2011 REGIONAL AMBIENT FISH TISSUE MONITORING PROGRAM; SUMMARY OF THE IOWA ANALYSES

Prepared by:

Watershed Monitoring and Assessment Section
Iowa Geological and Water Survey Bureau
Environmental Services Division
Iowa Department of Natural Resources

June 2012

Table of Contents	

List of tables:

Table	Title

List of figures:

Figure	Title

List of appendices:

Appendix	Title

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 State Hygienic Laboratory (SHL) 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 five different types of monitoring sites: 1) status, 2) trend, 3) follow-up, 4) turtle, and 5) random.

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 composite 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 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

Trend monitoring was not conducted for the 2011 RAFT. All 10 trend sites, however, will be monitored as part of the 2012 RAFT in Iowa.

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 (Appendix A; 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://www.iowadnr.gov/portals/idnr/uploads/fish/fish_consumption_advisories.pdf. If needed, IDNR Fisheries Bureau will conduct follow-up monitoring separately from the RAFT program to verify high levels of contaminants or to better delineate lengths of river consumption advisories. These follow-up samples are collected before the annual RAFT sampling and are analyzed at SHL.

Turtle Monitoring:
In 2009, IDNR fisheries biologists first collected snapping turtles from nine Iowa lakes as part of RAFT monitoring to better define contaminant levels in Iowa turtle populations. This monitoring used the left front shoulder muscle tissue from 2-3 turtles for the sample that was submitted for analysis following the same protocol used for fish. The turtle monitoring continued in 2010 at four Iowa lakes, was suspended in 2011 and will resume in 2012.

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.

2011 Results:
The 2011 RAFT program in Iowa involved the collection of 136 samples from 29 waterbodies. The high number of samples reflects the switch from fillet predator samples to tissue plug predator samples where the samples are individually analyzed and not composited. In August and September 2011, 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 2011 RAFT in Iowa (IDNR 2011). Once frozen, samples were transported or shipped to the Ankeny office of the SHL. The frozen tissue samples were stored at the SHL 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 2011. Samples were analyzed for a variety of contaminants, including pesticides, other toxic

organic compounds, and toxic metals (Appendix A). IDNR received results of all sample analyses in late May 2012.

Status monitoring in 2011 included collection of 109 fish samples from 24 sites. This was broken down into 21 bottom feeding fish fillet samples from 21 sites and 88 predator fish tissue plug samples from 20 sites.

The RAFT followup monitoring involved the collection of one bottom feeding fish fillet sample from one site and five predator fish tissue plug samples from one site . The special Fisheries Bureau followup monitoring included 12 predator tissue plug samples from five sites.

The results for the 2011 RAFT monitoring in Iowa for the primary contaminants of concern (mercury, PCBs, and chlordane) are summarized in Tables 1 and 2 and in Figures 1 and 2. Appendices B through D contain all data generated by the Iowa portion of the 2011 RAFT program.

A vast majority of the contaminant levels were low with the exception of mercury at approximately 8 sites (Table 1). These results are currently being addressed by IDNR Fisheries bureau with the assistance of the IDNR Watershed Monitoring and Assessment section and the Iowa Department of Public Health.

Table 1. 2011 IA RAFT status and follow-up sampling mercury (Hg) results from predatory fish. All samples were tissue plugs and Hg results are in mg/kg (or ppm).

Site #	RAFT Site Name	Fish	# of Plugs	Hg ave.	Hg StDev	Max Hg	Min Hg
3	Iowa River at Marshalltown	weye	4	0.323	0.045	0.355	0.257
8	Green Valley Lake N of Creston	lmb	4	0.200	0.024	0.224	0.174
40	North Raccoon River NW of Jefferson	weye	4	0.264	0.027	0.287	0.225
54	Des Moines River at U.S. 65/69, Des Moines	fcat	3	0.277	0.104	0.377	0.170
68	Shell Rock River W of Clarksville	weye	4	0.753	0.272	1.000	0.407
86	Lake Iowa N of Millersburg	lmb	5	0.412	0.125	0.542	0.232
111	Nishnabotna River at Hamburg	bcra	3	0.155	0.041	0.201	0.124
117	West Fork Cedar River S of Allison	smb	4	0.415	0.099	0.538	0.303
125	Turkey River S of Garber*	smb	5	0.376	0.102	0.504	0.219
130	Storm Lake at Storm Lake	weye	5	0.078	0.011	0.095	0.066
139	East Nishnabotna River near Red Oak	drum	4	0.295	0.209	0.590	0.105
148	Chariton River N of Centerville	wcra	5	0.316	0.043	0.386	0.269
152	Mississippi River upstream of Princeton	bcra	5	0.103	0.036	0.149	0.064
162	Yellow Smoke Lake	lmb	5	0.697	0.224	1.030	0.398
163	Wapsipinicon River 1 mi. SE of Independence	smb	5	0.245	0.024	0.281	0.227
164	Beaver Lake	lmb	5	0.257	0.077	0.365	0.168
166	Three Mile Lake near Afton*	weye	5	0.120	0.016	0.140	0.100
183	Little Sioux River at Gillet Grove	lmb	5	0.289	0.159	0.557	0.133
187	Badger Creek Lake near Booneville	lmb	5	0.124	0.012	0.143	0.114
273	Iowa River, Alden Canoe Access*	smb	5	0.212	0.085	0.280	0.070
274	Iowa River, Pine Lake State Park – Eldora*	smb	5	0.226	0.076	0.360	0.170
275	WF Des Moines River, Basswood – Emmetsburg*	weye	3	0.113	0.076	0.200	0.060
276	WF Des Moines River, Gotch Park – Humboldt*	weye	3	0.143	0.067	0.220	0.100
277	Mississippi River, Harper's Slough	bcra	5	0.123	0.012	0.140	0.109
278	Mississippi River at Huron Slough, SE of Oakville	wbas	5	0.109	0.024	0.146	0.085
279	Maquoketa River, ds of former Lake Delhi Dam	smb	3	0.320	0.049	0.376	0.289
* indicates a follow-up sample							

Table 2. 2011 IA RAFT status and follow-up advisory contaminant sampling results from bottom feeding fish. All samples were fillets and results are in mg/kg (or ppm).

Samp #	Site #	RAFT Site Name	County	Date	Fish	technical chlordane	sum chlordane isomers[2]	sum PCBs[3]	mercury
1193	3	Iowa River at Marshalltown	Marshall	9/14/2011	carp	<0.03	0.0101	<0.09	0.146
1196	8	Green Valley Lake N of Creston	Union	9/13/2011	ccat	<0.03	<0.01	<0.09	0.0541
1188	33	West Nishnabotna River upstream of Harlan	Shelby	8/17/2011	ccat	<0.03	0.0116	<0.09	0.0283
1197	40	North Raccoon River NW of Jefferson	Greene	9/28/2011	ccat	0.037	0.0511	<0.09	0.119
1180	54	Des Moines River at U.S. 65/69, Des Moines	Polk	9/9/2011	carp	0.034	0.0135	<0.09	0.153
1184	65	Big Sioux River N of Hawarden	Sioux	9/15/2011	ccat	<0.03	0.0101	<0.09	0.056
1189	68	Shell Rock River W of Clarksville	Butler	8/23/2011	carp	<0.03	<0.01	<0.09	0.206
1194	86	Lake Iowa N of Millersburg	Iowa	9/20/2011	ccat	<0.03	<0.01	<0.09	0.0145
1187	111	Nishnabotna River at Hamburg	Fremont	8/25/2011	carp	<0.03	0.0102	<0.09	0.0559
1190	117	West Fork Cedar River S of Allison	Butler	9/16/2011	ccat	<0.03	0.0118	0.091	0.136
1198	130	Storm Lake at Storm Lake	Buena Vista	9/26/2011	ccat	<0.03	0.0103	<0.09	0.0453
1186	139	East Nishnabotna River near Red Oak	Montgomery	8/18/2011	ccat	0.037	0.0151	<0.09	0.039
1181	148	Chariton River N of Centerville	Appanoose	8/19/2011	ccat	<0.03	<0.01	<0.09	0.197
1183	152	Mississippi River upstream of Princeton	Scott	9/6/2011	carp	<0.03	<0.01	<0.09	0.127
1191	163	Wapsipinicon River 1 mi. SE of Independence	Buchanan	9/1/2011	ccat	<0.031	0.0137	<0.09	0.067
1179	164	Beaver Lake	Dallas	8/31/2011	ccat	<0.03	<0.01	<0.09	0.0564
1185	183	Little Sioux River at Gillet Grove	Clay	9/14/2011	ccat	<0.03	<0.01	<0.09	0.115
1195	187	Badger Creek Lake near Booneville	Madison	9/29/2011	bbull	<0.03	<0.01	<0.09	0.0315
1288	250	Seminole Valley Park Lakes[1]	Linn	9/15/2011	carp	<0.03	<0.01	<0.09	0.138
1182	277	Mississippi River, Harper's Slough near Harper's Ferry	Allamakee	9/23/2011	carp	<0.03	<0.01	<0.09	0.0643
1192	278	Mississippi River at Huron Slough, 6.5 mi. SE of Oakville	Des Moines	8/19/2011	ccat	<0.03	0.0122	0.109	0.141
1239	279	Maquoketa River, ds of former site of Lake Delhi Dam	Delaware	8/30/2011	ccat	<0.03	<0.01	<0.09	0.169

[1] indicates a follow-up sample

[2] sum chlordane isomers = cis- chlordane + trans- chlordane + oxychlordane + cis- nonachlor + trans- nonachlor

[3] sum PCBs = Aroclor 1248 + Aroclor 1254 + Aroclor 1260

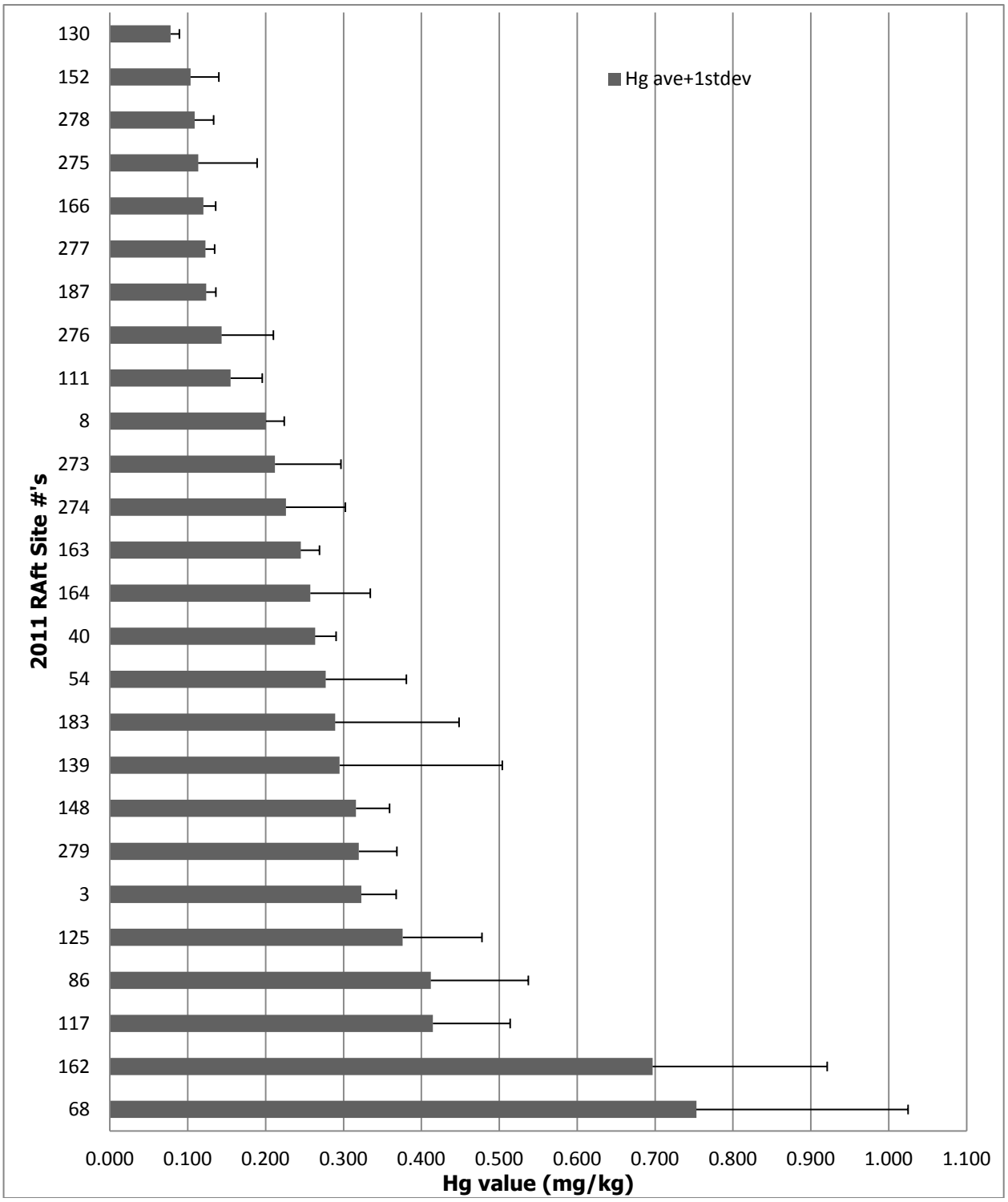

Figure 1. 2011 IA RAFT mercury status and follow-up sample results for predatory fish. All samples were tissue plugs and results are in mg/kg (or ppm). All of the values above 0.3 mg/kg have, or will be, addressed by IDNR through the issuance or continuation of consumption advisories or with follow-up monitoring in 2012. See Appendix B for a list of 2011 RAFT site numbers.

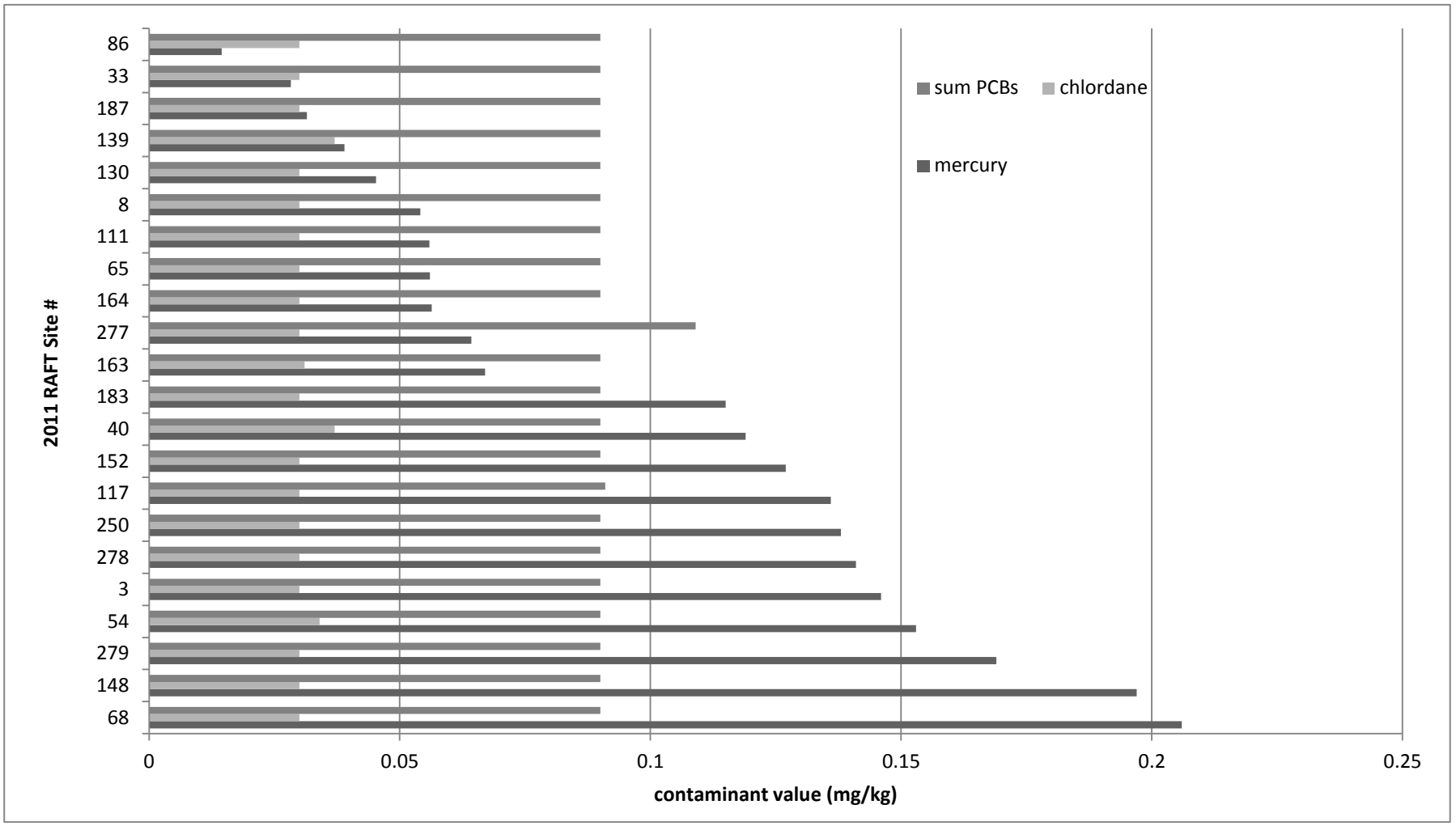

Figure 2. 2011 IA RAFT status sample results for chlordane, mercury and total PCBs. All samples were composited fillets from bottom feeding fish (primarily common carp and channel catfish). All of the values above advisory levels have, or will be, addressed by IDNR through the issuance or continuation of consumption advisories or with follow-up monitoring in 2012. See Appendix B for a list of 2011 RAFT site numbers.

References:

IDNR. 2006. Fish tissue monitoring in Iowa. Water Fact Sheet 2006-5. Geological and Water Survey, Iowa Department of Natural Resources. 4 pgs (ftp://ftp.igsb.uiowa.edu/igspubs/pdf/WFS-2006-05.pdf).

IDNR. 2011. Sampling Procedures for the 2011 Region VII Ambient Fish Tissue Monitoring Program in Iowa. Geological and Water Survey Bureau, Environmental Services 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.

Appendix A

Summary of contaminants and respective criteria for samples of fish collected for the 2011 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)

Appendix B

Complete listing and full description of the 2011 IA RAFT sampling sites.

Site #	RAFT ID	RAFT Site Name	County	Waterbody Type
3	5683	Iowa River at Marshalltown	Marshall	River/Stream
8	5978	Green Valley Lake N of Creston	Union	Lake
33	6836	West Nishnabotna River upstream of Harlan	Shelby	River/Stream
40	6977	North Raccoon River NW of Jefferson	Greene	River/Stream
54	7408	Des Moines River at U.S. 65/69, Des Moines	Polk	River/Stream
65	8316	Big Sioux River N of Hawarden	Sioux	River/Stream
68	8491	Shell Rock River W of Clarksville	Butler	River/Stream
86	9148	Lake Iowa N of Millersburg	Iowa	Lake
111	6495	Nishnabotna River at Hamburg	Fremont	River/Stream
117	6843	West Fork Cedar River S of Allison	Butler	River/Stream
125	7789	Turkey River S of Garber	Clayton	River/Stream
130	7862	Storm Lake at Storm Lake	Buena Vista	Lake
139	8498	East Nishnabotna River near Red Oak	Montgomery	River/Stream
148	8803	Chariton River N of Centerville	Appanoose	River/Stream
152	9052	Mississippi River upstream of Princeton	Scott	River/Stream
162	10236	Yellow Smoke Lake	Crawford	Lake
163	10237	Wapsipinicon River 1 mi. SE of Independence	Buchanan	River/Stream
164	10238	Beaver Lake	Dallas	Lake
166	10240	Three Mile Lake near Afton	Union	Lake
183	9177	Little Sioux River at Gillet Grove	Clay	River/Stream
187	N/A	Badger Creek Lake near Booneville	Madison	Lake
250	N/A	Seminole Valley Park Lakes	Linn	Lake
273	N/A	Iowa River, Alden Canoe Access	Hardin	River/Stream
274	N/A	Iowa River, Pine Lake State Park - Eldora	Hardin	River/Stream
275	N/A	West Fork Des Moines River, Basswood Rec. Area - Emmetsburg	Palo Alto	River/Stream
276	N/A	West Ford Des Moines River, Gotch Park - Humboldt	Humboldt	River/Stream
277	N/A	Mississippi River, Harper's Slough near Harper's Ferry	Allamakee	River/Stream
278	N/A	Mississippi River at Huron Slough, 6.5 mi. SE of Oakville	Des Moines	River/Stream
279	N/A	Maquoketa River, downriver of former site of Lake Delhi Dam	Delaware	River/Stream

Appendix C

Complete listing of the 2011 IA RAFT predator fish sampling results. See Appendix B for a list of 2011 RAFT site numbers and Appendix E for a list of fish names and abbreviations.

Samp#	Site ID	Fish	Biopart	SampleType	mean length (cm)	mean weight (g)	mercury (mg/kg)
1158	273	smb	plug	fisheries followup	33	510	0.2
1159	273	smb	plug	fisheries followup	35	725	0.26
1160	273	smb	plug	fisheries followup	33	480	0.07
1161	273	smb	plug	fisheries followup	34.2	605	0.25
1162	273	smb	plug	fisheries followup	34.5	645	0.28
1163	274	smb	plug	fisheries followup	38.5	795	0.36
1164	274	smb	plug	fisheries followup	36.3	695	0.19
1165	274	smb	plug	fisheries followup	35.2	620	0.17
1166	274	smb	plug	fisheries followup	37	760	0.2
1167	274	smb	plug	fisheries followup	37.3	810	0.21
1168	275	weye	plug	fisheries followup	46	1025	0.08
1169	275	weye	plug	fisheries followup	46.5	1190	0.2
1170	275	weye	plug	fisheries followup	47.5	1250	0.06
1171	276	weye	plug	fisheries followup	38.3	490	0.22
1172	276	weye	plug	fisheries followup	37.5	495	0.1
1173	276	weye	plug	fisheries followup	30	265	0.11
1174	166	weye	plug	fisheries followup	43.18	624.25	0.13
1175	166	weye	plug	fisheries followup	37.846	456.27	0.11
1176	166	weye	plug	fisheries followup	38.354	454	0.12
1177	166	weye	plug	fisheries followup	37.846	417.68	0.1
1178	166	weye	plug	fisheries followup	41.656	569.77	0.14
1199	187	lmb	plug	status	35.81	630.5	0.143
1200	187	lmb	plug	status	35.05	653.2	0.129
1201	187	lmb	plug	status	35.05	721.2	0.118
1202	187	lmb	plug	status	33.02	503.5	0.114
1203	187	lmb	plug	status	33.02	489.9	0.114
1204	164	lmb	plug	status	36.3	645	0.214
1205	164	lmb	plug	status	37.1	780	0.239
1206	164	lmb	plug	status	36.1	690	0.365
1207	164	lmb	plug	status	37.3	735	0.301
1208	164	lmb	plug	status	37.6	790	0.168
1209	148	wcra	plug	status	21.5	100	0.299
1210	148	wcra	plug	status	20.8	95	0.386
1211	148	wcra	plug	status	20.5	95	0.269
1212	148	wcra	plug	status	20.8	95	0.31
1213	148	wcra	plug	status	21.5	105	0.316
1214	54	fcat	plug	status	56.1	2025	0.284
1215	54	fcat	plug	status	42.9	795	0.17
1216	54	fcat	plug	status	48.3	1180	0.377
1217	139	fcat	plug	status	38.1	671	0.276
1218	139	fcat	plug	status	37.3	671	0.209
1219	139	fcat	plug	status	51	1704	0.59
1220	139	fcat	plug	status	37.3	671	0.105
1221	8	lmb	plug	status	35.56	666.8	0.224
1222	8	lmb	plug	status	34.04	555.7	0.187
1223	8	lmb	plug	status	32	385.6	0.216
1224	8	lmb	plug	status	32.51	496.7	0.174

Appendix C, continued.

Complete listing of the 2011 IA RAFT predator fish sampling results.

Samp#	Site ID	Fish	Biopart	SampleType	mean length (cm)	mean weight (g)	mercury (mg/kg)
1225	3	weye	plug	status	42.5	615	0.332
1226	3	weye	plug	status	42.5	665	0.355
1227	3	weye	plug	status	43.5	615	0.257
1228	3	weye	plug	status	49.2	990	0.347
1229	86	lmb	plug	status	34.3	560	0.542
1230	86	lmb	plug	status	34.6	555	0.519
1231	86	lmb	plug	status	32.6	480	0.232
1232	86	lmb	plug	status	33	415	0.398
1233	86	lmb	plug	status	34.4	540	0.369
1234	183	lmb	plug	status	41.91	1179.33	0.247
1235	183	lmb	plug	status	43.942	1215.62	0.557
1236	183	lmb	plug	status	38.1	866.36	0.232
1237	183	lmb	plug	status	40.132	1077.28	0.277
1238	183	lmb	plug	status	40.894	988.83	0.133
1240	279	smb	plug	status	35.6	662	0.289
1241	279	smb	plug	status	30.9	352	0.294
1242	279	smb	plug	status	32.6	467	0.376
1243	278	wbass	plug	status	25.5	212	0.0974
1244	278	wbass	plug	status	25	212	0.0846
1245	278	wbass	plug	status	25.8	224	0.12
1246	278	wbass	plug	status	24.5	190	0.0959
1247	278	wbass	plug	status	28.5	294	0.146
1248	277	bcra	plug	status	22.8	160	0.12
1249	277	bcra	plug	status	22.8	180	0.128
1250	277	bcra	plug	status	24.1	220	0.116
1251	277	bcra	plug	status	25.4	270	0.14
1252	277	bcra	plug	status	27	260	0.109
1253	152	bcra	plug	status	26.9	340	0.068
1254	152	bcra	plug	status	26.3	300	0.149
1255	152	bcra	plug	status	24.8	280	0.0644
1256	152	bcra	plug	status	24.1	260	0.122
1257	152	bcra	plug	status	26.5	324	0.114
1258	111	bcra	plug	status	24.9	266	0.201
1259	111	bcra	plug	status	23.4	196	0.14
1260	111	bcra	plug	status	17.8	82	0.124
1261	40	weye	plug	status	31.8	264	0.287
1262	40	weye	plug	status	37.1	438	0.275
1263	40	weye	plug	status	34.3	309	0.225
1264	40	weye	plug	status	34.3	325	0.267
1265	68	weye	plug	status	47.3	1013	0.668
1266	68	weye	plug	status	48.1	1046	1
1267	68	weye	plug	status	51.4	1149	0.407
1268	68	weye	plug	status	42.1	711	0.937
1269	130	weye	plug	status	39.9	600	0.081
1270	130	weye	plug	status	39.1	552	0.0952
1271	130	weye	plug	status	38.9	518	0.0659
1272	130	weye	plug	status	34.8	363	0.0706
1273	130	weye	plug	status	36.1	359	0.0772

Appendix C, continued.

Complete listing of the 2011 IA RAFT predator fish sampling results.

Samp#	Site ID	Fish	Biopart	SampleType	mean length (cm)	mean weight (g)	mercury (mg/kg)
1274	163	smb	plug	status	34.6	595	0.227
1275	163	smb	plug	status	32.8	519	0.281
1276	163	smb	plug	status	33.6	573	0.228
1277	163	smb	plug	status	32.8	501	0.259
1278	163	smb	plug	status	32.4	500	0.23
1279	117	smb	plug	status	42.4	1164	0.379
1280	117	smb	plug	status	41.1	1052	0.439
1281	117	smb	plug	status	35.9	778	0.538
1282	117	smb	plug	status	37.7	842	0.303
1283	162	lmb	plug	status	45.2	1222	0.684
1284	162	lmb	plug	status	37.3	719	1.03
1285	162	lmb	plug	status	39.6	1056	0.398
1286	162	lmb	plug	status	38.9	861	0.671
1287	162	lmb	plug	status	37.1	691	0.701
1289	125	smb	plug	followup	40.4	856	0.377
1290	125	smb	plug	followup	41.4	1041	0.504
1291	125	smb	plug	followup	40.1	861	0.388
1292	125	smb	plug	followup	47	1334	0.392
1293	125	smb	plug	followup	39.6	962	0.219

Appendix D

Complete listing of the 2011 IA RAFT bottom feeding fish sampling results. See Appendix B for a list of 2011 RAFT site numbers and Appendix E for a list of fish names and abbreviations.

Samp #	Site #	Fish	Biopart	Sample Type	BHC (Lindane)	cadmium (Total)	chlordane, cis-	chlordane, technical	chlordane, trans-	DDD	DDE	DDT	dieldrin
1179	164	ccat	fillet	status	UJ0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	<0.005	<0.005	<0.003
1180	54	carp	fillet	status	<0.002	UJ0.02	0.0036	0.034	<0.002	<0.004	0.018	<0.005	0.0053
1181	148	ccat	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	<0.005	<0.005	<0.003
1182	277	carp	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	<0.005	<0.005	<0.003
1183	152	carp	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	<0.005	<0.005	<0.003
1184	65	ccat	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	<0.005	<0.005	<0.003
1185	183	ccat	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	<0.005	<0.005	<0.003
1186	139	ccat	fillet	status	<0.002	UJ0.02	0.0031	0.037	0.0025	<0.004	0.0073	<0.005	0.0061
1187	111	carp	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	0.0061	<0.005	0.013
1188	33	ccat	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	0.0091	<0.005	0.0052
1189	68	carp	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	0.0074	<0.005	<0.003
1190	117	ccat	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.0059	0.022	<0.005	0.011
1191	163	ccat	fillet	status	<0.002	UJ0.02	0.0034	<0.031	<0.002	<0.004	0.0071	<0.005	<0.003
1192	278	ccat	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	0.008	<0.005	<0.003
1193	3	carp	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	0.005	<0.005	<0.003
1194	86	ccat	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	<0.005	<0.005	<0.003
1195	187	bbull	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	<0.005	<0.005	<0.003
1196	8	ccat	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	<0.005	<0.005	0.055
1197	40	ccat	fillet	status	<0.002	UJ0.02	0.0023	0.037	0.0028	0.0083	0.027	<0.005	0.0063
1198	130	ccat	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.006	0.045	<0.005	0.0038
1239	279	ccat	fillet	status	<0.002	UJ0.02	<0.002	<0.03	<0.002	<0.004	0.008	<0.005	<0.003
1288	250	carp	fillet	followup	UJ0.002	UJ0.02	UJ0.003	<0.03	UJ0.002	UJ0.004	J0.0067	UJ0.005	UJ0.003

Appendix D, continued.

Complete listing of the 2011 IA RAFT bottom feeding fish sampling results.

Samp #	Site #	Fish	Biopart	Sample Type	heptachlor	heptachlor epoxide	hexa chloro benzene	lead	mean length (cm)	mean weight (g)	mercury	nonachlor, cis-	nonachlor, trans-
1179	164	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	51	1272	0.0564	<0.002	<0.002
1180	54	carp	fillet	status	<0.003	<0.003	<0.001	UJ0.11	51.1	1821	0.153	<0.002	0.0039
1181	148	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	42.8	694	0.197	<0.002	<0.002
1182	277	carp	fillet	status	<0.003	<0.003	<0.001	UJ0.11	41.74	1136	0.0643	<0.002	<0.002
1183	152	carp	fillet	status	<0.003	<0.003	<0.001	UJ0.11	44.08	1286.8	0.127	<0.002	<0.002
1184	65	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	42.418	587.4	0.056	<0.002	0.0021
1185	183	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	47.583	1062.91	0.115	<0.002	<0.002
1186	139	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	44.2	731	0.039	<0.002	0.0055
1187	111	carp	fillet	status	<0.003	<0.003	<0.001	UJ0.11	49	1818	0.0559	<0.002	0.0022
1188	33	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	40.7	621	0.0283	<0.002	0.0036
1189	68	carp	fillet	status	<0.003	<0.003	<0.001	UJ0.11	49.5	1494	0.206	<0.002	<0.002
1190	117	ccat	fillet	status	<0.003	0.0042	<0.001	UJ0.1	49.3	1123	0.136	<0.002	0.0038
1191	163	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	39.3	581	0.067	<0.002	0.0043
1192	278	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	45.4	756	0.141	<0.002	0.0042
1193	3	carp	fillet	status	<0.003	<0.003	<0.001	UJ0.11	44.32	1168	0.146	<0.002	0.0021
1194	86	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	38	475	0.0145	<0.002	<0.002
1195	187	bbull	fillet	status	<0.003	<0.003	<0.001	UJ0.11	32.07	556.8	0.0315	<0.002	<0.002
1196	8	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	51.31	1442.4	0.0541	<0.002	<0.002
1197	40	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	41.8	584	0.119	<0.002	0.005
1198	130	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.11	42.6	652	0.0453	<0.002	0.0023
1239	279	ccat	fillet	status	<0.003	<0.003	<0.001	UJ0.1	44.475	702.25	0.169	<0.002	0.002
1288	250	carp	fillet	followup	UJ0.003	UJ0.003	UJ0.001	UJ0.11	49.4	1563	0.138	UJ0.002	UJ0.002

Appendix D, continued.

Complete listing of the 2011 IA RAFT bottom feeding fish sampling results.

Samp #	Site #	Fish	Biopart	Sample Type	number of specimens	number of species	oxy chlordane	PCB, Aroclor 1248	PCB, Aroclor 1254	PCB, Aroclor 1260	penta chloro anisole (PCA)	selenium	trifluralin
1179	164	ccat	fillet	status	4	1	<0.002	<0.04	<0.03	<0.02	<0.001	UJ0.33	<0.003
1180	54	carp	fillet	status	3	1	<0.002	<0.04	<0.03	<0.02	0.0014	J0.95	<0.003
1181	148	ccat	fillet	status	5	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.62	<0.003
1182	277	carp	fillet	status	5	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.8	<0.003
1183	152	carp	fillet	status	5	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.48	<0.003
1184	65	ccat	fillet	status	5	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.81	<0.003
1185	183	ccat	fillet	status	3	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.98	<0.003
1186	139	ccat	fillet	status	5	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.72	0.06
1187	111	carp	fillet	status	4	1	<0.002	<0.04	<0.03	<0.02	0.001	1.34	<0.003
1188	33	ccat	fillet	status	4	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.77	<0.003
1189	68	carp	fillet	status	5	1	<0.002	<0.04	<0.03	<0.02	<0.001	1.19	<0.003
1190	117	ccat	fillet	status	4	1	<0.002	<0.04	<0.03	0.021	0.001	J0.65	<0.003
1191	163	ccat	fillet	status	5	1	<0.002	<0.04	<0.03	<0.02	<0.001	1.02	<0.003
1192	278	ccat	fillet	status	5	1	<0.002	<0.04	<0.03	0.039	<0.001	1	<0.003
1193	3	carp	fillet	status	5	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.97	<0.003
1194	86	ccat	fillet	status	5	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.44	<0.003
1195	187	bbull	fillet	status	4	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.81	<0.003
1196	8	ccat	fillet	status	3	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.51	<0.003
1197	40	ccat	fillet	status	5	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.6	<0.003
1198	130	ccat	fillet	status	5	1	<0.002	<0.04	<0.03	<0.02	<0.001	J0.46	<0.003
1239	279	ccat	fillet	status	4	1	<0.002	<0.04	<0.03	<0.02	<0.001	UJ0.32	<0.003
1288	250	carp	fillet	followup	4	1	<0.002	<0.04	<0.03	<0.02	UJ0.001	1.05	UJ0.003

< = The analyte was not detected at or above the reporting limit (U or K).
J = The identification of the analyte is acceptable; the reported value is an estimate.
UJ = The analyte was not detected at or above the reporting limit. The reported value is an estimate.

Appendix E

Fish and turtle species table that includes: common and Scientific names, abbreviations and RAFT codes.

abbreviation	common name	Scientific name	RAFT code
bbull	black bullhead	*Ameiurus melas*	4
bcra	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 olivaris*	19
gordhrs	golden redhorse	*Moxostoma erythrurum*	390
lmb	largemouth bass	*Micropterus salmoides*	31
shdrdhrs	shorthead redhorse	*Moxostoma macrolepidotum*	192
smb	smallmouth bass	*Micropterus dolomieu*	47
turtle	snapping turtle	*Chelydra serpentina*	n/a
wbass	white bass	*Morone chrysops*	57
wcra	white crappie	*Pomoxis annularis*	59
weye	walleye	*Sander vitreus*	55
yper	yellow perch	*Perca flavescens*	63