Mercury Concentrations in Fish from Pueblo Reservoir

Water Quality Control Division
Colorado Department of Public Health and Environment

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by Lucia Machado
Monitoring Unit, Water Quality Control Division

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This report is available on the CDPHE website at:
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For additional information regarding this report please contact Lucia Machado in the Colorado Department of Public Health and Environment, Water Quality Control Division, at 303-692-3585.

4300 Cherry Creek Drive South
Denver CO 80246-1530

Water Body Identification (WBID): COARMA01
Pueblo Reservoir

Table of Contents

Summary

The Colorado Department of Public Health and Environment's Water Quality Control Division investigated the concentrations of mercury in edible portion (fillets) of fish collected in Pueblo Reservoir. The division collected 60 walleye, 63 wipers, 16 channel catfish, 1 tiger musky, 9 spotted bass and 5 black crappie from Pueblo Reservoir, with the assistance of the Colorado Division of Wildlife, in October 2004. Composite samples of fillets from each species were analyzed by the Department of Public Health and Environment's laboratory and by the U.S. Environmental Protection Agency, Region 8 laboratory.

All samples that were analyzed by the department's laboratory had concentrations of mercury below the method detection limits (MDL). MDLs were 0.3 mg/kg (wet weight) for analyses conducted in December 2004 and 0.1 mg/kg for analyses conducted in February 2005. Samples analyzed in March 2005 by the EPA laboratory had mercury concentrations that ranged from <0.016 mg/kg to 0.1 mg/kg. The EPA laboratory's reporting limits ranged from 0.014 to 0.022 mg/kg.

All sample concentrations were below the department's current action level for mercury of 0.5 mg/kg (wet weight). The information gathered from this study was used to assess the potential health risk from mercury to the public from consumption of those fish. At this time, the division is not recommending that restrictions be issued on the consumption of any fish caught in this reservoir due to mercury.

Introduction

Mercury enters the environment as a result of natural events such as erosion of soils, volcanoes, fires and surface degassing and from anthropogenic sources such as industrial processes, commercial products and the combustion of fuels. It is found everywhere, transported in the atmosphere, deposited over land and water surfaces, and eventually finds its way into rivers and lakes. Since the 19th century, the total amount of mercury in the environment has increased by a factor of two to five above pre-industrial levels. (EPA Mercury Research Strategy, Sept. 2000)

Because mercury and its compounds are persistent and bioaccumulative, they pose risks of mercury poisoning for humans and animals. The organic form of mercury, methylmercury, is the most toxic form and most readily bioaccumulates in the tissues of animals and humans. Inorganic mercury, which is less efficiently absorbed and more readily eliminated from the body than methylmercury, does not tend to bioaccumulate.

Mercury bioaccumulates most efficiently in the aquatic food web, especially in fish, which bioaccumulate high concentrations of mercury. Nearly all of the mercury that accumulates in fish tissue is methylmercury. Because consumption of fish is the major source of mercury to humans, the monitoring of mercury in fish can provide the most direct indication of the potential risks.

This study of Pueblo Reservoir is part of a larger division study that started in 2004 to quantify the levels of mercury in fish in selected reservoirs throughout the state. Pueblo Reservoir was selected for evaluation because of the high angler use and the abundance of species that are known to bioaccumulate mercury at levels that pose health risks and are harvested by the public.

Pueblo Reservoir, also known as Lake Pueblo, was opened to the public in 1975, as part of the Lake Pueblo State Park. Pueblo Reservoir is a 4,646 surface-acre waterbody used for water-skiing, sailing, swimming and fishing. There are two full-service marinas and two boat ramps at the reservoir. It is located approximately six miles west of the City of Pueblo, within the Arkansas River basin, in southern Colorado.

Pueblo Reservoir is heavily used for recreation and fishing. Division of Wildlife manages the reservoir as a walleye fishery. They collect walleye eggs and milt and hatch the eggs at a Division of Wildlife hatchery. The fry and fingerlings are either put back in the reservoir, stocked in other lakes in the state or sent out-of-state. The reservoir and the walleye are valuable to the community and to the Division of Wildlife.

The objective of this study is to assess whether concentrations of mercury in fish found in Pueblo Reservoir are above the department's action level of 0.5 mg of mercury per kilogram of fish (wet weight). Based on the assessment, the department can decide whether to take further action, including conduct targeted studies (as time and resources allow), or issue fish consumption advisories. The assessment may also help in evaluating the potential risk that these contaminants may pose to wildlife that consume these fish.

This study targeted fish that are most likely to be caught and consumed by the public. The selection of the target fish species in a reservoir is a specific decision based on the Division of Wildlife biologist's knowledge of the relative abundance of species and angler harvest. For Pueblo Reservoir, the target species were walleye (*Stizostedion vitreum*) and wipers (*Morone saxatilis x Morone chrysops*) because they are very abundant in this reservoir and highly desirable to anglers.

Methods

Sampling Strategy

Lake Selection

The Water Quality Control Division developed a monitoring and assessment plan to investigate levels of mercury in fish in almost 100 lakes, reservoirs and rivers in Colorado, over a five-year period, starting in 2004. Waterbodies to be sampled were chosen from among the entire population in the state based on the following criteria:

- If there are no historical data on contaminants in fish tissue;
- A high harvest of fish from the waterbody
- The need to update existing fish consumption advisories;
- Any on-going collaborative studies of contaminants in any media, with other entities such as the U.S. Geological Survey, U.S. Fish and Wildlife Service, universities, etc. and
- If there are concerns or questions about health risks for a specific lake or reservoir.

Pueblo Reservoir was included in the monitoring plan because of the lack of information about mercury levels in the fish, the abundance of certain types of sport fish that are likely caught, and the high levels of angler use. Additionally, the City of Pueblo contacted the division during the summer of 2004 to request that Pueblo Reservoir be studied as soon as possible.

Fish Collection

Fish were collected during the Division of Wildlife's regularly scheduled fish population survey of Pueblo Reservoir on October 8, 2004. Fish were captured in gillnets set overnight. The Water Quality Control Division coordinated its fish collection with the Division of Wildlife's survey in order to minimize negative impacts on the fish populations that could result from multiple sampling events and to optimize resources. Fish collection and field processing followed the Water Quality Control Division's Standard Operating Procedures. Fish contamination was minimized by not allowing fish slated for inclusion in the sample to rest on the bottom of the boat, or to be handled by the person operating the boat. Fish were kept in buckets with water until brought on shore. They were then killed and placed in plastic bags; packed in ice; and immediately transported to the laboratory where they were placed in freezers for subsequent processing. Once at the laboratory, the fish were measured to the nearest 1mm.

Table 1 lists the species collected, the total numbers collected and the range in lengths. Walleye and wipers were selected as target species principally because they are found in this reservoir in large numbers and both species are highly desirable by anglers. They are also at the top of the food web, which makes them good indicators of mercury bioaccumulation. Other fish species that were analyzed for mercury in this study were

not caught in numbers that satisfied the study statistical design but did provide valuable supplemental data about mercury bioaccumulation in the reservoir. Appendix 1 presents the data about all fish specimens sampled from the reservoir and used in the study. The table includes the unique identifier number for each fish specimen, the species abbreviation and the length. The unique identifier number was later used to create the table of composited samples (see Appendix 2).

Table 1. Fish collected from Pueblo Reservoir in October 2004.

Species	Number collected	Length Range (mm)
Walleye (*Stizostedion vitreum*)	60	330 - 650
Wipers (*Morone saxatilis x Morone chrysops*)	63	260 – 600
Channel catfish (*Ictalurus punctatus*)	16	420 -650
Tiger muskie (*Esox lucius* x *Esox masquinongy)*	1	700
Spotted bass (*Micropterus punctulatus*)	9	420 - 650
Black crappie (*Pomoxis nigromaculatus*)	5	170 - 220

Tissue Type

Because the main concern of this study is to evaluate potential risks associated with consuming potentially contaminated fish, the edible portion or fish fillets were used for analyses. Skinless fillets from each fish were collected according to the Water Quality Control Division's Standard Operating Procedures. Skin was removed from the fillets to provide the most conservative (highest concentrations) assessment of mercury.

Sample Composition

One of the first issues addressed in the state-wide sampling plan was whether to analyze tissue samples from individual fish or to analyze composite samples of tissues from several fish. This is an important study consideration that requires the balancing of the desire for precise estimates of variability in tissue concentration with the analytical costs. The Water Quality Control Division followed the EPA (2000) recommendation to use composite samples of the edible portion (fillets) when evaluating the mean concentration of mercury in the target population of fish. Composite samples are homogeneous mixtures of samples from two or more individual organisms, analyzed as a single sample. The main advantage of using composite samples is the reduced analytical costs, as compared to the costs of acquiring and handling the samples. The disadvantage of using composite samples is that individual extreme concentrations are lost in the mix of the composite.

Composite samples in this study met the following criteria:

- All specimens in a composite are of the same species;

- The smallest specimen in the composite is not smaller than 85 percent of the length of the largest specimen in the composite;
- And the fish are collected during the same sampling event.

Appendix 2 presents the table of composite samples, which was created using the fish specimens' unique identifier numbers.

Sample Design

The objectives of the Division of Water Quality Control in the statewide monitoring plan are to collect sufficient samples to estimate the mean mercury concentration in each population of fish with a known statistical certainty and to statistically test whether the mean mercury concentration of the samples for each species and size group exceeded the action level of 0.5 mg/kg. The division followed the statistical sampling design, rationale, and calculations recommended in EPA (2000) for an optimal monitoring design. Optimal designs require prior information about population standard deviation and the actual difference between the mean mercury concentrations and the action level. For situations where this information is lacking, EPA (2000) provides guidance in Table 6.1 and 6.2 for estimating sufficient sample size. The division consulted these tables and selected the following specifications in its sampling design:

- A detectable difference of 50 percent between the site-specific mean mercury concentrations and the action level;
- A probability of detecting a true difference between the mean and the action level of 70 to 80 percent (statistical power);
- A level of statistical significance of 0.05 (commonly used in biological sampling);
- The need to minimize the costs associated with analysis of the samples because of a fixed analytical budget;
- The decision to assign a maximum estimated population standard deviation of 0.024 as the target for attaining the desired statistical power.

The resultant design is conservative in that it likely requires more samples to be collected than actually are required to achieve the desired statistical power. It calls for the collection of 120 fish per waterbody with 60 fish collected per species from two different species and 30 fish collected for each of 2 size classes within each species. The desired number of fish per composite is 6 and the number of replicate composite samples is 5. When it is not possible to collect this combination of fish for a particular waterbody, sample size is modified by adjusting the number of fish per composite and the number of composites so that the estimated standard error remains less than or equal to 0.024. For these situations, the new estimated standard error is calculated and supplied with the results.

For Pueblo Reservoir, walleye were composited in 20 samples of three fish each. This combination generated an estimated standard error of 0.016, which provides a greater level of precision, compared to the goal of 0.024. The other species collected in sufficient numbers for a calculated standard error of 0.024 was wipers where 10 samples

of 6 fish each were analyzed. The other fish species collected were composited and analyzed, but the data were used as supplemental information only, not for decision making.

Tissue Analysis

Fish Processing

Fish specimens were prepared for mercury analysis at the state's laboratory in accordance with the division's Standard Operating Procedures. In the laboratory, all fish specimens were held frozen prior to processing and were processed as soon as possible after collection, depending on staff time availability.

Fish were processed in two steps. First, all fish fillets were removed, inserted in labeled containers and frozen. Fish were only partially thawed during processing to preserve the integrity of the tissue and the cells. Second, the sample compositing scheme was generated (see Appendix 2) and the composite samples were made up.

Prior to use, all fish processing equipment was washed with detergent and rinsed with tap water. Fish were placed on plastic cutting boards and whole fillets or a significant portion of a fillet were removed with high quality stainless steel knives. The skin was removed from the underlying muscle tissue after filleting. Sufficient mass of tissue was removed to meet the analytical detection requirements and the remainder saved as archived material. Fish tissue was transferred to unused 50ml Nalgene vials, which were labeled individually and kept frozen as archived material.

After the sample compositing scheme was generated, it was used to allocate fillets that make up each composite, with the same fish processing equipment that was used for fish filleting. The vials containing fish tissue were taken from the freezer and grouped according to the prepared compositing scheme. A small portion of tissue was cut from each fillet and placed in another unused and labeled 50 ml Nalgene vial. Each small portion extracted from the fillet was of approximate equal size. The vial was first weighed empty and then with the fish material and the net weight of the fish sample was calculated. All the information was captured on a laboratory sheet form that was submitted to the state laboratory with the samples and with the chain of custody document. Samples were analyzed within their recommended holding time for mercury of 6 months.

Mercury Analysis

All samples were analyzed for total mercury using US EPA Method 245.6, for cold vapor atomic absorption spectrometry. Total mercury was the analytical method chosen because it provides a comparable estimate of methylmercury which is the main form of mercury accumulated in fish and it is much less costly to analyze than methylmercury. This is consistent with the EPA (1995a) that recommends that fish contaminant monitoring programs measure total mercury and make the conservative assumption that

all mercury is present as methylmercury in order to be most protective of human health. In addition to mercury, the concentrations of selenium and arsenic in fish tissue were determined as part of this study, but are not reported here.

Composite tissue samples were analyzed as three distinct analytical events. That is to say that the same fish tissue material from the fish specimens were composited using the same compositing scheme and submitted for analysis in three separate events: two sampling analysis were conducted at the state laboratory and one at the EPA laboratory. One set of composite samples was processed on November 22, 2004 and analyzed by the state laboratory on December 12, 2004. The second set of samples was processed on January 14, 2005 using composite samples archived at the state laboratory and analyzed by the state laboratory on February 8, 2005. The third set of samples was processed on November 22, 2004 as splits, prepared with the first set of composite samples submitted to the state laboratory, and analyzed by EPA laboratory on March 1 and 16, 2005 (the set of samples was divided in two batches, as requested by EPA).

The concentration of total mercury was expressed in units of mg/kg (wet weight). The method detection limit (MDL) for mercury analysis in fish tissue for the state laboratory was 0.3 mg/kg for the 2004 analyses and 0.1 mg/kg for the 2005 analyses. EPA laboratory reporting limit varied from 0.014 to 0.022 depending on the weight of sample analyzed. For example, for a 0.250 gram sample, the limit was 0.020 mg/kg.

Data Validation and Verification

Several quality assurance steps were taken to ensure that data quality and data integrity met the data objectives for the study. Fish collection, processing and compositing were done following division protocols. The compositing scheme was created taking in consideration the range of fish lengths, so that the composite was made with fish of comparable sizes. Proper documentation was prepared to document all the steps in the process, to include chain of custody documentation. The results of the laboratory analysis and all field data are stored in an Access database. A complete set of field and laboratory data can be found in Appendix 3.

Pueblo Reservoir samples were analyzed in three separate analytical events to ensure data quality. The division used the Pueblo Reservoir study as an opportunity to also conduct checks on several steps in the process of gathering data, such as sample preparation and laboratory procedures. The first time that the composite samples were prepared, a set of split samples was also prepared. The first set was submitted to the state laboratory and the second set was submitted to the EPA laboratory (in two batches). Both laboratories use the same analytical method (EPA 245.6), but due to instrumentation and other laboratory-specific differences, they produce results at different detection limits. The results from both processes were very consistent; no anomalies in the results were detected. The third set of samples was analyzed by the state laboratory and results were again very consistent, with no anomalies detected even when compared to the two previous analyses.

Data results and chain of custody documentation were received and reviewed for completeness by the project manager. All data documentation was complete, and there were no apparent problems or anomalies.

Results

All mercury concentrations for the fish tissue composite samples for Pueblo Reservoir were below the detection limits, when analyzed by the state laboratory. When the same composite samples were analyzed by EPA laboratory, some mercury concentrations were found above the reporting limit. However, this difference is due to the EPA laboratory's lower detection limits. But all the results, from all analyses events, were substantially below the department's adopted action level of 0.5 mg of mercury per kg of fish. These relationships are shown in Figure 1.

Mercury Concentrations in Fish Fillets from Pueblo Reservoir

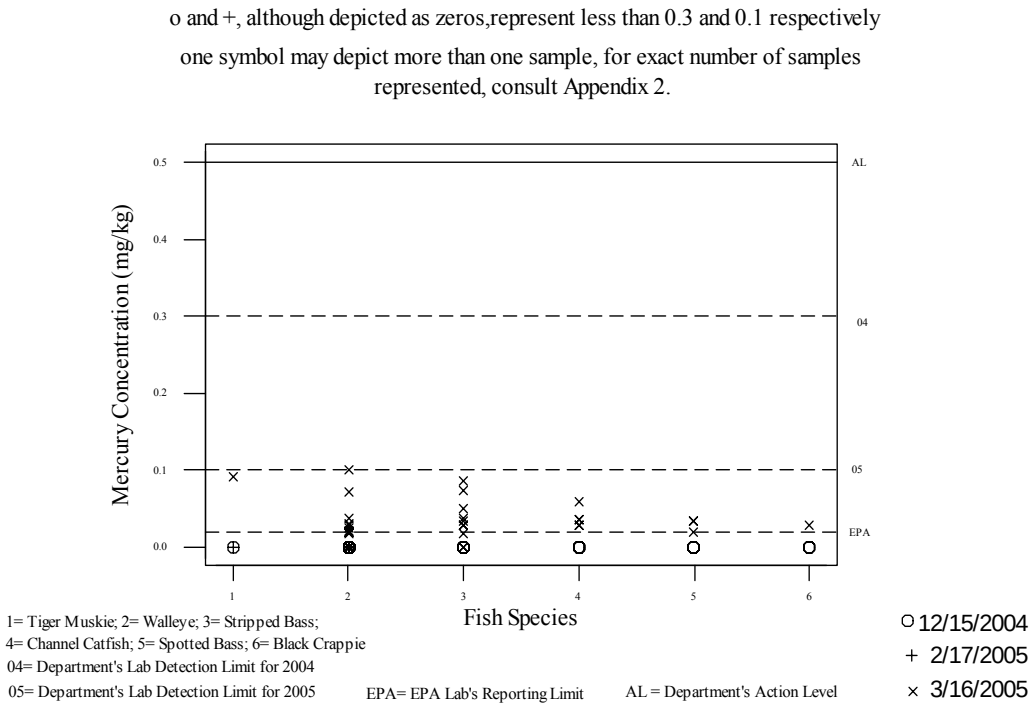

Figure 1

No further descriptive or summary statistics were performed, nor was the null hypothesis tested, because all the data points were substantially below the screening level of 0.5 mg/kg.

Discussion

Pueblo Reservoir was sampled in order to evaluate the potential risk to the public from consuming walleye and wipers and other species that may be potentially contaminated with mercury. Mercury bioaccumulates as it moves up the food web and in the case of Pueblo Reservoir, walleye and wipers are at the top of the food web. By investigating walleye and wipers, this study looked at not only the very desirable species, but also took in consideration the greatest opportunity for mercury to be found in fish in the lake.

The mercury results indicate that the reservoir does not have a mercury problem. We can say that based on two important indicators: first, because two predator species were used for the study and second because the data results were substantially below the action level of 0.5 mg/kg. This action level was used by the state as the threshold for issuing fish consumption advisories at four other waterbodies in the Colorado. The reservoir might be re-sampled during the next 5-year cycle, depending on available resources.

Conclusion

Mercury was found at levels below the department's action level of 05. mg/kg in all fish collected and analyzed from Pueblo Reservoir. At this time, the division is not recommending that restrictions be placed on the consumption of any fish caught in this reservoir due to mercury.

Acknowledgments

The division appreciates the assistance of Jim Melby and Doug Krieger of the Colorado Division of Wildlife who conducted fish sampling for this study. U.S. EPA contributed laboratory analyses of split samples. Thanks to James Dominguez, a staff member for the Department of Public Health and Environment's Water Quality Control Division, who participated in sampling, processing and, in general, handling every step of the study.

References

U.S.EPA's *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume I: Fish Sampling and Analysis*, Third Edition (USEPA 2000).

U.S.EPA Office of Research and Development: *Mercury Research Strategy*, EPA/600/R-00/073, September 2000.

Appendix 1

Fish Field Data

Pueblo Reservoir

Field Data Sheet – 10/08/2004 – Gill Nets

Sample ID	*Species*	*Total Length (mm)*
Pueb001	CCF	558
Pueb002	CCF	501
Pueb003	CCF	582
Pueb004	CCF	583
Pueb005	CCF	577
Pueb006	CCF	336
Pueb007	CCF	648
Pueb008	CCF	447
Pueb009	CCF	570
Pueb010	WAL	410
Pueb011	WAL	349
Pueb012	WAL	462
Pueb013	WAL	353
Pueb014	WAL	378
Pueb015	WAL	390
Pueb016	WAL	441
Pueb017	WAL	378
Pueb018	WAL	357
Pueb019	WAL	482
Pueb020	SBS	504
Pueb021	SBS	462
Pueb022	SBS	448
Pueb023	SBS	308
Pueb024	SBS	327
Pueb025	SBS	503
Pueb026	SBS	271
Pueb027	SBS	296
Pueb028	SBS	284
Pueb029	SPB	294
Pueb030	SPB	251
Pueb031	BCR	218
Pueb032	SPB	350
Pueb033	SPB	290
Pueb034	BCR	279
Pueb035	SBS	222
Pueb036	SPB	266
Pueb037	SPB	182
Pueb038	SPB	213
Pueb039	BCR	170
Pueb040	BCR	294

Pueblo Reservoir

Field Data Sheet – 10/08/2004 – Gill Nets (cont.)

Sample ID	*Species*	*Total Length (mm)*
Pueb041	SBS	372
Pueb042	SPB	208
Pueb043	SPB	211
Pueb044	BCR	166
Pueb045	TGR	702
Pueb046	SBS	224
Pueb047	SBS	281
Pueb048	SBS	288
Pueb049	SBS	318
Pueb050	SBS	500
Pueb051	SBS	491
Pueb052	SBS	565
Pueb053	SBS	307
Pueb054	SBS	260
Pueb055	SBS	440
Pueb056	SBS	362
Pueb057	SBS	482
Pueb058	SBS	465
Pueb059	SBS	502
Pueb060	SBS	460
Pueb061	SBS	438
Pueb062	SBS	592
Pueb063	SBS	292
Pueb064	SBS	283
Pueb065	SBS	498
Pueb066	SBS	496
Pueb067	SBS	279
Pueb068	SBS	499
Pueb069	SBS	263
Pueb070	SBS	558
Pueb071	WAL	581
Pueb072	WAL	354
Pueb073	WAL	390
Pueb074	WAL	338
Pueb075	WAL	419
Pueb076	WAL	338
Pueb077	WAL	650
Pueb078	WAL	443
Pueb079	WAL	418
Pueb080	WAL	410

Pueblo Reservoir

Field Data Sheet – 10/08/2004 – Gill Nets (cont.)

Sample ID	*Species*	*Total Length (mm)*
Pueb081	WAL	405
Pueb082	WAL	398
Pueb083	WAL	327
Pueb084	SBS	452
Pueb085	SBS	477
Pueb086	SBS	482
Pueb087	SBS	497
Pueb088	SBS	285
Pueb089	SBS	470
Pueb090	SBS	482
Pueb091	SBS	508
Pueb092	SBS	500
Pueb093	WAL	427
Pueb094	WAL	352
Pueb095	WAL	340
Pueb096	WAL	371
Pueb097	WAL	365
Pueb098	WAL	361
Pueb099	WAL	390
Pueb100	WAL	368
Pueb101	WAL	439
Pueb102	WAL	440
Pueb103	WAL	415
Pueb104	WAL	394
Pueb105	WAL	490
Pueb106	WAL	404
Pueb107	WAL	438
Pueb108	WAL	383
Pueb109	WAL	391
Pueb110	WAL	358
Pueb111	WAL	410
Pueb112	WAL	468
Pueb113	WAL	540
Pueb114	WAL	352
Pueb115	SBS	453
Pueb116	SBS	487
Pueb117	SBS	464
Pueb118	SBS	492
Pueb119	SBS	453
Pueb120	SBS	494

Pueblo Reservoir

Field Data Sheet – 10/08/2004 – Gill Nets (cont.)

Sample ID	*Species*	*Total Length (mm)*
Pueb121	SBS	490
Pueb122	SBS	562
Pueb123	SBS	522
Pueb124	SBS	300
Pueb125	SBS	274
Pueb126	SBS	510
Pueb127	SBS	513
Pueb128	SBS	300
Pueb129	SBS	530
Pueb130	SBS	597
Pueb131	SBS	468
Pueb132	SBS	456
Pueb133	WAL	397
Pueb134	WAL	401
Pueb135	WAL	378
Pueb136	WAL	440
Pueb137	WAL	393
Pueb138	WAL	390
Pueb139	WAL	403
Pueb140	WAL	453
Pueb141	WAL	469
Pueb142	WAL	452
Pueb143	WAL	458
Pueb144	WAL	652
Pueb145	WAL	416
Pueb146	WAL	406
Pueb147	WAL	393
Pueb148	CCF	418
Pueb149	CCF	487
Pueb150	CCF	583
Pueb151	CCF	591
Pueb152	CCF	579
Pueb153	CCF	583
Pueb154	CCF	613

Abbreviations:

TGR = Tiger Muskie
WAL = Walleye
SBS = Striped Bass
CCT = Channel Catfish
SPS = Spotted Bass
BCR = Black Crappie

Appendix 2

Table of Composite Samples

Table of Composite Samples for Pueblo Reservoir

Composite Sample ID	*Individual Fish IDs*
PUEBTGR01	Pueb045
PUEBWAL02	Pueb144 + Pueb077 + Pueb071
PUEBWAL03	Pueb113 + Pueb105 + Pueb019
PUEBWAL04	Pueb141 + Pueb112 + Pueb012
PUEBWAL05	Pueb143 + Pueb140 + Pueb142
PUEBWAL06	Pueb078 + Pueb016 + Pueb102
PUEBWAL07	Pueb136 + Pueb101 + Pueb107
PUEBWAL08	Pueb093 + Pueb075 + Pueb079
PUEBWAL09	Pueb145 + Pueb103 + Pueb010
PUEBWAL10	Pueb080 + Pueb111 + Pueb146
PUEBWAL11	Pueb081 + Pueb139 + Pueb106
PUEBWAL12	Pueb134 + Pueb082 + Pueb133
PUEBWAL13	Pueb104 + Pueb147 + Pueb109
PUEBWAL14	Pueb137 + Pueb015 + Pueb073
PUEBWAL15	Pueb099 + Pueb138 + Pueb108
PUEBWAL16	Pueb014 + Pueb017 + Pueb135
PUEBWAL17	Pueb096 + Pueb100 + Pueb097
PUEBWAL18	Pueb098 + Pueb110 + Pueb018
PUEBWAL19	Pueb013 + Pueb094 + Pueb114
PUEBWAL20	Pueb072 + Pueb095 + Pueb011
PUEBWAL21	Pueb074 + Pueb076 + Pueb083
PUEBSBS22	Pueb130 + Pueb062 + Pueb052 + Pueb122 + Pueb070 + Pueb129
PUEBSBS23	Pueb123 + Pueb127 + Pueb126 + Pueb091 + Pueb020 + Pueb025
PUEBSBS24	Pueb059 + Pueb050 + Pueb092 + Pueb068 + Pueb065 + Pueb087
PUEBSBS25	Pueb066 + Pueb120 + Pueb118 + Pueb051 + Pueb121 + Pueb116
PUEBSBS26	Pueb057 + Pueb086 + Pueb090 + Pueb085 + Pueb089 + Pueb131
PUEBSBS27	Pueb058 + Pueb117 + Pueb021 + Pueb060 + Pueb132 + Pueb119
PUEBSBS28	Pueb084 + Pueb115 + Pueb022 + Pueb055 + Pueb061 + Pueb041
PUEBSBS29	Pueb056 + Pueb024 + Pueb049 + Pueb023 + Pueb053 + Pueb124
PUEBSBS30	Pueb128 + Pueb027 + Pueb063 + Pueb048 + Pueb088 + Pueb028
PUEBSBS31	Pueb064 + Pueb047 + Pueb067 + Pueb125 + Pueb026 + Pueb069
PUEBCCT32	Pueb007 + Pueb154 + Pueb151
PUEBCCT33	Pueb004 + Pueb153 + Pueb150
PUEBCCT34	Pueb003 + Pueb152 + Pueb005
PUEBCCT35	Pueb009 + Pueb001 + Pueb002
PUEBCCT36	Pueb149 + Pueb008 + Pueb148
PUEBSPS37	Pueb030 + Pueb032 + Pueb029

Table of Composite Samples for Pueblo Reservoir (cont.)

Composite Sample ID		*Individual Fish IDs*
PUEBSPS38	=	Pueb033 + Pueb036 + Pueb038
PUEBSPS39	=	Pueb043 + Pueb042 + Pueb037
PUEBBCR40	=	Pueb040 + Pueb034
PUEBBCR41	=	Pueb039 + Pueb044
PUEBBCR42	=	Pueb031

Appendix 3

Table of Laboratory Results

Table of Laboratory Results for Pueblo Reservoir
Mercury Concentrations in mg/kg (wet weight)

Composite Sample ID	*LSD Analyzed in December 2004*	*LSD Analyzed in February 2005*	*EPA Analyzed in March 2005*
PUEBTGR01	< 0.3	< 0.1	0.092
PUEBWAL02	< 0.3	< 0.1	0.100
PUEBWAL03	< 0.3	< 0.1	0.071
PUEBWAL04	< 0.3	< 0.1	0.038
PUEBWAL05	< 0.3	< 0.1	0.030
PUEBWAL06	< 0.3	< 0.1	0.025
PUEBWAL07	< 0.3	< 0.1	0.028
PUEBWAL08	< 0.3	< 0.1	0.021
PUEBWAL09	< 0.3	< 0.1	<0.021
PUEBWAL10	< 0.3	< 0.1	0.020
PUEBWAL11	< 0.3	< 0.1	0.020
PUEBWAL12	< 0.3	< 0.1	<0.016
PUEBWAL13	< 0.3	< 0.1	<0.019
PUEBWAL14	< 0.3	< 0.1	<0.017
PUEBWAL15	< 0.3	< 0.1	<0.021
PUEBWAL16	< 0.3	< 0.1	0.018
PUEBWAL17	< 0.3	< 0.1	<0.019
PUEBWAL18	< 0.3	< 0.1	<0.020
PUEBWAL19	< 0.3	< 0.1	<0.019
PUEBWAL20	< 0.3	< 0.1	<0.018
PUEBWAL21	< 0.3	< 0.1	<0.019
PUEBSBS22	< 0.3	NA	0.086
PUEBSBS23	< 0.3	NA	0.073
PUEBSBS24	< 0.3	NA	0.037
PUEBSBS25	< 0.3	NA	0.050
PUEBSBS26	< 0.3	NA	0.034
PUEBSBS27	< 0.3	NA	0.029
PUEBSBS28	< 0.3	NA	0.028
PUEBSBS29	< 0.3	NA	0.017
PUEBSBS30	< 0.3	NA	<0.018
PUEBSBS31	< 0.3	NA	<0.021
PUEBCCT32	< 0.3	NA	0.036
PUEBCCT33	< 0.3	NA	0.028
PUEBCCT34	< 0.3	NA	0.059
PUEBCCT35	< 0.3	NA	0.028
PUEBCCT36	< 0.3	NA	0.035
PUEBSPS37	< 0.3	NA	0.033

Table of Laboratory Results for Pueblo Reservoir
Mercury Concentrations in mg/kg (wet weight)
(cont.)

Composite Sample ID	*LSD Analyzed in December 2004*	*LSD Analyzed in February 2005*	*EPA Analyzed in March 2005*
PUEBSPS38	< 0.3	NA	0.033
PUEBSPS39	< 0.3	NA	0.019
PUEBBCR40	< 0.3	NA	0.028
PUEBBCR41	< 0.3	NA	NA
PUEBBCR42	< 0.3	NA	NA

NA = No sample submitted.

Fish Species Abbreviations:

TGR = Tiger Muskie
WAL = Walleye
SBS = Striped Bass
CCT = Channel Catfish
SPS = Spotted Bass
BCR = Black Crappie