NEW MEXICO
FISH CONSUMPTION ADVISORY PROGRAM

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Prepared by

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In cooperation with
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and
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1.0 BACKGROUND

1.1 EPA Perspective

Contamination of aquatic resources, including freshwater, estuarine, and marine fish and shellfish, has been documented in the scientific literature for many regions of the United States (NAS, 1991). Environmental concentrations of some pollutants have decreased over the past 25 years as a result of better water quality management practices. However, environmental concentrations of others, such as heavy metals, pesticides, and toxic organic compounds, have increased due to intensifying urbanization, industrial development, and use of new agricultural chemicals. Our nation's water bodies are among the ultimate repositories of pollutants released from these activities. Pollutants come from permitted point source discharges (e.g., industrial and municipal facilities), accidental spill events, and nonpoint sources (e.g., agricultural practices, resource extraction, urban runoff, in-place sediment contamination, groundwater recharge, vehicular exhaust, and atmospheric deposition from various combustion and incineration processes).

Once these toxic contaminants reach surface waters, they may concentrate through aquatic food chains and bioaccumulate in fish and shellfish tissues. Aquatic organisms may bioaccumulate environmental contaminants to more than 1,000,000 times the concentrations detected in the water column (EPA, 1992a, 1992b). Thus, fish and shellfish tissue monitoring can serve as an important indicator of contaminated sediments and water quality problems, and many states routinely conduct chemical contaminant analyses of fish and shellfish tissues as part of their comprehensive water quality monitoring programs (Cunningham and Whitaker, 1989; Cunningham, 1998; Cunningham and Sullivan, 1999). Tissue contaminant monitoring also enables state agencies to detect levels of contamination in fish and shellfish tissue that may be harmful to human consumers. If states conclude that consumption of contaminated fish and shellfish poses an unacceptable human health risk, they may issue local fish consumption advisories or bans for specific water bodies and specific fish and shellfish species for specific populations (e.g., pregnant/nursing women, children, subsistence fish consumers).

1.2 Fish Tissue Contamination and Water Quality

The extent of contamination of fish tissue can be indicative of the water quality status of a given water body. The stated objective of the Federal Water Pollution Control Act, better known as the Clean Water Act (CWA), is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." It also indicates that, consistent with provisions of the statute, "it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved" (CWA § 101(a)(2)). This language is commonly referred to as the "fishable and swimmable" goal of the CWA. Because many people who catch fish consider eating them to be an integral part of the fishing experience, waters that contain fish that pose an unacceptable health risk when consumed fail to meet the "fishable" goal of the CWA (EPA,

2002, 2003b). Furthermore, development of fish consumption advisories is consistent with the New Mexico Water Quality Act implied goal "to protect the public health, welfare, and to enhance the quality of water" (§§ 74-6-1 *et seq.*, NMSA 1978).

The U.S. Environmental Protection Agency (EPA) considers fish tissue contaminants to be important indicators of water quality (EPA, 2003a). As such, if a fish consumption advisory has been issued for a given water body, EPA guidance recommends that water body be considered impaired under §101(a)(2) of the CWA and included on the list of impaired waters under §303(d) of the CWA, commonly referred to as the "303(d) list" (EPA, 2003b).

Presently the State of New Mexico only has one fish tissue-based numeric water quality criterion (0.3 mg/kg for methylmercury) in its Water Quality Standards (NMQCC, 2011).

1.3 State of New Mexico Historical Background

In the early 1990s, the New Mexico Environment Department (NMED), New Mexico Department of Health (NMDOH), and New Mexico Department of Game and Fish (NMDGF) initiated a fish consumption advisory program. NMDGF collected fish samples and provided them to NMED, who prepared the fish samples and delivered them to NMDOH Scientific Laboratory Division (SLD) for analysis. NMDOH Office of Epidemiology (currently, Division of Epidemiology and Response) reviewed the results and determined the level of consumption restriction advised to the public, if any. This program focused exclusively on mercury contamination. By the mid 1990s, funding for the program had declined and while the program remained in effect, no new data were collected.

Beginning in 2000, the program started to collect new data which have since been reviewed, analyzed, and interpreted, resulting in updated fish consumption advisories published on the NMED website (http://www.nmenv.state.nm.us/swqb/advisories), the NMDOH Environmental Public Health Tracking (EPHT) website (https://nmtracking.unm.edu/environ_exposure/fish), and within the NMDGF Fishing Proclamation.

Since 2003, data derived from EPA's National Fish Tissue Study (http://water.epa.gov/scitech/swguidance/fishshellfish/techguidance/study/index.cfm), NMED, and Los Alamos National Laboratory have raised concern about fish tissue contamination in New Mexico. These data suggest that contaminants such as polychlorinated biphenyls (PCBs) and DDT (an organochlorine pesticide) and its derivatives, as well as mercury, may be present in concentrations that could pose an unacceptable health risk for people who eat fish from New Mexico waters.

2.0 MONITORING STRATEGY

2.1 Study Objective

The fish tissue monitoring strategy used by the State of New Mexico is based on US Environmental Protection Agency (EPA) recommendations (EPA, 2000a). Although EPA recommends a two-tiered system, the State of New Mexico has implemented a one tier system and will continue to do so until such time as resources allow for a two-tiered system. The objective of sampling studies is to determine the concentration of one or more contaminants in a representative sample of fish tissue from one or more species, and one or more size classes of those species, from a given location.

The following elements must be considered when planning sampling studies:

- Study objective (see above)
- Target species (and size classes)
- Target analytes
- Target analyte threshold values
- Sampling locations
- Sampling times
- Sample type
- Sample handling and analysis
- Data analysis

2.1.1 Target Species

Species targeted for monitoring will vary according to the water body in question. Target species should be commonly consumed and have the potential to bioaccumulate high concentrations of contaminants. Species recommended for targeting by EPA are listed in Table 1. EPA recommends monitoring of at least one bottom-feeding species and one predator species at each monitored water body.

Table 1 EPA Recommended Target Species

Predator	**Bottom Feeder**
white bass (*Morone chrysops*)	common carp (*Cyprinus carpio*)
largemouth bass (*Micropterus salmoides*)	white sucker (*Catostomus commersoni*)
smallmouth bass (*Micropterus dolomieui*)	channel catfish (*Ictalurus punctatus*)
white crappie (*Poxomis annularis*)	
walleye (*Sander vitreum*)	
flathead catfish (*Pylodictis olivaris*)	
northern pike (*Esox lucius*)	
brown trout (*Salmo trutta*)	

2.1.2 Target Analytes

The primary analytes of concern in New Mexico are methylmercury, selenium, total DDT (and other organochlorine pesticides), and PCBs. These analytes have been selected from empirical evidence; they are the ones where concentrations often warrant advisories both within New Mexico and nationally. The one exception is Se which is included because EPA is in the process of developing a fish tissue-based Se criterion. Analytes of secondary concern include polybrominated diphenyl ethers (PBDEs) and dioxins/furans.

2.1.3 Target Analyte Threshold Values

For development of fish consumption advisories, target analyte threshold values (the concentration that triggers the issuance of an advisory) are based on EPA risk-based consumption limit tables (EPA, 2000b). For DDT and PCB concentrations, EPA lists concentrations and their associated meals per month guidance by cancer health endpoints and non-cancer health endpoints. Cancer health endpoints are more conservative than non-cancer health endpoints. New Mexico issues DDT and PCB advisories on the basis of cancer health endpoints. These limits are summarized for the analytes of primary concern in Table 2. While EPA guidance (EPA, 2000b) provides for consumption thresholds for greater than 4 meals a month, New Mexico does not issue advisories at greater than 4 meals a month as few individuals are likely to consume fish from a given waterbody at this rate. As such, the public perception that these fish are "contaminated" and should not be consumed at all could result in the loss of the potential health benefit from consuming fish that outweighs the actual risk.

Table 2 Fish consumption thresholds for analytes of primary concern used by NMED (from EPA, 2000b)

Consumption Limit (8 oz. meals per month)	Mercury[1] (ppm wet weight)	Selenium (ppm wet weight)	DDT (ppm wet weight)	PCBs (ppm wet weight)	Dioxin/Furans and PCB TEQs (ppt wet weight)
No advisory	0 – 0.12	0 - 5.9	0-0.035	0 – 0.0059	0 – 0.075
4	>0.12 – 0.23	>5.9 - 12	>0.035 – 0.069	>0.0059 – 0.012	>0.075 – 0.15
3	>0.23 – 0.31	>12 - 16	>0.069 – 0.092	>0.012 – 0.016	>0.15 – 0.2
2	>0.31 – 0.47	>16 - 23	>0.092 – 0.14	>0.016 – 0.023	>0.2 – 0.3
1	>0.47 – 0.94	>23 – 47	>0.14 – 0.28	>0.023 – 0.047	>0.3 – 0.6
0.5	>0.94 – 1.9	>47 – 94	>0.28 – 0.55	>0.047 – 0.094	>0.6 – 1.2
None (<0.5)	>1.9	>94	>0.55	>0.094	>1.2

[1] Fish consumption limits for methylmercury are used

For development of the 303d list, approved fish tissue-based water quality criteria, if available, will be used over EPA guidance targets (see current NMED Assessment Protocols for more details http://www.nmenv.state.nm.us/swqb/protocols). Currently, the only fish tissue-based water quality criterion in effect is for methylmercury (0.3 mg/kg).

2.1.4 Sampling Locations and Geographic Extent of Advisories

Sampling locations are generally coincident with SWQB's watershed-based water quality surveys, which recur on an approximately 8-year rotation. Specific locations will be prioritized based on data collected by NMDGF that indicate those water bodies that have the highest numbers of fish harvested per angler. Those water bodies that NMED has identified as having or are suspected of having high levels of contamination will also receive high priority.

The geographic extent of an advisory based upon fish collected from a given lake applies to the entire lake. Advisories based upon data collected from fish in a given river do not apply to the entire river; rather they will apply to a reach of the river. This reach at a minimum will extend the length of the assessment unit (AU) from which the fish were collected. AU's are used as part of SWQB's water quality assessment and are considered to be reaches of given water that have consistent hydrologic, ecological, geomorphic, and water quality characteristics. Descriptions of AUs can be found in the most recent §303(d)/§305(b) Integrated List & Report on the SWQB website (http://www.nmenv.state.nm.us/swqb/303d-305b/2010-2012/). The reach can be extended beyond this such that contamination may be expected to be similar across locations in the entire reach. For example, a river advisory would not extend beyond a major impoundment, major urban area or past significant hydrologic, ecologic, or geomorphic changes. The overall extent of the reach should be defined by easily identifiable landmarks, such as a highway, impoundment, or tributary river to facilitate public understanding.

2.1.5 Sampling Times

Sampling should be conducted during the period when the target species are most frequently harvested by the public. Otherwise, sampling is best conducted during late summer or early fall as this time period coincides with the highest lipid content (a reservoir for organic pollutants) for many species. Exceptions would include when the contaminants of concern are organophosphate pesticides, which should be sampled and analyzed for in late spring or early summer within one or two months of their application, as these compounds are degraded and metabolized rapidly.

2.1.6 Sample Type

Sample type depends on the objective of the study. New Mexico typically collects composite samples of fillets, as more information for less cost can be obtained. However, some data resolution is lost in this process as compared to individual fillets.

If the contaminant of concern is methylmercury, leaving the skin on will result in a lower concentration of contaminant for a given mass because methylmercury tends to concentrate in muscle tissue. Therefore, skinless fillets provide a more conservative estimate of health risk from exposure to methylmercury. Skinless fillets may also be appropriate for scaleless species (e.g., catfish) that are normally eaten without the skin. Organic contaminants tend to concentrate in fatty tissues, so leaving the skin and belly flap on would provide a more conservative estimate of health risk from exposure to those analytes. However, it should be noted that warmwater species are generally consumed with the skin off, while salmonids are generally consumed with the skin on. Thus, regardless of the analyte of concern, following the local consumption pattern

may yield the most realistic, but not necessarily the most conservative, results. New Mexico typically removes the skin from catfish fillets, but for other species, the skin is left on with the scales removed. The lab is instructed to take a cross section of the fillet that includes a proportional amount of skin when preparing the tissue for analysis.

Individual fish included in composite samples must all be of the same species and of similar size (the smallest individual should be at least 75% of the total length of the largest individual), should be collected at the same location (within 14 days, if not at the same time), and should be collected in sufficient numbers to provide a 100-200 g composite homogenate sample of edible tissue.

2.1.7 Sample Handling and Analysis

Fish that are determined to be useful for the purposes of a given study should be immediately dispatched with a sharp blow to the skull with a clean wooden or metal club. Other fish should be returned to the water with as little stress and handling as possible.

Each fish should be placed on ice as soon as possible after collection. If fish cannot be shipped to the analytical facility within a short time, they should be frozen solid (-20°C) as soon as possible. Prompt shipment to the analytical facility is preferable. Arrangements should be made with the analytical facility prior to fish collection as to whether whole fish will be shipped for preparation at the lab or fillets will be prepared and shipped. Individuals included in one composite should be clearly marked and packaged to avoid any ambiguity.

Ideally, all analytes listed in Section 2.1.2 as primary analytes of concern in New Mexico should be included in analyses. If resources allow, or if other considerations warrant it, secondary analytes may be included.

A lipid analysis should also be performed and reported (as percent lipid by wet weight) for each composite tissue sample. This measurement is necessary to ensure that gel permeation chromatography columns are not overloaded when used to clean up tissue extracts prior to analysis of organic target analytes. In addition, because bioconcentration of nonpolar organic compounds is dependent upon lipid content (i.e., the higher the lipid content of the individual organism, the higher the residue in the organism), lipid analysis is often considered essential by users of fish and shellfish monitoring data. Consequently, it is important that lipid data are obtained for eventual inclusion in a national database of fish and shellfish contaminant data (EPA, 2000a).

2.1.8 Data Analysis and Laboratory Blank Corrections

The following procedure is recommended for analysis of the individual target analyte concentration for each composite sample from reported laboratory data.

- A datum reported below the sample detection limit (SDL), including a datum reported as not detected (i.e., ND, no observed response) should be assigned a value of one-half the SDL.

- A datum reported as below the quantitation limit should be assigned one half the reported value.
- A datum reported at or above the sample detection limit should be used as reported.
- A datum reported at more than 5 times the lab blank will be accepted, but if less than 5 times the lab blank, it should be assigned a value of 0.

3.0 PROPOSED MONITORING SCHEDULE

As resources allow, monitoring for fish tissue contamination will loosely follow the regular SWQB water quality monitoring surveys. That is, popular fishing areas within watersheds being surveyed for water quality standards compliance will be included in that year's monitoring efforts. In this way, fish tissue contamination monitoring will approximately follow the eight year rotation schedule for covering the state (ftp://ftp.nmenv.state.nm.us/www/swqb/MAS/Monitoring/10-YearStrategy.pdf). In addition, if other considerations arise that warrant monitoring (e.g., we become aware of known or suspected contamination issues), other water bodies can be included (as resources allow) in monitoring efforts in any given year as necessary.

4.0 OUTREACH

Effective public outreach is a critical component of a successful fish consumption advisory program. All the effort involved in determining which fish in which water bodies may constitute a health risk is of little value unless this information is effectively disseminated to the public.

4.1 Current Outreach Efforts

Current outreach activities by NMDGF include notification of the fish consumption advisory program in the annual fishing proclamation (http://www.wildlife.state.nm.us/publications/documents/rib/2010/10-11_Fishing_RIB.pdf) and maintaining a link on the NMDGF website to the fish consumption advisory. Current outreach activities by NMED include maintaining a toll-free phone number that members of the public can call to receive information on fish consumption advisories and maintaining a website with the fish consumption advisory (http://www.nmenv.state.nm.us/swqb/advisories/). Current outreach activities by NMDOH include maintaining a toll-free phone number for the general public to receive information, advice, and recommendations in response to their environmental health concerns, including fish consumption advisories and posting the fish consumption advisory and other resources on the NMDOH EPHT website (https://nmtracking.unm.edu/environ_exposure/fish/).

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