# 2008 REGIONAL AMBIENT FISH TISSUE MONITORING PROGRAM; SUMMARY OF THE IOWA FISH ANALYSES

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## Introduction:

To supplement other environmental monitoring programs and to protect the health of people consuming fish from waters within this state, the state of Iowa conducts fish tissue monitoring. Since 1980, the Iowa Department of Natural Resources (IDNR), the United States Environmental Protection Agency Region VII (U.S. EPA), and the University of Iowa Hygienic Laboratory (UHL) have cooperatively conducted annual statewide collections and analyses of fish for toxic contaminants. Beginning in 1983, this monitoring effort became known as the Regional Ambient Fish Tissue Monitoring Program (RAFT). Currently, the RAFT program is the only statewide fish contaminant-monitoring program in Iowa. Historically, the data generated from the RAFT program have enabled IDNR to document temporal changes in contaminant levels and to identify Iowa lakes and rivers where high levels of contaminants in fish potentially threaten the health of fish-consuming Iowans (see IDNR 2006). The Iowa RAFT monitoring program incorporates four different types of monitoring sites: 1) status, 2) trend, 3) random and 4) follow-up.

## Status monitoring:

The majority of RAFT sites sampled each year determine whether the waterbodies meet the "fish consumption" portion of the fishable goal of the federal Clean Water Act. In other words, these sites are used to screen for contamination problems and to determine the water quality "status" of the waterbodies. Analyses for a variety of pesticides, other toxic organic compounds, and metals are conducted on samples of omnivorous bottom-dwelling fish and carnivorous predator fish. Most status sites on rivers and lakes have either never been sampled or have not been sampled within the last five years (rivers) or 10 years (lakes). Staff of the IDNR divisions of Environmental Services and Conservation and Recreation select the status sites. Status monitoring occurs on most types of Iowa waterbodies (interior rivers, border rivers, and manmade and natural lakes) in both rural and urban areas. Lakes and river reaches known to support considerable recreational fishing receive highest priority, but IDNR attempts to sample all lakes and river reaches designated in the *Iowa Water Quality Standards* for recreational fishing. Approximately one-third to one-half of Iowa RAFT status sites are on lakes; the remaining sites are either on interior rivers or on the border rivers (Mississippi, Missouri or Big Sioux).

## Trend monitoring:

In 1994 U.S. EPA Region VII in cooperation with the Region VII states (Iowa, Kansas, Missouri, and Nebraska), identified sites that would be monitored at regular intervals to determine trends in levels of contamination. One sample of three to five common carp from each station is submitted for whole-fish analysis. Whole-fish samples are more likely to contain detectable levels of most contaminants than are fillet samples (edible portions). Examination of the trend monitoring results may help identify temporal changes in contaminant concentrations and may expose new contaminants entering the food chain. From 1996-2005, half of the trend sites were sampled on odd years and the other half were sampled in even years. In 2006, due to a change in RAFT program design (U.S. EPA 2006), all 10 trend sites were sampled. All 10 trend sites were sampled again in 2008 and will be sampled every other year in the future. The following ten sites are Iowa's part of the RAFT trend monitoring program:

1. Mississippi River downstream from Dubuque, Dubuque County
2. Mississippi River downstream from Linwood, Scott County
3. Wapsipinicon River north of Donahue, Scott County
4. Des Moines River at Keosauqua, Van Buren County
5. Little Sioux River near Washta, Ida County
6. Mississippi River at Lansing, Allamakee County
7. Maquoketa River at Maquoketa, Jackson County
8. Iowa River at Wapello, Louisa County
9. Skunk River at Augusta, Lee County
10. Des Moines River at Des Moines, Polk County

**Random Monitoring:**
In 2006, based on recommendations in U.S. EPA's RAFT workplan (U.S. EPA 2006), Iowa began sampling random sites across the state as part of an effort to determine the current level of contaminants in fish tissue on a statewide basis. The 2006 sampling sites were selected from a previous random sampling project and data were collected only from large interior rivers. In 2007, the sample sites were selected from a random list of smaller public lakes and ponds. Given that U.S. EPA Region VII has recently changed the emphasis of the RAFT program again, the future of random sampling for Iowa fish contaminants is uncertain.

**Follow-up Monitoring:**
If the level of a contaminant in a fish tissue sample exceeds IDNR/IDPH advisory trigger levels and/or IDNR levels of concern (Table 1; IDPH 2007), the RAFT program conducts follow-up monitoring to better define the levels of contaminants. For example, if status monitoring shows that contaminant levels in fish from a waterbody exceed IDNR/IDPH advisory trigger levels, additional samples will be collected as part of follow-up monitoring for the next year's RAFT program. If follow-up monitoring confirms that levels of contamination exceed State guidelines for protection of human health, a fish consumption advisory is issued. For more information on consumption advisories see the IDNR RAFT website: http://wqm.igsb.uiowa.edu/wqa/raft.html.

**2008 Results:**
The 2008 RAFT program in Iowa involved the collection of 43 samples from 31 waterbodies (Table 2). In June through October 2008, IDNR fisheries biologists collected, processed and prepared the RAFT samples for shipping. These activities were conducted according to procedures described in the workplan for the 2008 RAFT in Iowa (IDNR 2008). Once frozen, samples were transported or shipped to the Ankeny office of the UHL. The frozen tissue samples were stored at the UHL until shipment to the U.S. EPA Region VII laboratory in Kansas City, Kansas. All samples were shipped to the U.S. EPA Region VII laboratory for analysis by December 2008. Samples were analyzed for a variety of contaminants, including pesticides, other toxic organic compounds, and toxic metals (Table 1). IDNR received results of all sample analyses in June 2008.

Status monitoring in 2008 included collection of 14 composite fillet samples from seven sites. Trend monitoring included collection of nine composite whole-fish samples of common carp from nine sites. Follow-up monitoring included 20 collections of composite samples from 16 sites. The criteria used to evaluate the results of this monitoring are summarized in Table 1. Levels of nearly all contaminants were low in all samples collected.

**References:**

IDNR. 2006. Fish tissue monitoring in Iowa. Water Fact Sheet 2006-5. Geological and Water Survey, Iowa Department of Natural Resources. 4 pgs (*http://wqm.igsb.uiowa.edu/publications/fact%20sheets/2006FactSheets/2006-5%2011x17.pdf*).

IDNR. 2008. Sampling procedures for the 2008 Region VII Ambient Fish Tissue Monitoring Program in Iowa. Water Quality Bureau, Environmental Protection Division, Iowa Department of Natural Resources. 16 pp

IDPH. 2007. Fish consumption advisory protocol in Iowa. Iowa Department of Public Health. 8 pgs.

U.S. EPA. 2006. EPA Region 7 Regional Ambient Fish Tissue Monitoring Program (RAFTMP) program rationale, design and implementation plans for 2006 - 2010. Environmental Services Division, U.S. Environmental Protection Agency Region 7 and the Region 7 Fish Tissue Monitoring Workgroup. 24 pgs.

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| abbreviation | common name | Scientific name | RAFT code |
|---|---|---|---|
| bgill | bluegill | *Lepomis macrochirus* | 8 |
| blcrp | black crappie | *Pomoxis nigromaculatus* | 5 |
| carp | common carp | *Cyprinus carpio* | 12 |
| ccat | channel catfish | *Ictalurus punctatus* | 16 |
| drum | freshwater drum | *Aplodinotus grunniens* | 20 |
| fcat | flathead catfish | *Pylodictis olivarus* | 19 |
| golrdhrs | golden redhorse | *Moxostoma erythrurum* | na |
| lmb | largemouth bass | *Micropterus salmoides* | 31 |
| smb | smallmouth bass | *Micropterus dolomieu* | 47 |
| wbass | white bass | *Morone chrysops* | 57 |
| weye | walleye | *Sander vitreus* | 55 |
| ybull | yellow bullhead | *Ameiurus natalis* | na |

Table 1. Summary of contaminants and respective criteria for samples of fish collected for the 2008 Regional Ambient Fish Tissue (RAFT) monitoring program in Iowa.

| | Contaminant | Detection Level (ppm[2]) | IDNR/IDPH advisory level (ppm) | IDNR/IDPH advisory meal allowance | FDA Action Level (ppm) | IDNR "level of concern" wet weight (ppm) |
|---|---|---|---|---|---|---|
| 1 | chlordane, technical | 0.03 | 0 to 0.6 | unrestricted | 0.3 | |
| | | | >0.6 to <5.0 | one meal per week | | |
| | | | 5.0 and over | do not eat | | |
| 2 | mercury | 0.0181 | 0 to 0.3 | unrestricted | 1.0 | |
| | | | >0.3 to <1.0 | one meal per week | | |
| | | | 1.0 and over | do not eat | | |
| 3 | PCB, Aroclor 1248 | 0.04 | sum = 0 to 0.2 | unrestricted | sum = 2.0 | sum = 1.0 |
| 4 | PCB, Aroclor 1254 | 0.03 | sum >0.2 to <2.0 | one meal per week | | |
| 5 | PCB, Aroclor 1260 | 0.02 | sum 2.0 and over | do not eat | | |
| 6 | chlordane, cis- | 0.002 | | | sum = 0.3 | sum = 0.15 |
| 7 | chlordane, trans- | 0.002 | | | | |
| 8 | nonachlor, cis- | 0.002 | | | | |
| 9 | nonachlor, trans- | 0.002 | | | | |
| 10 | oxychlordane | 0.002 | | | | |
| 11 | DDD, 4,4'- | 0.004 | | | sum = 5.0 | sum = 2.5 |
| 12 | DDE, 4,4'- | 0.005 | | | | |
| 13 | DDT, 4,4'- | 0.005 | | | | |
| 14 | BHC (lindane) | 0.002 | | | none | 0.1 |
| 15 | cadmium | 0.06 | | | none | 0.3 |
| 16 | diazinon[1] | 0.04 | | | none | none |
| 17 | dieldrin | 0.003 | | | 0.3 | 0.15 |
| 18 | heptachlor | 0.003 | | | sum = 0.3 | sum = 0.15 |
| 19 | heptachlor epoxide | 0.003 | | | | |
| 20 | hexachlorobenzene | 0.001 | | | none | 0.01 |
| 21 | lead | 0.17 | | | none | 1.0 |
| 22 | mirex[1] | 0.003 | | | 0.1 | 0.05 |
| 23 | pentacloroanisole | 0.001 | | | none | 0.1 |
| 24 | pentachlorobenzene[1] | 0.001 | | | none | none |
| 25 | selenium | 0.5 | | | none | none |
| 26 | 1,2,4,5-tetrachlorobenzene[1] | 0.004 | | | none | none |
| 27 | trifluralin | 0.003 | | | none | 0.2 |

[1]trend samples only

[2]ppm = parts per million and is equivalent to milligrams/kilogram (mg/kg)

Table 2. Summary of the 2008 IA RAFT trend site samples.

| Site Name | Des Moines River at Des Moines | Des Moines River NNW of Keosauqua | Iowa River E of Wapello | Little Sioux River S of Washta | Maquoketa River NE of Maquoketa | Mississippi River at Lansing | Mississippi River at Linwood | Mississippi River ds of Dubuque | Wapsipinicon River SSE of Grand Mound |
|---|---|---|---|---|---|---|---|---|---|
| County | Polk | Van Buren | Louisa | Cherokee | Jackson | Allamakee | Scott | Dubuque | Scott |
| Date | 9/22/2008 | 8/21/2008 | 9/23/2008 | 8/13/2008 | 8/7/2008 | 9/11/2008 | 8/1/2008 | 8/1/2008 | 9/19/2008 |
| Fish | carp | carp | carp | carp | carp | carp | carp | carp | carp |
| Biopart | whole | whole | whole | whole | whole | whole | whole | whole | whole |
| Sample Type | trend | trend | trend | trend | trend | trend | trend | trend | trend |
| 1,2,4,5-tetrachlorobenzene | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 | <0.004 |
| cadmium | 0.12 | 0.21 | <0.07 | <0.07 | <0.05 | <0.03 | <0.07 | <0.04 | <0.08 |
| chlordane, technical | 0.17 | 0.0833 | 0.067 | <0.03 | 0.039 | <0.03 | 0.047 | <0.03 | 0.042 |
| sum DDT+DDE+DDD | 0.031 | 0.0369 | 0.0422 | 0.0465 | 0.0312 | 0.0154 | 0.0353 | 0.016 | 0.019 |
| dieldrin | <0.012 | 0.026 | 0.035 | 0.012 | 0.014 | <0.0048 | 0.026 | 0.0043 | 0.022 |
| BHC (lindane) | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| heptachlor | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| heptachlor epoxide | 0.0039 | 0.0071 | 0.011 | 0.0034 | 0.0068 | <0.003 | 0.0068 | <0.003 | 0.0086 |
| hexachlorobenzene | 0.0038 | 0.0011 | <0.001 | <0.001 | 0.002 | <0.001 | 0.0017 | <0.001 | <0.001 |
| lead | <0.14 | <0.024 | <0.14 | <0.14 | <0.14 | <0.14 | <0.14 | <0.184 | <0.14 |
| mercury | 0.0738 | 0.102 | 0.135 | 0.0636 | 0.136 | 0.0445 | 0.2014 | 0.104 | 0.0959 |
| mirex | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| sum PCBs (Aroclors 1248+1254+1260) | 0.283 | 0.187 | 0.217 | 0.09 | 0.105 | 0.138 | 0.273 | 0.159 | 0.09 |
| pentachloroanisole (PCA) | 0.0047 | 0.0041 | 0.0076 | <0.001 | 0.0027 | 0.0012 | 0.0042 | 0.0021 | 0.0031 |
| pentachlorobenzene | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| selenium | <1.45 | <1.8 | <1.82 | <1.79 | <1.96 | <1.47 | <1.14 | <1.27 | <1.22 |
| trifluralin | <0.003 | 0.0053 | <0.003 | 0.0059 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |

Table 3. Summary of the 2008 IA RAFT status site samples (except mercury).

| Site Name | Bacon Creek Lake | Cedar River at Palisades Park | Cedar River just downstream of Waterloo | DMACC Pond, Ankeny | Easter Lake on Yeader Creek SE of Des Moines | Grays Lake, Des Moines | Iowa River - Hills CO Park Access - Hills |
|---|---|---|---|---|---|---|---|
| County | Woodbury | Linn | Black Hawk | Polk | Polk | Polk | Johnson |
| Date | 8/19/2008 | 7/15/2008 | 8/7/2008 | 9/15/2008 | 8/27/2008 | 8/27/2008 | 7/31/2008 |
| Fish | ccat | carp | carp | ccat | ccat | ccat | carp |
| Biopart | fillet | fillet | fillet | fillet | fillet | fillet | fillet |
| Sample Type | status | status | status | status | status | status | status |
| cadmium | <0.024 | <0.024 | <0.024 | <0.024 | <0.024 | <0.024 | <0.024 |
| chlordane, technical | <0.03 | <0.03 | <0.03 | <0.03 | 0.065 | 0.055 | <0.03 |
| chlordane, cis- | <0.002 | 0.003 | 0.003 | <0.002 | 0.0084 | 0.0063 | <0.002 |
| nonaclor, cis- | <0.002 | <0.002 | <0.002 | <0.002 | 0.0036 | 0.0024 | <0.002 |
| sum DDT+DDE+DDD | <0.014 | 0.028 | 0.0368 | <0.1076 | 0.0669 | 0.0372 | <0.014 |
| dieldrin | <0.003 | 0.014 | 0.0087 | <0.027 | <0.0032 | 0.011 | 0.0097 |
| BHC (lindane) | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| heptachlor | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| heptachlor epoxide | <0.003 | 0.0053 | 0.0031 | <0.003 | <0.003 | <0.003 | 0.0065 |
| hexachlorobenzene | <0.001 | <0.001 | 0.0011 | <0.001 | <0.001 | <0.001 | <0.001 |
| lead | <0.16 | <0.38 | <0.27 | <0.26 | <0.3 | <0.14 | <0.22 |
| oxychlordane | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| sum PCBs (Aroclors 1248+1254+1260) | <0.09 | 0.132 | 0.132 | <0.09 | 0.158 | 0.094 | <0.09 |
| pentachloroanisole (PCA) | <0.001 | 0.0025 | 0.0014 | <0.023 | 0.0053 | 0.0066 | 0.0067 |
| selenium | <0.45 | <0.78 | <0.45 | <0.45 | <0.45 | <0.45 | <0.44 |
| chlordane, trans- | <0.002 | <0.002 | <0.002 | <0.002 | 0.0038 | 0.0033 | <0.002 |
| nonachlor, trans- | <0.002 | 0.0046 | 0.0037 | <0.0022 | 0.0077 | 0.007 | 0.0021 |
| trifluralin | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | 0.0067 | <0.003 |

Table 4. Summary of the 2008 IA RAFT followup samples (except mercury).

| Site Name | Cedar Bend Lake at Cedar Rapids | Cedar Lake at Cedar Rapids | Cedar Lake at Cedar Rapids | Des Moines River at Des Moines | Little River Lake W of Leon | Skunk River N of Brighton | Upper Iowa River at Decorah |
|---|---|---|---|---|---|---|---|
| County | Linn | Linn | Linn | Polk | Decatur | Washington | Winneshiek |
| Date | 7/21/2008 | 7/17/2008 | 7/17/2008 | 8/22/2008 | 8/15/2008 | 8/27/2008 | 8/6/2008 |
| Fish | carp | ccat | carp | carp | ccat | carp | golrdhrs |
| Biopart | fillet | fillet | fillet | fillet | fillet | fillet | fillet |
| Sample Type | followup | followup | followup | followup | followup | followup | followup |
| cadmium | <0.024 | <0.024 | 0.16 | <0.024 | <0.04 | <0.024 | <0.024 |
| chlordane, technical | 0.03 | 0.18 | 0.034 | <0.031 | <0.15 | <0.03 | <0.03 |
| chlordane, cis- | 0.0037 | 0.025 | 0.005 | <0.0027 | <0.01 | <0.0021 | <0.002 |
| nonaclor, cis- | <0.002 | 0.0096 | <0.002 | <0.002 | <0.01 | <0.002 | <0.002 |
| sum DDT+DDE+DDD | 0.0188 | 0.202 | 0.061 | <0.034 | <0.07 | <0.019 | <0.014 |
| dieldrin | <0.0077 | <0.011 | <0.0052 | <0.024 | <0.015 | <0.017 | <0.003 |
| BHC (lindane) | <0.002 | <0.002 | <0.002 | <0.002 | <0.01 | <0.002 | <0.002 |
| heptachlor | <0.003 | <0.003 | <0.003 | <0.003 | <0.015 | <0.003 | <0.003 |
| heptachlor epoxide | <0.003 | 0.005 | <0.003 | <0.0065 | <0.015 | <0.0047 | <0.003 |
| hexachlorobenzene | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 |
| lead | <0.14 | <0.14 | <0.14 | <0.14 | <0.14 | <0.14 | <0.14 |
| oxychlordane | <0.002 | 0.0036 | <0.002 | <0.002 | <0.01 | <0.002 | <0.002 |
| sum PCBs (Aroclors 1248+1254+1260) | 0.125 | 0.39 | 0.105 | <0.09 | <0.45 | <0.141 | <0.09 |
| pentachloroanisole (PCA) | 0.002 | 0.0078 | 0.0027 | <0.0026 | <0.005 | <0.0017 | <0.001 |
| selenium | <0.83 | <0.67 | <1.24 | <1.07 | <0.45 | <0.88 | <1.11 |
| chlordane, trans- | 0.0026 | 0.013 | 0.0031 | <0.002 | <0.01 | <0.002 | <0.002 |
| nonachlor, trans- | 0.0032 | 0.019 | 0.0029 | <0.0047 | <0.01 | <0.0047 | <0.002 |
| trifluralin | <0.003 | <0.003 | <0.003 | <0.021 | <0.015 | <0.003 | <0.003 |

Table 5. Summary of the 2008 IA RAFT status and follow-up mercury samples.

| Site Name | County | Date | Fish Species (fillet) | Sample Type | mercury (mg/kg) |
|---|---|---|---|---|---|
| Bacon Creek Lake | Woodbury | 8/18/2008 | lmb | status | 0.269 |
| Cedar River at Palisades Park | Linn | 7/15/2008 | wbass | status | 0.132 |
| Cedar River just downstream of Waterloo | Black Hawk | 8/7/2008 | weye | status | 0.212 |
| DMACC Pond, Ankeny | Polk | 9/15/2008 | lmb | status | 0.242 |
| Easter Lake on Yeader Creek SE of Des Moines | Polk | 9/9/2008 | lmb | status | 0.105 |
| Grays Lake, Des Moines | Polk | 9/9/2008 | lmb | status | 0.089 |
| Iowa River - Hills CO Park Access - Hills | Johnson | 7/31/2008 | wbass | status | 0.218 |
| Cedar River W of Osage | Mitchell | 8/11/2008 | smb | followup | 0.19 |
| East Fork Des Moines River at Algona | Kossuth | 9/5/2008 | weye | followup | 0.14 |
| Grade Lake | Clarke | 8/14/2008 | lmb | followup | 0.303 |
| Lake Geode E of Lowell | Henry | 9/18/2008 | lmb | followup | 0.267 |
| Lake of Three Fires NE of Bedford | Taylor | 8/26/2008 | lmb | followup | 0.207 |
| Morman Trail Pond E of Bridgewater | Adair | 9/25/2008 | lmb | followup | 0.22 |
| Morman Trail Pond E of Bridgewater | Adair | 9/25/2008 | weye | followup | 0.361 |
| Red Haw Lake ESE of Chariton | Lucas | 8/18/2008 | lmb | followup | 0.428 |
| Skunk River N of Brighton | Washington | 8/27/2008 | fcat | followup | 0.132 |
| Turkey River S of Garber | Clayton | 8/7/2008 | smb | followup | 0.269 |
| Upper Centerville Reservoir | Appanoose | 8/19/2008 | lmb | followup | 0.522 |
| Upper Iowa River at Decorah | Winneshiek | 8/6/2008 | golrdhrs | followup | 0.351 |
| Volga River near Volga Recreation Area | Fayette | 8/1/2008 | smb | followup | 0.326 |

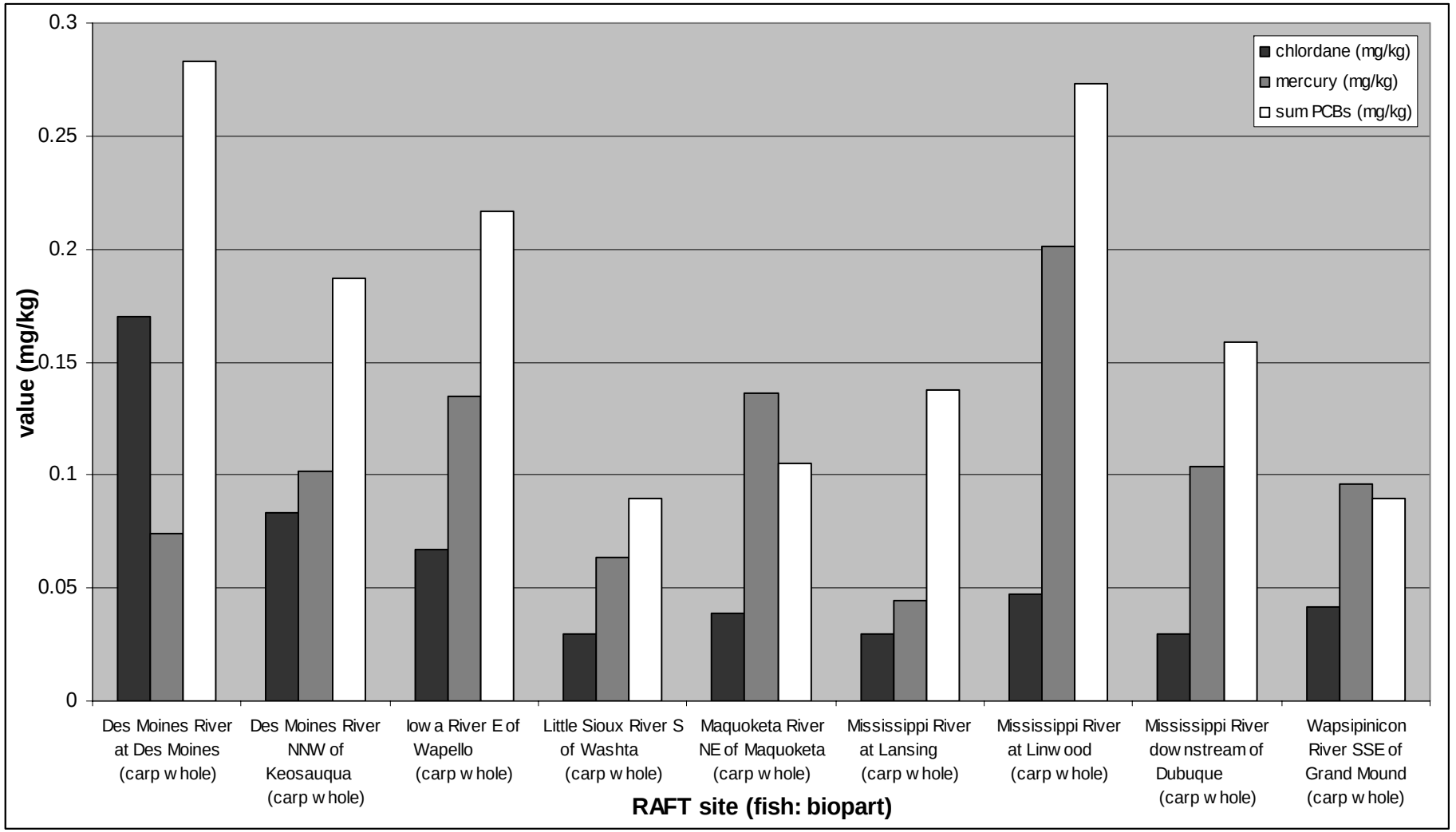


Figure 1. 2008 Iowa RAFT trend site sample results for mercury, chlordane and total PCBs using whole carp.

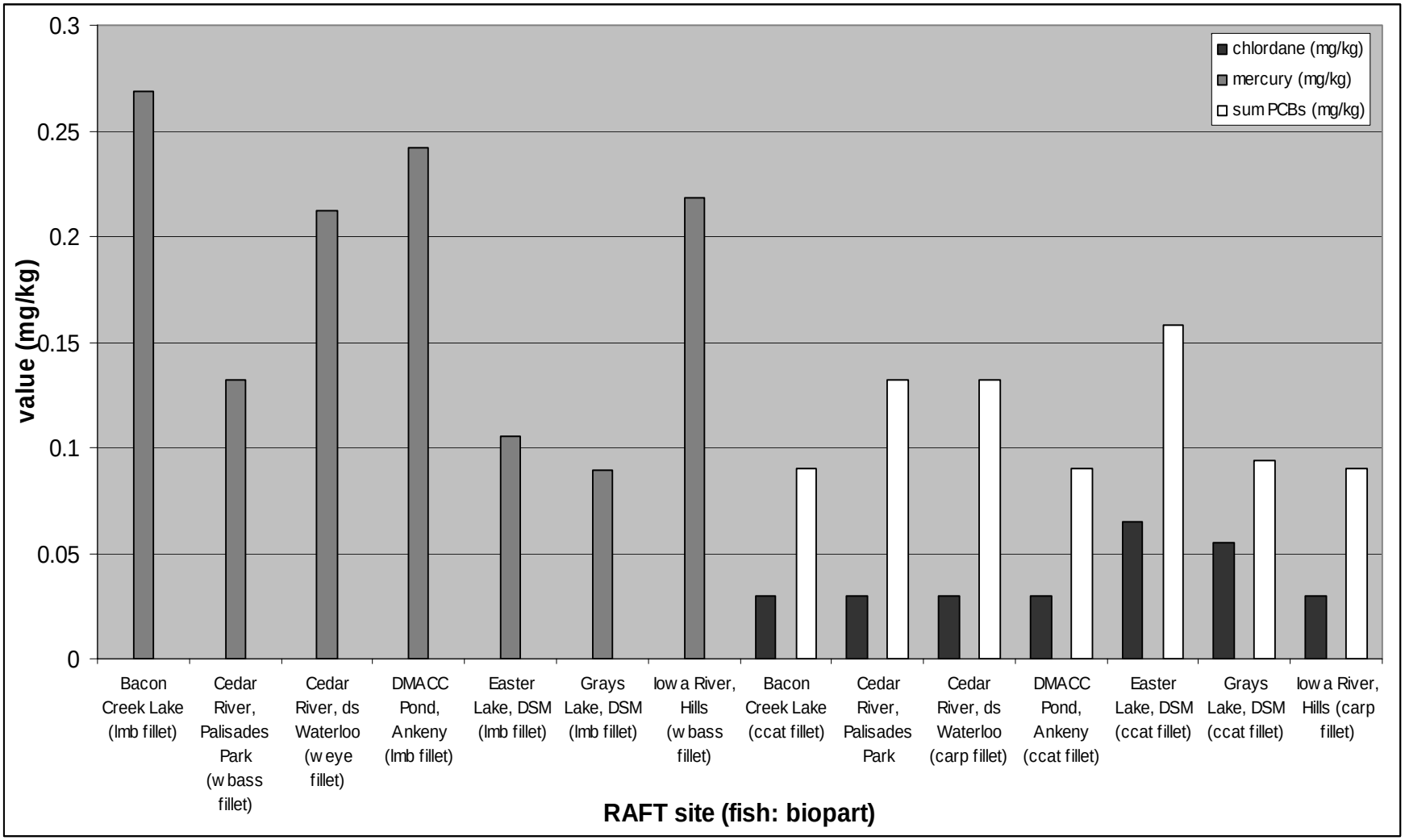


Figure 2. 2008 Iowa RAFT status sample results for chlordane, mercury and total PCBs.

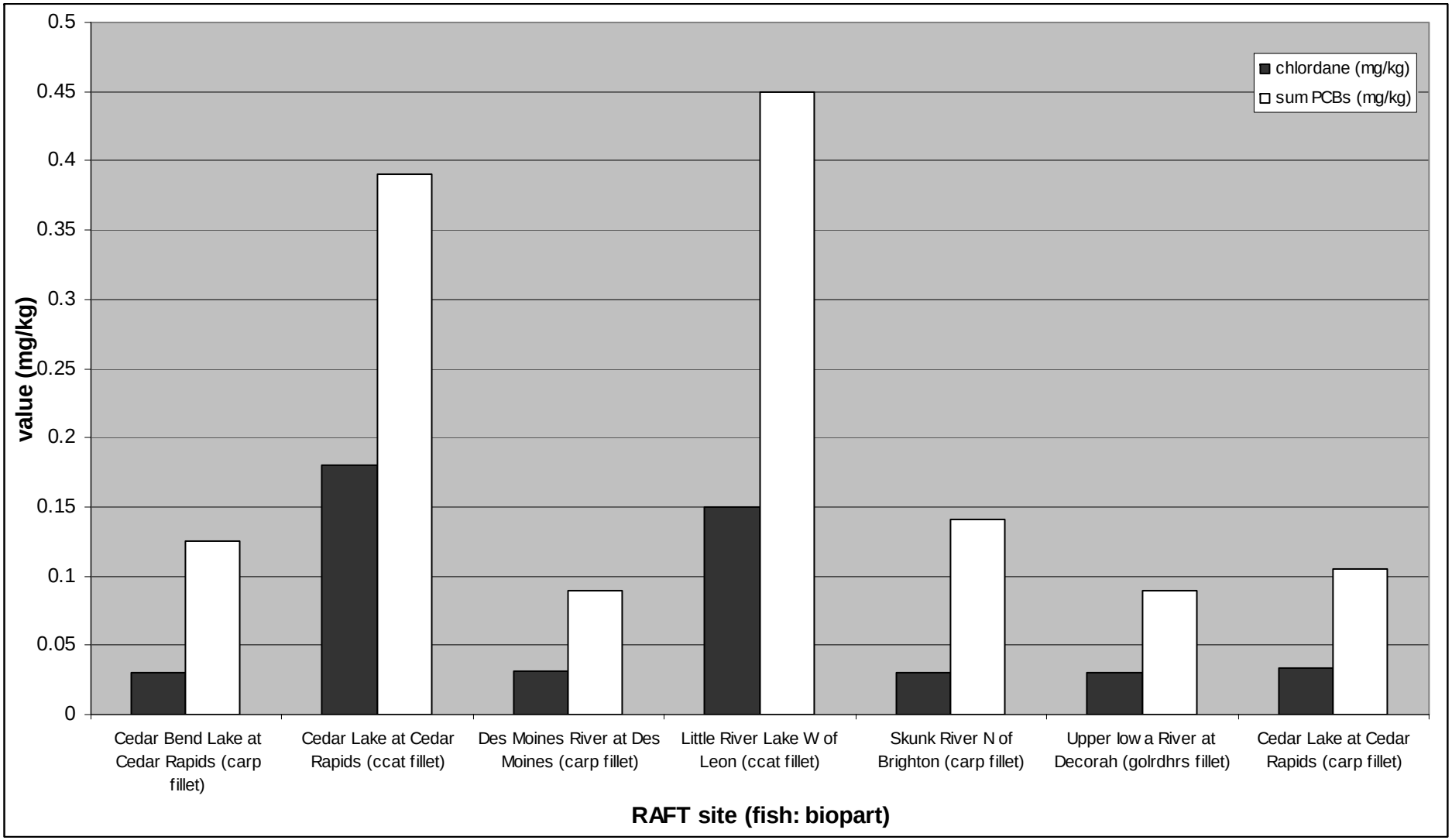


Figure 3. 2008 Iowa RAFT follow-up sample results for chlordane and total PCBs. The level of total PCBs (sum of Aroclors 1248, 1254 and 1260) in the 2008 sample of channel catfish fillets from Little River Lake was below the analytical level of detection (see Table 4) and thus does not exceed the IDNR/IDPH one meal per week advisory level of 0.20 ppm for total PCBs. Previous (2005) RAFT monitoring at this lake showed very low levels of total PCBs in the sample of channel catfish fillets (<0.09 ppm). Although the 2008 sample from Cedar Lake exceeded this advisory trigger, this lake is already covered by a one meal per week consumption advisory.

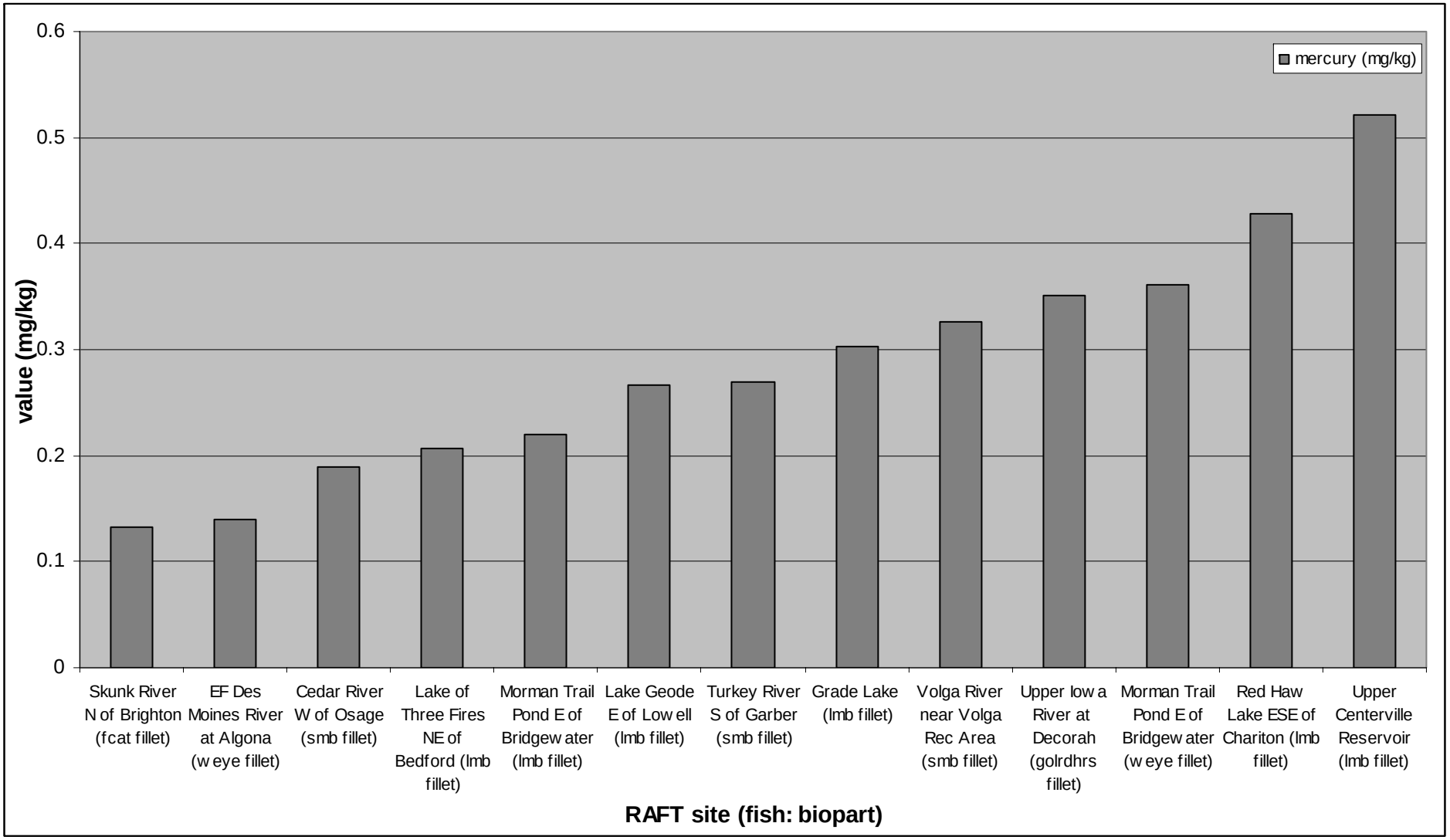


Figure 4. 2008 Iowa RAFT follow-up sample results for mercury. Waters with samples having levels of mercury above the IDNR/IDPH one meal per week advisory trigger of 0.3 ppm are either covered by existing consumption advisories (i.e., Volga and Upper Iowa rivers) or are being sampled as part of RAFT follow-up monitoring in 2009.