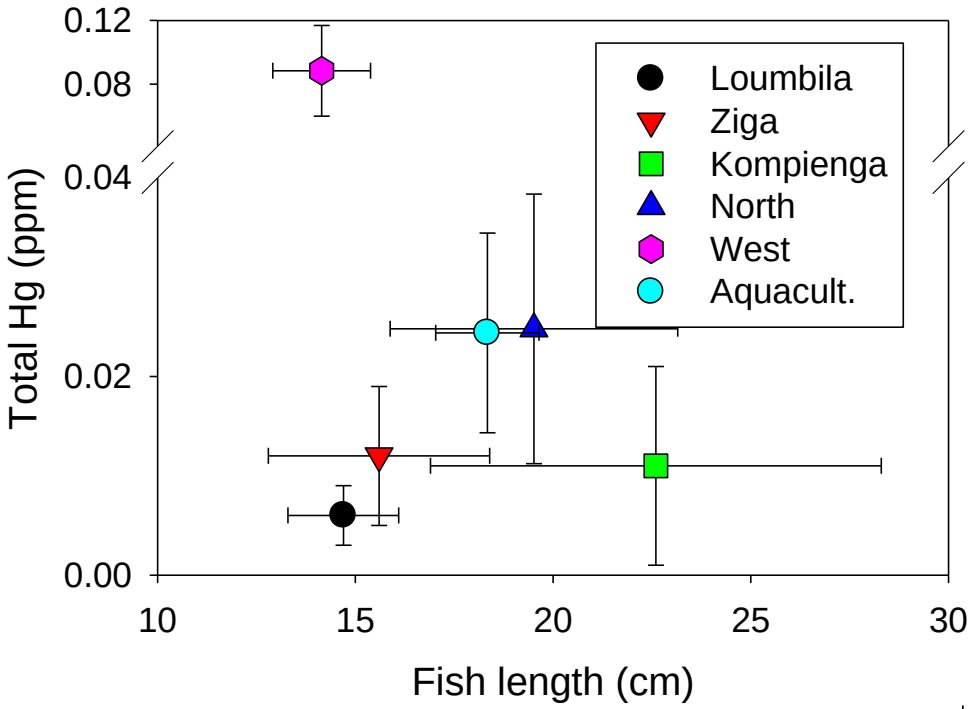
Cote d'Ivoire population 23.7 million in 2017
Relative 2015 emissions: 0.09 g/person/yr
Global 2015 average: 0.28 g/person/yr
USA average: 0.12 g/person/yr

Globally, ASGM 33.8%, Combustion 22.4%, Non-ferrous metal production 15.1%, Cement production 10.8%

Rain: C d'I (n=2) <1 ng/L; Precip USA: $\leq$ 15 ng/L annual average

Concentrations of dissolved total and methylmercury for the various sites sampled in the four regions

Dissolved Concs. Samples from Ivory Coast	Region	THg ng/L		MeHg ng/L		%MeHg
		Mean	Std	Mean	Std	
ADJEKRO	East	3.45	0.85	**0.119**	0.017	3.50
BIANNOUAN	East	**8.84**	0.25	**0.214**	0.030	2.40
ABOULIE	East	**15.60**	0.68	**0.421**	0.06	2.70
KANAKONO	North	2.88	0.14	0.067	0.005	2.30
PAPARA	North	3.37	0.11	0.069	0.004	2.00
SISSINGUE	North	3.67	0.24	0.065	0.015	1.80
SISSINGUE	North - Field Dup	4.96	0.25	0.090	0.007	1.80
HIRE	Central	1.36	0.01	0.029	0.006	2.10
BONIKRO VILLAGE	Central	1.41	0.09	**0.374**	0.030	**26.6**
BONIKRO MINING	Central	3.40	0.22	0.051	0.013	1.50
MEANTOUO MINING	West	2.86	0.16	0.070	0.003	2.40
MEANTOUO VILLAGE	West	6.09	0.57	**0.139**	0.030	2.30
FLOLEU (CAVALLY River)	West	**11.23**	2.10	0.078	0.012	0.70
FLOLEU (CAVALLY River)	West - Field Dup	**16.17**	1.63	**0.150**	0.020	0.92
Connecticut River (Haddam)	CT, USA	2.00	0.250	0.024	0.010	1.20
Hudson River (above ETM)	NY, USA	1 to 2				
Penobscot River, ME	Contaminated	<2.5		<0.05		0.7-2.2
Berry's Creek, NJ	Contaminated	≤ 18		≤ 0.8		0.5-5

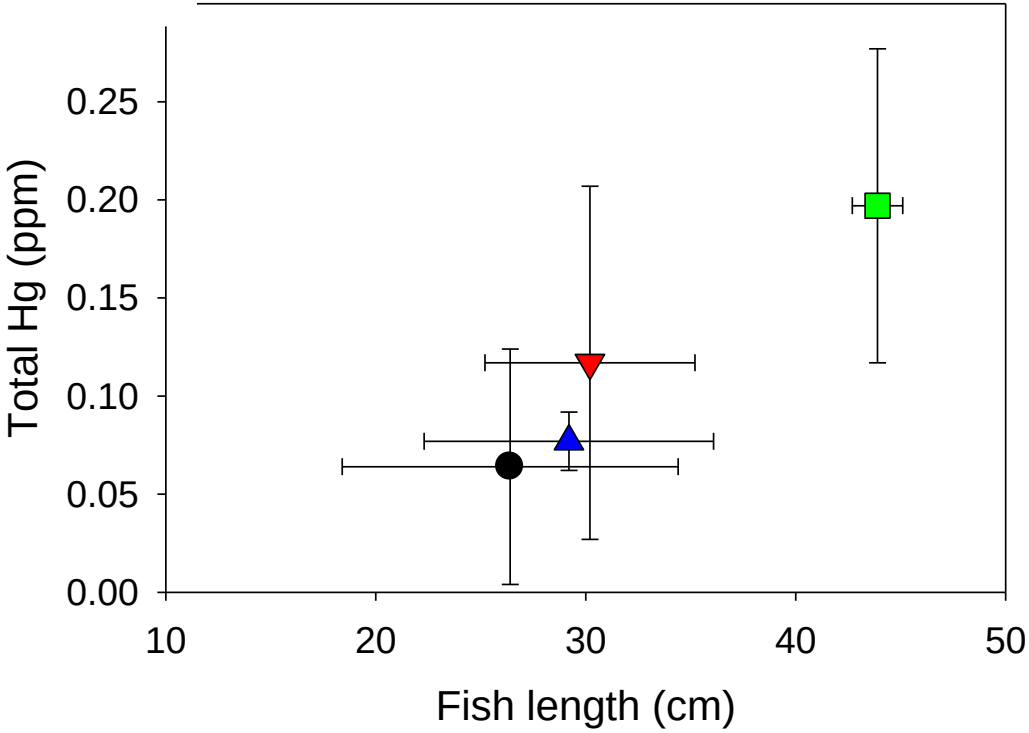


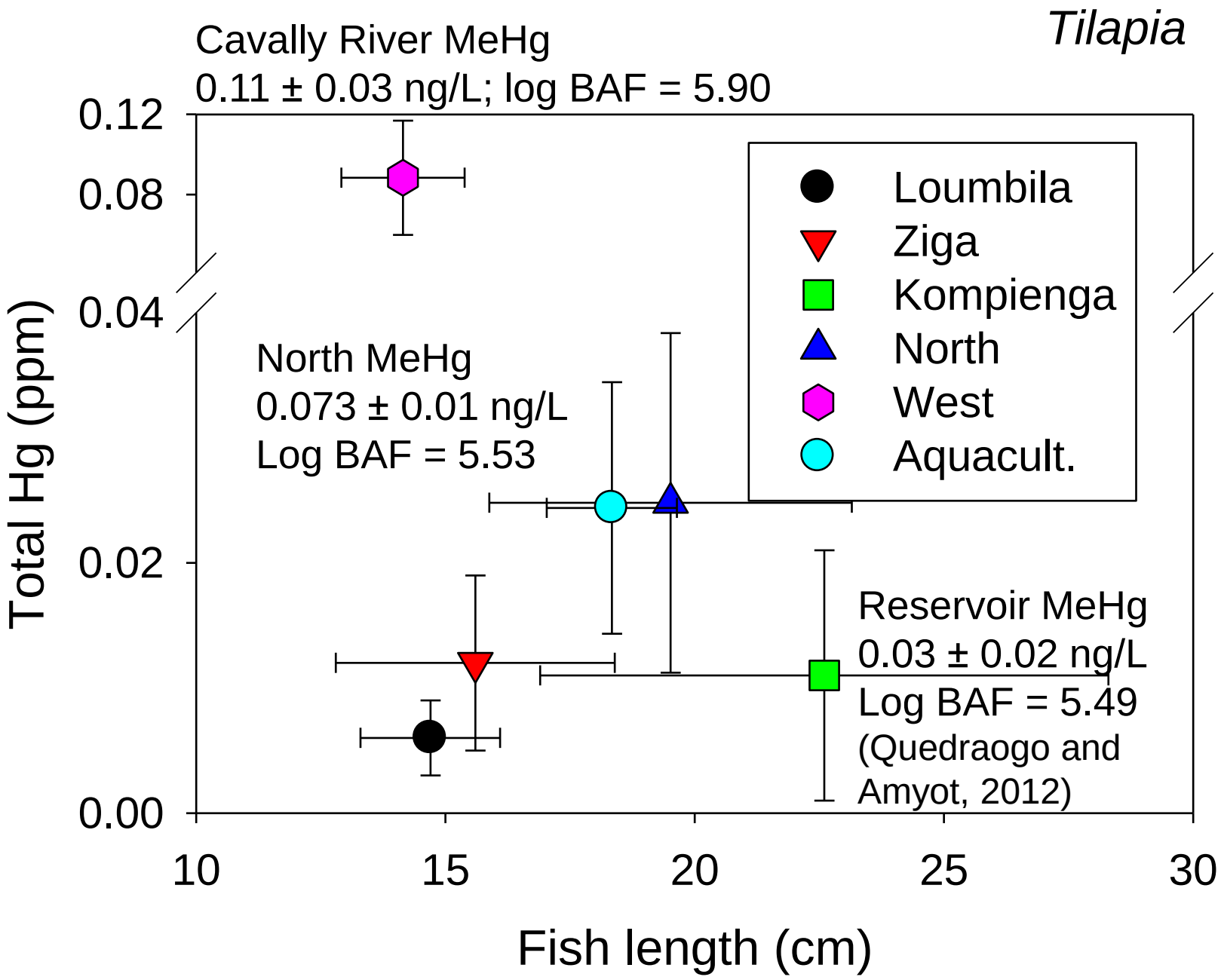
Tilapia sp. (Oreochromis)

1. Concentrations lower than other fish
2. Highest in the West
3. Similar in North and in aquaculture ponds in Cote d'Ivoire
4. Lowest for the Burkina Faso reservoirs (Loumbia; Ziga & Kompienga; Quedraogo and Amyot (2012)
5. US FDA average: 0.013 ± 0.004

Clarias anguillaris

1. Fish from one reservoir were much larger and had higher Hg
2. Fish from north were similar to reservoir fish
3. US FDA average: 0.024 ± 0.054




Tilapia
Cavally River MeHg
0.11 ± 0.03 ng/L; log BAF = 5.90
North MeHg
0.073 ± 0.01 ng/L
Log BAF = 5.53
Reservoir MeHg
0.03 ± 0.02 ng/L
Log BAF = 5.49
(Quedraogo and Amyot, 2012)
Loumbila
Ziga
Kompienga
North
West
Aquacult.
Total Hg (ppm)
0.12
0.08
0.04
0.02
0.00
10
15
20
25
30
Fish length (cm)

Calculated BAF's for different fish species from the West

BAF's for the West based on Cavally R. diss. MeHg	
Oreochromis sp. (omnivore)	5.89
Parachana sp./obscura (carnivore)	6.2/6.49
Heterobranchus longifilis (omnivore)	6.01
Hepsutus ilodoe (carnivore)	6.56
Maricusenius senegelensis	6.4
Clarias gariepinus (omnivore)	6.55
Polypterus endilcheri (carnivore)	6.45

The average fish consumption per capita is 17 kg/yr, or 41 g/d - equivalent to two 5 oz fish meals/wk. Many people consume fish daily. If the consumption was entirely fish from impacted regions, then exposure could exceed the EPA health limit of 0.1 µg/kg body weight per day (red values); shown here for a 60 kg person:

Fish MeHg (µg/g)	Intake (µg/kg/d)	Intake (µg/kg/d)	Intake (µg/kg/d)
	at 41 g/d	*at 62 g/d*	*at 82 g/d*
0.05	0.04	0.06	0.08
0.1	0.08	**0.12**	**0.16**
0.2	**0.16**	**0.25**	**0.33**
0.25	**0.21**	**0.31**	**0.41**
0.3	**0.25**	**0.37**	**0.49**

Summary

1. External sources and long-range atmospheric mercury transport does not account for the elevated levels of Hg in Cote d'Ivoire rivers
2. Mining activities have a substantial impact on the water quality and mercury concentration in Cote d'Ivoire rivers
3. Levels of Hg and MeHg are elevated in some of the waters sampled, especially those impacted by mining activities
4. The fraction of total Hg as MeHg in waters, sediment and fish are similar to found in other riverine systems
5. Bioaccumulation factors increase with fish trophic level, as found in most aquatic systems
6. Levels of MeHg in fish are substantial compared to those found in un-impacted locations and are high enough that people who routinely consume fish from these locations could be exposed to elevated levels of MeHg and be subsequently impacted